



THAI TRADITIONAL FOLDING KRATHONG: THE DESIGN AND DEVELOPMENT FOR
CLOTHING COLLECTION



By

MISS Chanakarn RUANGNARONG

A Thesis Submitted in Partial Fulfillment of the Requirements
for Doctor of Philosophy DESIGN ARTS (INTERNATIONAL PROGRAM)

Graduate School, Silpakorn University

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Thai traditional folding Krathong is considered to be exquisite crafts. Thai people in the past had the connection with banana leaves and used them as a container, rice offering trays and a Krathong, a small leaf container. However, when there has been an increasing use of plastic, there has been a gradual decrease in the use of banana leaves from everyday life. Moreover, it has negatively affected the number of people who are interested in using banana leaves.

This research aimed to preserve this art and combined it with fashion design to create new styles of clothing from the roots of Thai art and culture. This research focused on applying Thai traditional folding Krathong so called “Hak-kor-ma” pattern, which is one of the basic forms of banana leaf folding, in designing accessible clothing so that other people would easily understand the concepts. The researcher designed various ways and styles to wear this clothing in order to provide more varieties which match lifestyles of today's consumers. The results of the study showed six prototypes of the krathong-inspired clothing for women, which can be adapted to maximise the utility.

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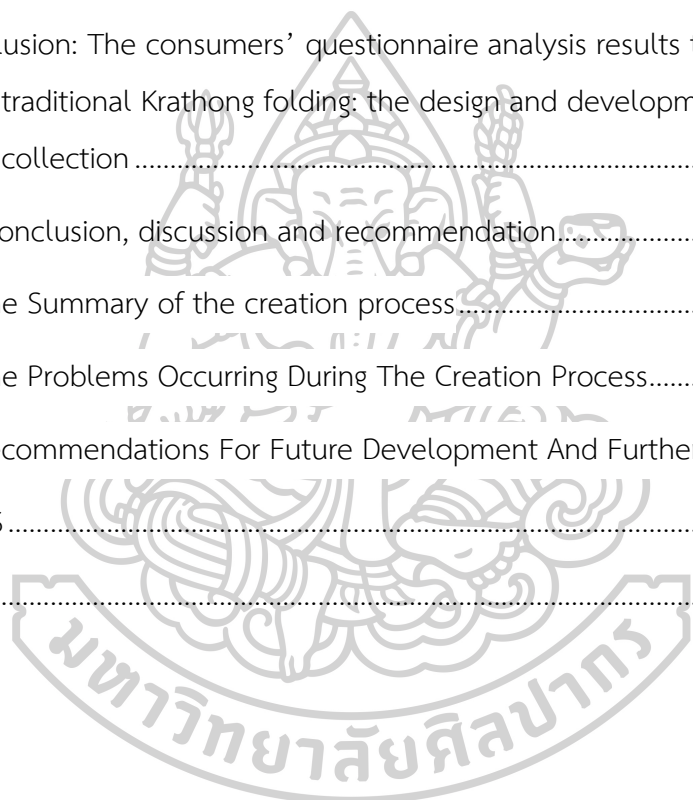
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Chapter 1

Introduction

Since the time of the ancient Siam, Thai ancestors have created numerous branches of Thai crafts and arts which are currently considered as a fine, unique, and elaborated heritage of all Thais. These branches cover applied arts, painting, sculpture, architecture, literature, music, and handicrafts. This craftsmanship exhibits the modesty, generosity, and gracefulness of Thainess.

Thai craft, art, and culture have originated from the art patronages of Buddhism and the Thai Royal institution. Under the patronages of these two institutions, Thai craft, art and culture are cherished and become a sight to the World's awareness. One of the unique Thai crafts is the 'Thai traditional folding Krathong' or the art of banana leaf folding. The nature of Thais which is simple, but creative, humble, delicated, and elegant is reflected through the craftsmanship of converting the simple natural household materials like banana leaves to the beautiful, valuable, and useful craft. Banana leaf is a part of Thai way of life from birth till death. It is a mattress for the newborns, a container for food and snack to enhance their flavour, and a basketry toy such as banana leaf carp, muffins, grasshoppers, and so on. Also, it is used to demonstrate the extreme craftsmanship of the makers since the masterpieces of Thai traditional folding Krathong are seen in various Thai ceremonies. Thai traditional folding Krathong is an advanced skill passing from generation to generation. However, this transition is declined due to the coming of plastic material. Nowadays, the elaborated and delicated Thai traiditonal folding Krathong is considered a rare craft. It could be only seen in the very important ceremony. This craftsmanship is only existed among the old generation and the practiced artisans because it requires practices and skills. Therefore, this advanced graceful art is gradually gone over generations. As the one in the field of fashion design, the researcher has been awared of the mentioned problems. Therefore, she is interested in integrating the Thai traditional folding Krathong with the fashion design and then change from the natural

biodegradable materials to the cloth. The outcome of this integration yields the new fashion styles of clothing that reflects the modern way of life mixed with the respected Thai artistic heritage. By doing so, she could be able to preserve this Thai traditional folding Krathong. Also, it could serve as a starting point for the creation of other branches of art works.

According to the review of literature and previous studies, it was found that the Japanese folding practices or 'Origami' has been adopted and adapted into several fields such as fashion design, jewelry, furniture, architecture, book, satterlite, etc. Upon this review, the researcher has set the assumption that Thai traditional folding Krathong, too, could be adopted or adapted into the field of fashion design. Apart from the mentioned usefulness, the result of this study will be a spark of the general and international awareness towards Thai arts and culture.

In this study, the researcher intends to investigate the adaptation of Thai traditional folding Krathong. To facilitate the consumer-friendly design, the researcher selects the simple and uncomplicated folding prototypes from a pool of folding patterns. The researcher also sets the criteria for selecting the fabric that (1) the folding patterns could prominently remain after folding, (2) it is adequately thick, patterned, and suitable for folding process as well as resistant to the heat and steamer, and (3) it could be a clothing that is flexible for dressing in many occasions according to the consumers' customization. These criteria create the worthiness and allow the consumers to be able to customize their own dressing styles. In addition, the fabric wrinkles combined with the permanent folding from the folding process will become geometrical patterns which will be, then, create the unique contemporary patterns rather than the simple wrinkle.

Research problem

Upon inspection of the Thai traditional folding Krathong, how could the Krathong-inspired clothing be designed and developed?

Objectives of research

1. To investigate Thai traditional folding Krathong.
2. To examine the suitable fabric and appropriate folding patterns of Krathong-inspired clothing.
3. To explore the guideline for designing the Krathong-inspired clothing.

Scope or delimitation of the study

This study aims to investigate the use of Thai traditional folding Krathong in order to design and develop Krathong-inspired clothing. It only focuses on the banana leaf Krathong.

Outcomes

1. It systematically collects the information on Thai traditional folding Krathong patterns.
2. It assembles the suitable fabrics and appropriate folding patterns of Krathong-inspired clothing.
3. It results in Krathong-inspired clothing.

Research methodology

1. Investigate the Thai traditional folding Krathong.
2. Investigate the appropriate fabric for folding patterns and meet the requirement of being proper attire.
3. Obtain and verify the appropriate folding patterns for designing and developing the Krathong-inspired clothing by trying the folding patterns on various fabric.
4. Explore the dressing behaviors of the consumers in order to synthesize the design and patterns that meets the consumers' needs.
5. Based on the obtained finding, formulate the framework for designing the proper Krathong-inspired clothing.
6. Trial the Krathong-inspired clothing design according the obtained framework.

7. Design and develop the Krathong folding patterns for designing and developing the Krathong-inspired clothing.

8. Develop a brochure to introduce the folding patterns and the guidelines for improving the Krathong-inspired clothing.

9. Summarize the results and state the suggestion for the future development.

Definition

Krathong refers to the Thai craft and art of folding banana leaves into various patterns, used to exquisitely decorate the containers. Those decorated containers are offered as a worship to the Buddhist monks, teachers, and other sacredness in religious ceremony. Intakul (2009, p. 71) Krathong, commonly made from banana leaf, can range from simplest to the most sophisticated forms imaginable. Simple Krathong baitong are widely used as containers, mostly for food, while the more sophisticated versions are used in ceremonies and festivals. Another type, Krathong dokmai, a flower container with a conical lid, is made entirely from banana leaf. Krathong dokmai are generally used as an offering, in conjunction with a bundle of incense sticks and candles on a pedestal tray.

Thai silk refers to the fabric woven from the raw silk material which is a natural product of the silkworm. The authentic woven fabric creates the shine of the clothing as well as durability of the fabric itself. It provides warmth in cold weather and keeps the body temperature cool in hot weather.

Polyester refers to the artificial polymer produced from the man-made fibers.

Chapter 2

Literature review

This research aimed to create a model of making clothes which was adapted from the Thai traditional ways of folding Krathong. The related literature and studies are divided into four parts. The first part is related with the information on Thai traditional ways of folding Krathong in order to get a better understanding of folding techniques and folding limitation in terms of creating clothes. The second part focuses on the related folding techniques in the fashion design, which might benefit other researchers who study the patterns and develop the concept and process of creating clothes. Part three is related to the characteristics of the fabrics for making and folding clothes in order to effectively choose the right fabric for designing clothes. The last part deals with the information on clothes design concept in order to study the appropriateness and beauty of clothes, and to apply the information to support the foundation of creating the effective and suitable clothes for each occasions. The objective of this study is to study and preserve the art of folding Krathong and combine it with the art of fashion design. This study presents the literature review in three parts as follows:

- Part 1: Thai traditional folding Krathong
- Part 2: Fabrics and Pleating
- Part 3: The folding in the designing fields

Part 1: Thai traditional folding Krathong

The history of folding Krathong

Thailand is known as the art and cultural richness country that was created by Thai ancestors. This valuable cultural heritage has been inheriting from the past to present. The uniqueness of Thai art is described in terms of exquisiteness and fineness.

The art also represents the identity of Thai people that they are generous, noble, and the strong belief in the Buddhism.

Thai art and cultures originated from the Buddhism. That is because of the promotion and maintenance of the Royal institution especially the King. Hence, Buddhism becomes prosperous in Thailand. However, Thai people start to neglect their precious culture and pay their attention to the Western culture; therefore the valuable Thai culture is gradually lost. For that reason, Thai culture is inherited only by those who are really interested in it.

The art of folding banana leaves is one of art field that should be preserved because it plays an important role in Thai tradition and festivals, as well as in Thai lifestyles. The common evidence is shown as the food and dessert containers such as containers of steamed curry, steamed flour with coconut filling, Thai pudding with coconut topping, and glutinous rice steamed in banana leaf. It is also used as an important container in a significant ceremony such as the betel bowl for the marriage ceremony, betel bowl to pay respect to sacred items, teacher's observation flower bowl, or candles and incenses tray for apologizing, and floating lantern in the Loy Krathong festival. The exquisite crafts are created specifically in the special occasions.

According to Chantanapalin (1997), it is hard to tell when the art of folding Krathong originated, who the pioneer was, and who the inheritor of this field of culture was. Even Professor Praya Anuman Rajadhon, Thai and western art expert, could not answer the questions. The supporting reference was written in the Royal work about twelve months ceremony, in the chapter related to the royal lanterns. It said "The royal lantern floating was the festival not only for the royal members but also for everyone. Another reason that Loy Krathong was not the royal ceremony is that it did include the Buddhism and Brahmin ceremony in this festival. Lantern floating and Krathong floating festival is the ancient Siamese festival that originated since the capital was located in the North." At that time, Noppamas or Thao Srichulaluk who was the chief royal consort of Phra Ruang, the king of Siam during Sukhothai period, created and decorated the exquisite Krathong which was more extraordinary than those made by the concubines of the king. The decoration was created by the flowers made from colorful pollen, and the fruit was carved into the bird of prey which pecked at the

pollen of lotus petal. The presentation of Krathong was exquisite and colorful. The incense and cow's joint oil lantern were used to decorate Krathong.

The documents prove that Thai ancestors were talented in creating containers and things from flowers, leaves, and other materials long before the Sukhothai period. However, there was no evidence for the posterity to inherit.

During Rattanakosin period, Somdej Jao Praya Damrong Rajanubhab told the story of folding Krathong to Chao Khun Thanee, the daughter of Chao Praya Mahasena (Bunnag) who was the king's concubine and also Krom Muen Surinrak's mother. She was also the famous florist in that era (around 1816 BC).

Two hundred and two years ago, before the reign of Rama 4 and Rama 5, there were many royal family members and their servants that were skillful in creating the flowers, a garland, a net, a floral mobile, and a floral tray. However, no one has mentioned the banana leaves' works. It was hypothesized that the art of folding banana leaves might be limited only in creating the food and dessert containers. Later on, in the reign of Rama 5, The Kings, the Queen, and his concubines were interested in the art of folding Krathong. Queen Saovabha Phongsri trained the governors and the Rajini school teachers about the techniques of folding banana leaves, arranging flowers, and creating dry flowers. Furthermore, the Queen supported the folding banana leaf work, and adapted the new techniques of folding banana leaves and flower arrangement.

It appears that the origin of the Thai culture is based on the Buddhism and the Royal Institution. In conclusion, the art of folding banana leaves originated in the royal palace, and then it was introduced to the other people. The ministers' children were sent to the female royalties in order to be trained the skill of folding banana leaves. Thus, during the ceremonies such as topknot-cutting, ordination, marriage, auspicious, and cremation, these ministers' children were able to present their skill of folding banana leaves to other people.

The materials and the banana leaves preparation

In order to fold banana leaves, the well preparation of the materials needed to complete the job is the key, so that the time will not be wasted. Also, suitable materials will support the effectiveness of the banana leaf folding.



Figure 1 Tani Banana tree

Source: <http://www.thaiarcheep.comกล้วยตานีมีคุณค่าและสา.html>

.1Banana leaf preparation

Types of banana leaves: The most suitable banana leaves for folding Krathong is *Musa balbisiana* (Tani banana) because of its softness and thickness texture. Thus, the leaves are not fragile. The line of the leaves can be straight and wide.

Ages of banana leaves: The best banana leaves for folding should not be too young or too old. The leaves should be big and dark green. The young leaf is not durable because it withers and rips easily. Also it is unsteady. The old leaf has a short life and easily changes its color from green to yellow.

Cutting the banana leaves from the tree techniques: The leaves should be cut out from the tree in the late morning or in the late afternoon, so the dew on the leaves is completely dried out. For a selling purpose, the banana leaves should be cut in the morning in order to keep its freshness and long life. When cutting the banana leaves from the tree, some leaves at the base of the whole leaf should be kept, so it still photosynthesizes to maintain the age of the stem and the leaves sheath. With this technique, the leaves will not dry out and be rotten easily. Also, it will keep the banana trunk beautiful and big.

Wiping techniques: The leaves should be sliced off the stem and then torn into a big piece. We should wipe the leaf with the clean and soft cotton cloth from the base to the end of the leaf. A stain can be removed by a half-dry cloth and an irremovable stain can be torn out. The dirt can be washed out and we need to leave it dry before wiping it once again.

Tearing the banana leaves techniques: Before tearing the banana leaves, the edge should be removed for easily tearing and pinning. Seize the leaf with a pin or a thumb nail before tearing to get the similar sizes of banana sheets.

Cutting the banana leaves for folding techniques: In order to make a food and dessert container, use the bowl to model the circle shape of the banana leaf and use a pair of scissors or sharp knife to cut the leaf on the cutting board.

Folding the banana leaves: The soft part on the top of the leaf is the best part for folding. Fold the banana leaf gently by avoid pressing it while folding because it can become black and wither easier than the other part of the leaf.

Sewing techniques: After folding the banana leaves, arrange the folds in the pattern needed. Lock the tip of the fold to line them up in the same position. It is best to choose the same shade of green in each set of arrangement. Last, spray the water regularly to keep the work fresh.

Shaping techniques: Arrange the folds into appropriate length then insert the last piece of the fold into the first one. And then sew them tightly and neatly. The sewing line should be in the same line and cover the unwell-ordered sewing line it with “Ta-Kaab” or the centipede knit.

Maintaining technique: To keep the finished work fresh, soak the folded banana leaves in water for 2 hours, and then cover with the moist cloth. For example, it takes several days to make a large Krathong tray. When completing each part of the tray, it needs to be kept fresh by soaking it in water. Arrange the parts in the enameled bowl, and then cover them with the moist cloth. This technique will help keeping the parts of the Krathong fresh before putting them together. While presenting the Krathong, water spraying is essential to keep Krathong green and fresh, and remove the rotten part off. The fresh banana leaves can be washed for next folding.

.2The materials for banana folding works

2.1 Scissors: It is crucial to choose the appropriate sizes of scissors for each process of folding. The big scissors is used for cutting banana leaves. The small and light-weight scissors is use to cut the tread.

2.2 Needles: Number 8 needle is used in the regular work. Needle number 9 is used in detailed work.

2. 3 Pin: The pin with pearl top is rarely used. If the pin gets dirty from the sticky resin, clean it with the detergent water before storing it. To lock the banana leaves up, it is best to use the small head pins or the small long leg nails.

2. 4 Tread: Use Number 60 dark green double treads. A single tread is not suggested to use because it may cut the banana leaf.

2.5 Small bamboo pin: It should be small and sharp. It is used in the flower arranging work for decorating Krathong.

2.6 Straining cloth: It is used to cover the torn banana leaves or the finished work. Soak the cloth in water; twist the cloth to drain out the water, and cover the works with this moist cloth.

2. 7 Wiping cloth: Cotton is the best for wiping because of its softness and it absorbs the water well. Banana leaves should be wiped before folding.

2. 8 Hard eraser: It is used to press on the pin because it is soft and hard to slip off.

2.9 Other materials: There are other materials such as cutting boards, pliers, tweezers, wire, wire-cutter, ruler, cutter, tray, enameled bowl , and etc.

The patterns of banana leaves work

There were many patterns of the banana leaves folding from the past to present. This study focused specifically on the art of folding Krathong.

1. A floral Krathong: The folding techniques are similar to the crating of the regular Krathong but the funnel is inserted in the middle of Krathong. It is decorated with the flowers arranged in lotus-shaped. It is normally placed on the top of the candle and incense tray which is used for paying respect to the elders. During the ceremony, the funnel should be removed in order to present the flowers, incenses,

and candles. It is also used to pay homage to the triple gem, the king, and the royal family members. Moreover, it is used to present to the preceptor during the ordination ceremony. The purpose of using floral Krathong is to ask for forgiveness and blessing.



Figure 2 A floral Krathong

Source: Sakarin Hongrattanavorakit (2007). **Art of Banana leaves folding**. Bangkok: O.S. printing House: p.19.

2. Floating Krathong: The purpose of making this Krathong is to use if to ask for forgiveness from Pramae Kongkha, the goddess of river. It is made from the natural materials such as Excoecaria leaves, Cordyline leaves, banana stalk, water hyacinth, marigold, cape jasmine. The candles and incenses are inserted, and decorate Krathong with flowers.



Figure 3 Floating Krathong

Source: By Ajarn Vijit Sonhom

3. Tray of gifts or Betal bowl: It is a gift container from the groom to ask for the hands of the bride based on the Thai tradition. The gifts are consisted of nine areca-batal nuts, nine betal vines, nine graptopyllum leaves, nine kewense leaves, nine

graptopyllum pictum leaves. Auspicious things such as paddy, popped rice, golden bean, black sesame are put in the silver bags and golden bags. Thai people believe that these objects can bring prosperity. Auspicious flowers and leaves such as orange jasmine, star gooseberry, crown flower, cape jasmine, glode amaranth, marigold, bougaville, and etc. are used to decorate the tray.



Figure 4 Tray of gifts or Betal bowl

Source: Sakarin Hongrattanavorakit (2007). **Art of Banana leaves folding**. Bangkok: O.S. printing House: p. 18.

4. Bride-price tray is a container for putting the money given to the bride's parents by the groom's parents. Only the auspicious flowers are used to decorate the tray.



Figure 5 Bride-price tray

Source: <http://www.asyourmind.com/article/article-1/>

5. Holy-water tray is used to contain the blessed water in the marriage ceremony, water pouring ceremony, or blessing in the special occasions such as

Songkran day, retirement day, and birthday. It is customarily created in the short model tray.



Figure 6 Holy-water tray

Source: Sakarin Hongrattanavorakit (2007). **Art of Banana leaves folding**. Bangkok: O.S. printing House: p. 20.

6. Wai-Khru tray is the banana leaf tray that is created to pay respect to one's grateful teacher in order to reminisce their favor in terms of teaching the useful knowledge. There is no specific pattern of creating this kind of tray. However, the creators need to prepare the flowers, incenses, candles and additional materials as follows.



Figure 7 Wai-Khru tray

Source: By students at the Departments of Creative Crafts Technology, Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi.

7. Baisri : It is a Kwan's (guardian spirit) invitation and consolation made from banana leaves. It looks like layered Krathong. Baisri has many sizes based on its layers

such as three layers, five layers, seven layers, and nine layers. The pole is stick in the middle as a core of Baisri. The oblation is put in it. Bai means rice, while Sri means fortune. By putting these two words together, it means fortunate rice. Baisri serves as objects to pay respect to deities and teachers. Kwan is made from the banana leaves and decorated with flowers to make it look exquisite. The creating of Baisri originated from the belief of Brahmin. Normally, Baisri has a triangle shape. To be specific, it has a wide edge but sharp top. It resembles the Mount Meru which is the home of the Shiva, the greatest god. After the ceremony, Baisri is believed to be the holy objects so it cannot be discarded. In the past, people normally floated it in the river, but nowadays, people leave it under a tree. Baisri is used in many ceremonies such as Royal ceremony, encouragement ceremony, a spirit's house libation, main pillar lifting ceremony, Wai-Khru ceremony, and deity libation.



Figure 8 Baisri

Source: By students at the Departments of Creative Crafts Technology, Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi.

Krathong Folding Techniques

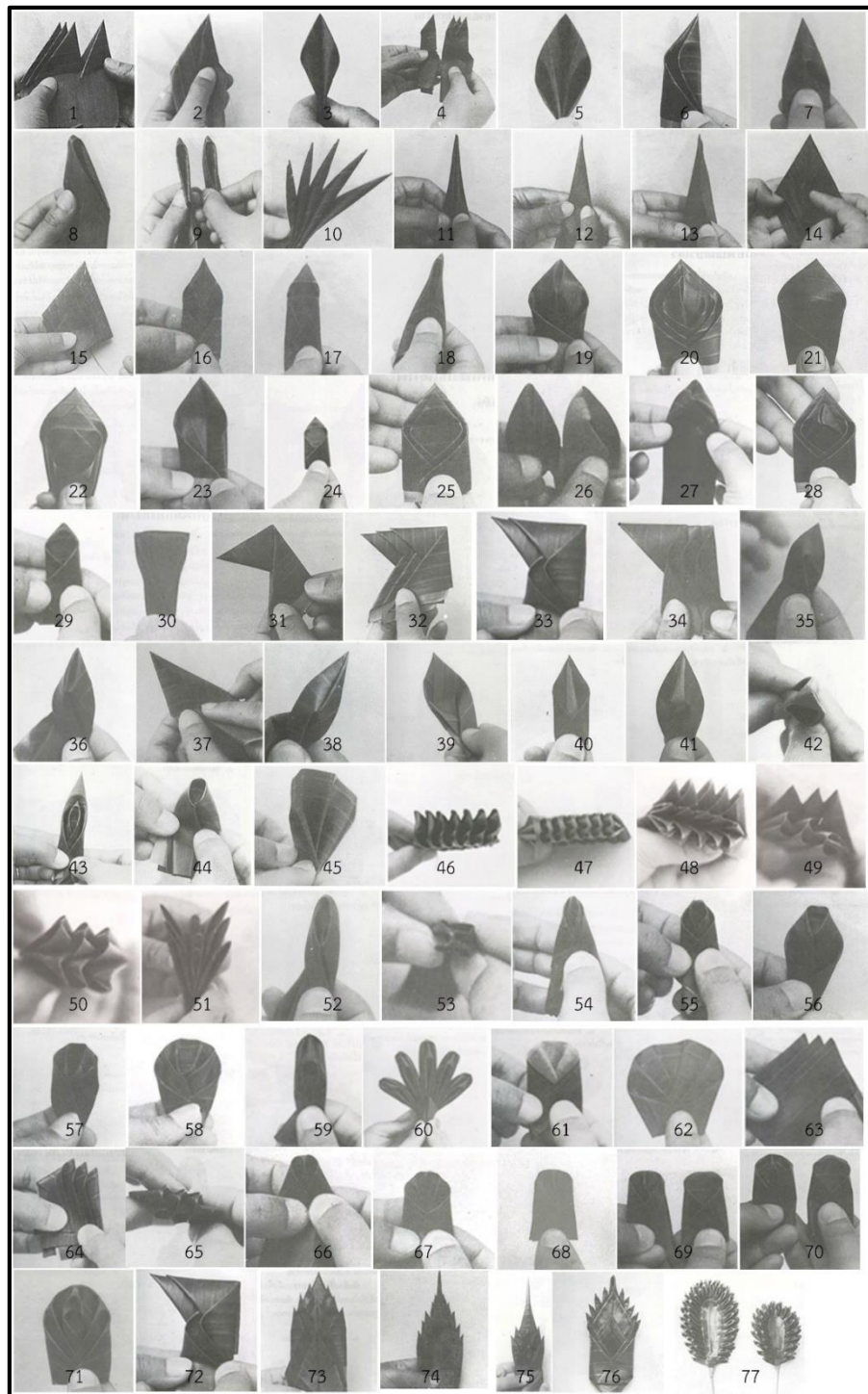


Figure 9 Krathong Folding Technic 77 types

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing.

1. The model of Kleab Fun Pla (Serration)

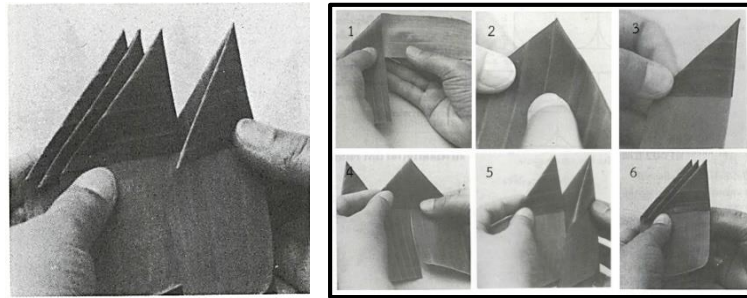


Figure 10 The model of Kleab Fun Pla (Serration)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 86-88.

A serration (Kleab Fun Pla) is the ancient way of folding Krathong. It is the basic of the other folding styles, and it is also used as the body of Krathong.

Directions: 1) Cut banana leaf into 1 3/4 inches wide. Hold the banana leaf by putting the soft edge on the right hand side. Fold the left corner downward to create a right angle edge. 2) Fold the right edge downward to adjoin the the center crease 3) Pull two flaps across each other in the bending pattern. 4) Use your middle finger and index finger to lock the finished fold. Fold the new one. 5) Once the new fold is completed, insert new fold into the previous one in descending order. And 6) Arrange the folds into set of three. Backstitch the folds to bind them together. Backstich is the technique to strengthen the folds.

2. The model of Kleab-Ku Larb Krung Kleab (Half rose petal)

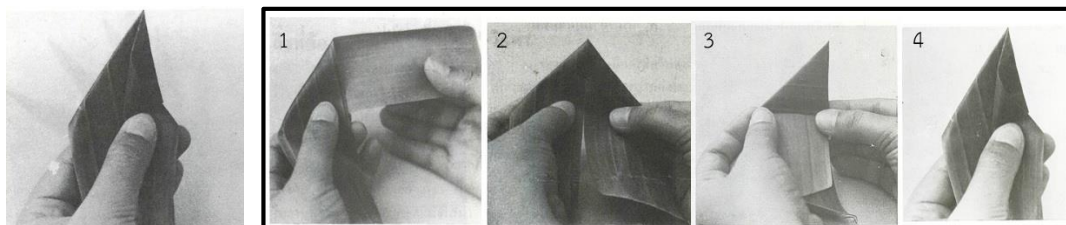


Figure 11 The model of Kleab-Ku Larb Krung Kleab (Half rose petal)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 88-89.

A half rose petal (Kleab Ku Larb Krung Kleab) is used to make a Krathong's body, a plate, or a dish. It is a basic Krathong fold of other Kleab Ku Larb folds and other folding styles.

Directions: 1) Cut banana leaf into 1 1/2 inches wide. Fold the hard edge downward vertically to meet the centre crease to create the triangle. 2) Fold the soft edge to adjoin the other side at the center. 3) Fold both side in half. And 4) Diagonally outside reverse fold to the right. Press the bottom edge firmly by using left thumb to prevent the fraction. If you want to make a dish, Krathong, or a vase with a half rose's petal folding style, you can insert one fold to the other fold to create a set of staright line.

3. The model of Kleab Ku Larb (Rose petal)

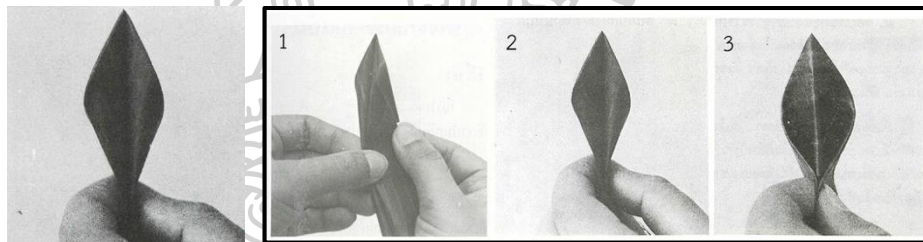


Figure 12 The model of Kleab Ku Larb (Rose petal)

Source: Maneerat Chantanapalin (1997). *Art of banana leaves folding*. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 89-90.

This is a continuing process of a half rose's petal (Kleab Ku Larb Krung Kleab).

Directions: 1) Repeat the steps of the model of Ku Larb Kreung Kleab in another side. 2) Picture shows the front side that looks similar to a rose petal. And 3) Picture shows the back side that looks similar to a budding rose.

4. The model of Kleab Ku Larb Yam (Rose blossom)

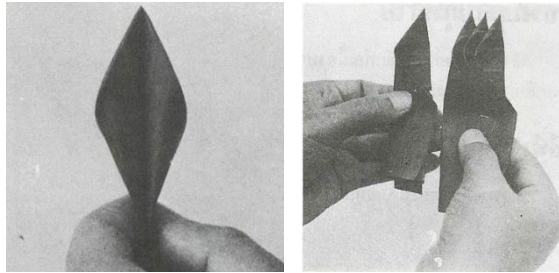


Figure 13 The model of Kleab Ku Larb Yam (Rose blossom)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 90.

Directions: 1) Cut banana leaf into 1 3/4 inches wide and follow the steps of folding Kleab Ku Larb. 2) Insert the folds in to one another by inserting the new fold in front of the previous fold. The new fold that is going to insert into the set is in the left hand in the picture. Turn the diagonal crease outside.

5. The model of Kleab Hu Kratai (Rabbit's ear)

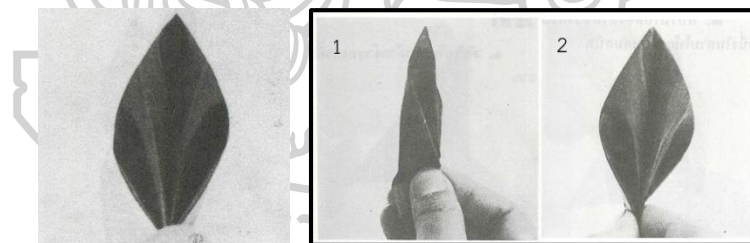


Figure 14 The model of Kleab Hu Kratai (Rabbit's ear)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 91.

Kleab Hu Kra Tai or a rabbit's ear is the fold that looks similar to a rose petal Krathong. Only the model of Hu Kratai requires requires folding in the double reverse patterns.

Directions: 1) Start the same way as you did with rose petal kratong (Kleab-Ku-Larb) but crease the edge back one more time. Repeat the similar steps with the

bottom. Do the same way with the other side. It also has longer strip left in both sides. And 2) Picture shows the front side of the fold.

6. The model of Kleab Puang Komen (Garnet)

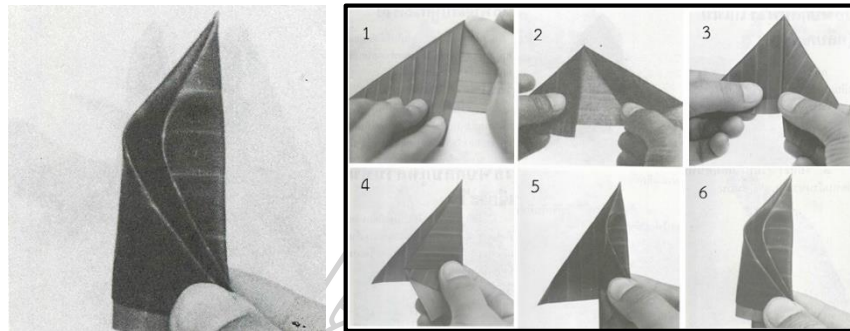


Figure 15 The model of Kleab Puang Komen (Garnet)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 69, 91-93.

A red jade vine Krathong is adapted from the model of Kleab Ku Larb. It looks similar to the Komen (Garnet) which is red and the Dok Khae (Agasta) which is white.

Directions: 1) Fold the edge of a banana leaf in the left hand side downward vertically to create the triangle shape. 2) Fold the edge of a banana leaf on the right hand side downward at the one-third position, and make the sharp top. 3) Fold the right edge to meet at the verticle line. 4) Fold the right edge one more time. 5) Unfold a diagonal crese at the bottom of the fold. And 6) Fold the bottom edge in the same direction to the previous one. Leave some space between each flap. **This fold is good for sewing into a half circle shape or a circle-shaped plate. It can be use to decoreate the vase, a basket , and other models.*

7. The model of Kleab Ku Larb Hin JeaRa Nai (Polished Widow's-thrill)

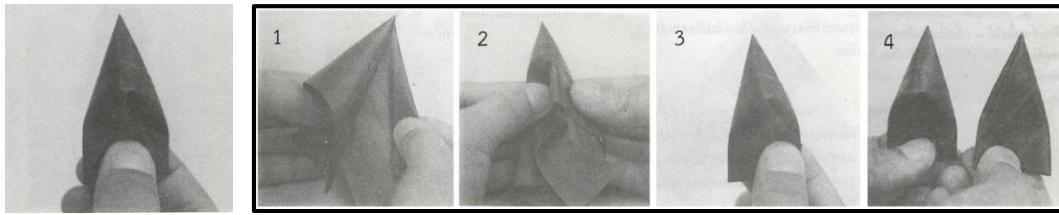


Figure 16 The model of Kleab Ku Larb Hin JeaRa Nai (Polished Widow's-thrill)
Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing; p. 70, 94-95.

The uniqueness of Kleab Ku Larb Hin JeaRa Nai (Polished Widow's-thrill) is its pocket that is similar to the petal of widow's-thrill. It is used to decorate places.

Directions: 1) Cut banana leaf into 1 1/2 – 1 3/4 inches wide. Roll it in cone shape. Fold the right edge inward. 2) Roll up the cone to meet the right fold. The edge of the right fold should locate below the cone. 3) Squash a corner point. Cross the left flap to the right flap, opening the pocket. This is done only with the upper part. And 4) Fold the edge back to the left hand side again (As can be seen in the picture on the left). The back of the fold should appear as in the picture on the right.

8. The model of Kleab-Ratchaphruek (Golden shower three)

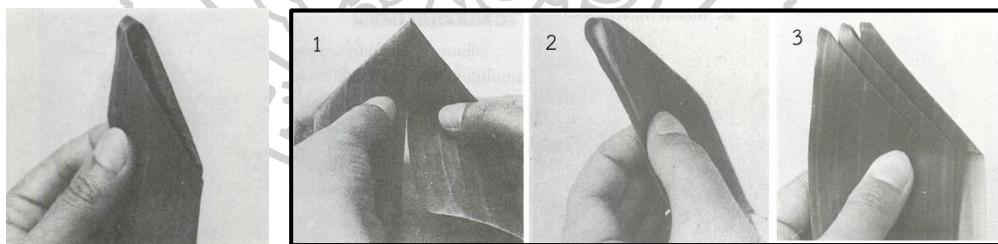


Figure 17 The model of Kleab-Ratchaphruek (Golden shower three)
Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing; p. 70, 95-96.

This is an ancient style of folding Krathong but it is not popular. This style of folding is also able to create a Benjamat fold.

Directions: 1) Use a medium long banana leaf. Cut banana leaf into 1 1/2 inches wide and fold both left side edge and right side edge downward vertically to

meet at the center crease. 2) Outside reverse. And 3) Continue the next fold and covering the new fold to the previous one on the left hand side. Sew every set of three folds and continue connecting it to meet the expected length. Sew one more fold in the middle and decorate its bottom with a Benjamat fold. Pin them.

9. The model of Kleab Baan Chuen (Zinnia)

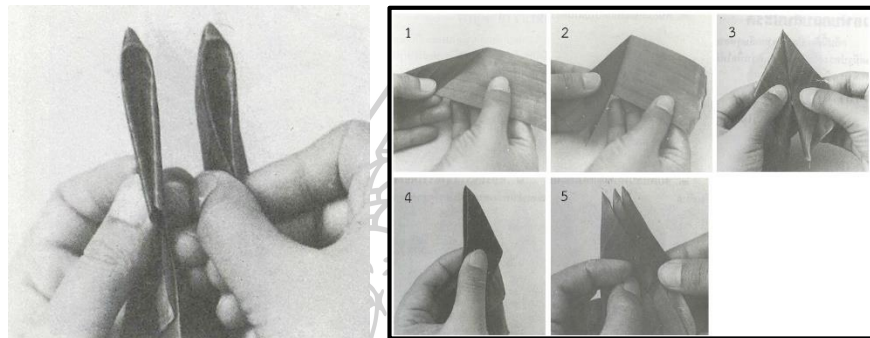


Figure 18 The model of Kleab Baan Chuen (Zinnia)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 70, 96-97.

The purpose of designing a zinnia Krathong or Kleab-Baan-Chuen is to create a fold that is stronger than a golden flower three Krathong (Kleab-Ratchaphruek) folding style. However, both folding styles look quite similar.

Directions: 1) Use a short length banan leaf. Cut a banana leaf into 1 3/4 inches wide for 60 pieces. Fold the left side edge downward vertically. 2) Fold another half downward to create another angle at the center. 3) Double fold the left edge. 4) Outside reverse. And 5) Insert the second and the thrid folds into the first one on the left hand side. Sew them to create a body of Krathong. Decorate it with three folds of Kleab-Pha-Ka in each set. There are five layers of the body. Thus, the sizes of Kleab-Pha-Ka in each set are 1 1/4 inches, 1 1/2 inches, and 1 3/4 inches wide.

10. The model of Kleab Niu Meau Nang (Lady's Fingers)

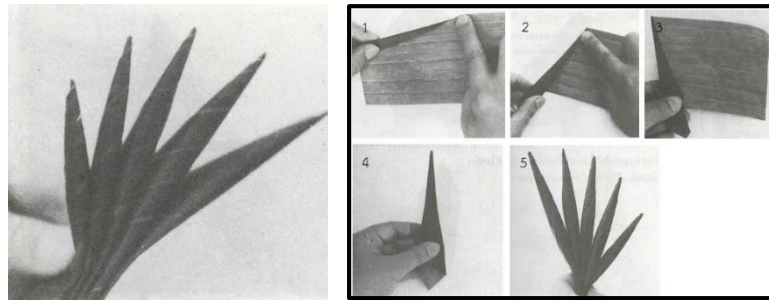


Figure 19 The model of Kleab Niu Meau Nang (Lady's Fingers)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 70, 100-101.

Directions: 1) Cut five sizes of banana leaf, that are 2 inches, 2 1/4 inches, 2 1/2 inches, 2 3/4 inches, and 3 inches wide. 2) Hold the hard edge of the banana left with left hand, fold it in for 1/2 inches. With the right fingers, fold the 3 inches space of the right edge diagonally to meet the left corner. 3) Roll the base of the fold. Make sure that the top is stable, and it should be sharp and tight. 4) Roll it inward to the middle line. 5) Continue folding it to the end of the banana leaf. Turn the edge of the fold into the middle position. And 6) Roll four more pieces, and put the five pieces in descending order. Make sure that the finished edge of the folds turn to the back side. Arrange the top of the fold in to different layer.

11. The model of Kleab Na Nak (Naga's face)

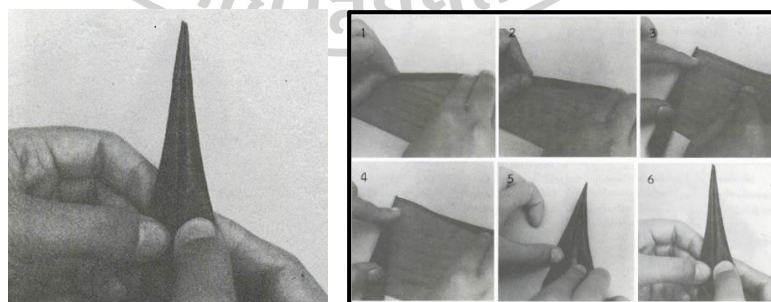


Figure 20 The model of Kleab Na Nak (Naga's face)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 70, 101-103.

Naga face Krathong or Kleab Na Nak is the ancient way of making naga face baisri. It can be also used to decorating the other models.

Directions: 1) Cut the banana leaf into 2 inches wide. Hold the hard edge with left hand. Fold the 1 centimeter of the edge inward. With the right fingers, press the spire of the unit. Make sure the spire lasts around 4 – 5 inches. 2) Fold the half one more time with left hand. 3) Roll the flap inwards. Make sure it is steady and firm. Stop rolling when it reaches the centre crease. 4) Start folding the right side at 0.5 centimeters. 5) Keep folding until there is a small space left. And 6) Fold the right edge onto the left edge. Make both side looks equally big.

12. The model of Kleab Chiang Mai Na Nak (Naga's face in Chiang Mai Style)

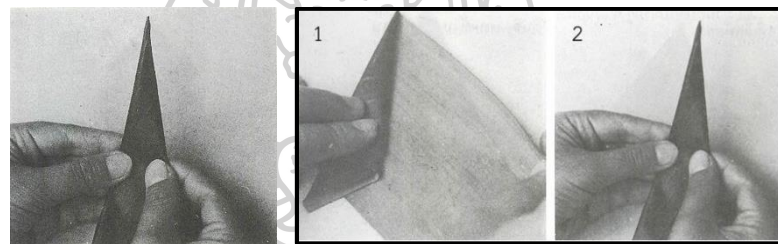


Figure 21 The model of Kleab Chiang Mai Na Nak (Naga's face in Chiang Mai Style)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 103-104.

Chiang Mai naga face Krathong or Kleab Chiang Mai Na Nak is the way of creating baisri by peopl in Chiang Mai province.

Directions: 1) Strat by folding the edge in 3/4 inches wide and 4 inches long. Fold the left side to the right side. Fold it a little further than the vertical line. And 2) Fold the right edge inward. Make is as wide as the left side. When is is almost done, equally extend the left and right flaps to create the spire.

13. The model of Kleab Hang Hong (Swan's Tail)

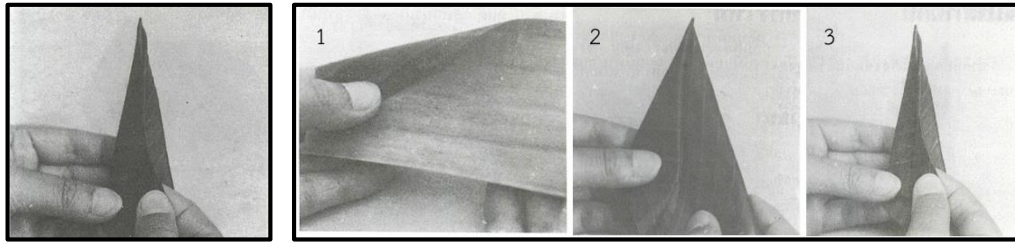


Figure 22 The model of Kleab Hang Hong (Swan's Tail)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 104-105.

Swan's tail Krathong or Kleab Hang Hong was adapted from Kleab Na Nak. It has a beautiful curve line.

Directions: 1) Cut a banana leaf into 3 1/2 inches wide each. Repeatedly fold the left flap. 2) Stop folding when there are 2 1/2 inches left. Repeatedly fold the right flap to meet the left flap. And 3) Lift the right flap and swing it upwards (Similar to the Kleab-Ku-Larb techniques). Make a beautiful curve line. When it is on the Baisri, it should look like a Swan is moving its wings and tail. That is the rationale behind the name "Kleab Hang Hong."

14. The model of Kleab Phaka (Flower)

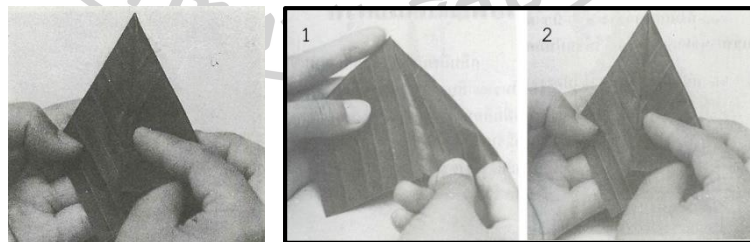


Figure 23 Directions: The model of Kleab Hang Hong (Swan's Tail)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 105.

Directions: 1) Cut a banana leaf into 1- 1 3/4 inches wide. Fold the 1/3 section of the left edge downward and fold the right to meet the left edge. And 2) Fold the

right edge again to the center crease. The spaces occupied by the left and right edges are now equal.

15. The model of Kleab Phaka Son (Layered Flower)

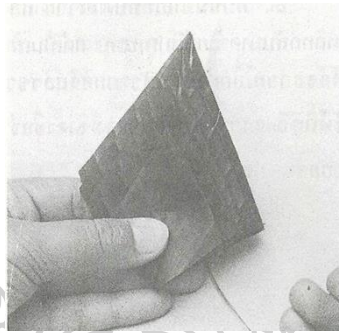


Figure 24 The model of Kleab Phaka Son (Layered Flower)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 106.

Directions: Layer the Kleab-Pha-Ka into a set of 2-3 units, and then sew them together.

16. The model of Kleab Leb Krut (Garuda's nail)

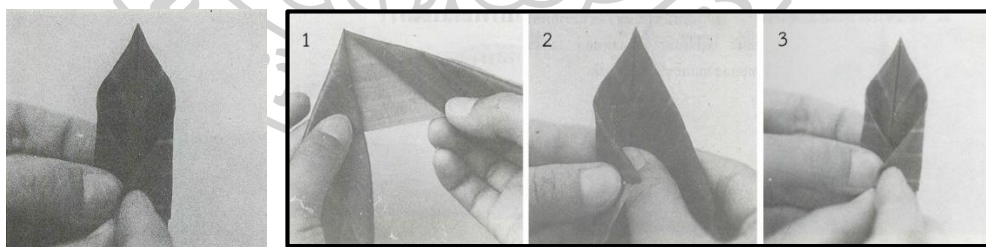


Figure 25 The model of Kleab Leb Krut (Garuda's nail)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 106-107.

This is the unnamed and ancient way of folding Krathong. There is no original name for this folding style. However, it was called "Kleab-Leb-Kruth" because of its sharp and strong look. It is used to decorate Krathong or cone.

Directions: 1) Cut a banana leaf into 1 1/4 inches wide. Double fold each side. 2) Fold the left edge to the right corner. And 3) Fold the right edge to the left corner.

17. The model of Kleab Bua Sai (Red Indian Water Lily)

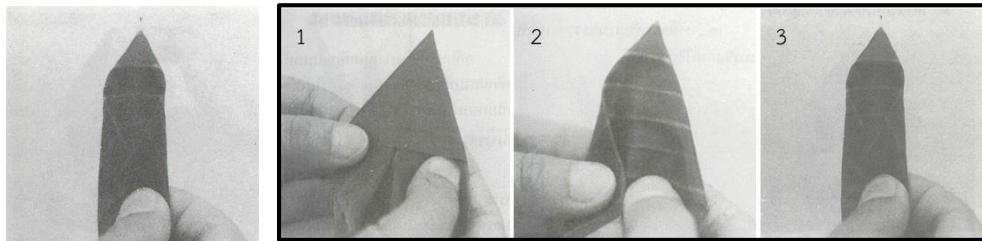


Figure 26 The model of Kleab Bua Sai (Red Indian Water Lily)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 71, 107-108.

A water lily Krathong or Kleab Bua Sai is a way of folding ancient Krathong. There is no original name, so the writer name it this way to avoid confusion.

Directions: 1) Cut a banana leaf into 1 1/2 inches wide. Fold it the same way as you did with Kleab Leb Krut. Before the last step of folding, cross the fold at the front to flip the back side. 2) Fold the left diagonal edge to the right corner. And 3) Fold the right diagonal edge to the left corner.

18. The model of Kleab Lep Meu Nang (Rangoon Creeper)

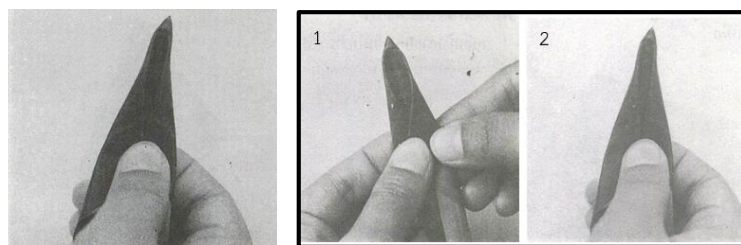


Figure 27 The model of Kleab Lep Meu Nang (Rangoon Creeper)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 108.

Kleab Leb Meu Nang is adapted from Kleab Bua Sai. It is used to decorate a cone, Krathong, threshing basket, and tray.

Directions: 1) Start the same way as you did with the Kleab Bua Sai. Adjoin the left and right diagonal edges. Leave space in the middle narrower than the space of Kleab Bua Sai. And 2) Fold it downward to adjoin both edges as shown in the picture.

19. The model of Kleab Rak Rae (Dahlia Rosea)

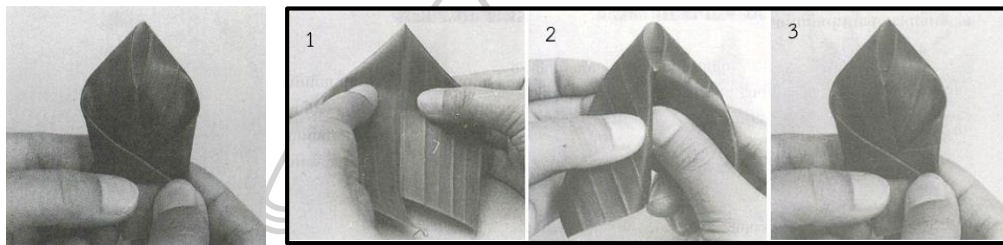


Figure 28 The model of Kleab Rak Rae (Dahlia Rosea)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 109.

This model is adopted from Ajarn Yeuan Phanuthat. This model is delicate. It requires a gentle fold. You should not scratch it with anything because it bruises easily. This kind of fold is delicate and beautiful.

Directions: 1) Cut a banana leaf into 1 1/2 inches wide and 3 – 3 1/2 inches long. Fold the right and left side downward vertically. 2) Press the crease up, creating a pocket. Fold the left flap to the right. And 3) Fold the left edge to cross over the right edge.

20. The model of Kleab Rak Rae Son (Layered Dahlia Rosea)

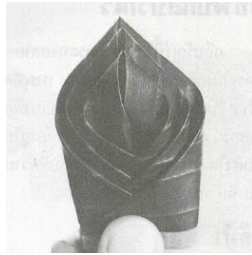


Figure 29 The model of Kleab Rak Rae Son (Layered Dahlia Rosea)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 110.

The way to fold Kleab Ruk Rae Son is similar to Kleab Ruk Rae. You can do it by placing the Kleab-Ruk-Rae into layers. Squash a front corner point, opening the pocket. Then, unit by unit, fold the flap diagonally across the vertical center crease.

21. The model of Kleab Ka Long (Snowy Orchid Tree)

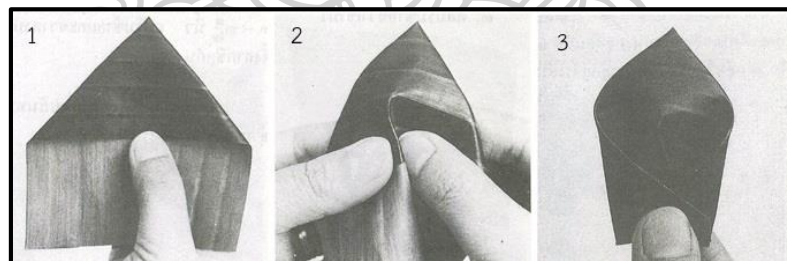


Figure 30 The model of Kleab Ka Long (Snowy Orchid Tree)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 110-111.

The way to fold Kleab Ka Long is quite similar to Kleab Ruk Rae. The differences between these two models are as follows:

Directions: 1) Cut a banana leaf into 1 1/2 inches wide. Fold the right and left side downward vertically and flip back side to the front. 2) Press the crease up, creating a pocket. And 3) Pull two edges across each other in the bending pattern. Make sure that the pocket is not fractioned.

22. The model of Kleab Ka Long Son (Layered Snowy Orchid Tree)

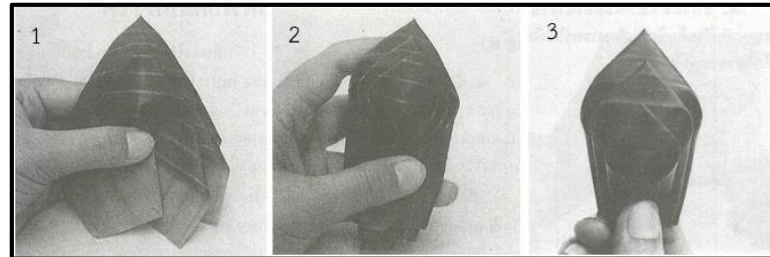


Figure 31 The model of Kleab Ka Long Son (Layered Snowy Orchid Tree)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 111-112.

The way to fold Kleab Ka Long Son is quite similar to Kleab Ka Long.

Directions: 1) Start folding three Kleab Ka Long folds and place them into a set of three layers. Create a bulge of three folds at the same time. 2) Unit by unit, fold the flap diagonally across the vertical center crease until all three layers are completed. And 3) Layer the fold by placing two or three Kleab-Ga-Long folds on top of each other. Place the biggest one at the bottom and the smallest one on top.

23. The model of Kleab Chongko (Purpurea Linn)

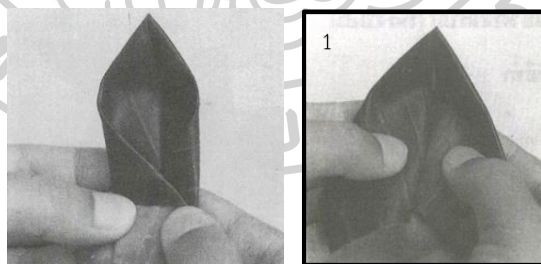


Figure 32 The model of Kleab Chongko (Purpurea Linn)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 72, 112.

Kleab Chongko (Purpurea Linn) looks like Kleab-Ga-Long is and it is suitable for decorating Krathong Jerm. It is Called Chong-Ko because it looks similar to a purple orchid or Chong-Ko flower. The name was also given as a memorial for the students*

to win the Krathong Jerm competition at Baan Somdet Chaophraya Teacher College in April 19, 1982.

Directions: 1) Cut a banana leaf into 1 1/2 inches wide. Fold the left edge and right edge downward and adjoin them. Create a spire. Squash a front corner point, opening the pocket. **She was a sophomore undergraduate from Suan Dusit Teacher College. Her name was Miss Ketsara Srirakarn.*

24. The model of Kleab Feuang Fa (Paper Flower)

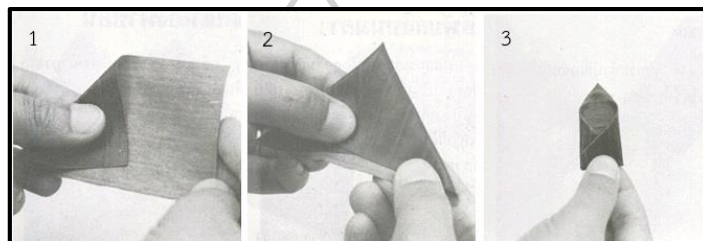


Figure 33 The model of Kleab Feuang Fa (Paper Flower)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 73, 113.

Directions: 1) Fold the left edge a little over the center line to the right. 2) Cover the left edge by folding a right edge over it. Make sure that the corners are in equal size, and the top is sharp. And 3) Turn it over and pull two edges to cross each other.

25. The model of Feuang Fa Son (Layered Paper Flower)

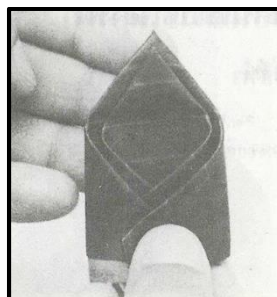


Figure 34 The model of Feuang Fa Son (Layered Paper Flower)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 73, 113-114.

Directions: A layered paper flower or Kleab Feuang Fah Son is adapted from Kleab-Fueng-Fah. After finishing the step two folding of Kleab Feuang Fah, and turn it over.

26. The model of Kleab Nom Saw (Nom Saw Flower)

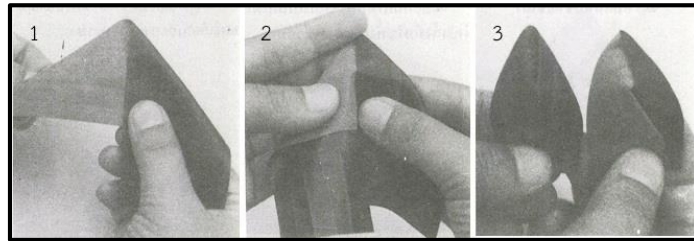


Figure 35 The model of Kleab Nom Saw (Nom Saw Flower)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 73, 114-115.

Kleab-Nom-Sao was demonstrated by one of the students. It can be folded using rose petal, Banburi (Allamanda), or Phlapphleung (Crinum Lily). It can be used to decorate the other models. It looks really nice when using it to make a flower ear wearing, or to decorate the flower work.

Directions: 1) Fold the right edge downward vertically. Turn it over and Fold the left edge vertically. 2) Squash a corner point, opening the pocket. Place the left fold onto the right fold. And 3) The right side picture shows the finished fold. If the durable, fresh green colour is needed, fold the ivory side in the step no. 1, as the finished one is shown on the left.

27. The model of Kleab Kajorn (Cowslip)

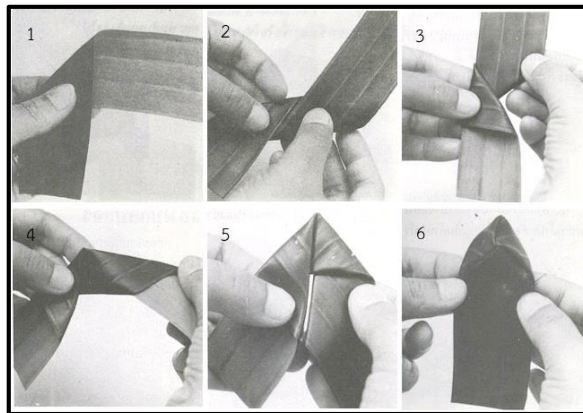


Figure 36 Directions: The model of Kleab Kajorn (Cowslip)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 73, 115-117.

The original creator is unknown. The techniques were delivered by the process of memorization.

Directions: 1) Fold the left edge downward vertically. 2) Fold the right edge upward vertically, and adjoin the previous fold. 3) Fold the left edge inside. 4) Fold the right edge to the right, and then fold it downward. 5) Fold it downward, and cross the right bottom over the left bottom. And 6) Cross and insert the left to the right and make them meet the corner.

28. The model of Kleab Fueng Fah Kha Jorn

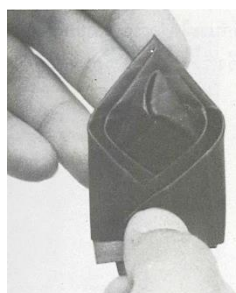


Figure 37 The model of Kleab Fueng Fah Kha Jorn

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 117.

Directions: Insert Kleab Kra Jorn into Kleab FuengFah. This is called “Kleab Fueng Fah Kha Jorn.”

29. The model of Kleab Nang Yam (Glory flower)

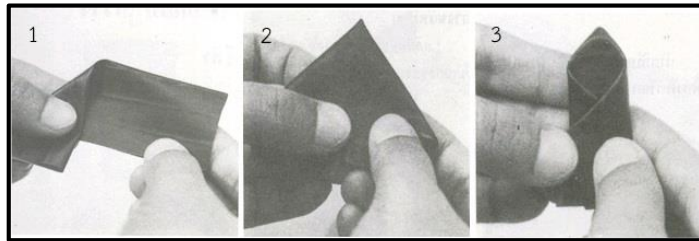


Figure 38 Kleab Nang Yam (Glory flower)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 117-118.

Directions: 1) Fold a banana leaf into two layers. Fold the left edge downward vertically. 2) Fold the right edge to meet the other side, and flip the back side to the front. And 3) Fold ad cross left and right edges. It will create the space that makes it looks similar to a fetal of Glory flower (Dok Nang Yam). Thus, it is called Kleab-Nang-Yam.

30. The model of Kleab Hu Kwang (Indian Almond)

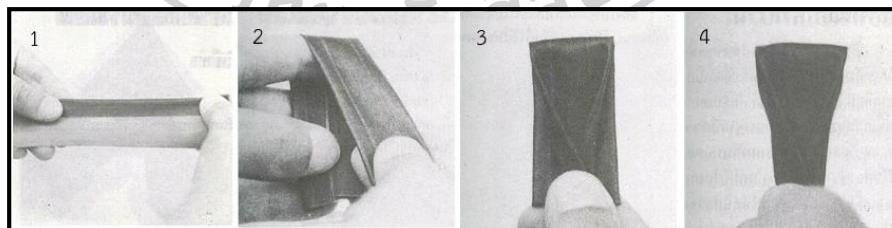


Figure 39 The model of Kleab Hu Kwang (Indian Almond)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 118-119.

Directions: 1) Fold 1 : 4 of the leaf from the left edge. 2) Fold 1 : 4 of the leaf from the right edge. The edges of both side should meet at the center. Fold the

upper edge downward. 3) Fold and cross the right edge and the left edge to meet at the center. This is called “Huu-Kwang-Dan-Deaw (One-sided Hu Kwang).” And 4) Fold another side by following the same previous techniques. It will create the shape like Hu Kwang. Therefore, it is called “Kleab-Hu-Kwang.”

31. The model of Hua Kwan (Woodpecker)

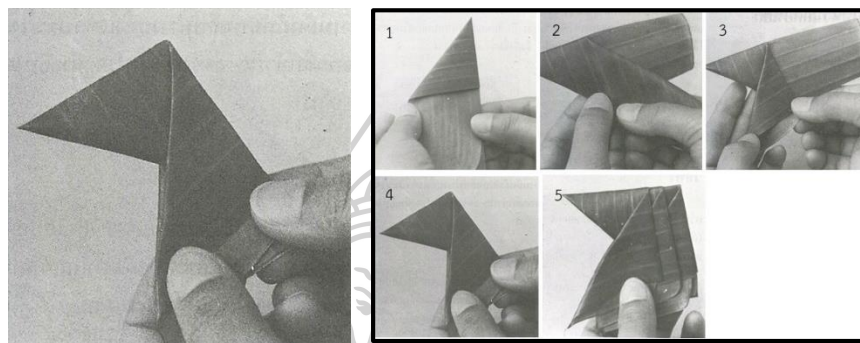


Figure 40 The model of Hua Kwan (Woodpecker)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed. Bangkok: Amarin Printing and Publishing: p. 120-121.

Kleab Hua Kwan can be called in many ways such as Kleab Hua Nok (Bird's head). It is because this kind of fold looks like all the mentioned name. It is the standard ancient Krathong folding technique. It is very durable. It requires a long banana leaf because it requires many steps of folding. It is used as the inner part of Krathong, vase and other containers.

Directions: 1) Use the long and straight line banana leaf. Cut a banana leaf into 1 1/2 inches wide. Start the same way as you did with Kleab-Ku-Larb. Then, flip the edge up. 2) Flip the front bottom down to the edge of the leaf. 3) Fold it to the left one more time. 4) Fold the back side by using the front side steps. When it is done, it will look similar to the bird's head, an anx, or a horse's neck. That is the reason behind the three names, that are : Kleab Hua Kwan, Kleab Hua Nok, and Kleab Kor Mah. And 5. Insert three folds to each other in a straight line. Leave 1/4 inches space for each fold. Adjust them and lock them by sewing them with tread.

32. The model of Hak Kor Ma or Hua Nok Kor Yak (Indented-headed Bird)

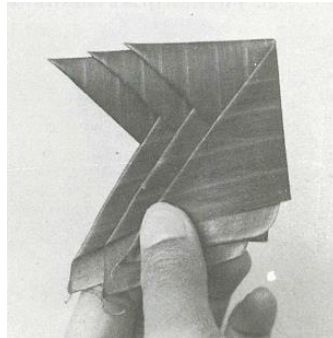


Figure 41 The model of Hak Kor Ma or Hua Nok Kor Yak (Indented-headed Bird)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 122.

Directions: The ways to create Kleab Hua Nok Kor Yak are similar to Kleab Hua Nok, but you need to insert one fold inside another fold to create a notched pattern.

33. The model of Kleab Hua Nok Lai Pia (Braid-like Bird)

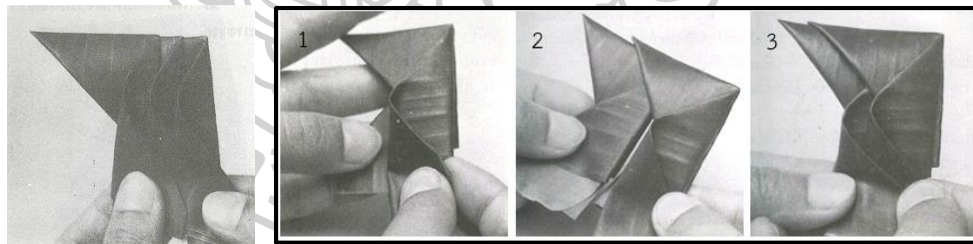


Figure 42 The model of Kleab Hua Nok Lai Pia (Braid-like Bird)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 74, 122-123.

The ways to fold a Kleab Nok Hua Lai Pia are similar to Kleab Nok. The following directions need to be followed.

Directions: 1) Fold the edge back vertically. Make sure that the angle of reflective is equal to the angle of incidence. Do not wring the curve and do not create a corner. Make both side similar to each other. 2) Fold another piece of fold. Then,

insert the new one to the previous one on the left side. And 3) Leave the space appropriately, and then flip the bottom of the fold to create the braid line. Each set of Krathong consists of three folds, sew each set with tread.

34. The model of Kleab Hua Kwan Plaeng (Adapted Woodpecker)

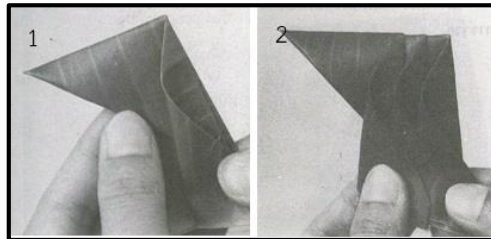


Figure 43 The model of Kleab Hua Kwan Plaeng (Adapted Woodpecker)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 74, 123-124.

A modified axe Krathong or Kleab Hua Kwan Plaeng used the same techniques as in the Kleab Nok Hua Klai Pear folding directions. The different is found during the stage of folding the angle of reflective and the insert technique.

Directions: 1) Flip the edge to create an angle of reflective. And 2) Insert another fold at the sharp top. Flip the diagonal edge to the same direction. Leave the appropriate space (approximately 1/4 inches.). Each set of Krathong consists of three folds, sew each set with tread. It looks similar to Ku-Larb-Yam Krathong.

35. The model of Kleab Sattaban (Sattaban Lotus)

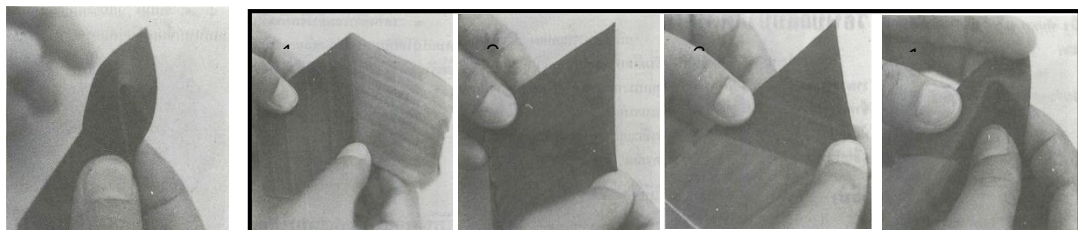


Figure 44 The model of Kleab Sattaban (Sattaban Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 75, 124-125.

Kleab Sathabun is the ancient fold. Initially, this model is untitled. It is name this way to avoid confusion. It looks like a small lotus. It is used for decorating a cone and Krathong body. It is also created a pattern on a plain area.

Directions: 1) Use the short banana leaf. Cut a banana leaf into 1 1/2 inches wide. Fold 1:3 of the leaf to the right. 2) Fold the right edge to the left to meet the left corner. 3) Fold the back side to the front. 4) Hold the corner, press the right hand. Lift the left edge cross to the right. And 5) Cross the bottoms. If you are not keen enough, sew it with tread. Then, sew at the six corners of Krathong. If you are an experts, you do not have to sew the folds before sew them at the corner of Krathong.

36. The model of Kleab Sattabut (Sattabut Lotus)

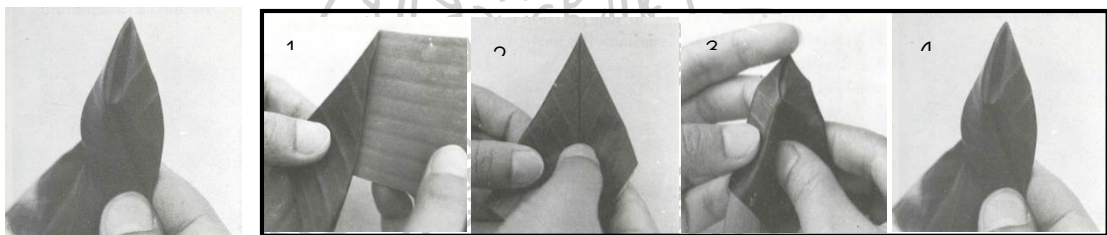


Figure 45 The model of Kleab Sattabut (Sattabut Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 75, 126-127.

Kleab Sattabut is the ancient way of folding Krathong. Initially, this model is untitled. It is name this way to avoid confusion. It is used for decorating a cone and Krathong body. It is also created a pattern on a plain area.

Directions: 1) Cut a banana leaf into 1 1/2 inches wide. Fold the left edge diagonally to meet the centre crease to create the triangle shape. 2) Fold the right edge diagonally to meet the centre crease to create the triangular spire. 3) Hold the corner, press the right hand. Lift the left edge cross to the right. And 4) After finished the fold, cut the bottom to make it equal to the fold.

37. The model of Kleab Na Chang (Elephant's Face)

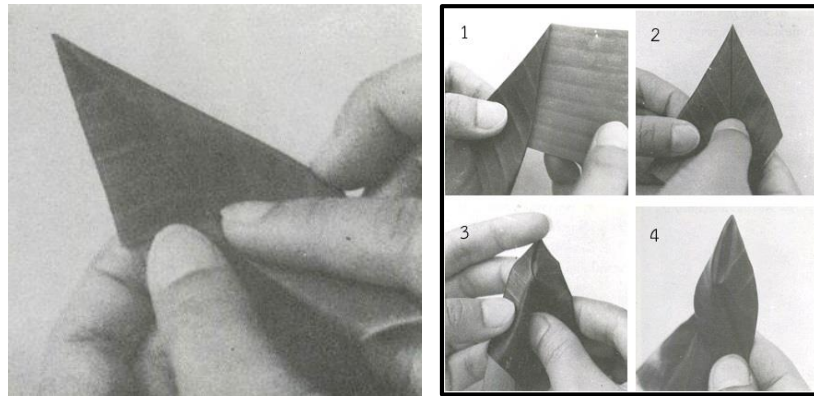


Figure 46 The model of Kleab Na Chang (Elephant's Face)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 75, 127-128.

Kleab Na Chang is an ancient way of folding Krathong. It is used to create baisri. It is also good for dimensioning other models.

Directions: 1) Cut a banana leaf into 2-3 inches. Fold the hard edge (left side) to create a right angle. 2) Fold the left side one more time. 3) Fold the right edge to adjoin the edge line. And 4) Fold the right edge a a little bit over the left side.

38. The model of Kleab Sattabongkot (Sattabongkot Lotus)

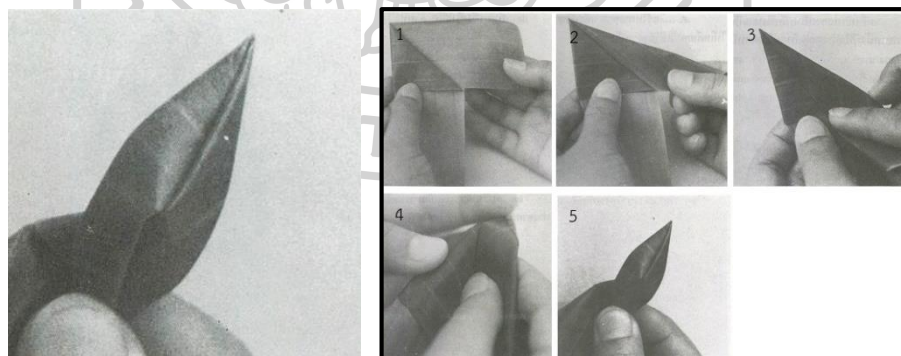


Figure 47 The model of Kleab Sattabongkot (Sattabongkot Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 75, 128-130.

Kleab Sattabongkot is an ancient way of folding Krathong. It looks like a double red lotus. It has a strong sharp top. It is used for decorating Krathong's body, a cone , a vase, and etc.

Directions: 1) Use the short banana leaf. Cut a banana leaf into 1 1/2 inches wide. Fold the left flap across to the bottom and pool out to the right. 2) Fold the right edge to meet the centre crease. 3) Fold it one more time. 4) Nudge the bottom by press the middle edge line down. Lift the edge on the left up. And 5) Cross it to the right. Then, cut the bottom to make it equal to the fold.

39. The model of Kleab Bua Luang (Royal Lotus)

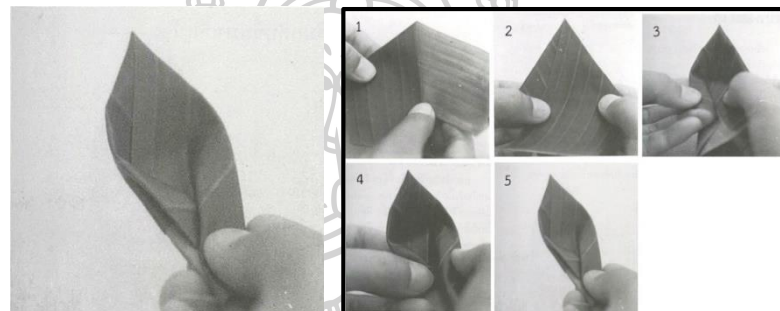


Figure 48 The model of Kleab Bua Luang (Royal Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 130-131.

Kleab Bua Luang is an ancient way of folding Krathong. It looks like an Indian lotus. The two corners of the fold make it different from other folding styles. It is used for decorating Krathong's body, a cone , a vase, and etc.

Directions: 1) Use the short banana leaf. Cut a banana leaf into 1 3/4 inches wide. Fold 1:3 of the leaf to the left. 2) Fold the right edge to the left. Leave the space from the left edge for 1/4 inches. 3) Cross the left edge to create a corner. Press the right side with the right hand. 4) Hold the right corner, and repeat the previous steps. And 5) The picture shows the finished Krathong fold. The corner is adjustable based on the location of using the Krathong fold. For example, if you want to decoratate the edge of the dish or the bottom of the pan, you need to adjust it flat at the outside but a little up at the inside.

40. The model of Bua Ngern (Silver Lotus)

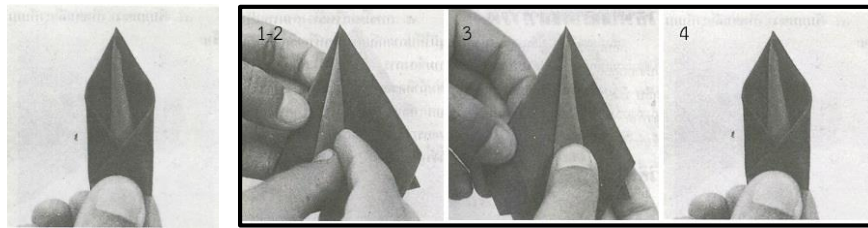


Figure 49 The model of Bua Ngern (Silver Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 132-133.

KleabBua Ngern is the new design of krathing fold. It was designed in April 1986. It is unique as its ivory color shown in the center of the model in the same fashion as the model of Sattabongkot.

Directions: 1) Start the same way as you did with Kleab-Pha-Ka, which is to fold 1 : 3 of the left side to the right. 2) Fold the right edge to the left and flip it a little. 3) Fold it twice, leave the ivory color in the middle. And 4) Cross both edge over each other. This fold is appropriate in decortating a flower tray, or creating a flower. It helps reducing the use of flowers because it has a combination of light color and dark green.

41. The model of Bua Thong (Golden Lotus)

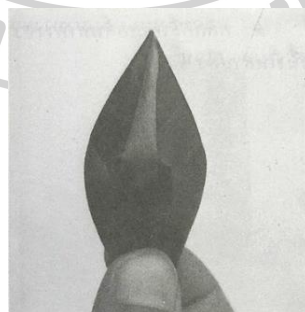


Figure 50 The model of Bua Thong (Golden Lotus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 133.

Directions: Kleab Bua Thong is adapted from Kleab-Bua-Ngen. It replicates the steps no. 1 – 3 of the model of Bua Ngen. Only the last step that requires the two outer flaps to be folded in to the vertical centre crease (This model is reversed version of the model of Bua Luang.)

42. The model of Montarop (Magnoliaceae)

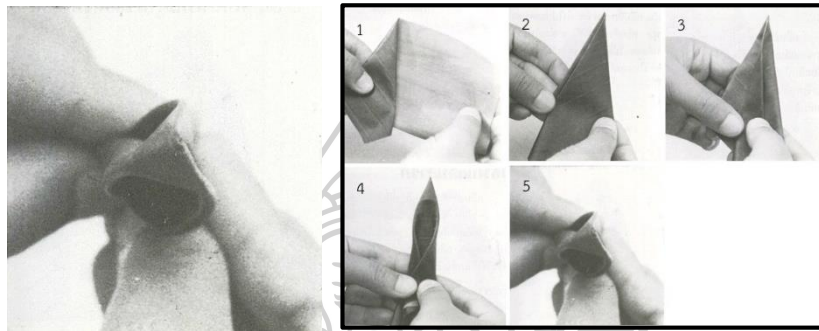


Figure 51 The model of Montarop (Magnoliaceae)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 134-135.

Kleab-Montarop is quite unique because it contains three flaps around the crease creating the outside and inside crimp like the model of Leb Meau Nang. If the flap is large, its front layer could be decorated with the model of Leb Meau Nang.

Directions: 1) Start folding by following Kleab Nah Chang folding steps that is folding the left edge to create a right angle, and fold it again. 2) Fold the right edge down to adjoin the edge of the left side, and then fold it equally to the left. 3) Flip 1 : 3 of the upper part to the right. 4) Flip the back side to the front, and cross both edges to create a space. And 5) Picture shows the upper side of the fold. If the fold is small, you can use it as it it.

43. The model of double Montarop (Magnoliaceae)

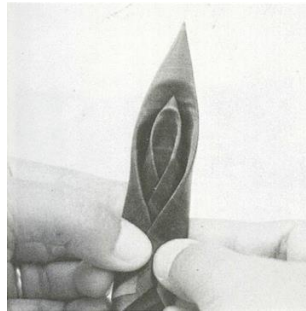


Figure 52 The model of double Montarop (Magnoliaceae)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 135.

If the fold is big, insert a Leb Meau Nang fold in it before following step 4. People use this kind of fold to decorate the cone of flower.

44. The model of Kleab Saarapee (Saarapee blossom)

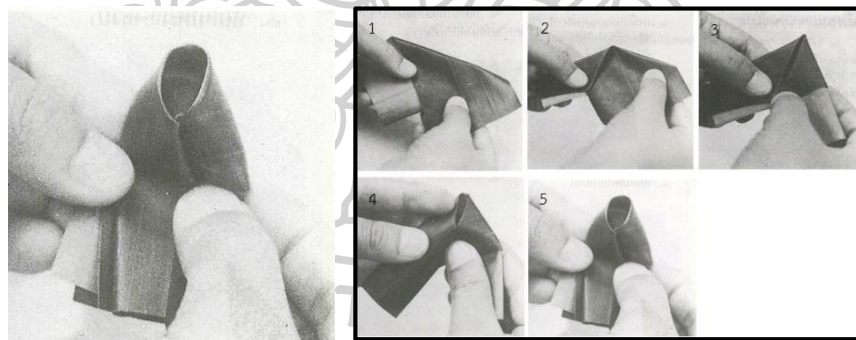


Figure 53 The model of Kleab Saarapee (Saarapee blossom)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 136-137.

Kleab-Saaraphee is the fold that have round tip. It is quite strong, and more durable than Kleab Buakradong, Kleab Rattanamalee, Kleab Maneelada, Kleab Pakakrong, and etc. It is appropriate to use as a decorating fold.

Directions: 1) Fold the banana leaf to make a diagonal at 55 degrees. 2) Fold the left edge downward vertically. 3) Fold the right edge to adjoin the left one.

4) Press both side down to bulge the corner. And 5) Cross the left edge over the right. It will create the oval space that look like Saaraphee flower. Therefore, it is named as Kleab Saaraphee.

45. The model of Kleab Bua Kradong (Victoria Amazonica)

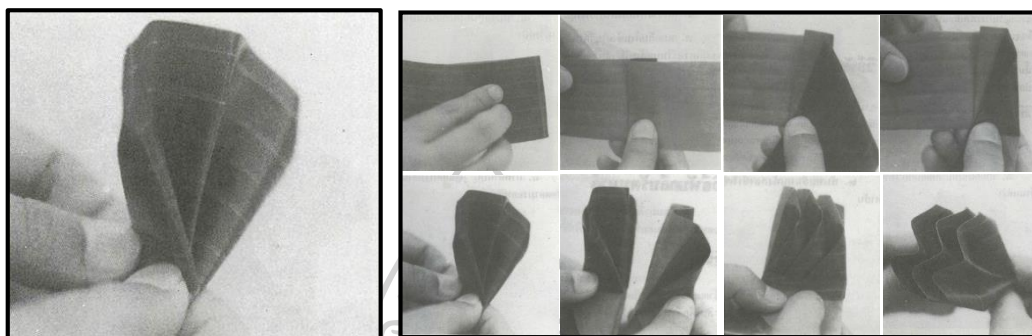


Figure 54 The model of Kleab Bua Kradong (Victoria Amazonica)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 77, 137-140.

The model of Kleab Bua Kradong was long created by the respective teacher. This model is unique because its edges are multiple and continuous. It is suitable for decorating the rim or edge of the big bamboo basket. To fold this model, one is required to be so skillful in other models that their hands are gentle enough for folding this model. In addition, it is recommended that this model should be done during winter or monsoon seasons. Summer is not an appropriate time for the heat could easily spoil the edges of this model.

Directions: 1) Use a long banana leaf. Cut a banana leaf into 2 – 2 1/2 inches wide. For the bigger size, cut a banana leaf into 2 1/2 inches wide. Fold the right edge to the left. 2) Inside-reverse- fold the 0.5-inch right portion of this layer as you return the corner to the left. 3) Squash-fold the upper right sections, being careful to make the squash creases hit the center of folded line made in the previous step. 4) Using the existing crease, fold over, repeat over the previous creases. 5) Repeat the same folding process on the other side (The picture depicts the creases.) 6) Tuck in each corner to form rounder shoulders. 7) After the 3 creases are tucked and sewn together, your

model should now look like this. And 8) The picture shows the upper view of how to insert the fold to each other.

46. The model of Kleab Rattanamalee (Rattanamalee Blossom)

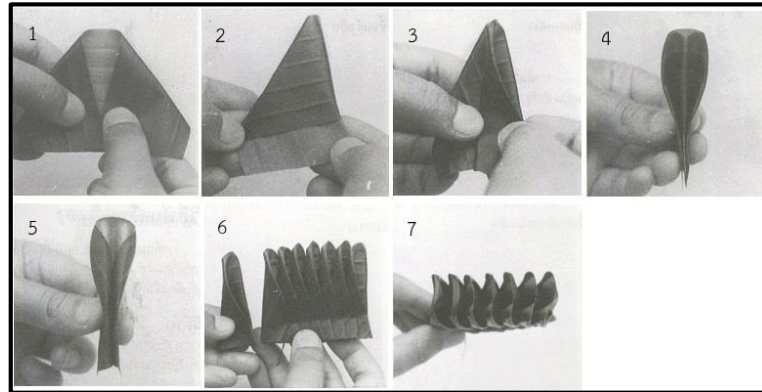


Figure 55 The model of Kleab Rattanamalee (Rattanamalee Blossom)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 140-142.

Kleab Rattanamalee is the beautiful but fragile fold. It needs a special care when folding because it can get bruised easily.

Directions: 1) Cut a banana leaf into 2 inches wide. Fold and cross the left side and right side partly onto each other. Make sure the crease is 1/2 inches wide. 2) Fold both sides to each other in half. 3) Flip the edge to meet the center crease. 4) Repeat step 3 with another side. The picture shows the back side of the fold. 5) Picture shows the front side of the fold. 6) Picture shows the arrangement of the folds in descending order. Sew it to keep it in shape. **This kind of fold is good for making Krathong's body, Vase, Basket, flask, and jar. It is also good for decorating the edge of tray, plate, and etc.* And 7) Picture shows the upper side of the folds.

47. The model of Kleab Maneelada (Maneelada blossom)

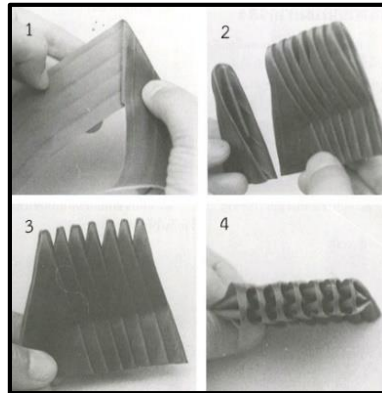


Figure 56 The model of Kleab Maneelada (Maneelada blossom)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 142-143.

Kleab Maneelada is a fold that continues the stages from Kleab Rattanamalee. It is fragile. It needs special care when folding.

Directions: 1) Cut a banana leaf into 1 1/2 – 1 3/4 inches wide. Fold 1 : 3 of the left edge to the center crease. Fold it twice, so you get three creases. 2) Fold the left side by following step 1. Insert the fold in front of each other in descending order. 3) The picture shows the front side of the folds after sewing. Use this side as the front side presentation. *** This kind of fold is good for making Krathong's body, Vase, Basket, flask, and jar. It is also good for decorating the edge of tray, plate, and etc. And 4) Picture shows the upper side. The ways to use Kleab Maneelada is similar to Kleab Rattanamalee.

48. The model of Phakakrong (Weeping Lantana)

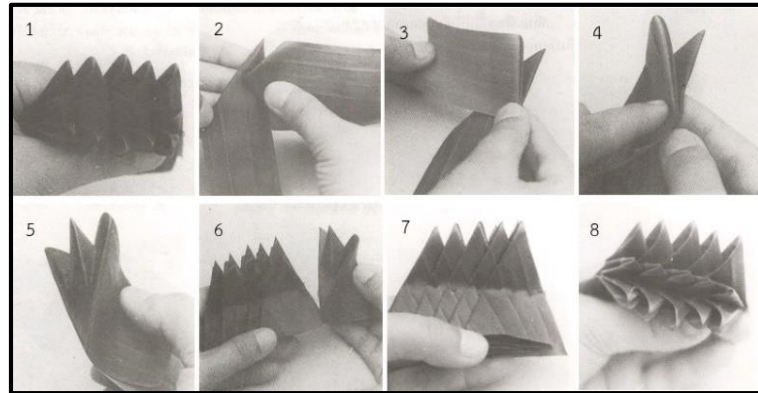


Figure 57 The model of Phakakrong (Weeping Lantana)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 144-146.

Although this model is similar to the model of Phiseua, it is a converted version of the model of Phiseua. The stronger unit functions as a core of the model while the more fragile one functions as a sepal.

Directions: 1) Start from the long banana leaf strip : 1 1/2 inch wide. The first step of this model replicates the first step of the model of Kleeb Kularb. 2) Creating the outside crimp by moving the right strip onto the left strip. The pattern of crease is identical on the layer underneath. 3) Fold the right strip to the left. 4) Fold the left edge diagonally to meet the centre crease. Then, repeat the process with the right edge. 5) Left picture : the lateral surface. 6) Then, slide one unit into another before sewing to create the long strip. 7) Left picture : the lateral surface. And 8) Left picture: the foreside.

49. The model of KleeB Mak Beng (The Areca-nut Petal)

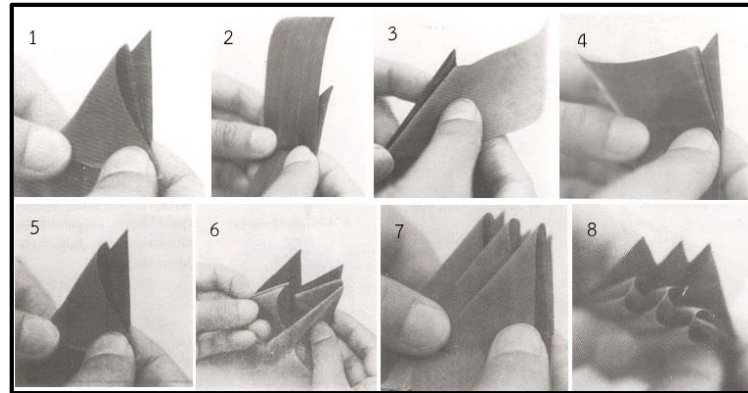


Figure 58 The model of KleeB Mak Beng (The Areca-nut Petal)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 146-149.

This model was demonstrated by the niece of Khun Khampeng Bannasri. It was then well-known among the Thai craftsmen. Later, it was adapted into the model of KleeB Mak Beng Plang. Five years later, the author publicized this model in her book and it became popular because of its uniqueness. It looks like a 2-unit interlocked model ; however, it is actually a 1-unit with two edges.

Directions: 1) Start from the long banana leaf strip : 1 1/2 inch wide. The first step of this model replicates the first step of the model of KleeB Funpla. Only leave the long strips on both sides. 2) Fold the two strips upwards. 3) Fold the strips from left to right. 4) Reverse-fold. 5) Fold the left edge diagonally to the right. 6) Then, slide one unit into another. 7) Once the 3 units are interlocked, sew them together to create the long strip. And 8) Left picture: the foreside.

50. The model of KleeB Mak Beng Plang (The Revised Areca-nut Petal)

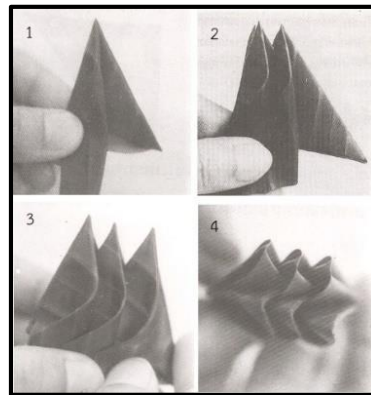


Figure 59 The model of KleeB Mak Beng Plang

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 149-150.

Directions: 1) When the model of KleeB Mak Beng is done, outside-reverse-fold the model, making it look like the model of KleeB Kularb. 2) Slide another unit of the model of KleeB Mak Beng and outside-reverse-fold. 3) Left picture: the foreside. And 4) Left picture: the foreside shows the detail of the interlocked units.

51. The model of KleeB Phiseua (the Butterfly)

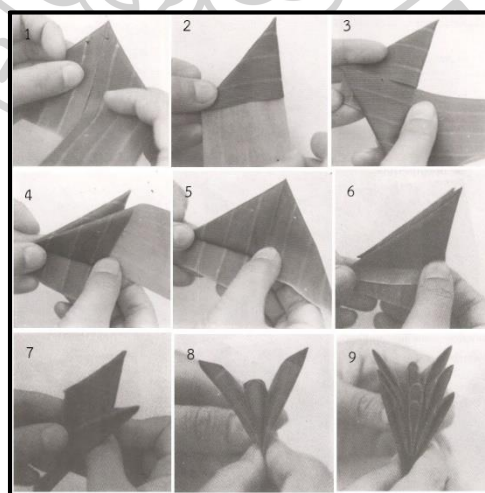


Figure 60 The model of KleeB Phiseua (the Butterfly)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 150-152.

This model looks like a living butterfly and Phakakrong combined. Differently, this model has spired-edge outside and the edge of this model is at the center of the crease. This model is suitable for decorating the tray, plate, candlestick, etc.

Directions: 1) Start from the long banana leaf strip : 1 3/4 inch wide. The first step of this model replicates the first step of the model of Kleeb Funpla. Only leave the long strips on both sides. 2) Fold the edge to the left, creating the triangle. 3) Fold the strip to the right. 4) Fold the strip upward. 5) Refold the strip downward. 6) Fold the edge to the left. 7) Pull open the slit. Using right finger, press the crease up to the centre crease. 8) Left picture : the backside. It looks like a flying butterfly. And 9) Left picture : the foreside. This is the 3-interlocked unit.

52. The model of Kleeb Benjamat (Chrysanthemum)

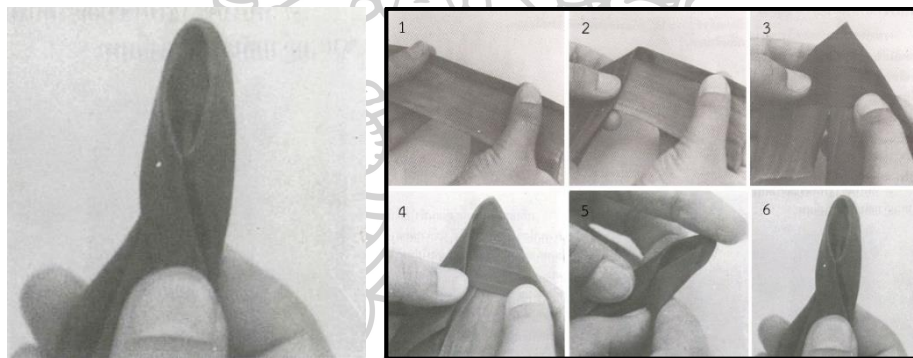


Figure 61 The model of Kleeb Benjamat (Chrysanthemum)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 153-154.

This model was unexpectedly created by the author while working on the model of Kleeb Ratchaphreuk. When completed, it was found that this model was lovely. It was a starting point for creating other models.

Directions: 1) Start from the short banana leaf strip : 1 3/4 inch wide. Valley fold. Make sure the crease is 1/4 inch wide. 2) Fold the left edge diagonally to the bottom. 3) Repeat the Step no. 2 with the right edge. Flip it over. 4) Pleat on top. The upper left strand moves on top of the lower strand forming a pleat in the strip. 5) Repeat the Step no. 4 on the right edge. Then, valley fold. This step replicates the

steps of the model of Kleeb Sattabut. And 6) Then, cut off the excess oblong of the model. It is suitable for decorating the model of Kleeb Ratchaphreuk or the 6-corner Kratong. Since this model was publicized, it has become very popular because of its unique beauty. It is a rounded-shape model, which looks like the Chrysanthemum.

53. The model of Kleeb Med Mayom (The seeds of Star Gooseberry)

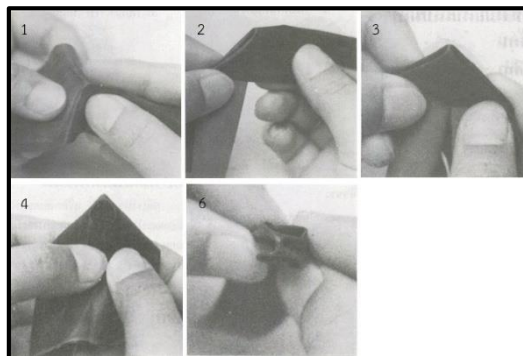


Figure 62 The model of Kleeb Med Mayom (The seeds of Star Gooseberry)
Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 155-156.

This model looks like the edges of the star gooseberry and the crown flower. It is good for decorating the objects in an auspicious ceremony.

Directions: 1) Start from the long banana leaf strip : 3-inch wide. Mountain fold. Press the pointed center of the strip gently so it reverses direction. 2) Push the corner between the strands. 3) Repeat the Step no. 2 on the left edge. 4) Pull two strips down in the bending pattern to create the triangle. And 5) Repeat the Step no. 4 in another side.

54. The model of Kleeb Lepmeunang (The Rangoon Creeper)

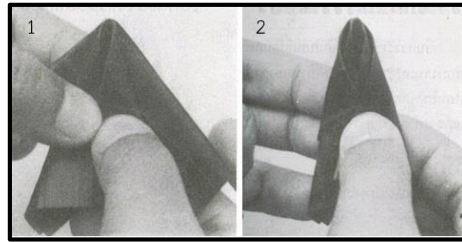


Figure 63 The model of Kleeb Lepmeunang (The Rangoon Creeper)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 156-157.

Directions: 1) The first step of this model replicates the first step of the model of Kleeb Dokrak or Kleeb Med Mayom. Then, fold the crossing strips vertically along the centre crease. And 2) Cross the two strips in the front. From the foreside, it looks like a double-stranded model of Kleeb Lepmeunang. So, it is called the model of Kleeb Lepmeunang Son (the double-layered Rangoon Creeper). It is suitable for decorating the other models.

55. The model of Kleeb Benjamat Son (The double-layered Chrysanthemum)

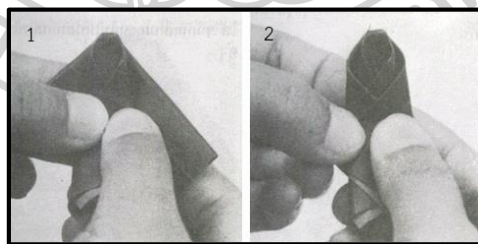


Figure 64 The model of Kleeb Benjamat Son (The double-layered Chrysanthemum)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 157.

This model looks like the chrysanthemum. The way to fold this model replicates the model of Kleeb Lepmeunang Son. It is suitable for decorating the other models.

Directions: 1) The first step of this model replicates the first step of the model of Kleeb Med Mayom or Kleeb Dokrak. There is some space between the edges. Crossing the left and right edges creates the round-shaped form, which looks like the petal of the chrysanthemum. And 2) Repeat the Step no. 2 with the other two edges.

56. The model of Kleeb Wichien (The lightning)

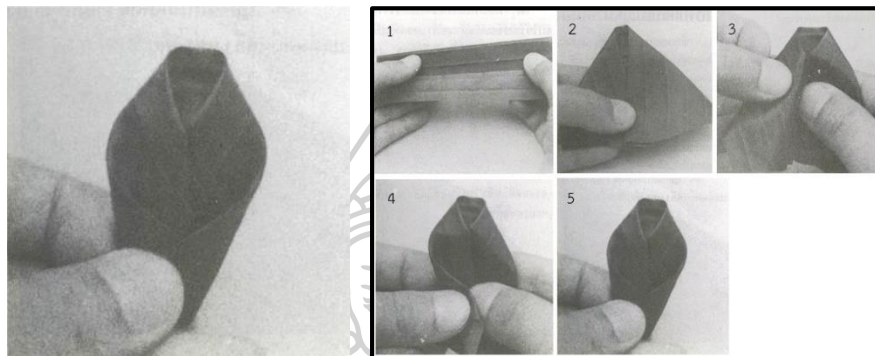


Figure 65 The model of Kleeb Wichien (The lightning)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 158-159.

This model is unique for it has a spire-shaped petal. It has a triangular space at the center crease. It is suitable for decorating the other models.

Directions: 1) Start from the short banana leaf strip : 2-inch wide. Mountain fold. Make sure the crease is 1/3 of the whole strip. 2) Cross the left edge on the right edge and leave the strip ends loosen. Make sure the space is 1/4 inch wide. 3) Make the pocket by pressing the finger up under the backside of the unit. 4) Hold the left edge and fold it diagonally to the right. And 5) Fold the right edge diagonally to the left.

57. The model of KleeB Banburi (The Allamanda)

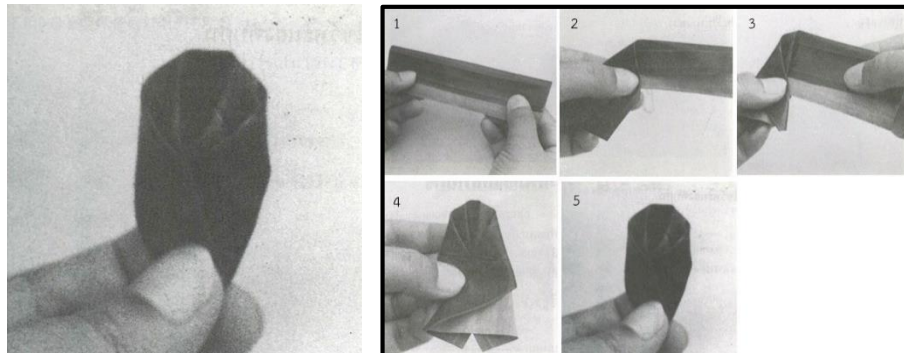


Figure 66 The model of KleeB Banburi (The Allamanda)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 159-161.

This model replicates the model of KleeB Waw Wichien. Differently, the edges are intercrossed. Then, valley fold into a bottom pocket.

Directions: 1) Start from the short banana leaf strip : 2-inch wide. Mountain fold. Make sure the crease is 3/4 inch wide. 2) Fold the left edge diagonally to meet the center crease. Valley fold and create the small pocket the bottom. 3) Again, fold the left edge diagonally to meet the center crease. 4) Repeat the Step no. 2 – 3 with the right edge. And 5) Press the crossing strip firmly. Valley fold the bottom and cross the left edge onto the right edge.

58. The model of KleeB Banburi Son (The Double-layered Allamanda)

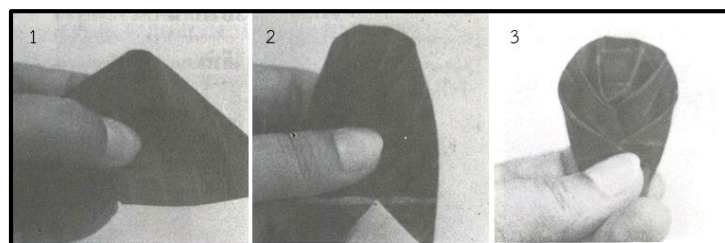


Figure 67 The model of KleeB Banburi Son

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 161-162.

This model adds one more layer on the model of KleeB Banburi.

Directions: 1) The first step of this model replicates the first step of the model of KleeB Banburi. Then, the two edges are crossed diagonally, and the outside strip is higher than the interior strip. 2) Repeat the Step no. 1 and leave some edges of the two strips (for the third fold). Valley fold and create the small pocket the bottom (like the model of KleeB Banburi). And 3) Cross left edge over the right edge.

59. The model of KleeB Waw Mayura (The Peacock)

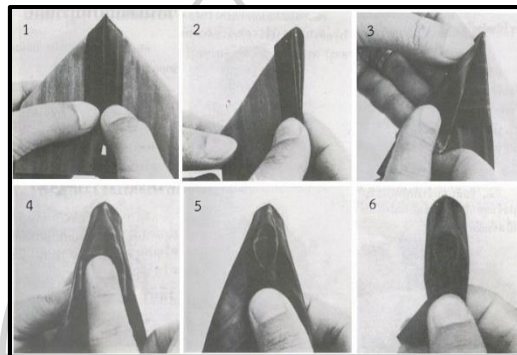


Figure 68 The model of KleeB Waw Mayura (The Peacock)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed. Bangkok: Amarin Printing and Publishing: p. 162-164.

Directions: 1) Start from the long banana leaf strip : 2 1/4 inch wide. Mountain fold. Make sure the crease is 1/4 inch wide. Then, fold the two edges downward to the bottom to create the triangle. Make sure the ivory side is in the outer surface. 2) Swing the left flap vertically inwards to the right. 3) Outside-reverse-fold the left edge from the right back to the left. Squash the flap symmetrically in half. Repeat the process on the other side. 4) Hold the unit firmly. Swing the top corner down between the layers. Squash a flat, opening the pocket. 5) Cross the left and right edges together. Then, petal fold. And 6) Cross the outer left and right edges together, creating the petal fold. The model of KleeB Waw Mayura (Initially, it was called the model of Waw Mayura Lek.) It is a delicate and beautiful model. It has a round-shaped petal with a double-layered petal folds.

60. The model of Kleeb Waw Mayuras (The Peacock)

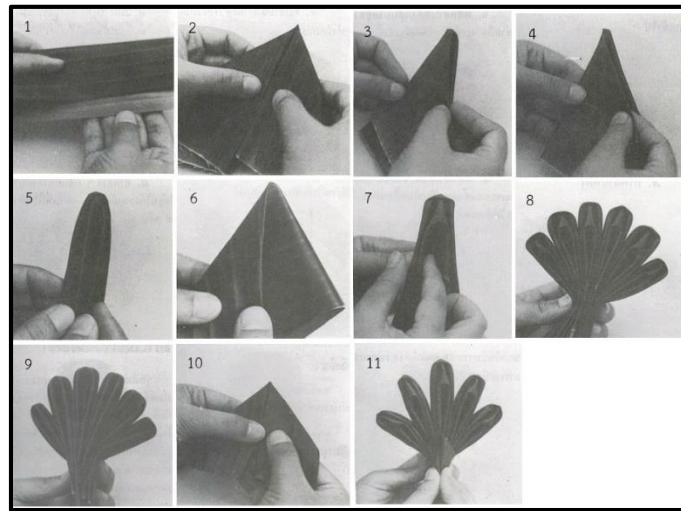


Figure 69 The model of Kleeb Waw Mayuras (The Peacock)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 164-167.

This model (Initially, it was called the model of Kleeb Waw Mayura Yai.). It is more extensive and complicated than the model of Kleen Waw Mayura.

Directions: 1) Start from the long banana leaf strip : 5-inch wide. Mountain fold on the ivory side. 2) Pull two strips down in the bending pattern to create the triangle. 3) Outside-reverse-fold from the front to the back. It looks like the model of Kleeb Ratchaphreuk. 4) Swing the edge diagonally to vertically meet the center crease. Repeat the process with another side. When completed, it should look like in the left picture. 5) Left picture : the backside. 6) Turn the unit over. The completed one should look like in the left picture. 7) Press the finger on the center crease, making the corner down between the layers. 8) To create the long-curved strip, interlock 5 units together. 9) Left picture : the backside. 10) Fold the long banana leaf strip : 5-inch wide. Mountain fold and pull two strips down in the bending pattern to create the triangle. And 11) Slide the complete unit from the Step no. 9 into the complete unit from the Step no.10. Left picture : the long-curved strip with 5-interlocked units.

61. The model of Kleeb Dokjok (The Dokjok)

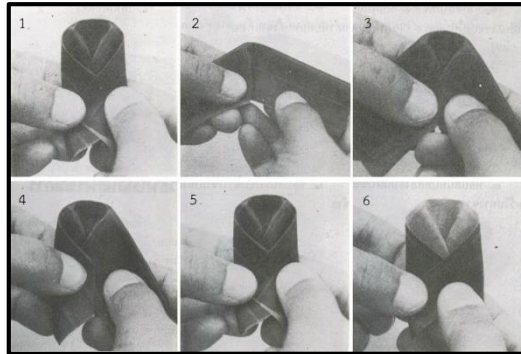


Figure 70 The model of Kleeb Dokjok (The Dokjok)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 168-169.

This model is the 3-layered model developed by the author. It was a sister to the model of Kleeb Duangjai or Kleeb Jaajom. It looks like Dokjok so it was entitled as 'Dokjok'. It is suitable for decorating other models.

Directions: 1) Start from the long banana leaf strip: 2 1/2 inch wide. Mountain fold on the ivory side. 2) Squash fold the bottom left to the right. When completed, it should be notated like in the picture. 3) Squash fold the bottom right to the left. When completed, it should be notated like in the picture. 4) Fold the left edge diagonally to cross the right edge, creating the layer on the left. 5) Fold the right edge diagonally to cross the left edge. There would be 3 layers in total. It is called 'Kleeb Dokjok' because it looks like a floating Dokjok in the pond. It is suitable for decorating basket, Kratong, etc. And 6) To fold the more fragile model of Kleeb Dokjok, skip a mountain fold in the Step no. 1. **This fragile model is not appropriate for summer. It is suitable for winter and monsoon.*

62. The model of Kleeb Suphannika (The Silk Cotton Tree)

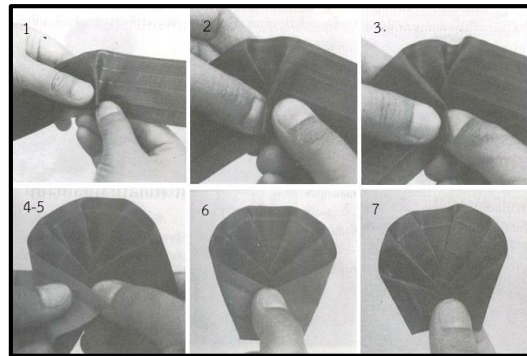


Figure 71 The model of Kleeb Suphannika (The Silk Cotton Tree)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 170-171.

This model is developed from the model of Kleeb Dokjok. It has 5 edges in total.

Directions: 1) Start from the long banana leaf strip : 1 1/2 inch wide. Squash fold from the left to the right. 2) Squash fold from the right to the left. 3) Squash fold from the left to the right. 4) Squash fold from the right to the left. 5) Squash fold from the left to the right. 6) Squash fold from the right to the left. When completed, it should look like in the picture. This is the 1st style. And 7) For the 2nd style, cross the left and right edges together. This style hides the ivory side.

63. The model of Kleeb Koson Soi (The Garden Croton)

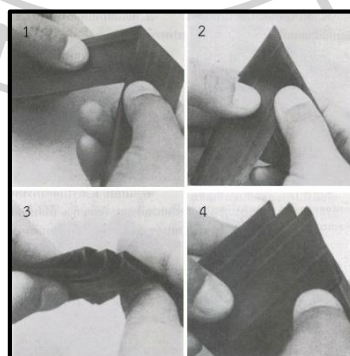


Figure 72 The model of Kleab Ka Long Son (Layered Snowy Orchid Tree)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 172-173.

This model is a new and unique model. From the frontside, it is spired-shape. From the foreside, it is s-shaped. When interlocked and sewn, it is suitable for decorating the bodies of the tube, vase, and plate because of its endurance.

Directions: 1) Start from the long banana leaf strip : 2 1/2 inch wide. Fold the strip in a bending fashion downwards. 2) Cross the right edge onto the left edge, creating the triangle. Make sure that the space is 1/3 wide. 3) Fold the left edge onto the backside of the right edge. And 4) When multiple units are interlocked, it is in a curved and curled shape. It looks like a shape of the garden croton so it is entitled 'Kleeb Koson Soi'. Left picture: the lateral surface.

64. The model of Kleeb Phuttarn (The Cotton Rose Hibiscus)

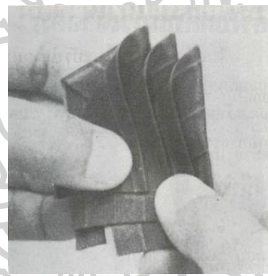


Figure 73 The model of Kleeb Phuttarn (The Cotton Rose Hibiscus)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing; p. 173.

Directions: This model is developed from the model of Kleeb Koson Soi by outside-reverse-folding the left edge diagonally to the right to create the curved edges. It looks like the cotton rose hibiscus, so it is entitled 'Kleeb Phuttarn'. This model is suitable for decorating Kratong, jar, bottle, and plate.

65. The model of Kleeb Karawek (The Paradise Window Bird)

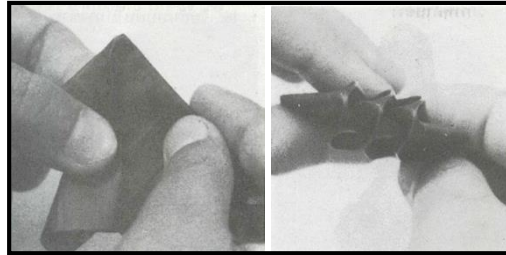


Figure 74 The model of Kleeb Karawek (The Paradise Window Bird)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 173-174.

Directions: This model is developed from the model of Kleeb Koson Soi by outside-reverse-folding the bottom and upper edges vertically to meet the center crease. When the multiple units are interlocked, it is curved and curled like the Karawek so it is entitled 'Kleeb Karawek. It is suitable for decorating the bodies of bowl, plate, jar, and Kratong.

66. The model of Kleeb Kaeo Jaojom (The Lignum Vitae)

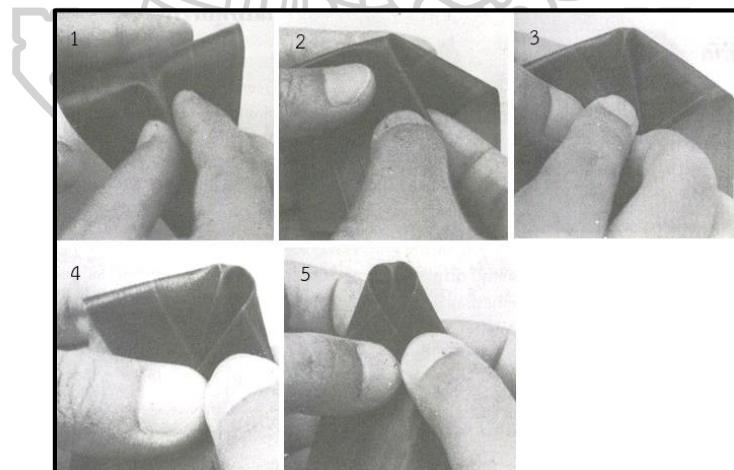


Figure 75 The model of Kleeb Kaeo Jaojom (The Lignum Vitae)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 174-175.

This model is a round-shaped twin. It is entitled ‘Kleeb Kaeo Jaojom or Kleeb Duangjai because it is heart-shaped.

Directions: 1) Mountain fold the left edge and valley fold the center crease. 2) Fold the right edge to the left. 3) Fold the right edge back to the right, leaving the edge right at the center crease. 4) Cross the right edge diagonally onto the left. And 5) Fold the left edge to the right, creating a diagonal bending shape. This fold makes the unit looks rounded. It is freely adjusted. It is suitable for decorating the other models.

67. The model of Kleeb Ruang Pheung (The Hive)

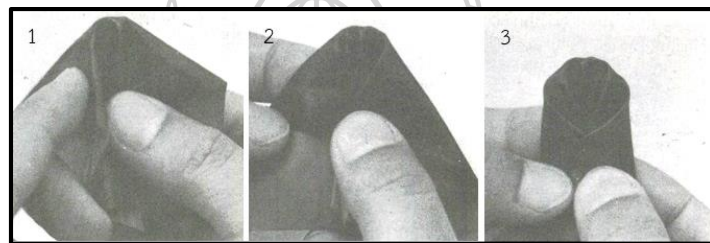


Figure 76 The model of Kleeb Ruang Pheung (The Hive)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 176.

Directions: 1) This model replicates the Step no. 1 - 3 of the model of Kleeb Kaeo Jaojom. Then, press the finger on the left edge to create the interior strand. 2) Swing the left edge to the right and swing the right edge to the left. It is almost the same as the model of Kleeb Kaeo Jaojom, but it has more space on the edges. And 3) Mountain fold the left and right edges before crossing them together. By this way, this model has 4 strands, creating a shape of twin heart. It is suitable for decorating plate or Kratong. It looks like a bee hive, so it is entitled ‘the model of Kleeb Ruang Pheung’ or ‘Kleeb Duangjai Khu’.

68. The model of Kleeb Phayabmok (The Cape Leadwort)

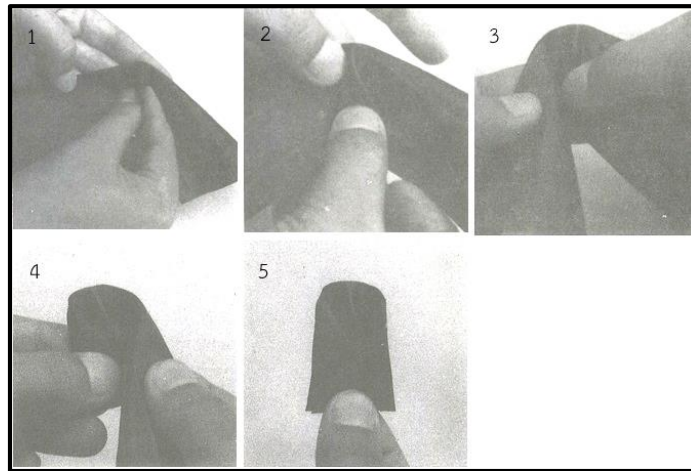


Figure 77 The model of Kleeb Phayabmok (The Cape Leadwort)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 177-178.

This model is similar to the model of Kleeb Kaeo Jaojom. Differently, it has a center strand and outside-reverse outer fold.

Directions: 1) Start from the long banana leaf strip : 2 3/4 inch wide. Mountain fold. Make sure the space is 1 1/4 inch wide. Then, fold the edge vertically along the center crease as shown in the picture. 2) Press the finger firmly on the bottom edge. 3) Open the layers evenly and press the sides together, in effect squashing the unit in half. Then, swing the edge to the right. 4) Repeat the process to the right edge. And 5) Then, cut off the excess oblong of the model. It is now similar to the model of Kleeb Kaeo Jaojom.

69. The model of Kleeb Phayapmek (The Cat's Whiskers)

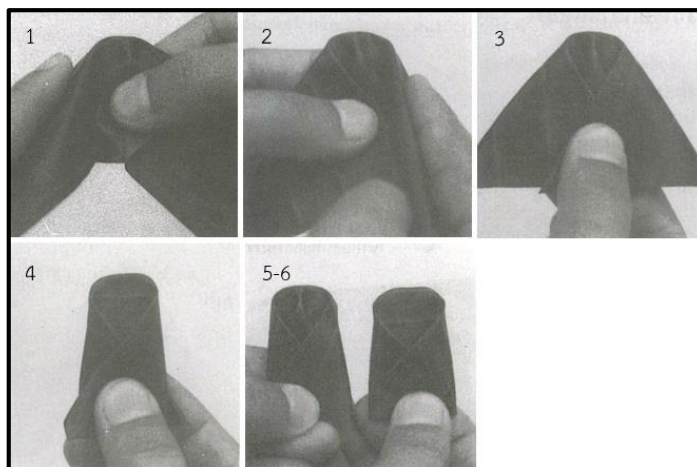


Figure 78 The model of Kleeb Phayapmek (The Cat's Whiskers)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 178-180.

This model is similar to the model of Kleeb Phayabmok. Differently, this model is outside-reverse-fold to the back.

Directions: 1) This model replicates the Step no. 1 - 2 of the model of Kleeb Phayabmok. Then, press the finger on the left edge to create the interior strand and lift the upper edge upwards. 2) Swing the edge to the right. 3) Repeat the process to the right edge. 4) Fold the edge diagonally backwards. 5) Left picture : The frontside. And 6) Right picture : The backside.

70. The model of Kleeb Anchan (The Butterfly Pea)

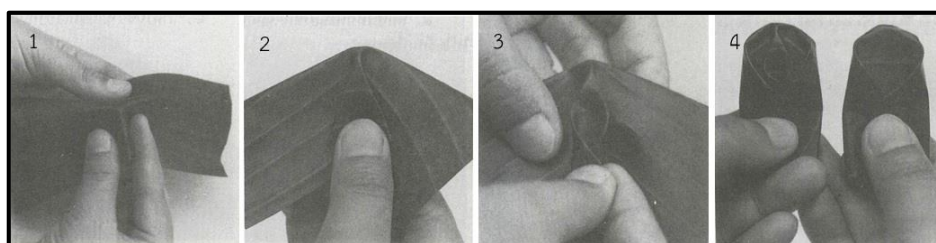


Figure 79 The model of Kleeb Anchan (The Butterfly Pea)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 180-181.

This model is developed from the model of Kleeb Kaeo Jaojom and Kleeb Ruang Pheung. This model has a deep strand, which looks like Anchan, so it is entitled 'Kleeb Anchan'.

Directions: 1) Lift the right edge and valley fold it diagonally to the center crease. Then, mountain fold the strip horizontally backwards. 2) Press the finger firmly. 3) Swing the left and right edges to cross each other. And 4) Swing the outer left and right edges to cross each other. Then, fold the strip end backwards. Left picture : the backside.

71. The model of Kleeb Anchan Son (The Layered Butterfly Pea)

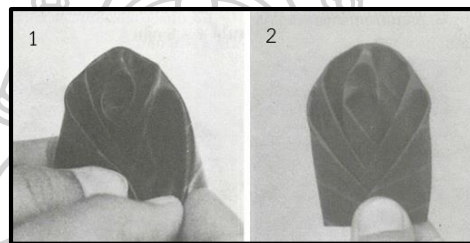


Figure 80 The model of Kleeb Anchan Son

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed. Bangkok: Amarin Printing and Publishing: p. 181-182.

This model is developed from the model of Kleeb Anchan. Additionally, there are two more strands: one on the left and another one on the right.

Directions: 1) Repeat the Step no. 1 – 3 of the model of Kleeb Anchan. When it comes to the Step no. 4, swing the edges forwards (If the edges are swung backwards, it creates the model of Kleeb Anchan). And 2) Left picture: the complete unit.

72. The model of Kleeb Kularb Phuphing (The Phuphing Rose)

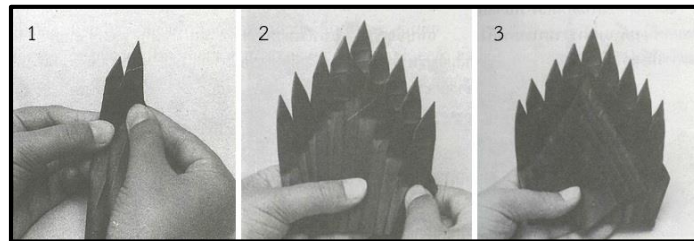


Figure 81 The model of Kleeb Kularb Phuphing (The Phuphing Rose)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 182-183.

This model is a mixture between the models of Kleeb Kularb and Kleeb Phaka. It is suitable for decorating a bigger container or other models.

Directions: 1) Start from the long banana leaf strip: 1 3/4 inch wide. Repeat the steps of the model of Kleeb Kularb. Then, diagonally slide one unit into another. 2) Repeat sliding and sewing the unit into another until it comprises of 5 – 6 units. And 3) Place the 5-layer model of Kleeb Phaka on the frontside of the model of Kleeb Kularb Phuphing to create the dimension. It is called the model of Kleeb Kularb Phuphing.

73. The model of Kleeb Bua Thip (The Bua Thip)

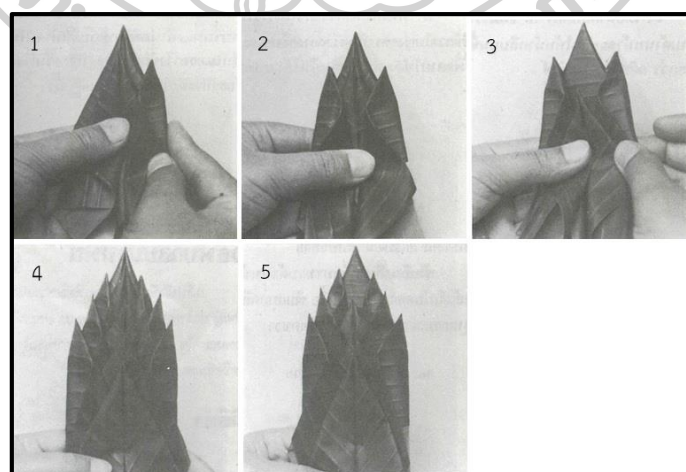


Figure 82 The model of Kleeb Bua Thip (The Bua Thip)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 183-184.

This model is a mixture between the models of Kleeb Kularb and Kleeen Leam. It is suitable for decorating a vast Kratong or Khanmak Eak (A tray of gifts (from the groom to the bride's family)).

Directions: 1) Start from the long banana leaf strip : 1 3/4 inch wide. Double-fold the left edge. Double-fold the right edge. The two edges must meet the center crease. Fold another unit and place it on the first unit. Then, slide the model of Kleeb Kularb, made from a 1 3/4 inch wide strip, into the right corner. 2) Slide another unit into the left corner. 3) Outside-reverse-fold backwards. Make sure the complete unit is spire-shaped like the front side. Sew them together. 4) Turn it over. To start the 2nd layer, repeat the same process. For the 2nd layer, use the 2-inch wide strip. For the 3rd layer onwards, use the 2 1/2 inch wide strip. And 5) Left picture : The backside. This layer is curled and structured by the metal wide.

74. The model of Kleeb Mak Pradab (The Betel Nut)

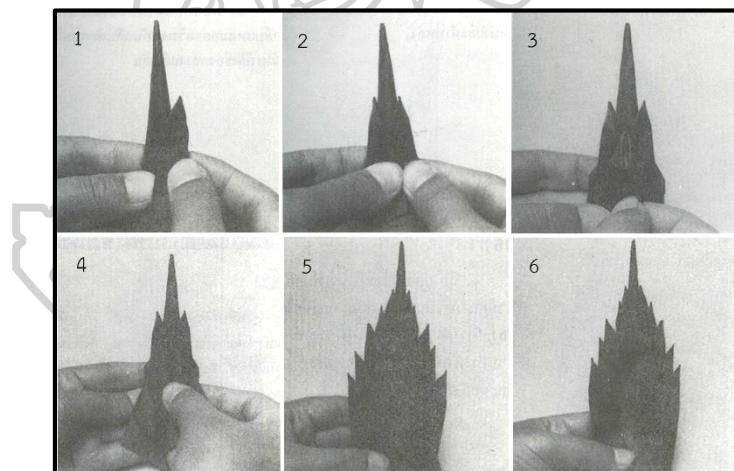


Figure 83 The model of Kleeb Mak Pradab (The Betel Nut)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 175-176.

This model is considered a large-scale model. It is suitable for being a container for the betel nut in Khanmak Eak. As seen from its shape and color, it is a mixture of the models of Kleeb Niu Meunang, Kleeb Kularb, Kleeb Bua Sattabut, and Kleeb Leam.

Directions: 1) Start from the long banana leaf strip : 3-inch wide. Fold the model of Niu Meunang, making it a spire. Then, use the 2-inch wide strip to make a lower belt flap (The lower the belt flap is, the bigger the strip it will be.) 2) Fold the model of Kleeb Kularb, making it a lower belt flap. Slide it onto the left and the right. 3) Fold the model of Kleeb Sattabut. Place it at the center crease and sew them together. 4) Turn it over. Fold the model of Kleeb Sattabut. Place it at the center crease and sew them together. 5) Repeat these steps, layer by layer, in both front-and-backsides. And 6) Left picture : The backside.

75. The model of Kleeb KabMak Tang (The Betel Nut)

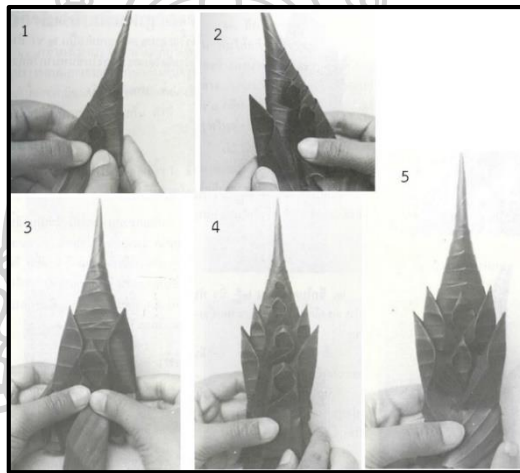


Figure 84. The model of Kleeb KabMak Tang (The Betel Nut)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 187-188.

This model is for being a container for a betel nut and decorating Khanmak Eak. It cherishes the shape and color. As seen from its shape and color, it is a mixture of the models of Kleeb Niu Meunang, Kleeb Med Mayom, Kleeb Kularb, Kleeb Bua Sai and Kleeb Phanung Chaithong.

Directions: 1) Start from the long banana leaf strip : 3-inch wide. Fold the model of Niu Meunang, making it a spire. Use a 2 – 2 1/4 inch wide strip and a 2 1/2 inch wide strip to fold the 3 units of the model of Phanung Chaithong. Then, slide the model of Niu Meunang into the model of Phanung Chaithong. Use a 2 1/2 inch wide strip to fold the

model of Kleeb Med Mayom. Then, place the model of Kleeb Med Mayom at the center crease of the model of Karb Mak. 2) Use a 2 1/2 inch wide strip to fold the 2 units of the model of Phanung Chaithong. Slide them to the left and right. Use a 3- inch wide strip to fold the 2nd unit of the model of Kleeb Med Mayom. Use a 2 1/2 inch wide strip to fold the 2 belt strip of the model of Kleeb Kularb. Slide them to the left and right. 3) Turn it over. Use a 1 1/2 inch wide strip to fold the model of Kleeb Bua Sai. Use it to close the strands among the belt strips. 4) Keep extend the layer sizes. The number of the layers depends on the size of the container. If the container is large and deep, the models should be structured and scaffolded with the u-shaped metal wire. And 5) Left picture : the backside.

76. The model of Kleeb Leb Phaya Khрут (The Claws of the Garuda)

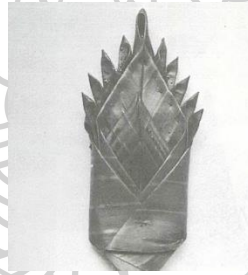


Figure 85 The model of Kleeb Leb Phaya Khрут (The Claws of the Garuda)
Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.
Bangkok: Amarin Printing and Publishing: p. 189.

This model is similar to the model of Kleeb Leb Khрут, but it is larger and needs a mixture of several models as follows:

Directions: 1.) Use two 3-inch wide strips to fold the 2 units of the model of Kleeb Leb Khрут. Pin the bottom edge. 2) Use four 1 – 1 1/2 inch wide strips to fold the cores of the models of Kleeb Leb Khрут. Double-mountain-fold to the center crease. Then, interlock them together layer by layer. Place the model of Kleeb Leb Khрут Yai on the frontside and sew them together. And 3) To decorate the model of Kleeb Leb Khрут Yai, use the model of Kleeb Leb Meunang to create the spire. Then,

use the model of Kleeb Kularb to decorate the lateral side by sliding 2-layer unit of the model of Kleeb Leb Khrut Yai together (See Picture below).

77. The model of Leb Meunang Phaya (The Claws of the Queen)

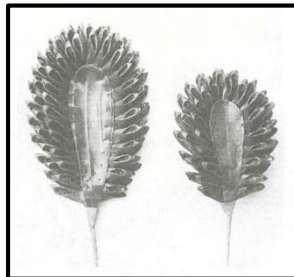


Figure 86 The model of Leb Meunang Phaya (The Claws of the Queen)

Source: Maneerat Chantanapalin (1997). **Art of banana leaves folding**. 3rd ed.

Bangkok: Amarin Printing and Publishing: p. 189.

Directions: 1) Use six banana leaves. Cut them into a petal shape. Pin the 3rd and the 4th layers them with a metal wire and then make a u-shaped metal wire. 2) Use 1 1/4 inch wide strips to fold the cores of the model of Kleeb Niu Meunang. Pin them from top to bottom, in both left and right edges. It could be either 2 or 3 layers. Then, cut the banana leaves into petal shape. Place it on the frontside to cover the strands. And 3) Fold the model of Kleeb Sattabut.

Conclusion

As reviewed in the previous sections, the grounded data for this study was obtained. This study, which aims at providing the guidelines for designing the costumes inspired by the banana leaf folding patterns, examines all 77 folding patterns in order to design and develop this art to be at its finest. To achieve the arts of design and develop the patterns, the thorough consideration of the fabrics employed for the folding patterns is necessary because the right fabrics contribute to the consumers' satisfactions, consumers' needs, and the climate conditions. Therefore, the following section reviews the fabrics that qualify for the folding patterns focused in this study.

Part 2: Fabrics and Pleating

This part represents the visual guide of fabric, focused on the way to create apparel and how a fabric will look on body because fabric is a key to create clothing (Baugh, 2011) This study aims at the fabrics which qualify for folding patterns and are available in the modern days. In this study, the fabrics are defined as the materials consisting of a network of natural and/or artificial fibers which are produced by spinning, weaving, knotting, or knitting into the cloth. This study also emphasizes the arts of pleating applied to various fabrics in order to examine the suitable fabrics for the desirable folding patterns and techniques.

Fabric

Fabric is the medium of the garment designer. It is a two-dimensional, flexible surface that is transformed into a three-dimensional form through the vision of the designer.

It is the job of apparel designers to create three-dimensional forms from a two-dimensional surface. They use fabric as a painter uses color on a canvas. Fabric is the color, and the human body is the canvas. Once this visual understanding is clear, the journey to select the best fabric to realize the design can begin.

Designers describe their designs in emotive terms, and the fabric must reflect the designer's intention. And here lies the continuing dialogue between designers and the textile industry: "What do you mean by the term 'techno'?" "What is 'edgy'?" "Clarify 'new.'"

Designers are trained to develop a vision in terms of surface, silhouette, and "good" design; they are not trained to translate that vision into understandable terms for the textile industry. So, as the designer finished the design concept and moves to the textile suppliers to find the fabric, communication often breaks down between the supplier and designer.

The fabrics are classified according their fibers. They are natural fibers, synthetic fibers, and semi-synthetic fibers. These three fabrics are popular among the fashion industry and clothing industry.

1. Natural fibers

The natural fibers include those produced by plants and animals. The ones produced from plants normally cheaper, more available, and more popular than those from animals. The natural fibers produced from plants involve cotton, linen, ramie, and bamboo fibers. In addition, the natural fibers include the fibers obtained from animals. Silk, for example, is produced from silkworms. It is highly costly because of its finest texture. Another example for the fibers produced by animals is wool, which is the fiber obtained from sheep. Wool is also expensive.

1.1 Cotton: Cotton is a fabric woven from soft, fluffy staple fibers that grow in a protective case around the seeds of the cotton plants. The cotton fibers are pulled from the protective case and the seeds before they are spun and woven into cloth. Cotton fabric is noted for its low price and qualities. It is durable, wrinkle resistant, absorbent, and substantive. Cotton fabric has low flammability. It is suitable for the hot and humid climate because of its breathability and absorption of sweat. The mentioned qualities make cotton fabrics appropriate for the ready-to-wear.

1.2 Linen: Linen fabric is a fiber produced from the flax plants. After the harvesting, the fibers are achieved through retting process, which uses bacteria to decompose the fibers in the flax plants. The decomposed flax plants are then stalked in bundles and left in exposure to sunlight. To get the fibers, the whole bundles are passed through fluted rolls to reduce the flax plants into small particles. The small particles are then combed to separate the fibers through the sets of pins. After the process is done, the cotton fibers are spun into yarns and woven into cloth. The natural color of linen is ivory. The white linen is produced by the bleaching. Linen has been long used for more than 7,000 years since the time of the ancient Egypt. It was found that the ancient Egyptian mummies were wrapped in linen. Linen and cotton share the qualities of breathability, durability, strength, and longevity. Linen is great at absorption of sweat, but its fibers are stiff and crease easily. Linen is appropriate for the summer because it is comfortable, low maintenance, and resistant to alkaline, acid, and chemical substances.

1.3 Ramie: Ramie fabric is obtained from the inner bark or phloem of the ramie plants. Ramie was originated from China. Nowadays, China, India, and Russia lead in the

plantation of ramie. Under the certain conditions, ramie can be harvested up to several times. When the ramie plants begin flowering and the leaves become yellow, it is a time for harvesting. The stems of ramie plants are harvested and produced in the same fashion as linen. The ramie fibers are extracted through the retting process. The stems are decorticated and the cortex is scraped to remove most of the outer bark. The obtained fibers are spun and woven into textiles. The natural color of ramie fabrics is brown. The substantive ramie fabrics are obliged to bleach in dark color rather than the white color. Ramie fabrics are soft comparing to other fabrics. When woven into cloth, ramie textile is resistant to the prolonged exposure to sunlight, light weighted, and resistant to the diluted alkaline. However, the concentrate alkaline and high temperature can cause the degumming of the fibers. The acid is also able to cause the maceration of the fabrics. Ramie fabric wicks away moisture and dries quickly. All mentioned qualities make ramie fabric a good choice for natural looking, primitive, and informal fashions.

1.4 Silk: Silk has a long history in China for more than 2,000 years. Silk is composed of fibroin from the silkworms' cocoons. In the northeastern region of Thailand, the cultivation of silk is an important cottage industry. Silk fabric is referred to as the queen of fibers for its shimmering and luxurious appearance that contribute to the consumers' satisfactions. Silk fabric is quite expensive. Silk has been used as human's cloth since the ancient times. It had its origin in China when the Chinese learned how to rear the silkworm and unwind the cocoons to produce the silk fibers. Generally, silk fabric is shimmering, durable, and comfortable. It keeps the body cool on hot days and preserves the body heat in the cold times. It is also substantive. Color and patterns are printed on silk fabrics easily. Silk fibers can grate and create the particular sound so-called grated silk. Silk fabric is a symbol of luxury. It is occasionally used for the luxurious fashions and wares. Silk fabric requires special maintenance. The silk fibers that remove the wax attached to the fibers out tended to be lightweight and soft. To catalyst it to withstand the wrinkles, it needs special process. Silk becomes dull easily after it is cleansed for several times. Silk fabric is not resistant to the detergents that contain any concentrate alkaline and the long exposure to the sunlight. To cleanse the silk fabric, the cleaner needs to be extra careful. Silk fabric composes of natural protein fibers which

are glue-like substances that help keep silk taut. Therefore, silk fabric has its molecules arranged in near parallel orientation in both ends, creating the durability and strength.

1.5 Jute: Jute fabric is collected from bast fiber, along with linen and ramie. It has been used since the dawn of the history; however, it was not considered an economic plant until the 18th century. Jute is one of the most popular fabrics of the world, especially among the developing countries, due to its affordable price.

1.6 Muslin: Muslin is a cotton fabric of plain weave. It is made in a wide range of weights from delicate sheers to thick bed sheet. The fabric is made from carded yarns. Muslin fabric is versatile fabric used today, with an extensive array of usages. Muslin holds the longest history of manufacture. This fabric is so breathable that it is suitable for the hot climate areas. Muslin fabric is classified into many categories according to the thread count (TC). For example, the 115-TC-muslin fabric is only for the fair quality, 120-TC-muslin for moderate quality, and 140-TC-muslin for the original, thick, and durable ones. During the time of the Middle Ages, India is the major production of the thin muslin imprinted with silver and gold leaves. With its long history, muslin fabric receives increasing popularity. In the 17th century, muslin fabric was manufactured in Europe, Paisley, and Scotland. By the end of the 18th century, muslin fabric became popular among Frenches (Source: Fairchild's Dictionary of Textiles). However, muslin does not contain only one meaning. It has multiple meaning according to the speakers and the counties. In British-English, muslin means the lightweight cotton cloth in a plain weave. Muslin is also a slang for lady in British-English. In American-English, muslin means any ordinary cloth. Also, the navy uses the word 'muslin' as a slang for the sail wings. Due to its qualities of lightweight and breathability, muslin fabric is appropriate for shirt, woman dress, bed sheet, pillow case, curtain, cover, etc.,.

2. Synthetic fabrics

Synthetic fabrics are textiles made from man-made fibers. These fibers are manufactured from plant-derived cellulose which are processed through the melt-spinning process. The fiber is heated until it starts to melt and then the melt fiber is

drawn out using tweezers. The fibers in this category involve rayon, lyocell, acetate, and triacetate.

2.1 Polyester: Polyester is the fibers produced from the condensation polymerization reaction of the dicarboxylic acids and dihydric alcohols such as the reaction of ethylene glycol and terephthalic acid. As a result, the complete polymer chain or polymer repeat units which comprise of 80 – 100 units are obtained. The obtained polyester is extruded in ribbon form and cut into chips. Then, it is melt and drawn out using the spinnerette. When expose to the air, the fibers become solid. Then, it is stretched in order to acquire the durability and strength. Polymer fibers is not resistant to the concentrate alkaline and acid. It can be melt by metacresol. In addition, polyester fiber is oleophilic fiber, which is absorbent to the oil. Polyester fabric is wrinkle-free, comfortable, and easy-care. It is wash-and-wear fibers. Polyester fibers can be blended with other fibers such as rayon, silk, cotton, linen, and wool to acquire the better qualities in terms of durability, appearance, and appropriateness. The ratio of the mixed-fiber material must contain at least 60% of polyester fibers. For example, one mixture can be 65% of polyesters and 35% of cotton. So, polyester fabric could be either produced from the pure polyester fibers or blended from the mixed-fiber one. These special properties allow polyester fibers as part of delicate light cloth to thick fabrics used for shirt, skirt, trousers, and suit.

2.2 Organza: Organza is a crisp, sheer fabric that always uses high-twist, multifilament yarns. The result is a lustrous, but not shiny, buoyant fabric that feels “grainy,” like fine-grained sandpaper on the fabric surface. Organza is selected for women’s blouse, formal dresses, and trimming details. Because of the crisp hand of organza, it is an excellent choice for exaggerated design details that require changes in silhouette without adding weight. This fabric can be gathered or pleated, and such “layering” of this sheer fabric will add color intensity wherever the fabric layers are shown.

Organza is considered a formal fabric, used for special occasions. Full-skirt silhouettes, bouffant sleeves, and exuberant ruffles make this fabric a designer’s choice for their luxurious dresses and blouses. Originally produced with silk fiber, organza

is now most often made using polyester fiber because polyester is less expensive than silk and is easier to care for. Lustrous, sometimes “sparkle” surface.

2.3 Organdy: Organdy Like organza, organdy is a sheer, crisp fabric. Organdy nearly always uses spun yarn and is nearly always cotton fiber or blended cotton and polyester fiber. Organdy’s crisp finish can be starch, which is not permanent and can be removed and restored in the laundry. More durable crisp finishes require chemicals and heat to complete the finishing process. Heat-based chemical finishes are durable in the laundry and do not need to be restored. 100 percent cotton organdy can be finished using this more durable crisp finish, which is recommended. More durable crisp finishes have been developed for organdy, so it is no longer necessary to use a non-durable crisp finish.

Organdy’s characteristic crisp hand and cotton fiber’s absorbency make this fabric an ideal hot-weather fabric. Summer blouses, shirts, or dresses use cotton organdy. Its crisp hand makes it a favorite fabric for wide-sleeve or full-skirt silhouettes. Organdy is often used for little girls’ spring and summer party dresses.

2.4 Nylons: Nylons are condensed polymers produced from amides which are formed at both ends of each monomer in a process analogous to polypeptide biopolymers. Therefore, nylons are not the specific name for a certain fiber. In fact, nylons are the term used to call any fibers formed from polyamide. Nylons’ original components comprise of air, coal, and water. Under the high pressure, nylons are made from the reaction of Adipic acid and Hex methylene Diamine. Then, a solid nylon salt can be formed using an exact ratio 1:1. The molecules are aligned and brought the fibers closer together. A spinning drum is rotated, the pressure is controlled, and the heat is rapidly reduced. Finally, this process utilizes the orientations and dimensions of the molecules. This process is referred to as the melt spinning. The obtained nylon fibers are shimmering and almost colorless. To increase its pigmentary properties, titanium dioxide is added into the molten nylon before it is extruded in ribbon form, crystalized, and cut into chips. Then, it is melt and drawn out using tweezers. To avoid the deterioration of nylon, the oxygen is vacuumed from the steam chamber during the melting process. The obtained nylon fibers are dull and less durable. Then, the nylon fibers are further cold-drawn by stretching about 400% to acquire the transparent and

durable fibers. Nylon fabric is considered a good quality. It has all the desirable properties of strength and elasticity. To increase its qualities, nylon fibers are mixed with other fibers. It is compact molecule structure and shape, and abrasion resistance. However, it is less rapid in moisture absorption. The suitable nylon fabric should be highly resilient and comfortable so the fabric itself is breathable. In addition, nylon fabric is easy-care fabric, which can be cleansed using soap, detergents, and bleach. It does not require dry-cleaning. However, nylon fabric is sensitive to the prolonged exposure to sunlight that can cause more readily fades and less compact fiber structure.

2.5 Spandex: Spandex is a synthetic fiber, known for its exceptional elasticity. It can be stretched to a certain degree and it recoils when released. It is an elastomer, which is made up of a polymer called polyurethane. Spandex was first manufactured under the brand name Lycra. The Spandex fabric is moisture-wicking, resistant to the chemical substance, except the concentrate alkaline and Chlorine bleach which reduces Spandex's durability and elasticity. The safe ironing temperature for Spandex fabric is around 300 °F or lower. Comparing to the natural fabrics, Spandex fabric is better in terms of resistance to human's sweat and fat. Spandex fiber is substantive, dyed, and resistant to oxidation. With these qualities, Spandex fabric is used for producing lingerie, swimming suit, socks, and medical elastic bandages such as knee and ankle support bandages.

As reviewed in this section, the knowledge on the fabrics are essential for the designers who intend to select the right fabrics for their designs. As the objective of this study is to examine the appropriate folding techniques, the following section provides the overview of the folding processes and techniques necessary for the framework of this study.

3. Pleating

Pleating creates and expansive fabric by layering fabric at regular intervals for a "volume" effect or by creating pressed creases in fabric either randomly or at regular intervals. The resultant voluminous effect can expand the silhouette of the design, which is not possible through seaming detail or by any other means.

Pleating effects can be achieved by physically stitching the fabric in specific patterns, through chemical means, and through heat and pressure. How the pleating is accomplished depends on the designer's vision and the fabric selected. Pleated fabrics are never heavier than medium weight and, for the most interesting effects, top weight are recommended.

Pleating a fabric enlivens the fabric, creating movement, space, and loft in what began as a flat, lightweight surface. There are several methods for pleating.



Figure 87 Textural pleating This unfitted top uses pleating to emphasize vertical

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 234.

Four main categories of pleats

1. Stitching

Folding and pressing fabric into regular patterns that add expansion to a design. When the wearer isn't moving, the pleats stay closed. When the wearer moves, the pleats expand with the body movement.

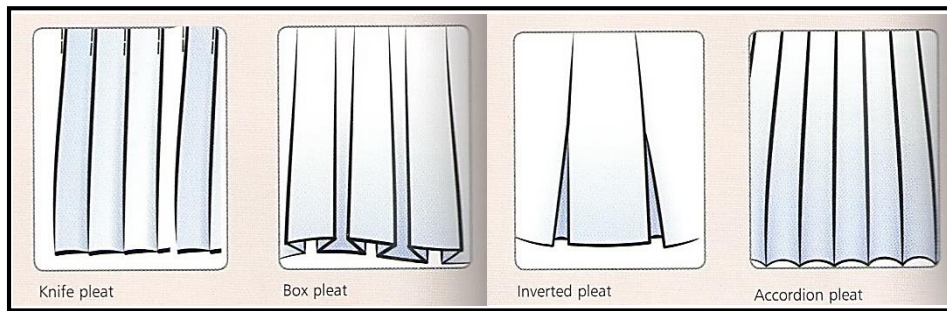


Figure 88 Categories of stitched pleats

Source: **Baugh, G. (2011). The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 234.

These categories are changed and manipulated depending on the designer's vision. Sewn pleats will add fit and drape and change the silhouette as the wearer moves and walks. Spacing between the pleats can vary.

2. Chemicals + water + heat

Natural fibers, such as silk or cotton, are finished using a variety of chemicals, heat, and sometimes pressure, to produce the pleating texture. These chemical finishes are usually durable for the life of the garment. However, heat can diminish the texture. The chemicals require water and there may be some chemical waste disposal concerns. Usually, only yardage is pleated using this method.

3. Heat + pressure

With the introduction of polyester-manufactured fiber, pleating fabrics without chemicals or stitching is now possible. In a technique borrowed from embossing, special pleating paper is used to emboss the pleating pattern on the fabric by using heat and pressure. The variety of pleating designs can be quite diverse, depending on the fabric and design of the pleated image. Only polyester fiber fabrics used because this fiber is the only one that remains soft after being heated. Therefore, the pleated fabric will retain the original soft hand and drape of the fabric, while taking the new pleated texturing. Pleats produced using this method are durable, except in the

presence of high heat. Yardage, cut pattern pieces, or complete sewn garments can all be pleated.

3.1 Pleating with pleating paper

During paper pleating, fabric is sandwiched between two pleated paper layers. After paper pleating, the heated fabric cools, and the papers are pulled apart leaving the pleated polyester fabric. Pleating sewn garments is a highly skilled process, and the resulting garments are unique. Pleating papers are recyclable.



Figure 89 Pleating with pleating paper

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 235.

Before: The garment is sewn, including the hem, then placed in special pleated paper, rolled, then bundled. The package is placed in an autoclave for pressurized steam and heat to achieve heat setting.

After: The completed skirt, cooled, after several different pleating techniques (pleating on pleating). The texturing can be uniquely changed season after season by the designer.

3.2 Hand pleating

Hand pleating does not require pleating paper and must be carried out by skilled hand-pleaters, experienced in creating the same result on multiple garments. By twisting or folding and typing sewn garments through several pleating steps, unique

garment designs can be created from a simple silhouette. Many pleating experiments are necessary to develop a signature pleating style.

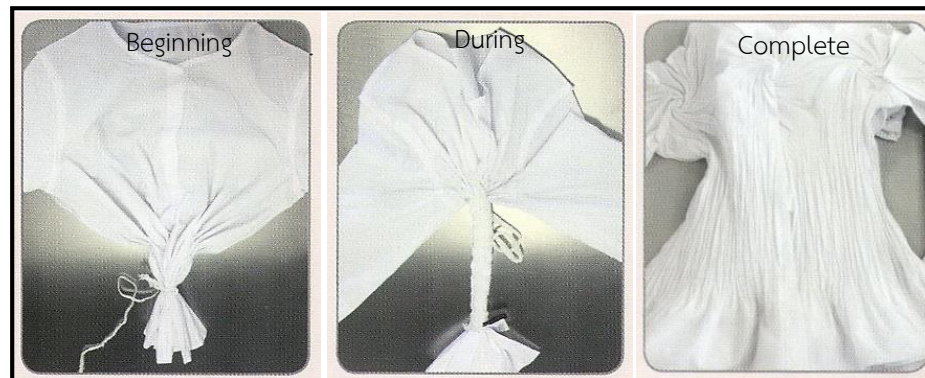


Figure 90 Hand pleating

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 235.

Beginning: The pleated top, heat-set pleated and tied in place for the first heat-setting.

During: The bodice is tightly bundled, ready for heat setting.

Complete: The sewn blouse is being several times, is now ready for closure details and final trimming.

Pleated silk fiber fabrics

Pleated silk fiber fabrics are some of the most luxurious used in apparel. The beautiful, soft, lustrous silk fabrics – which are very lightweight – are chemically treated to become pleated, while still retaining their original character.

The main point for a designer to understand when selecting a fabric that will add volume to the design is that nature silk fiber can be manipulated into a durable pleated fabric. Pleated silk fabrics are always lightweight. In most cases, the fabric is pleated first and then cut into pattern pieces to be sewn together. However, it is possible to sew the garment first and then chemically treat the sewn garment for the pleated effect.

Lightweight pleated silk fabrics, such as China silk, silk organza, silk georgette, and silk chiffon, are often selected by designers to produce elegant garment. The added pleated volume allows the garment design to expand and contract as the wearer moves. The fabric has new character, which is impossible in non-pleated fabric.



Figure 91 Crinkle silk taffeta

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 236.

Facts and figures

1) Distinctive features

- Textured, creased surface – not a flat surface.
- Usually lustrous surface.
- Fabric is enlivened by the pleating process.

2) Strengths

- Textured surface.
- Drapes well, but with an expansive surface.
- Resilient.
- Slippage is usually not a problem.

3) Weaknesses

- Cutting and sewing fabric is difficult to control if pleated as fabric.
- Chemical pleated finish may be neutralized in dry-cleaning chemicals and heat.
- Seams in pleated fabric sometimes cannot be pressed.

4) Usual fiber content

- 100 percent silk.



Figure 92 The various silk and pleated

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 236.

Crystal-pleated chiffon: Silk georgette can be pleated with tiny pleats, adding volume to the fabric. This crystal pleating will add volume to the garment design.

Accordion-pleated China silk: This square weave silk fabric retains its luster, adding a crisp hand with the sharply creased pleats.

Pleated suede leather: Another protein material, leather, is sometimes pleated. This sueded lambskin has been chemically treated, like the silk fabrics shown here, to be pleated.

Pleated cotton fiber fabrics

Producing a durable pleated cotton fiber fabric requires chemicals and heat. In the past, designers used more traditional pleating designs, such as pleated skirts, bodices, or sleeves. Cotton fabrics are now pleated for different styles of texture, such as crinkling. The resultant "crinkled" fabric has a less defined pleated effect and instead has an all-over wrinkled appearance.

Originally, pleating and crinkling gave a less durable finish, but now cotton fabric can be chemically treated to retain textures and pleating effects. The hand of the fabric is generally not changed by the chemical pleating process.

Lightweight cotton fabrics are selected for pleating and crinkling. The resultant pleated and crinkled cotton fabrics are selected for pleating and crinkling. The resultant pleated and crinkled cotton fabrics have a “loft” or volume that makes them suitable for more casual designs. These techniques work well in pleating lightweight cotton jersey, with the benefit of a drapery, knit fabric hand.



Figure 93 Loosely woven cotton voile pleat

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 237.

Facts and figures

1) Distinctive features

- Pleated or crinkled surface texture.
- Fabric has volume and is expandable.
- Hand remains soft, although the fabric is less drapery than before

finishing.

2) Strengths

- Fabric accommodates simple designs and expands the silhouette.
- Textured with soft hand.

3) Weaknesses

- Seams are difficult to press – design with fewer seams.
- Pleating or texture will be diminished if exposed to dry-cleaning chemicals and high heat.

- Loses drapey hand due to pleating texture.

4) Usual fiber content

- 100 percent cotton.



Figure 94– Pleated Cotton.

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 237.

Crinkle-finish calico: The irregular surface of this square weave, calico cotton fabric is the result of heat and chemicals applied to the fabric while compressed. When released, the Calico fabric is durably creased.

Crinkled cotton sheeting: Though not a true pleated fabric, the crushed finish on this cotton sheeting fabric is a popular textured surface that uses the same process as for pleating cotton fabrics.

Pleated cotton voile: This voile was first embroidered and then pleated with chemicals and heat to achieve this texture before sewing into a fabric.

Polyester plain-weave pleated fabrics

Polyester fiber has transformed the world of fabric pleating. By simple heat and pressure, flat, lightweight polyester fabrics are be transformed into luxurious, pleated fabrics that perform better over time than natural fiber pleated fabrics.

By using only heat and pressure, this thermoplastic fiber retains its soft hand while being transformed into a variety of pleated textures. The pleating process is durable, although it is subject to relaxation if exposed to heat higher than 205°F (121°C)

Produce throughout the world, the concept of heat-setting top weight fabrics is limited only by the designer's vision. Pleating can be applied to the fabric, to cut pattern pieces, or to a garment that is already sewn. The final pleated garment silhouette is determined before the garment is pleated. The fabric should be no less than 60 percent polyester to be sure the pleating process will be durable. Even natural fiber blends with polyester are acceptable.

Polyester fabrics can be pleated without the use of chemicals. Therefore, there are fewer wastewater and emission pollution issues in the pleat finishing process. In addition, polyester fabrics can now be recycled into new high-quality fiber, so there is less concern about garments and fabrics destined for the landfill.



Figure 95 Printed fabric pleat

Source: Baugh, G. (2011). *The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential*. China: 1010 Printing International Ltd.: p. 238.

Facts and figures

1) Distinctive features

- Textured surface design or pleated design.
- Lightweight feeling, but fabric has volume.

2) Strengths

- Lightweight fabric with volume.
- Resilient.

3) Weaknesses

- Fabric retains body heat easily.
- Pleated finish can be released if subjected to high heat.

4) Usual fiber content

- 100 percent polyester.
- At least 60 percent polyester blended with other fiber, including natural fiber.

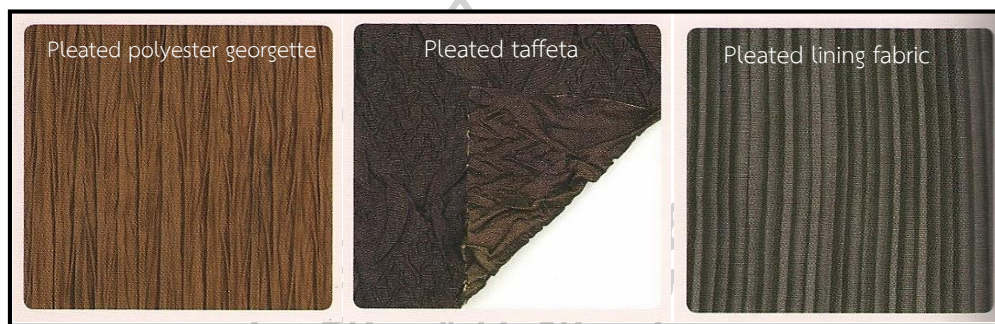


Figure 96 Polyester plain-weave pleated fabrics

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p.238.

Pleated polyester georgette: This finely pleated fabric resembles silk pleated georgette but provides the same effect for a lower cost and more durable pleated surface.

Pleated taffeta: This 60 percent polyester, 40 percent nylon fabric becomes stiffer after pleating because of the nylon fiber. Only polyester fiber stays soft after being heat-set. Nylon adds crispness to the fabric after pleating.

Pleated lining fabric: This 100 percent polyester fabric performs like a knitted fabric with this unique pleating design. The fabric remains soft after this heat setting method.

Crêpe and satin crêpe pleated fabrics

The use of thermoplastic fibers, such as polyester and nylon, in heat-set pleating has produced a variety of new textured pleated surfaces.

Designers can add a heat-set pleated texture to a medium weight fabric, differentiating the garment by the style of the pleated texture. There are pleating masters who design new pleating textures that are exclusive to a design company.

This heat-set pleating procedure allows a designer to use inexpensive fabrics and transform them into signature fabrics. Women's coats and jackets, in water-resistant polyester/nylon fabrics, have advanced the concept of lightweight rainwear with innovative textures and pleating. Women's sportswear companies have transformed simple, inexpensive fabrics into exclusive designs using this heat-set process.

In most cases, polyester multifilament yarns are used, and the fabric retains its soft hand. However, some fabrics include nylon or other fiber blends, and the fabric will retain some stiffness.



Figure 97 Crêpe pleated

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 239.

Facts and figures

1) Distinctive features

- Interesting, textured, pleated surface.
- Usually lustrous surface from simple multifilament yarns.
- Hand is often slightly more stiff than original fabric, due to not-polyester fiber blend.

2) Strengths

- Variety of textures and pleating designs for exclusive appearance.
- resilient fabric.
- Durable finish unless it exceeds 250°F (121°C).

3) Weaknesses

- Texture/pleats may relax if exposed to high heat.
- Heat-set hand can be stiff if fiber blend is more than 30 percent

nylon.

- Pressing seams can reduce the pleated finish at the seam.

4) Usual fiber content

- 100 percent polyester.
- Nylon/polyester blends.



Figure 98 Satin crêpe pleated fabrics

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010

Printing International Ltd.: p. 239.

Satin crêpe fabric before Pleating: 100 percent microfiber polyester fiber content gives this fabric a very smooth, drapery hand.

Satin crêpe fabric after Pleating: The sharp of the new pleating remain soft. The heat-set edges add new linear texture to the fabric.

Twice-pleated satin crêpe: This pleating pattern requires two different pleating designs to be applied separately. The resulting texture is unique to heat-set polyester fabrics.

Stitched pleating (Gabardine, poplin, taffeta, tricot knit)

Mechanically pleating by sewing or pressing is the most traditional method for adding expansion to a design. The fabric is layered in regular patterns, with the pleats either pressed or stitched in place.

Pleating mechanically requires a medium-weight fabric. Most lightweight fabrics are too difficult to control to keep the layering of the fabric equally spaced.

Spacing the size of each pleat and the method of holding the pleats in place are design decisions. The main point for the designer, when selecting the appropriate fabric, is to understand fully how a fabric will perform when pleated mechanically.

Almost any medium-weight fabric can be pleated, including jersey knits, double knits, and crêpe fabrics. Fiber content is also not an issue unless the designer intends to heat-set the pleats, which will require approximately 60 percent polyester fiber content for durable pleats without sewing.



Figure 99 Box-pleated skirt

Source: Baugh, G. (2011). *The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential*. China: 1010 Printing International Ltd.: p. 240.

Facts and figures

1) Distinctive features

- Always adding fabric with layers of fabric to allow the garment to expand.
- Pleats are nearly always parallel to the body.

2) Strengths

- Functional design method to add expansion to the design.

- When not active, pleats can remain closed and not show fabric volume.

- Pleats can add attractive design details.

3) Weaknesses

- Pleats can add weight to the garment, since most pleated garments use medium-weight fabrics.

- If stitched pleats, stitching lines must be carefully sewn to avoid pleats opening in an unsightly manner.

- Stitched-down pleats can fit the body poorly.

4) Usual fiber content: There is no limit to the fiber content. Spun yarns.

- 100 percent cotton and cotton/polyester blends.

- Rayon, acrylic, or polyester fiber blends.

- 100 percent wool or wool blends. Multifilament yarns:

- 100 percent polyester and polyester/rayon blends.

- 100 percent silk and silk blends.



Figure 100 Stitched pleating

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010

Printing International Ltd.: p. 240.

Bias-cut accordion pleats: Mimicking the bellows of an accordion, this pleating design can retain its pleat volume but is sewn flat into waistbands. Accordion pleats are sometimes edge-stitched to maintain the pleats in wool fabrics.

Matched plaid box pleats: This garment uses a plaid pattern that must be matched carefully around the entire skirt. The depth of the pleat must remain the same on all pleats. Note the stitched top of the pleat.

Inverted pleat: An inverted pleat has two creased edges meeting as if a seam. The effect is that no pleat is visible until the body moves. Inverted pleats are often used to expand the circumference of a slim skirt for ease of movement.

Paisley voile knife pleating: This skirt has been pleated in same-sized pleats, all in one direction around the body. This is the definition of knife pleating. This is a 100 percent wool fabric, and the pleats must be carefully maintained to keep the creased edge.



Figure 101 Pleated knit skirt

Source: Baugh, G. (2011). **The fashion designer's textile directory, a guide to fabric's properties, characteristics, and garment-design potential.** China: 1010 Printing International Ltd.: p. 240.

Conclusion

To sum, each folding technique has both strengths and weaknesses. To apply the folding techniques, colors, and process, the designers should carefully take the actual usage, folding patterns, and occasions into considerations. As a result, these considerations may contribute to the development of the fashion inspired by the arts of folding banana leaf.

Part 3: The folding in the designing fields

“In *The Infernal Machine*, Jean Cocteau conceptualizes the dimensions of time as a ‘folded eternity’, imagining a piece of folded fabric that each person pierces with a needle. The needle holes that run through the fabric, markers of a life lived as it passes through the folds of time, are only discovered once it has been unfolded.”
Gérard Ayache, Director, L’Institut Infométrie, La Grande Confusion blog, 23 June 2006 (Trebbi, 2012).

The world of folding

The word origami, which comes from the Japanese ‘oru’, meaning ‘fold’, and ‘kami’, meaning ‘paper’, literally denotes the actions of the art form. More than simply being a technique, it is above all a way of thinking differently about how to give to an object.

The classic way of teaching origami is through the master providing the student with verbal instructions and through observation and repetition. According to some researchers this ancient technique was born in Japan, while others argue it originates from China. The first book on origami, *Hiden Senbazuru Orikata* (‘The Secret of Folding One Thousand Cranes’), was published at the end of the eighteenth century. This bird, a symbol of happiness and immortality, encapsulates the Japanese aesthetic. The book contained the first ever sets of detailed instructions for making origami, or ‘crease patterns’ as they are known in today’s terminology.

With its mixture of magic and instinct, origami often seems like a sleight of hand. In many respects it’s a clever game that involves selecting the right paper—rough, smooth, glossy, satin or silky—knowing the right techniques—folding in half, gluing or wetting the paper—and of course getting the folds right. Origami, or the art of folding, became a fully-fledged science some time ago, all the while retaining its magic and poetry.

Origami made the transition from traditional to modern with the help of Shuzo Fujimimoto, the father of the geometric fold. But we have to thank the origami

master Akira Yoshizawa for providing us with a vocabulary of signs and symbols—the origamist’s equivalent of solfège—that allow us to differentiate valley fold from mountain folds, an advance that has allowed origami to break out of the restrictions of language barriers and be understood visually.

For a long time and for obvious reasons, the art of folding was limited to paper, textiles and other materials that can easily be worked with naturally. But current trends—and this is precisely the purpose of this book—have broken away from these restrictions. The emphasis is now on finding new shapes and forms, sometimes with the help of computer technology, which still start out as a flat piece of material, but are not restricted by the chosen material. For now practically any material, concrete included, can be ‘folded’. Much of the progress made has drawn on nature. One only needs to look at the contours of the land, the texture of cabbage leaves, the delicate pleats of palm leaves and the intricacies of animal skins to see that nature is certainly not sparing in its use of folds. This imitation of nature, known as ‘biomimicry’, has been the subject of some important pieces of research. Dennis Dollens, an architect based in New Mexico, has been studying the structural forms found in nature as part of his research into sustainable development. In his view great innovations can come from observing living things and their structures and mechanisms. The work of Dr. Taketoshi Nojima of the University of Tokyo is based around fold patterns found in nature, and in particular the growth processes of plants. It’s a whole new scientific field, very accurately christened ‘BiOrigami’ by Jean-Jacques Dupa, an engineer and researcher at the Commissariat à l’Energie Atomique in France.

For many years the furniture and décor communities were more interested in the ‘foldable’ than the ‘folded’. Through various innovations that made use of bolts, hinges, pivots and rotational systems, designers put forward some ingenious piece of work that are more compact and easier to store. Before becoming interested in the ‘folded’, architects made use of flexible and deployable designs, in the form of mobile structures that range from tents to the Mongolian yurt, and even to Guy Rottier’s cardboard house, built in 1968, or the kinetic architecture of Chuck Hoberman. But today the notion of folding is not restricted to the merely ‘foldable’ and responds

to imperatives that go beyond compactness, revealing an infinitely rich range of applications (Trebbi, 2012).

1. Folding in Engineering

Solar power, Origami-Style

As a high school student at a study program in Japan, Brian Trease would fold wrappers from fast-food cheeseburgers into cranes. He loved discovering different origami techniques in library books. Today, Trease, a mechanical engineer at NASA's Jet Propulsion Laboratory in Pasadena, California, thinks about how the principles of origami could be used for space-bound devices. "This is a unique crossover of art and culture and technology," he said.

Trease partnered with researchers at Brigham Young University in Provo, Utah, to pursue the idea that spacecraft components could be built effectively by implementing origami folds. Shannon Zirbel, a doctoral student at BYU, spent two summers at JPL working on these ideas, supported by the NASA Technology Research Fellowship, with Trease as her research collaborator. Researchers say origami could be useful one day in utilizing space solar power for Earth-based purposes. Imagine an orbiting power plant that wirelessly beams power down to Earth using microwaves. Sending the solar arrays up to space would be easy, Trease said, because they could all be folded and packed into a single rocket launch, with "no astronaut assembly required."

Panels used in space missions already incorporate simple folds, collapsing like a fan or an accordion. But Trease and colleagues are interested in using more intricate folds that simplify the overall mechanical structure and make for easier deployment.

Last year, Zirbel and Trease collaborated with origami expert Robert Lang and BYU professor Larry Howell to develop a solar array that folds up to be 8.9 feet (2.7 meters) in diameter. Unfold it, and you've got a structure 82 feet (25 meters) across. Their 1/20th-scale tabletop prototype expands to a deployed diameter of 4.1 feet (1.25 meters).

One technique that has been used for an origami-inspired solar array is called a Miura fold. This well-known origami fold was invented by Japanese astrophysicist Koryo Miura. When you open the structure, it appears to be divided evenly into a checkerboard of parallelograms. With this particular fold, there's only one way to open or close it: Pull on one corner and -- voila -- the whole thing is open with minimal effort. The mechanical structure of a device that folds this way is greatly simplified because only one input is required to deploy it.

Miura intended this fold for solar arrays, and in 1995 a solar panel with this design was unfolded on the Space Flyer Unit, a Japanese satellite. Despite this test, the technology is still in its early stages. But now, with an emphasis on small satellites and large structures, Trease says arrays inspired by this fold could see renewed usefulness. "The fact that we're going both bigger and smaller may open up domains where it may be relevant again," Trease said. The fold that Trease and colleagues used is not a Miura fold, but rather a combination of different folds. Trease's prototype looks like a blooming flower that expands into a large flat circular surface.

Trease envisions that foldable solar arrays could be used in conjunction with small satellites called CubeSats. And he says the origami concept could be used in antennas as well. It could be especially appropriate for spacecraft applications where it's beneficial to deploy an object radially -- that is, from the center, outward in all directions.

Origami was originally intended for folding paper, which has almost no thickness, so Trease and colleagues had to be creative when working with the bulkier materials needed for solar panels. "You have to rethink a lot of that design in order to accommodate the thickness that starts to accumulate with each bend," he said. Origami has been the subject of serious mathematical analysis only within the last 40 years, Trease said. There is growing interest in integrating the concepts of origami with modern technologies. "You think of it as ancient art, but people are still inventing new things, enabled by mathematical tools," Trease said (Landau, 2014).



Figure 102 Solar power using the principle of origami

Source: Elizabeth Landau. (2014). Retrieve from
<https://www.nasa.gov/jpl/news/origami-style-solar-power-20140814>

Researchers at NASA's Jet Propulsion Laboratory, Pasadena, California, and Brigham Young University, Provo, Utah, collaborated to construct a prototype of a solar panel array that folds up in the style of origami, to make for easier deployment. Credits: BYU



Figure 103 Brian Trease with a prototype of a solar panel

Source: Elizabeth Landau, Retrieve from <https://www.nasa.gov/jpl/news/origami-style-solar-power-20140814>

2. Folding in Furniture

Voxia

Voxia is a collection of one-piece, laminated wood chairs created by the Danish architect Peter Karpf for Iform.

The chairs' originality lies in their patented design, comprised of successive multi-play veneer layers that are positioned alternately at 45° or 90° angles, which optimizes the chairs' strength and bendability.

An economical assembly process allows for the chairs to be cut from just one wooden panel. With their simplicity and the purity of their Nordic lines, this collection shows off the ecological and economical potential of moulded wood. The Xus model is moulded straight from a single piece of wood into a three-dimensional shape.

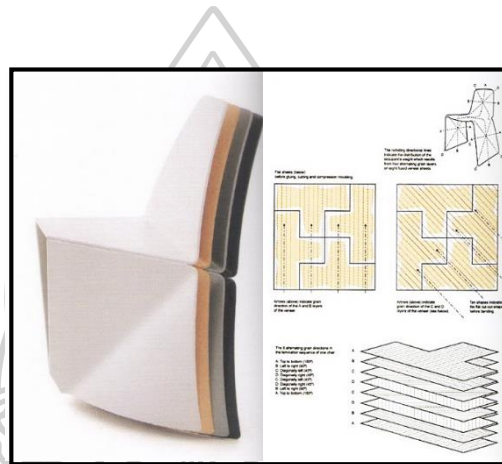


Figure 104 Cutting pattern for the Nxt and Tri, stackable chairs

Source: Trebbi (2012). **The art of folding: creative forms in design and architecture**. China: Promopress: p. 82.

3. Folding in Accessories

At Studio Lo, designers Eva Guillet and Aruna Ratnayake have developed their own special production methods. “With an awareness of the economic realities of the design industry, we set up our own independent company in 2005. Our desire to produce goods using responsible methods led us to use natural materials and work wherever possible with a local network of SMEs. We developed a ‘pauper’s design’ style that only requires a modest investment and is based around small-scale production runs. The research we carried out into materials optimization, customization and production chains led us to deploy water-jet cutting systems. As we make our pieces we endeavour to create expressive and clear production processes.



Figure 105 Creations by Studio Lō : bage, nest boxes, slippers, CD pockets

Source: Trebbi (2012). **The art of folding: creative forms in design and architecture.** China: Promopress: p. 62.

Bag: Made from screen-printed felt, water-jet cut, assembled using zips. The Opla bag stands at about a third of the width of a standard roll of felt. Its zip is like a detachable seam that is used to assemble the bag, and also opens up the possibility of adding ‘peripherals’ to it.” There are other folded fashion accessories that are worthy of mention, not least the range of coloured, Tetra carton-shaped felt bags produced by the Japanese label Tokyo Power, or Aiko Machida’s refined bags made from folded leather.

Slippers: made from a single piece of screen-printed felt, water-jet cut, assembled with fasteners. The slippers are made using a contiguous design pattern, meaning two slippers are made using each cut. This principle of ‘shared cuts’ is one that we try to incorporate into our creations. Rotating the printing screen and using a ‘shaky’ cutting technique also allows us to make one-off runs of our designs. Printable honeycomb CD pocket, 140g grooved paper, prototype. When flattened out, the pocket is 29.7cm long and can be printed on and customized using a selection of templates or with the help of the software on the accompanying CD. A simple series

of folds combine to create a pocket with an efficient closing motion. A double-sided tape fastening allows the pockets to create a modular, ultra-flat system of wall storage for CDs.



Figure 106 UM bags by Josh Jakus

Source: Trebbi (2012). **The art of folding: creative forms in design and architecture.** China: Promopress: p. 63.

The bags made by the Californian designer Josh Jakus, on the other hand, are made using a different approach. Jakus set himself two challenges. The first was to capitalize on the density, texture, strength and flexibility of felt to make objects from just one sheet of the material, and the second was to transform a flat surface into a three-dimensional object and vice-versa simply by using a zip. In 2005 Jakus created his UM bags using two layers of material made from 85% wool and 15% other fibres. In a similar vein, he creates objects in a way that takes advantage of the simplicity of their forms and the materials they are made from. For example, rather than simply being thrown away, the circle cut-outs that are created in making handles are used to make drinks coasters.

4. Folding in Fashion

Issey Miyake

In the summer of 2010, the Reality Lab. Presented a new line of clothing :

132 5. Issey Miyake.

The Reality Lab. Is a laboratory established by Issey Miyake in 2007 to explore new ways of “making things” for tomorrow. It is comprised of a team of 11, including young staff members who work side by side with core-members that are veteran engineers. This team has conducted extensive research in the area of new materials as well as in finding new ways to re-use existing materials. The team uses “re-generation” and “re-creation” as its key words, ever-mindful of a need to preserve the environment and our limited resources. By the application of their research and a mathematical principle of folding to a new manufacturing technology, the 132 5. Issey Miyake line was born, changing ideas about making clothes. Many members of the media were amazed by the beautiful changes in shape from when the garments were folded to when they were born ; and praised them for their beauty.

Now, nearly six years after its initial unveiling, the 132 5. Line continues to grow and evolve, even influencing other fields. (Sanae Shimizu, 2016: 5)

The structure of 132 5. Issey Miyake brought a new concept of “beauty when folded” to clothing. It also brought an element of surprise as no one could predict how the garment would look when worn, based upon its shape when folded. One of the primary features of this line is the metamorphosis from flat-folded to a three-dimensional shape.

Normally, the patterns that serve as blueprints for garments are based upon traditional formats of center-front, center-back, etc depending upon the physique and gender. However, each 132 5. Pattern consists of a single geometrical-creased pattern. The lines that delineate triangles also serve as “topographic” structural lines that serve as guidelines for the garment’s shape. This element not only sets these garments apart but is also the reason why 132 5. Is described as “a great revolution in clothing” (Shimizu, 2016).



Figure 107 132 5. Issey Miyake : 2D to 3D

Source: Issey Miyake folds Origami again. **132 5. Spring Summer 2012**. Retrieve from <http://www.tokyofashiondiaries.com/issey-miyake-folds-origami-again-132-5-spring-summer-2012/>

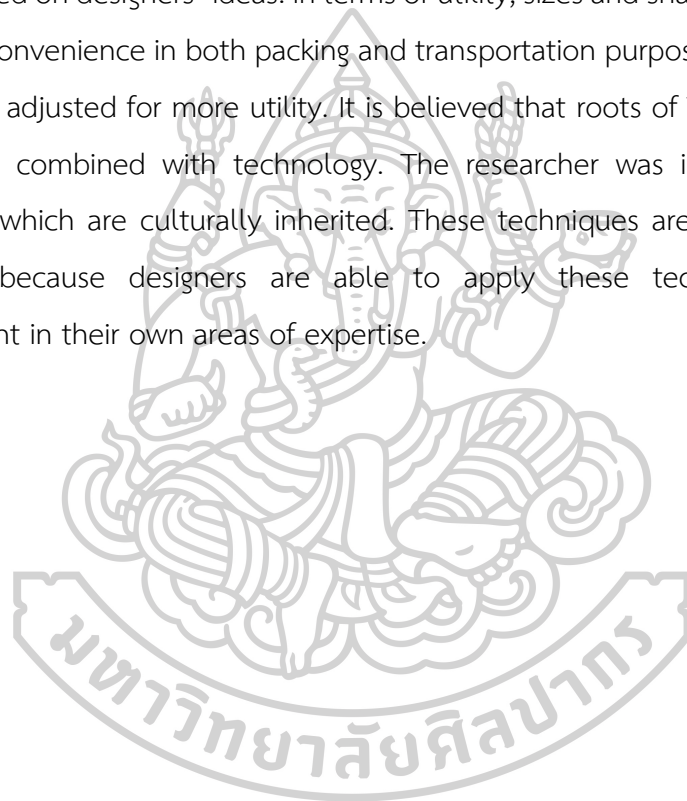


Figure 108 132 5. Issey Miyake clothing

Source: Kat-Cat, Issey Miyake's Origami collection. **132 5 is totally magic!**. Retrieve from: <https://thrucolorfuleyes.wordpress.com/2010/11/24/issey-miyakes-origami-collection-132-5-is-totally-magical/>

Conclusion

It can be seen that the ancient Japanese art of origami can be applied in various branches of designing such as engineering, architecture and fashion. Like Japanese cultures, the art of folding in Thai cultures are found in some words listed in the Royal Institute Dictionary. Some of the examples are “fold fabrics”, “fold a piece of paper”, bend together. In general designing, a shape is changed from two dimensions to three dimensions. In terms of beauty, beautiful and creative shapes are created based on designers’ ideas. In terms of utility, sizes and shapes can be adjusted, leading to convenience in both packing and transportation purposes. Sizes and shapes can also be adjusted for more utility. It is believed that roots of Thai cultures can be successfully combined with technology. The researcher was interested in folding techniques which are culturally inherited. These techniques are worth learning and preserving because designers are able to apply these techniques for future development in their own areas of expertise.



Chapter 3

Research Methodology

This chapter discusses the research design of investigating the various pattern of Thai traditional art of folding Krathong, and applied it in the design and development of cloth. It is also discussed the research methodology and research instruments. The researcher applied the art of folding Krathong to create cloth, and to select the best fabric in order to design and develop clothes. The target groups, the experts, the designers in the field of Thai traditional products and clothes are invited to evaluate the clothes in order to get the useful feedbacks for a further development. Additionally, the researcher employed the questionnaire to investigate the consumers' product preferences and consuming behaviors of the target group. This chapter is divided into four parts as follows:

Part 1: Research design and the survey of the consumers' opinion and behavior as a background for developing the prototype clothing

Part 2: Research methodology to create prototypes of cloth

Part 3: Data collection process using the expert's evaluation form and consumers' questionnaire, and data analysis

Part1 : Research design and the survey of the consumers' opinion and behavior as a background for developing the prototype clothing

This study aimed to investigate the traditional patterns of folding Krathong in order to apply it as a model in designing and developing cloth. In addition, the experiment on creating cloth as well as patterns and fabrics selection was done in order to create the best design of cloth. The research design is presented as follows:

1. Investigate the Thai traditional art of folding Krathong.
2. Employ the questionnaire to survey the consumers' opinion and behavior to use it as a background of developing the prototype clothing.

3. Investigate the suitable fabric for each folding patterns in order to create cloth.
4. Obtain and verify the appropriate folding patterns for designing and developing the Krathong-inspired clothing by trying the folding patterns on various fabrics.
5. Design and develop the Krathong folding patterns for designing and developing the Krathong-inspired clothing.
6. Collect the data related to the opinion toward the prototype clothing by interviewing the fashion design and fabric experts, or the expert in the field of Thai traditional products and clothes by using the evaluating form.
7. Collect the data in terms of opinion and satisfaction from the target group by using questionnaire.
8. Analyzed the data to obtain the experts and target group opinion for further development.

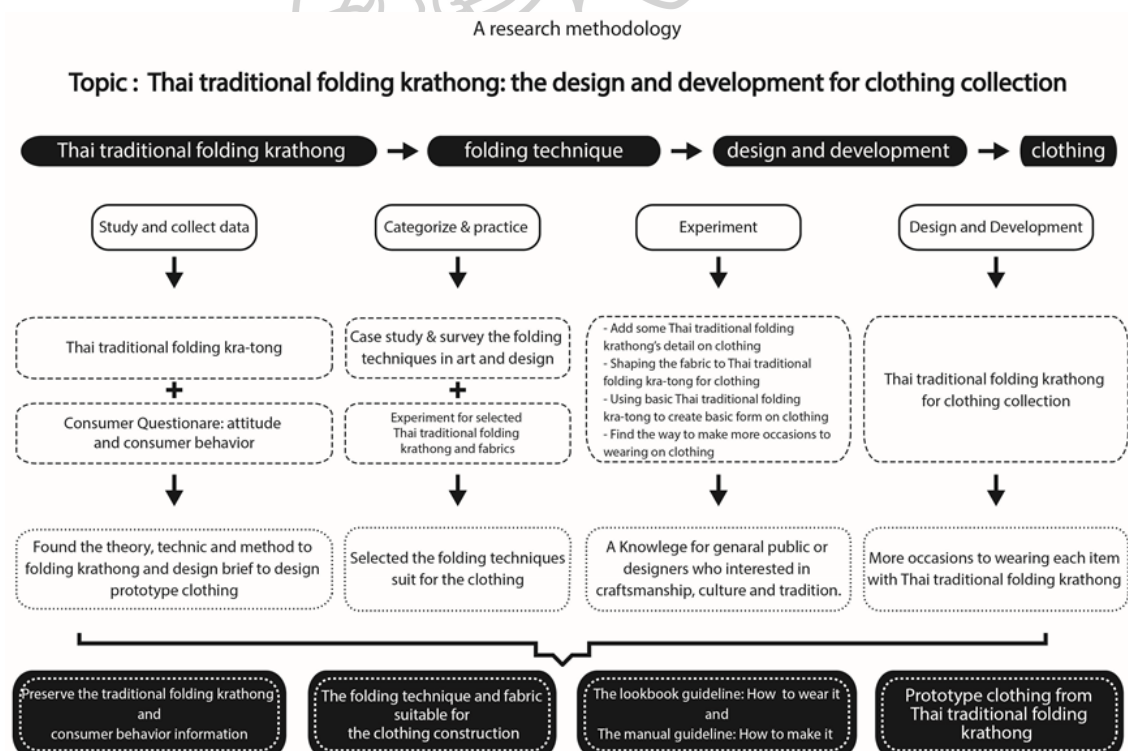


Figure 109 A research methodology

Part 2: Research methodology to create prototypes of cloth

This study focused on applying the traditional art of folding Krathong to design and create clothes. Therefore, the main focus of this study is to experience the best model on folding Krathong in order to create the best prototype of clothe that resemble the Thai cultural heritage. The experimental steps are as follows:

The folding experiment to select the best model of folding Krathong for the further designing

The researcher reviewed and collected the information of the traditional art of folding Krathong from the book entitles “The arts of folding banana leaves”. Also, Ajarn Vijit Sonhom, a lecturer form Faculty of Home Economy Technology, Rajamangala University of Technology Thanyaburi, assisted the researcher by allowing the researcher to sit in the Banana leaves and the traditional ways of Thai people class. The researcher has learnt the history of the art banana leaves folding, the materials, and the folding models from this course.

1. The selection of Krathong folding model

1.1 The criteria for choosing the Krathong folding model

Twelve Krathong folding models were selected as a pattern to develop clothes. The criteria on how to select the Krathong folding models are as follows:

- 1) The folding process begins from the rectangle banana leaf cut which is similar to the cloth design technique.
- 2) It has simple folding processes. It aimed to assess to people who do not have any Krathong folding skill.
- 3) The finished fold should not be too thick. That is because the texture of the fabric is thicker than banana leaf. If the fabric becomes too thick after folding, it can change the pattern of the Krathong fold.

1.2 Experiencing the selected Krathong model

- 1) Hak kor ma
- 2) Hua kwhan plang
- 3) Hua nik kor yak

- 4) Hak kor ma lie pia
- 5) Kleab fun pla
- 6) Kleab ku larb yam
- 7) Kleab ka ra wake
- 8) Kleab phee seua
- 9) Kleab ko sol sroy
- 10) Kleab pood tarn
- 11) Kleab rat cha pruk
- 12) Kleab puang ko men

2. The materials specification

The key of the good cloth is a good fabric that is used to create a cloth. Good fabric will support the nice pattern of the cloth. It is also affected on the wearing opportunities and the benefits of wearing the cloth.

2.1 The characteristics of the fabrics

The researcher set the characteristics of fabrics in order to select the best fabrics to fold. The criteria on selecting the clothes are as follows:

- 1) Stability
- 2) Good draping
- 3) Heat resistance
- 4) Smoothness
- 5) Balance
- 6) Wrinkle
- 7) Stretch
- 8) Strong
- 9) Soft with the wearable fabric

2.2 Fabric selection

According to the literature review on the characteristics of cloth, the fabric folding and wearing experiment, it reveals that the cloth that follows the characteristics in item 2.1 is the best fabric for creating the prototype clothing. That is because it can be worn in daily life, and appropriate with the weather in Thailand. The fabrics that the researcher selected for the experiments are as follows:

2.2.1 Natural Fabric

- 1) Cotton
- 2) Linen
- 3) Muslin
- 4) Jute
- 5) Ramie
- 6) Thai silk

2.2.2 Man-made fabric

- 1) Polyester
- 2) Nylon
- 3) Organza
- 4) Organdy
- 5) Satin

2.2.3 Blended Fabric

- 1) Cotton Spandex
- 2) Linen Viscose

After doing the experiment and reviewing the related study on the art of folding Krathong which is in chapter 2, the researcher selected twelve Krathong folding models and fabrics in order to experiment the most appropriate Krathong fold model to create the prototype clothing. The characteristics of the selection of Krathong folding model were discussed in chapter 3. The best model should be the Krathong folding technique that was not complicated to fold, and the outcome of the fold was not too thick. It should present the pattern of the fold clearly. Additionally, the folding instruction should be able to follow easily by everybody. The main characteristic in selecting the model of folding Krathong was the beginning process that must start from a rectangle shape of banana leaf. This was similar to the cloth folding that it also started from the rectangle shape. There were twelve types of fabric that were used for creating clothes which were selected by following the criteria mentioned in chapter 3. Additionally, the researcher tried out several models of Krathong folding as presented in the pictures below.



Figure 110 The experiment of Thai traditional folding Krathong with the various types

In order to investigate the accurate data for selecting the fabrics to design and develop clothes effectively, the researcher arranged the workshop to retrieve this data. Three Fabrics and fashion design students were invited to attend this workshop. They were asked to fold 12 types of fabrics by following twelve models of folding Krathong. A Silver star ES-85AF iron was used to set the folding pattern on every

folding fabrics. After that, the students were asked to rate the fabrics based on the give properties as presented in Table 1.





Table 1 Fabric Properties

Properties	Natural Fabrics						Man-made Fabrics				Blended Fabrics	
	Cotton	Linen	Muslin	Jute	Ramie	Ths i silk	Organza	Organdy	Nylon	Satin	Cotton+Spandex	Linen+Viscose
Good stability	3	2	2	2	2	3	3	3	1	1	2	2
Good draping	1	1	1	1	1	2	3	3	2	2	2	2
Heat resistance	3	3	3	2	2	3	2	2	1	1	2	2
Smoothness	2	2	2	2	2	2	2	2	2	3	2	2
Balance	3	3	3	3	3	3	2	2	1	1	3	3
Wrinkle	2	1	2	1	1	3	3	3	2	2	2	2
Stretch	2	2	2	2	2	2	3	3	1	1	3	2
Strong	3	3	3	3	3	3	2	2	1	1	2	2
Soft	2	3	2	2	2	2	2	2	2	3	3	3
Total	21	20	20	18	18	23	22	22	13	15	21	20

According to the results, it showed that the most appropriate type of fabric for folding was man-made fiber. The physical properties of this type of cloth were the stability after folding, and thermal resistant because the researcher had to use the heat from iron to help stabilized the folding cloth and to create a thin texture after folding. The fabric was also smooth, and did not creased easily. The fibers of this cloth were strong and non-irritating. Therefore, the Organza and Organdy fabrics were selected to try out in the developing of cloth using Hak kor Ma Krathong folding model. The basic pattern of the cloth was a rectangle piece of fabric which is similar to the

basic shape of the banana leaf before folding. The comparison of the Organza and Organdy fabrics is presented in Table 2.

Table 2 The results of experiment: part 1

Directory	Organza	Organdy
Thai traditional folding Krathong: Hak kor ma from banana leaf		
Thai traditional folding Krathong: Hak kor ma from Fabric		

The result from fabrics test revealed that both organdy and organza fabrics were not appropriate for the folding patterns, despite their very affordable cost. These two fabrics could not yield the crease, which was a by-product of the post-folding process created by the heat from the steaming. These two fabrics were very sensitive to the heat and their thin, fine, and translucent fibers restrained the utilities of the designs and occasions. Therefore, the researcher finally chose high-priced Thai silk because it had the finest quality for making the prototypes.

The researcher applied to the following results from the aforementioned tests to the main study as follows.

1. The creases created by the folding and unfolding processes could be used to create the new designs.
2. The transformation of the two-dimensional Krathong folding patterns to the three-dimensional ones could be possible because they shared the very same perspective of geometry.

Upon these results, the researcher could maximize the value and usefulness of the application of the Krathong folding patterns to the costume designs.

3. The experiment on designing the prototype of clothes

3.1 Conclude the data related to the consumers' opinion and satisfaction in order to create the cloth which adapted from the appropriate art of folding Krathong, and matched the consumer's needs.

3.2 Sketch by drawing and create prototype clothing on paper and various types of fabrics.

3.3 Use the most appropriate fabric for designing and developing the prototype clothing.

3.4 Analyze the characteristic of fabric at Textile Testing Center, and Thailand Textile Institute in order to retrieve the ideal fabric for folding.

3.5 Test the stability of fabrics and prototype clothing by using various techniques at the company that proficient in folding work. It was found that Thai silk was the most appropriate fabric for the creation and modification of Krathong folding patterns to the costume designs.

3.6 Design and develop a prototype clothing, and get a feedback from the experts in terms of the best folding pattern, usefulness, beauty, and weakness for further development.

3.7 Design and develop the cloth from the selected fabric.

3.8 Conclude and discuss. Get the experts' feedback once again after creating the final version of cloth. After that, exhibit the prototype clothing in public. Ask the audience to evaluate the prototype clothing for further conclusion and discussion.

Part 3: Data collection process using the expert's evaluation form and consumers' questionnaire, and data analysis

The instruments used to collect the data aimed to evaluate the prototype clothing in terms of pattern, benefit, and cultural value. The data was divided into

two groups. The first group related to the application of the 10 evaluation forms with the experts in the related field, and the target consumers. The second group is related to the application of 141 evaluation forms with the target group. There are also studies and literatures that are related to this study.

The criteria to select the experts: 10 people

1. They earn a bachelor degree, master degree, or above in the field of art, designing, or marketing.

2. They have five years' experience in the field of designing and marketing. The list of fifteen experts is as the following.

1) Mr. Korakot Aromdee: He is a product designer who is expert in cultural art and knowledge. He won the national and International awards in the field of product's design, and furniture design. He is the owner of the Korakot international limited partnership.

2) Assistant Professor Vinai Taravet: He is a florist and banana leaf folding designer, and the lecturer at the Departments of Creative Crafts Technology, Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi.

3) Mr. Chanoknan Mukdaphongsatorn: A creative director of Touching point company. He is product design and branding consultant. He is a fashion design part-time lecturer at Thammasat University.

4) Mr. Chalermkiat Khatikasemlert: He is a brand owner of Wonder Anatomie which is established and has been succeeding for more than 13 years. There are shops in Thailand, France, Russia, The United State of America, Spain, Singapore, and Hong Kong. He is also a street wear fashion designer who is famous for the outstanding patterns with the printed fabric, the 3D and strange materials.

5) Mr. Prarunrop Prueksopsee: He is the fashion designer, and the Textile, costume, garment and fashion design lecturer at Faculty of Fine and applied arts, Thammasart University.

6) Mr. Atthaphon Ponglawhapun: He is a Fashion and textiles lecturer at the department of Creative arts, Faculty of Fine and applied arts, Chulalongkorn University.

7) Mr. Vijit Sonhom: He is a florist and banana leaf folding designer, and a lecture at the Departments of Creative Crafts Technology, Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi.

8) Miss Orapan Tangviriya: She is the owner of Fabric living which is the brand that sells cloth, bedsheet, and the household goods made from cloth. This brand is established for more than 15 years. She also opened the Line café under the same name of the brand. The marketing strength of this brand is the soft texture of fabric.

9) Miss Nusara Paniangvait: She is a designer of the adjustable cloth by fastening.

10) Miss Chaleeporn Dittana: She is the leather good designer, and an accessories design part-time lecturer at Thammasat University. She is also participate in the community development projects of various provinces in Thailand.

Research instruments

1. An evaluation form applied to interview the experts and the target groups in order to investigate the valuable opinion in developing and adjusting the design. The evaluation topics are as follows.

- 1) Target group
- 2) Prototype clothing
- 3) The art of folding Krathong and cultural art

2. The evaluation form specifically the questions were validated by three fashion design and research experts. The list of the experts is presented below.

- 1) Associate Professor Sutasanee Boonyobhas
- 2) Dr.Sakorn Chonsakorn, Assistance Professor in Textiles and Clothing at the Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi.
- 3) Dr.Srikanjana Jatupatwarodom, Assistance Professor in Textiles and Clothing at the Faculty of Home Economics Technology, Rajamangala University of Technology Thanyaburi .

3. The online questionnaire employed to collect the data to investigate the consumers' behaviors and satisfaction of the target group. The samples were selected

by the estimated ages, life styles, works, preferences, and personality. The questionnaire is divided into three parts as follows.

- 1) General information of the questionnaire samples
- 2) Opinion and behaviors of the questionnaire samples
- 3) Prototype clothing information

4. The questionnaires specifically the questions were validated by three fashion design and research experts. The list of the experts is presented below.

1) Miss Prapakorn Sukonthamane, Associate Professor in Applies Arts Studies at the faculty of Decorative Arts, Silpakorn University.

2) Dr.Siwaree Arunyanart ,Reseracher in Fashion Creative Arts and Research Unit (FAC-RU), Chulalongkorn University.

3) Miss Waraporn Sampao, Instructor at the department of Textile, costume, garment and fashion design Faculty of Fine and applied arts, Thammasart University.

Data Analysis

Data was analyzed by using the following instruments.

1. Evaluation form to interview the experts and target group

The data was analyzed qualitatively. The data was applied as the background information to evaluate the prototype clothing. The data also used for improving the cloth.

2. The questionnaire to collect the consumers' opinion, behavior, and satisfaction

The data was analyzed quantitatively to get the statistical results and to get the highest scores results of each questionnaire's items.

3. Analyzed Data

3.1 The data obtained from questionnaire was analyzed by using percentage.

3.2 The data obtained from the questionnaire was calculated by mean \bar{X} (and standard deviation (SD). The following scale is used to calculate the results the evaluating form.

4	means	most agree
3	means	agree

2 means slightly agree

1 means least agree

The mean scores \bar{x} (between 3.51-4.00 means most satisfaction

The mean scores \bar{x} (between 2.51-3.50 means more satisfaction

The mean scores \bar{x} (between 1.51-2.50 means neutral satisfaction

The mean scores \bar{x} (between 1.00-1.50 means least satisfaction

3.3 The data obtained from the questionnaire was calculated by mean \bar{x} and standard deviation (SD). The following scale is used to calculate the results of the questionnaire.

5 means most agree

4 means agree

3 means moderately agree

2 means slightly agree

1 means least agree

The mean scores \bar{x} (between 4.51-5.00 means most satisfaction

The mean scores \bar{x} (between 3.51-4.50 means more satisfaction

The mean scores \bar{x} (between 2.51-3.50 means neutral satisfaction

The mean scores \bar{x} (between 1.51-2.50 means least satisfaction

The mean scores \bar{x} (between 1.00-1.50 means satisfaction with

improvement

Chapter 4

Research Findings

This chapter presents the results of the study. The data was obtained from the consumers' questionnaire, experimental results, and experts' evaluation form. The data was analyzed and concluded in order to retrieve the information in terms of opinions and satisfaction toward various models of the prototype clothing both in positive and negative ways. In addition, the data was employed as further development of designing cloth, or served as a guideline for others designers to be more interested in the Thai cultural arts. The results are divided into three parts.

Part 1: The results of the consumers' opinions and behavior as a background information of the patterns of Thai traditional Krathong folding to the design and development for clothing collection.

Part 2: The results of the creating the prototype clothing by applying Thai traditional Krathong folding to the design and development for clothing collection.

Part 3: The results from the experts' evaluation form and the consumer's questionnaire toward the application of the Thai traditional folding to the design and development for clothing collection.

Part 1: The results of the consumers' opinions and behavior as the background information of the patterns of Thai traditional Krathong folding to the design and development for clothing collection.

The questionnaire was given to 141 women and transgender people in order to investigate of the consumers' opinions and behavior as the background information for developing the prototype clothing (n=141). The data can be concluded into three parts as the follows: (1) the general information of the questionnaire samples, (2) opinions and behavior of the questionnaire samples, and (3) prototype clothing information. The results are as follows:

Table 3 The results of the general information of the questionnaire samples: Age

Data	Frequencies	Percentages
Age		
21-31 years old	74	52.50
39-53 years old	35	24.80
54 years old or above	32	22.70
Total	141	100.00

Table 3 shows the general information in terms of consumers' age. The largest group of consumers was the 21-38 years old people (52.50%). The second largest group was the 39-53 years old people (24.80%). Last, smallest group was the 54 years old or above people (22.70%).

Table 4 The results of the general information of the questionnaire samples: Marital status

Data	Frequencies	Percentages
Marital status		
Single	77	54.60
Married or living with partner	56	39.70
Divorced or separated	8	5.70
Widowed	0	0.00
Total	141	100.00

Table 4 shows the general information in terms of consumer's marital status. The largest group of the consumers was single (54.60%). The second largest group was people who were married or live with partner (39.70%). Last, the smallest group was people who were divorced or separated (5.70%).

Table 5 The results of the general information of the questionnaire samples:
Educational Background

Data	Frequencies	Percentages
Educational background		
Bachelor degree	70	49.60
Master degree	56	39.70
Doctoral degree	10	7.10
Higher vocational certificate	1	0.70
Vocational certificate	1	0.70
Senior High School	1	0.70
Others	2	1.40
Total	141	100.00

Table 5 shows the general information in terms of consumer's educational background. The largest group of consumers graduated with a bachelor degree (49.60%). The second largest group was the consumers who graduated with a master degree (39.70%). Last, smallest group of the consumers were not graduate on the list provided (others) (1.40%).

Table 6 The results of the general information of the questionnaire samples:
Occupations

Data	Frequencies	Percentages
Occupations		
Government officer/University officer	41	29.10
State enterprise officer	1	0.70
Company employee	48	34.00
Freelance	26	18.40
Others: House-wife	9	6.40
Others: Pensioner	7	4.90
Others: Retired government officers	3	2.10

Table 7 The results of the general information of the questionnaire samples:
Occupations (Continue)

Data	Frequencies	Percentages
Occupations		
Others: Fresh graduate	1	0.70
Others: Contractor	1	0.70
Others: Business owner	1	0.70
Others: Nurse	2	1.40
Others: Interior designer	1	0.70
Total	141	100.00

Table 6 and 7 shows the general information in terms of consumer's occupations. The largest group of the consumers was a company employee (34.00%). The second largest group of consumers was the government officer or the university officer (29.10%). Last, the smallest group of consumers was fresh graduate, business owner, contractor, and interior designer (0.70%).

Table 8 The results of the general information of the questionnaire samples: Income

Data	Frequencies	Percentages
Income (baths per month)		
0-10,000	5	3.50
10,001-30,000	39	27.70
30,001-50,000	69	48.90
50,001 or more	28	19.90
Total	141	100.00

Table 8 shows that the highest group of consumers earned 30,001-50,000 baths per month (48.90%). The second highest group earned 10,001 – 30,000 baths per month (27.20%). Last, the smallest group earned 0-10,000 baths per month (3.50%).

Table 9 The results of the consumers' habit and personality (3 items selected)

Statement	Frequencies	Percentages
Which statements best describe your habit and personality? (Please select 3 items)		
- I am a discipline person. I plan and aim to be successful.	48	14.24
- I want to be accepted by the others. I choose the high quality, reliable, and expensive product.	19	5.64
- I am a risk-taker, active, challenged person, and a quick decision maker.	25	7.42
- I am a creative person. I am open-minded especially with new things. I can get along with people easily.	59	17.51
- I am a simple and peaceful. I don't like confusion. I am unambitious.	62	18.40
- I am a self-confident person, and good at persuading others.	16	4.75
- I like change and don't clinch on something. I listen to people's opinion.	23	6.82
- I am interested in the cultural art. I like handicraft and unique objects.	55	16.32
- I am interested in technology and modern things.	27	8.01
Total	337	100.00

Table 9 shows the information regarding to the consumer's habit and personality. The largest groups of consumers were simple and peaceful people and unambitious (18.40%). The second largest group of the consumers was creative people who were open-minded to the new things (17.51%). The smallest group of consumers was the self-confident people with a persuasion skill (4.75%).

Table 10 The results of the consumers' habit and personality: The products' design

Statement	Frequencies	Percentages
Do you purchase products based on its design?		
Yes	120	85.10
No	21	14.90
Total	141	100.00

Table 10 shows the consumers habit and personality in terms of the product's design. 85.10% of the consumers bought products based on its design. 14.90% of the consumers did not pay attention to the design of the products.

Table 11 The results of the consumers' habit and personality: The cultural product

Statement	Frequencies	Percentages
Are you interested in the cultural products?		
Yes	120	85.10
No	21	14.90
Total	141	100.00

Table 11 shows the consumers habit and personality in terms of the cultural product. 85.10% of the consumers were interested in buying the cultural products. 14.90% of the consumers were not interested in purchasing the cultural products.

Table 12 The results of the consumers' habit and personality: The integration of cultural art and clothing

Statement	Frequencies	Percentages
Are you interested in the cultural art integrated cloth?		
Yes	118	83.70
No	23	16.30
Total	141	100.00

Table 12 shows the consumers habit and personality in terms of the integration of cultural art and clothing. 83.70% of the consumers were interested in the cultural art integrated cloth. 16.30% of the consumers were not interested in the cultural art integrated cloth.

Table 13 The results of the consumers' habit and personality: the adjustable clothing for various occasion

Statement	Frequencies	Percentages
Are you interested in the adjustable clothing for various wearing occasion?		
Yes	136	96.50
No	5	3.50
Total	141	100.00

Table 13 shows the consumers habit and personality in terms of the adjustable clothing for various wearing occasion. 96.50% of the consumers were interested the adjustable clothing that can be worn in various occasion. 3.50 % of the consumers were not interested the adjustable clothing that can be worn in various occasion.

Table 14 The results of the consumers' habit and personality: the application of Krathong folding techniques in developing cloth

Statement	Frequencies	Percentages
In your opinion, is it possible to apply the art of folding Krathong in fashion design?		
Yes	135	95.70
No	6	4.30
Total	141	100.00

Table 14 shows the consumers habit and personality in terms of the application of Krathong folding techniques in developing cloth. 95.70% of the consumers believed that the art of folding Krathong can be applied in fashion design. 4.30 of the consumers didn't believe that the art of folding Krathong can be applied in fashion design.

Table 15 The results of the consumers' habit and personality: the art of folding Krathong in other designing fields

Statement	Frequencies	Percentages
Is it possible to apply the art of folding Krathong to other designing filed?		
Yes	141	100.00
No	0	0.00
Total	141	100.00

Table 15 shows that 100% of the consumers believed that the art of folding Krathong can be applied in other designing fields.

Table 16 The results of the consumers' habit and personality: The shopping frequency

Statement	Frequencies	Percentages
How many times do you shopping for a fashion products per month?		
1-2 times per month	96	68.10
3-4 times per month	31	22.00
5 times or more times per month	14	9.90
Total	141	100.00

Table 16 shows the consumers habit and personality in terms of shopping frequency. 68.10 % of the consumers went shopping for fashion products 1-2 times per month. 22.00 % of the consumers went shopping for fashion products 3-4 times per month. Last, 9.90 % of the consumers went shopping for fashion products 5 or more times per month.

Table 17 The results of the consumers' habit and personality: The shopping budgets

Statement	Frequencies	Percentages
How much do you spend for the fashion products shopping per month?		
Less than 3,000 baths/month	75	53.20
3,001-6,000 baths/month	49	34.80
6,001-9,000 baths/month	13	9.20
9,001 or more baths/month	4	2.80
Total	141	100.00

Table 17 shows the consumers habit and personality in terms of shopping budgets. 53.20% of the consumers spent less than 3,000 baths in shopping for fashion products per month. 34.80% of the consumers spent 3,001 – 6,000 baths in shopping

for fashion products per month. Last, 2.80% of the consumers spent 9,001 or more baths in shopping for fashion products per month.

Table 18 The results of the consumers' habit and personality: Clothing styles

Statement	Frequencies	Percentages
Which of the following is your clothing style?		
Simplicity	55	39.00
Glamorous	10	7.10
Minimal	65	46.10
Sexy	3	2.10
Vintage	8	5.70
Total	141	100.00

Table 18 shows the consumers habit and personality in terms of clothing styles. 46.10 of the consumers had a minimal style preference. 39.00 % of the consumers had a simplicity style preference. Last, 2.10% of the consumers had a sexy style preference.

Table 19 The results of the consumers' habit and personality: The clothing silhouette

Statement	Frequencies	Percentages
How would you like to dress?		
Skin-tight	3	2.10
Fit	90	63.80
Loose	48	34.00
Total	141	100.00

Table 19 shows the consumers habit and personality in terms of the clothing silhouette. 63.80% of the consumers liked to wear fit clothes. 34.00% of the

consumers liked to wear loose clothes. Last, 2.10% of the consumers liked to wear skin-tight clothes.

Table 20 The results of the consumers' habit and personality: Color tones

Statement	Frequencies	Percentages
Which one is your favorite tone of colors?		
Monotone (white, gray, and black)	70	49.60
Earth tone	42	29.80
Pastel	18	12.80
Pastel	7	7.80
Colorful		
Total	141	100.00

Table 20 shows the consumers habit and personality in terms of the color tones. 49.60% of consumers liked monotone clothes. 29.80% liked earth tone clothes. Last, 7.80% liked colorful clothes.

Table 21 The results of the consumers' habit and personality: The choices of colors of cloth

Statement	Frequencies	Percentages
How do you mix the colors of your cloth?		
Similar tone color cloth	12	8.50
Mono color cloth	121	85.80
Contrasting color cloth	8	5.70
Total	141	100.00

Table 21 shows the consumers habit and personality in terms of the choices of colors of cloth. 85.8% of the consumers liked to wear one piece of cloth in mono

color. 8.50% of the consumers liked to wear a same tone color. Last, 5.70% of the consumers liked to wear a contrasting color.

Table 22 The results of the consumers' habit and personality: Cloth purchasing decision (3 items selection)

Statement	Frequencies	Percentages
What are the factors that affected the decision on purchasing cloth? (Please select 3 items)		
Pleasant pattern	122	31.94
Reasonable price	115	30.10
Neat sewing	55	14.40
Utility	70	18.18
Brands	16	4.19
Designer's reputation	4	1.05
Total	382	100.00

Table 22 shows the consumers habit and personality in terms of cloth purchasing decision. 31.94% of the consumers decided to buy cloth because of the pleasant pattern of cloth. 30.10% of the consumers decided to buy the cloth because of reasonable. Last, 5.70% of the consumers decided to buy cloth because of the designer's reputation.

Conclusion: The results of the consumers' opinions and behavior as a background of the patterns of Thai traditional Krathong folding to the design and development for clothing collection

The consumers were the 21-38 years old women and transgender people. They were single and graduated with a bachelor degree. They earned 30,001-50,000 baths per month. They were simple, peaceful, and unambitious. They were creative and open-minded. Also, they were self-confident and they had a persuasion skill.

They were interested in the product that emphasis on the design and the cultural art product. They were interested in the cultural integrated cloth, and the adjustable cloth which can be worn in various occasion. Moreover, they believed that the art of folding Krathong can be applied in the field of fashion design and other fields of designing.

The consumers spent 3,000 baths for 1-2 times a month to purchase clothes. They preferred to wear a minimal urban unique design cloth. They preferred a fit and a loose cloth. Also, monotone color (white, grey, black) was their most preference. They liked to wear one piece of cloth in mono color. Finally, the factor that affected the decision in buying cloth was the pleasant pattern of cloth, reasonable price, and the designer's reputation.

Part 2: The results of the creating the prototype clothing by applying Thai traditional Krathong folding to the design and development for clothing collection.

Based on the data provided by the consumers, it could be concluded that the consumers were simple, peaceful, and unambitious. Also, they were creative and open-minded. They could get along with other people easily. They were self-confident. They were good in persuading other people. The consumers were a discipline person who planned and aimed to be successful. They liked to make themselves look good, and like to build the confident to other people. Their clothing styles should represented their success. Generation X is the target group of this research. Therefore, this group of people preferred to consume a product that made their life comfortable and served their preferences.

States that people in generation X will choose the products based on the design. The design should be beautiful yet durable. Therefore, the generation X people consume on something that are modern but simple. They had an expensive taste. They used their thinking skills to work. The head of the family are working, and they live in a modern way. (Kumlangphaet, 2016)

Mentions that generation X people prefers a luxurious life, and they keep their look good at all times. They like experiencing new things. They concern about the benefits of the products, but they choose the products based on their emotion. Also, they are independent. They open for the new things. Moreover, this people have a good work, so they are sociable people. However, the limited of time in their daily life cause them to choose the various purposes products. Generation X people like a creative related job such as designing, they also prefer to work in a marketing field. They have money, and they decide to purchase something by their own decision. (Utiswannakul, 2010)

Therefore, the attitude and the preference of this group of people were reflected on the clothing styles to be worn in different occasions especially casual wear, party wear, and business wear. Additionally, the clothing pattern had to be beautiful and beneficial. The cutting of the cloth had to be neat and simple. They preferred a modern, polite and minimal simplicity styles. They liked to wear both fit and loose cloth. Their favorite color of cloth was monotone (white, gray, and black). Each item of clothes should had only one color. Beside the perspective in terms of beauty of clothes, the researcher designed prototype clothing which is adjustable to create the wearing opportunities that match their lifestyles and needs of the consumers.

The method of designing and developing the prototype clothing

This stage of the experiment, the method of developing cloth began with the rectangle shape of the fabric which is the basic shape of the banana leaf in folding Krathong. The fabric was draping on the dummy. Then, the cloth's position fixing which helped shaping the cloth to fit the wearer and to set the wearing method was applied. It was also helped creating the balance of the cloth. Moreover, the usefulness in terms of wearing opportunities was designed by creating an adjustable outfit. Thus, it could match with various lifestyles of the target group. The target group was the successful women who have to do many activities in one day. For example, they worked during the day, but after that, they might have to go to party. Thus, if the cloth can adjust into formal and luxurious style, it will increase the wearing

opportunities and save the budget for purchasing an evening gown. Also, it will help the target group to commute easier because they do not have to bring various clothes with them to wear in one day. Hence, the designed cloth can be adjusted into various styles. Each time the target group wear this cloth, they will get a dissimilar look. Therefore, six design of cloth were developed, and each design can be adapted into 2-5 more styles. The designing and developing methods is presented in Table 23.

Table 23 The conclusion of the designing and developing methods

The composition of design	Details
Story	Thai traditional art of folding Krathong
Specific information	Hak kor ma Krathong model
Color	White is the essence color of the material. It created the nature feeling, peacefulness, and represents the gentle, honest and kind characteristics of Thai people. It is also a color of cloth that matches with other color easily.
Materials	2 ply yarn silk is a fabric made from a natural fibers which was found in the local area like banana leaves. It is strong and durable. It is also appropriate with the weather in Thailand.
Silhouette	Fit style cloth and loose style cloth is the design. It represents the agility, simple but graceful characteristics. The pattern of cloth was created from one piece of rectangle fabric and several pieces of fabrics that were put together as a cloth. It is similar to the art of folding Krathong that the folding stage started from a rectangle banana leaf.
Details	The traditional art of folding Krathong and the geometry pattern from the crease on cloth.

The creative products analysis

The study entitled “Thai traditional folding Krathong: The design and development for clothing” has investigated the fashion designing the models by applied the art of folding Krathong. The pattern could be adjusted to wear in various occasions. It is best for 21-38 years old women. Kor ma folding pattern is the specific characteristic of the design based on the design framework. There are six prototypes clothing.

.1 Prototype clothing no. 1 : 5 Styles

- 1.1 Asymmetrical skirt
- 1.2 High-low strapless
- 1.3 Balloon blouse
- 1.4 Samurai blouse
- 1.5 One shoulder

2. Prototype clothing no. 2 : 3 Styles

- 2.1 Kimono jacket
- 2.2 Crop cape
- 2.3 Sherlock jacket

3. Prototype clothing no. 3 : 3 Styles

- 3.1 Hak kor ma waistcoat
- 3.2 Ribbon Sleeveless
- 3.3 Shawl in top

4. Prototype clothing no. 4 : 2 Styles

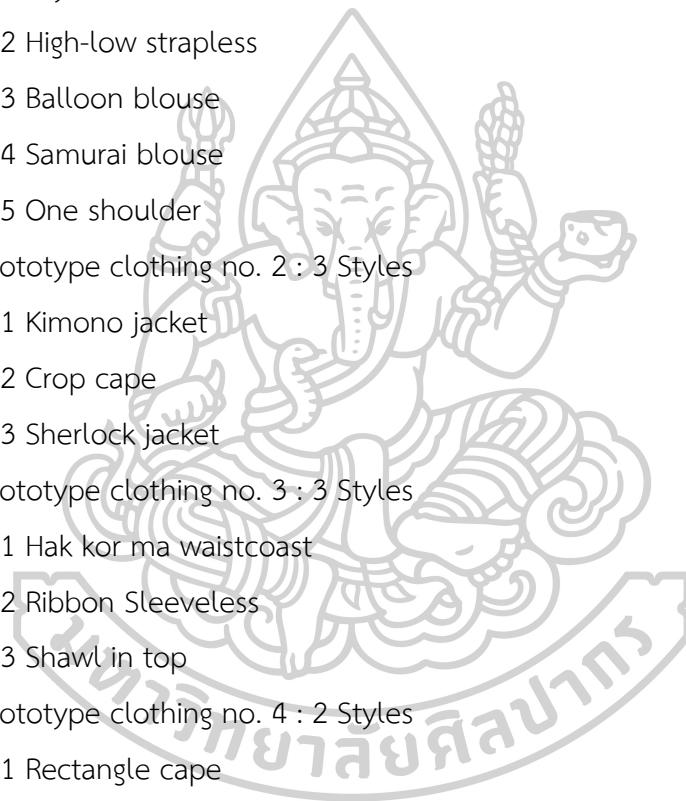
- 4.1 Rectangle cape
- 4.2 Oversize cape

5. Prototype clothing no. 5 : 4 Styles

- 5.1 Gown blouse with waist jump
- 5.2 Gown blouse with bow
- 5.3 Loose blouse
- 5.4 Sleeveless fit

6. Prototype clothing no. 6 : 3 Styles

- 6.1 Fluid blouse
- 6.2 Tie up the shoulder blouse



6.3 Asymmetric blouse



Figure 111 Prototype clothing no.1-6

1. Prototype clothing no.1

It created from a rectangle piece of fabric that was punched made six holes to thread the strap into the holes. This prototype can be worn in five ways.



Figure 112 Prototype clothing no.1: 5 Styles

1.1 Guideline 1: Asymmetrical skirt

It is a high and low skirt. After folding, one side of the skirt's hem is longer than another side. The length of the hem is depending on waistline of the person who wears it. Wearing it with shirt can create a formal look. Also, it can be worn with a smart style top to create a night gown for a party.



Figure 113 How to wear Asymmetrical skirt

- 1) Thread the strap into the hole. Wear it as a regular skirt.
- 2) Tighten a strap to fit your waistline.
- 3) Tie a bow on the side of the waist, and unleash the hem down.
- 4) This is a finished look.

1.2 Guideline 2: High-low strapless

It is a top-tube with short front and long back. The front side has a balloon design. At the back side, the cloth's hem unleashes equal to the length of the skirt. It is suited as a cloth for casual party because it creates a smart, active, and attractive look.



Figure 114 How to wear High-low strapless blouse

- 1) Pick the hem of the skirt at the front side. Pull it up at the chest level.
- 2) Adjust the body of the cloth to cling the chest.
- 3) Adjust the cloth to cling the chest. Keep the end of both side of the cloth to the back.
- 4) Button up the cloth. Adjust it to make it perfectly fit the shape.
- 5) This is a finished look.

1.3 Guideline 3: Balloon blouse

It is an off the shoulder balloon hem top. It is a comfortable loose top that create a sexy look but not naked. When moving arms, the shoulder will slightly appear. It can be worn in both formal and informal occasion which is depended on the choices of pants or skirts.



Figure 115 How to wear Balloon blouse

- 1) Lift both sides of the skirt's hem up.
- 2) Connect both hem of the skirt by button up to create sleeves.
- 3) Put your arms in the sleeves.

- 4) Lift sleeves up to the shoulder.
- 5) Adjust it into off the shoulder style.
- 6) Lift the other side of the hem up.
- 7) Button up the hem and repeat the step 1.3.2.
- 8) Put your arms in the sleeves.
- 9) Button up one extra button.
- 10) Adjust the top.
- 11) Get an off the shoulder balloon blouse.
- 12) This is a finished look.

1.4 Guideline 4: Samurai blouse

It is an flutter sleeveless top which is similar to Japanese Samurai costume. The strap is used to tie as a belt. It is appropriate to wear in the formal occasion with basic style pants. It will create a smart look. When wearing with a plain skirt, it will create a sweet look that can be worn to the party.

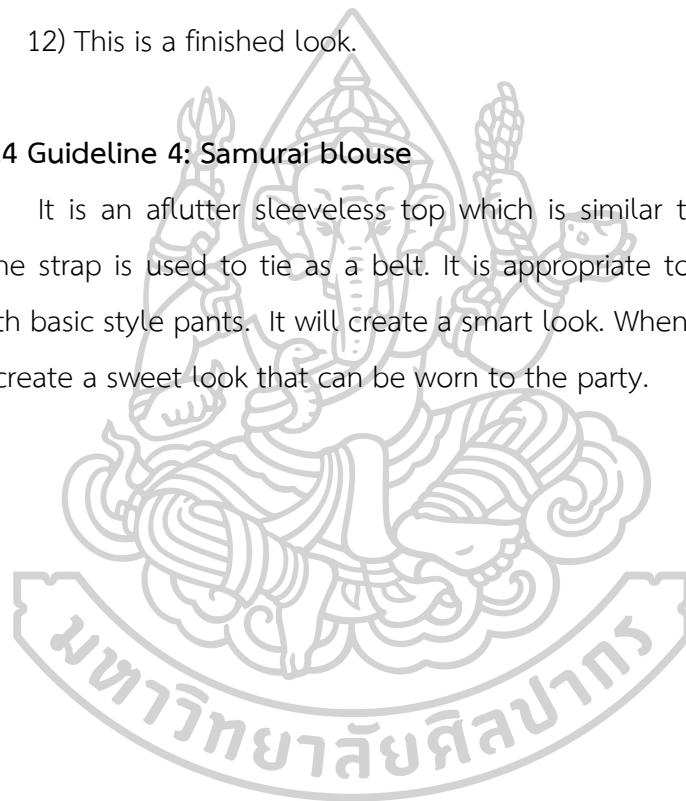




Figure 116 How to wear Samurai blouse

- 1) Unbutton the right button.
- 2) Unbutton the left button.
- 3) Pick the front cloth at the waist.
- 4) Prepare the straps to create a belt.
- 5) Wear the belt on the waist and adjust it to create a beautiful look.
- 6) This is a finished look.

1.5 Guideline 5: One shoulder

One shoulder style can be created by adapted a rectangle piece of cloth into a skirt by following the steps in Guideline 1. Then, tie the straps on one shoulder to create a one shoulder dress. It is a plain dress but it looks pretty and lively. The bow on the shoulder makes this dress becomes both formal and casual styles. It can wear with pant to create an earnest and smart look.

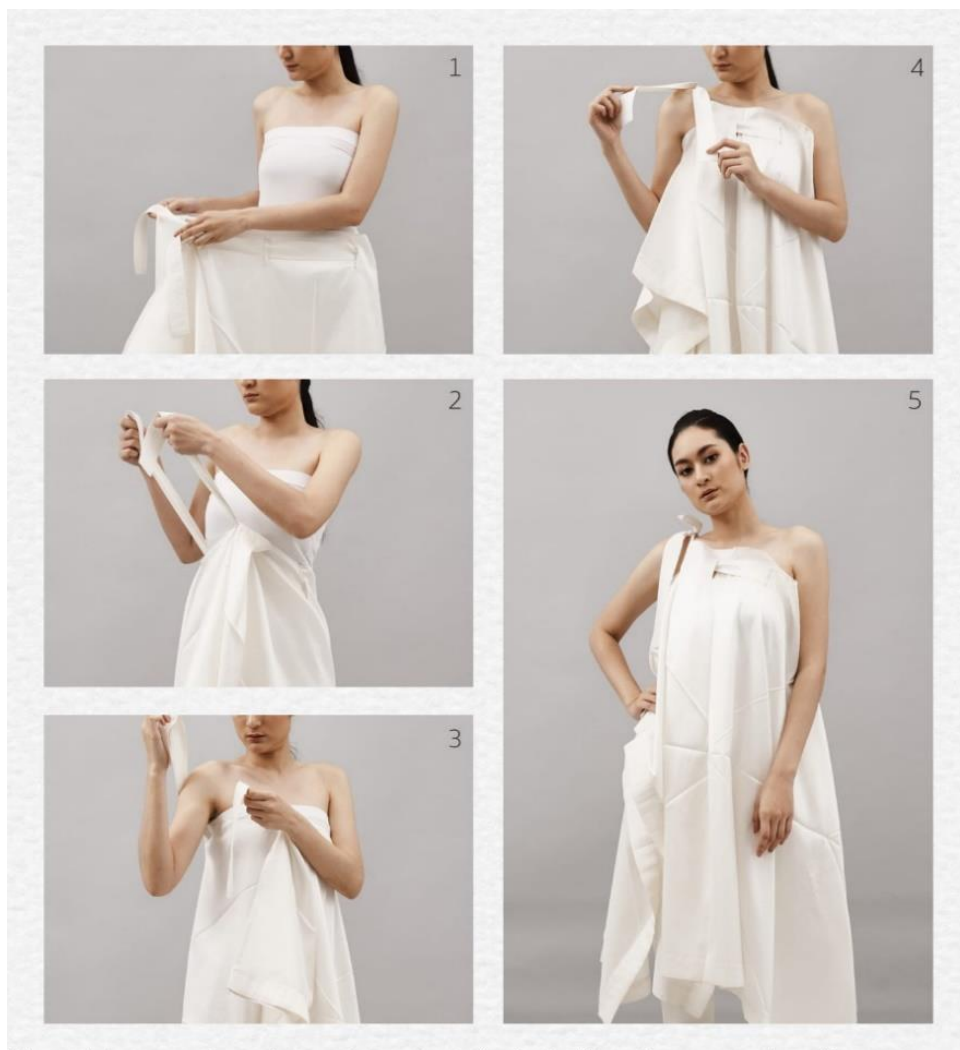


Figure 117 How to wear One shoulder blouse

1) Thread the strap into the perforate hole for belt. Wear it as a regular skirt.

2) Pull the straps. Make it a little loose.

- 3) Pull the strap on the right to the back side.
- 4) Pull the right strap behind an arm and tie a bow on a shoulder.
- 5) This is a finished look.

How to fold the cloth by using Hak-kor-ma folding model : Prototype clothing no.1

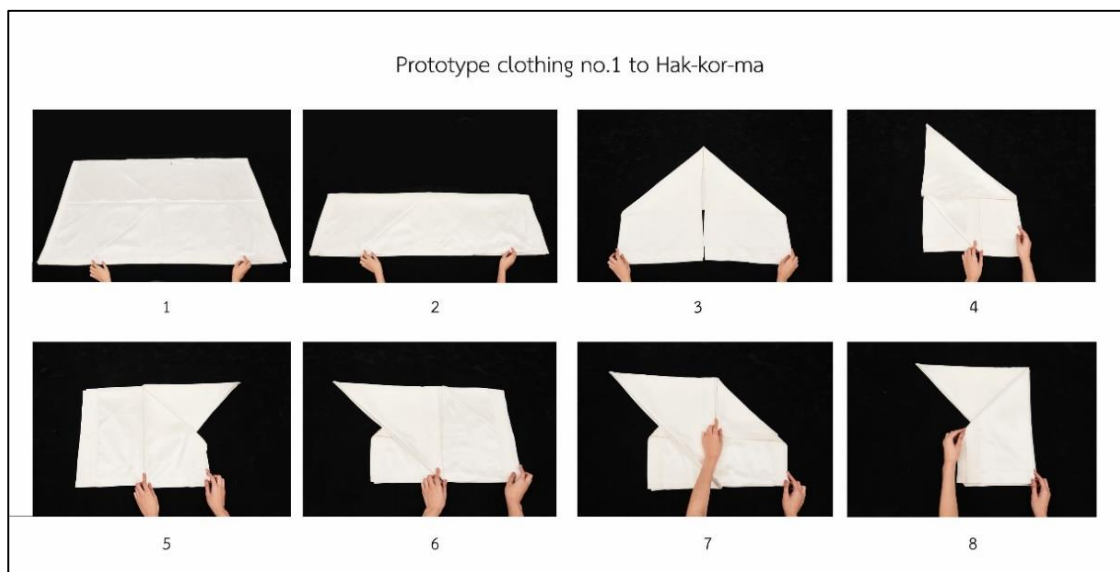


Figure 118 How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.1

1. Get the blouse ready for folding then half fold horizontally
2. Half fold once again
3. Fold the right and the left edge downward to adjoin the center crease
4. Fold both ends together
5. Fold the left seam upward as in Picture 4
6. Reverse it
7. Fold the seam downward to adjoin the edge of a fabric by repeating step 4
8. Fold both ends to the left side by repeating step 5. The complete fold will look like Hua Nok (Bird's head) or Kor Mah (Horse's neck) and Hua Kwan (Woodpecker).

2. Prototype clothing no. 2: 3 styles

It created from three pieces rectangle cloth that connected to make a body and a collar. This prototype can be worn in three ways.



Figure 119 Prototype clothing no.2: 3 Styles

2.1 Guideline 1: Kimono Jacket

A hip length four-part arm Kimono jacket with can be worn in both formal and casual occasions. It can mix and match with many styles of clothes.



Figure 120 How to wear Kimono Jacket

2.2 Guideline 2: Crop cape

A crop style short sleeves jacket can be worn in both formal and casual occasions. It can mix and match with many styles of clothes.



Figure 121 How to wear Crop cape

- 1) Take off the jacket that follows the Guideline 1.
- 2) Hold the shirt horizontally to get it ready to reverse.
- 3) Reverse by moving the hem upward and move the collar downward.
- 4) After reversing, the cloth will become a waist length crop style jacket.
- 5) Wear the jacket.
- 6) This is a finished look.

2.3 Guideline 3: Sherlock jacket

A short-front and long-back jacket is a normal but formal look that can show the identity of the wearer.



Figure 122 How to wear Sherlock jacket

- 1) Lift the right side hem up.
- 2) Fold the right hem downward and fold the left side hem to meet the right one at the center.
- 3) Button up and arrange the cloth.
- 4) This is a finished look.

How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.2

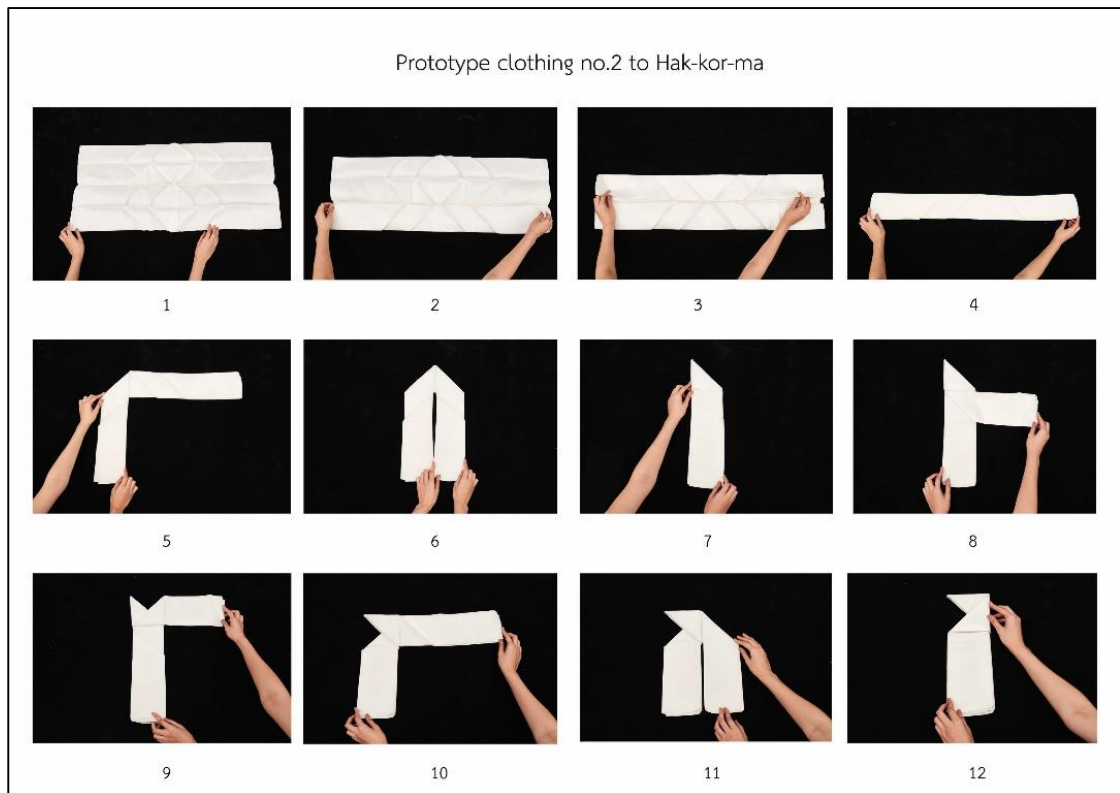


Figure 123. How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.2

1. Get the cape ready for folding
2. Half fold the bottom side to the crease
3. Half fold the top side to the crease
4. Fold both ends together
5. Fold the left edge downward to adjoin the center crease
6. Fold the right edge downward to adjoin the center crease
7. Fold both ends together
8. Fold the left seam upward as in Picture 8
9. Fold the left side over the right side
10. Reverse it and then fold the seam downward to adjoin the edge of a fabric by repeating step 8

11. Fold the left side over the right side
12. The complete fold will look like Hua Nok (Bird's head) or Kor Mah (Horse's neck) and Hua Kwan (Woodpecker).

3. Prototype clothing no. 3: 3 styles

A waistcoat or sleeveless with mandarin collar that created from the cutting pattern and insert the rectangle piece of cloth to make a collar. This prototype can be worn in three ways.



Figure 124 Prototype clothing no.3: 3 Styles

3.1 Guideline 1: Hak kor ma waistcoat

This style can be worn as a regular waistcoat.



Figure 125 How to wear Hak kor ma waistcoat

3.2 Guideline 2: Ribbon Sleeveless

It is a sleeveless with bow collar. It creates a formal look when wearing it with cigarette pants. When wearing it with pencil skirt, it will create a pleasant look but smart. It can create a nice gorgeous party look by matching it with Maxi skirt that made from lace, or shiny cloth.



Figure 126 How to wear Ribbon sleeveless blouse

- 1) Button up all the buttons and prepare to knot the bow at both sides of the collar.
- 2) Lift both sides of the collar up and knot the bow.
- 3) Unfold the overlap collars.
- 4) Adjust the bow to create beautiful finished look. The printed pattern is at the bow's straps.
- 5) This is a finished look.

3.3 Guideline 3: Shawl in top

It is a shirt with shawl in the collar. It can be worn as a waistcoat or sleeveless. The crease pattern is presented at the front side and also at the back side. It is appropriate for formal occasion.



Figure 127 How to wear Shawl in top

- 1) Unfold both sides of collar.
- 2) Spread both side of collar.
- 3) After spreading, arrange the shawl.
- 4) Make it looks beautiful by arranging the pattern to the front side and back side. This is a finished look.

How to fold the cloth by using Hak-kor-ma folding model : Prototype clothing no.3

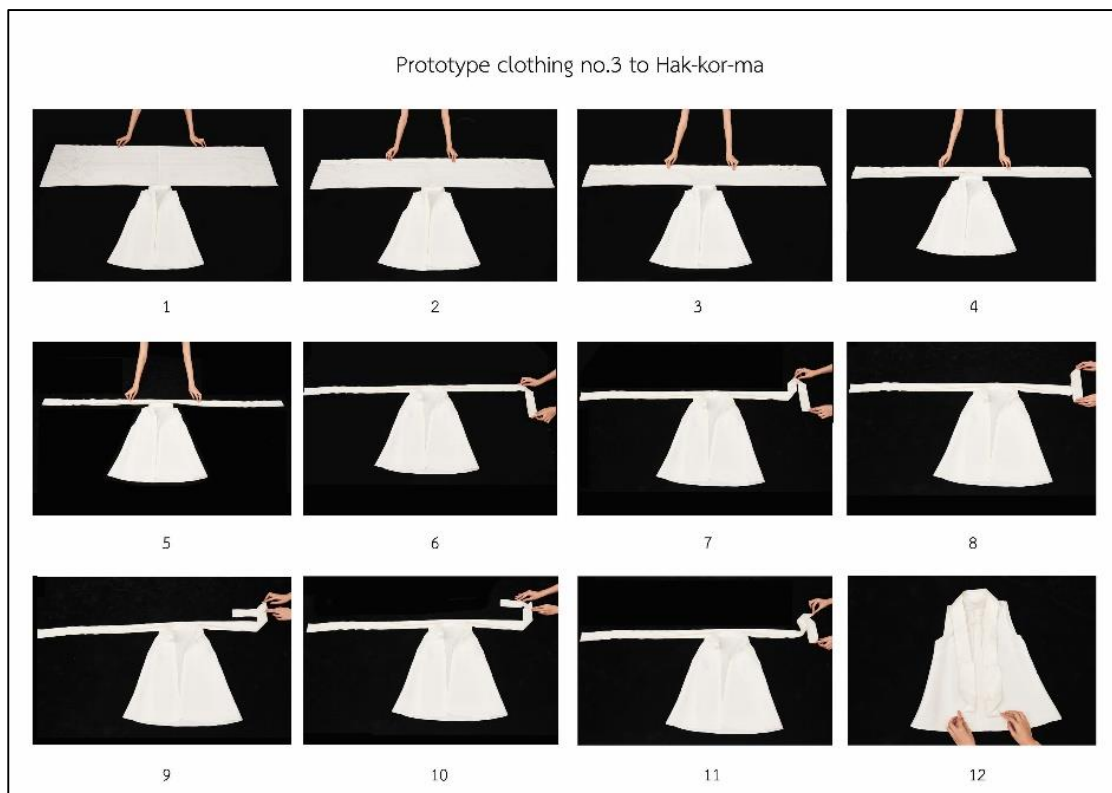


Figure 128 How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.3

1. Get the blouse ready for folding
2. Fold the cloth on the first line over the second line by following the crease. Step 2-5 imitates the technique of folding a fan which you have to fold upward and downward alternately.
3. Fold the second line downward to the back by following the crease.
4. Fold the third line downward by following the crease.
5. Fold the fourth line backward by following the crease.
6. Perpendicularly fold the right edge downward to create a right corner.
7. Lift the inner edge up to create another edge, and then perpendicularly fold downward to create a left corner.

8. Double fold the left edge to the right.
9. Hold the upper edge, and then double fold it downward to adjoin the edge of the cloth.
10. Double fold the seam once again.
11. Reverse the Kor-ma side downward to the back.
12. Fold the seam by repeating the step 2-11 once again. By following this steps, You can create a Hak-Kor-Ma collar waistcoat.



4. Prototype clothing no.4: 2 styles

It was made from three rectangular pieces of fabrics which were sewed together: the left front, the right front and the back piece with a front placket and side plackets. All of them were folded and heated from the steamed iron, resulting in beautifully geometric patterns. This prototype can be worn in two ways.



Figure 129 Prototype clothing no.4: 2 styles

4.1 Guideline :1Rectangle cape

This style was designed from three rectangular pieces of clothes. The clothes were sewed to make the left front, the right front and the back piece with a front placket and side plackets. The geometric pattern was created by the folding and ironing techniques. It can be worn like a long cape. It is appropriate for formal and casual occasion.



Figure 130 How to wear Rectangle cape

4.2 Guideline :2Oversize cape

It is a polite style cape for formal occasion. However, it is chic and unique. The Cape is matched with the common items.



Figure 131 How to wear Oversize cape

- 1) Take off the cape.
- 2) Reverse the cape by turning the hem upward.
- 3) Put arms into the hole as a regular cape.
- 4) The cape will turn to a short body cape with long sleeves.
- 5) This is a finished look.

How to fold the cloth by using Hak-kor-ma folding model : Prototype clothing no.4

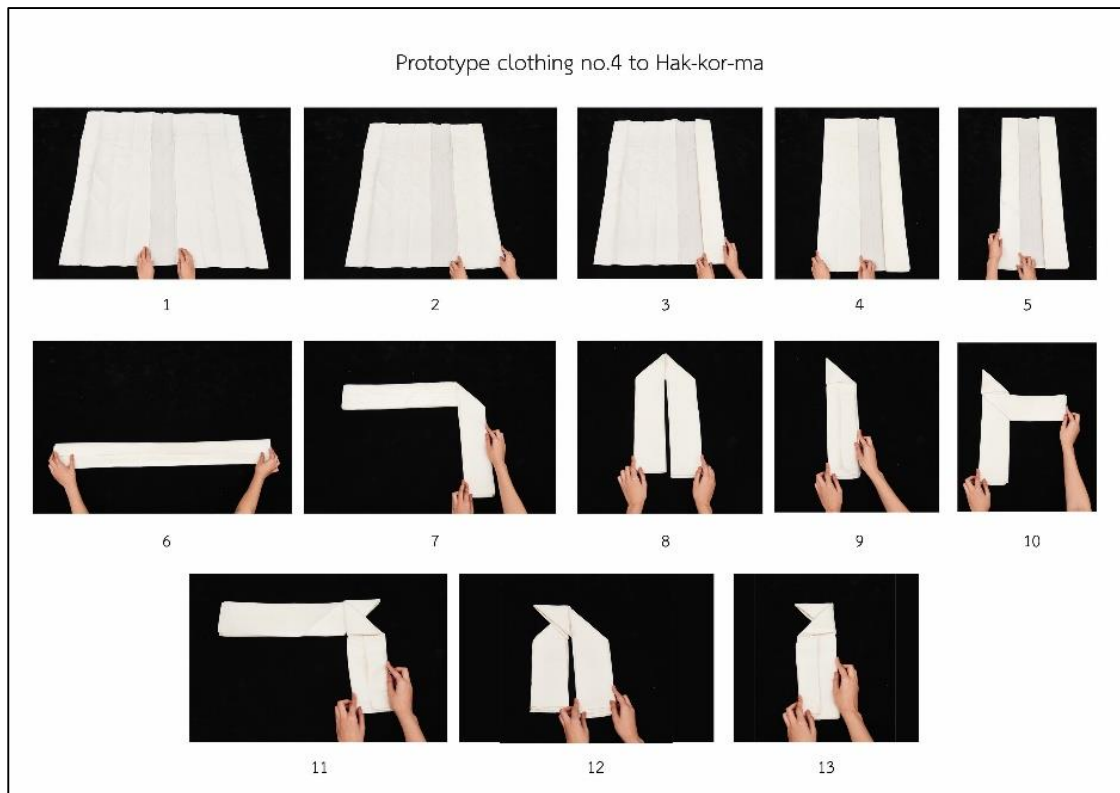


Figure 132 How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.4

1. Get the kimono ready for folding
2. Half fold the right hand side to the crease
3. Half fold the right side once again
4. Half fold the left side to the crease
5. Half fold the left side once again
6. Fold both ends together
7. Fold the right edge downward to adjoin the center crease
8. Fold the left edge downward to adjoin the center crease
9. Fold both ends together
10. Fold the left seam upward as in Picture 10
11. Fold the left side over the right side

12. Reverse it and then fold the seam downward to adjoin the edge of a fabric by repeating step 10

13. Fold both ends to the left side by repeating step 11. The complete fold will look like Hua Nok (Bird's head) or Kor Mah (Horse's neck) and Hua Kwan (Woodpecker).

5. Prototype clothing no.5: 4 styles

The loose blouse was made from two rectangular pieces of fabrics which were stitched together namely the front and the back piece. Then the designer made two holes for tying under the breast and made two long straps for tying to the waist. Again, the heat from the steam was used to create beautifully geometric creases. This prototype can be worn in four ways.



Figure 133 Prototype clothing no.5: 4 styles

5.1 Guideline 1: Gown blouse with waist jump

It is a blouse with waist jump. It can be worn by tying the straps at the level of the waist at the back. Make sure that the hem covers the straps around the waist. It is appropriate for casual occasions.



Figure 134 How to wear Gown blouse with waist jump

- 1) Wear it by turning the side that has the hole at the level of the breast to the front side.
- 2) Pull the straps to the backside. Fold the back side of the top.
- 3) Tie a bow at the back waist to create a jumper.
- 4) Arrange it to create a beautiful finished look.

5.2 Guideline 2: Gown blouse with bow

It is a blouse that can be worn by insert the straps into the holes that are under the breast. A bow is tied at the front side. A bow's straps will be left loosely.



Figure 135 How to wear Gown blouse with bow

- 1) Pull the strap to the back side and wrap around the body.
- 2) Pull the strap and insert it into the holes that are under the breast.
- 3) Inset the strap into the right hole.

- 4) Insert the strap into the left hole.
- 5) Pull the straps and tie a bow.
- 6) This is a finished look.

5.3 Guideline 3: Loose blouse

It is a loose sleeveless. It wafts when walking. It is appropriate for every person's shape. It can be worn formally and casually.



Figure 136 How to wear Loose blouse

- 1) Wear the blouse as normal and hold the strap of the blouse that has a snap fastener on it.
- 2) Inset the strap of the blouse into the holes that are under the breast. Turn it around to stick with the other side of the snap fastener at the outside corner.

- 3) Repeat the previous steps with other side and arrange it beautifully.
- 4) Arrange it to create a beautiful finished look.

5.4 Guideline 4: Sleeveless Fit

It is a body fit sleeveless with the bow on the waist. The bow's straps are presented at the side of the body. It is appropriate for both formal and casual occasions.



Figure 137 How to wear Sleeveless fit blouse

- 1) Reverse the back side to the front side.
- 2) Arrange it beautifully.

- 3) Gather the sided straps and prepare to tie a bow
- 4) Tie a bow at the waist level and then arrange it beautifully.
- 5) Arrange it beautifully.

How to fold the cloth by using Hak-kor-ma folding model : Prototype clothing no.5

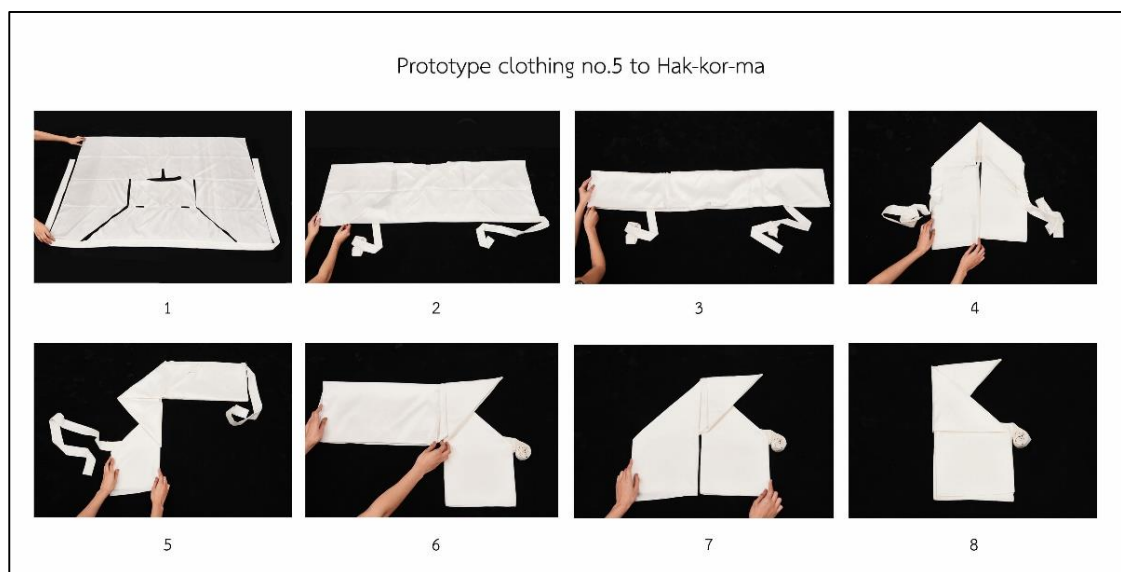


Figure 138 How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.5

1. Get the blouse ready for folding
2. Half fold horizontally
3. Half fold once again
4. Fold both edges to adjoin each other at the center crease, and fold both ends together.
5. Half fold the right side downward and fold the seam downward to adjoin the edge of the fabric
6. Reverse it and then fold the seam downward to adjoin the edge of the fabric
7. Fold the left side over the right side

8. After that roll or fold the straps

6. Prototype clothing no.6: 3 styles

It is created from a rectangle piece of fabric by making three holes on the neck and arms positions. This prototype can be worn in three ways.



Figure 139 Prototype clothing no.6: 3 styles

6.1 Guideline 1: Fluid blouse

It is boat neckline that waft differently when wearing. The end of one side of the sleeve is at the wrist. It is the loose blouse that fit with every kind of shape. It is appropriate for semi formal occasion.



Figure 140 How to wear Fluid blouse

- 1) Wear it like an oversized blouse
- 2) If you want to create a body fit look, hold the side of the blouse and stick it with a snap fastener.
- 3) This is a finished look.

6.2 Guideline 2: Tie up the shoulder blouse

It is a boat neck with short front and long sleeve at the backside. Bow is decorated on a shoulder to create a feminine look that is pleasant and charming. It is appropriate for casual occasion.



Figure 141 How to wear Tie up the shoulder blouse

- 1) Reverse the backside to the frontside.
- 2) Stick a snap fastener at the side.
- 3) Prepare the straps to tie a bow on a shoulder

4) Insert the straps through the collar, and then get it through the armhole.

5) Tie a bow beautifully on a shoulder.

6) This is a finished look.

6.3 Guideline 3: Asymetric blouse

It is a v-shaped collar with waist fit. At the backside, the hem is leave aflutter. It is appropriate for formal occasion.



Figure 142 How to Asymetric blouse

1) Insert the inner stripes from the backside through the arm hole, and then get it to the front side.

2) Tie a bow at the waist level.

3) This is a finished look.

How to fold the cloth by using Hak-kor-ma folding model : Prototype clothing no.6

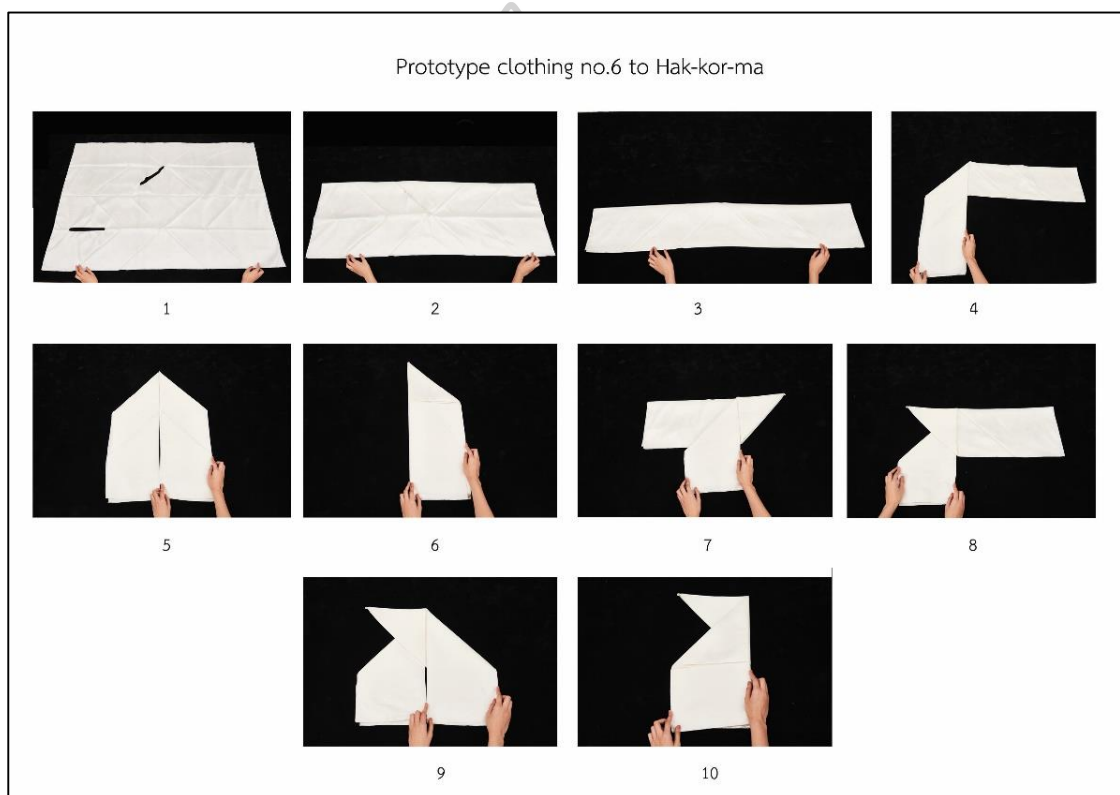


Figure 143 How to fold the cloth by using Hak-kor-ma folding model: Prototype clothing no.6

1. Get the blouse ready for folding
2. Half fold horizontally
3. Half fold once again
4. Half fold the left side to adjoin the center crease
5. Half fold the right side to adjoin the center crease

6. Fold both end together
7. Fold the left side seam to downward to adjoin the edge of the fabric
8. Reverse it and fold the seam downward to adjoin the edge of the fabric
9. Fold both ends to the left side
10. The complete fold will look like Hua Nok (Bird's head) or Kor Mah (Horse's neck) and Hua Kwan (Woodpecker), so it can be called by all three names.

Package

According to the review of the related literature, it was found that the attractive packaging could promote the success of the product because the highly competitive business world needed more than only a good quality. Therefore, the packaging design was not only a good value added, but it was also a comprehensive marketing plan that enhanced the success. The packaging design included:

1. Protection: The good packaging should be thermal insulation, vapor protection, and vibration dampening. It prevented the costume from one or more types of damages and kept the costume last long.
2. Transportation and distribution: The transportation of the packages should be convenient. The distribution should also be outstanding and fit for consumers' needs.
3. Sales promotion: Packaging was one of sales promotion strategies because it demonstrated the prominent features of the products, displayed description and advantages of the product, and attracted the consumers' attention. The distinctive packaging promoted the both trial and repeat purchases.
4. Consumer brand impression: The packaging should be portable, reusable, and convenient.
5. Brand image: The leading brands always emphasized the packaging designs because it showed dedication, attention, and determination of their own brands. It also promoted consumer confidence since they believed that the good product was in the good packaging. So, the good packaging contributed to the consumer's loyalty, which could be extended to other products.

Therefore, the researcher designed the packaging by exhibiting the costume folded into the Kleeb Hakkorma pattern to amaze the consumers and to create the uniqueness of the product.

Table 24 Design framework of packaging

Benefits	Designs
1. Protection	The transparent plastic sheet was selected because it allowed the consumers to observe the materials and products. Also, it was scratch protection, thermal insulation, vapor protection, and vibration dampening.
2. Transportation and distribution	The package stacking was in a package-on-package style so it was convenient for the transportation. In addition, the packages could be arranged by laying or hanging. Due to its flexibility in transportation and distribution, it was convenient for displaying in museum, art center, or fair.
3. Sales promotion	The graphic arts on the package was simple and small so that it would not intervene the display of the product. The graphic arts also involved picture and description to promote the consumers' understanding.
4. Consumer brand impression	The package was made of a transparent plastic sheet so that the consumers could observe the product clearly from the first glance. This would promote the consumer's brand confidence. Also, the package included handle, and ziplock, which was easy to use, reusable, compact, and convenient.
5. Brand image	The consumers' understanding on the product was promoted using both picture and description presented on the packaging. The transparent materials demonstrated the transparency of the manufacturer. Also, it promoted the sales volume as the consumer could buy the product as a souvenir due to the attractive packaging and friendly transportation.

The prototype of the packaging was designed based on the arts of Krathong folding patterns. The complete costume was folded into the KleeB Hakkorma pattern and it was contained in the transparent plastic bag with handle and zip lock. The description of the product was displayed on the bag. The instruction and recommendation of customization were also involved.



Figure 144 The prototype of the packaging

Guideline book

The researcher concluded all process involved in this study in the guideline book. This book would be beneficial for designers, fashion students, and those who are interested in this study. The content of the guideline book was comprehensible and easy to understand because the researcher provided the detailed procedure of this study. Also, the information provided in this guideline book could contribute to the future work. The researcher hoped that this book would shed light on the adaption of the arts of Krathong folding patterns and any other arts. It showed that we could preserve and modernize our heritage in the same time. The researcher also hoped that this study would be the starting point of this kind of fashion, which could be extended to other kinds of Thai arts. The guideline book consisted of three parts as follows:

Part I Introduction: This part involved the collection of the six flat prototypes.

Part II Instruction for wearing and folding the costume

- The manual for wearing, customizing, and folding the costume
- The manual for tailoring the six prototypes

Part III Lookbook

- The sketching images of the five prototypes
- The sketching images of customizing costumes lookbook



Figure 145 Front cover and Back cover

Part I Introduction: This part involved the collection of the six flat prototypes

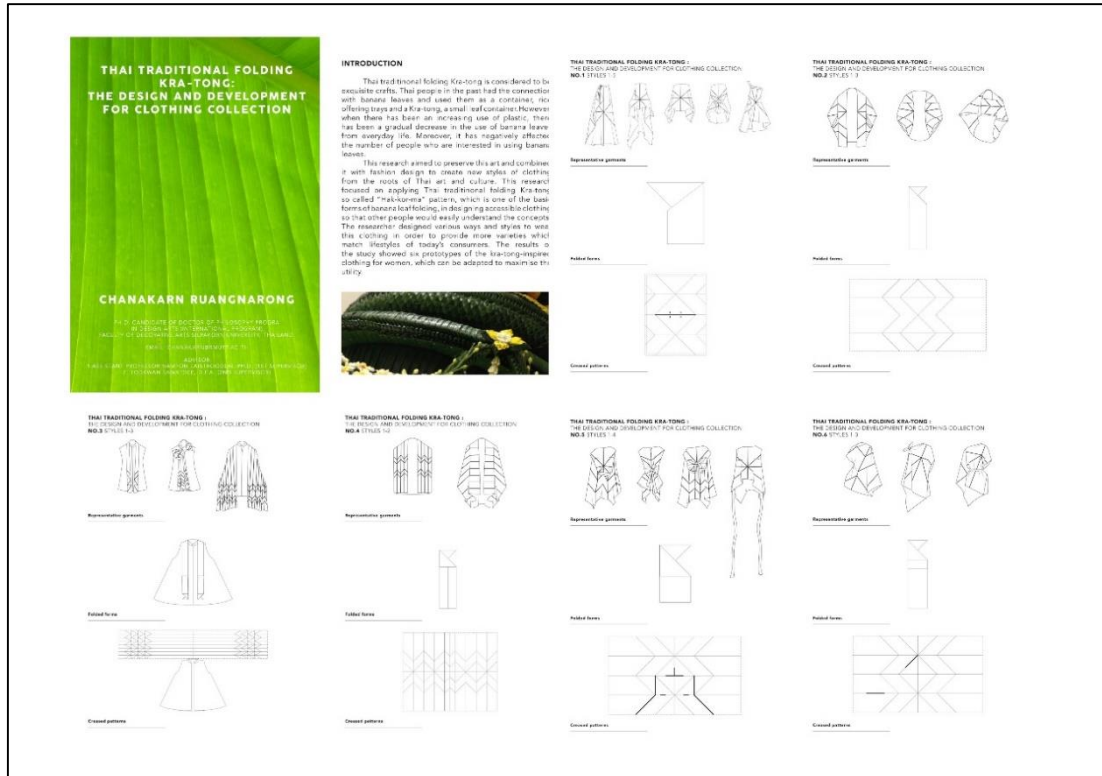


Figure 146 Content for Part 1 of the guideline book



Figure 147 Guideline book: Part 1

Part II Instruction for wearing and folding the costume

- The manual for wearing, customizing, and folding the costume

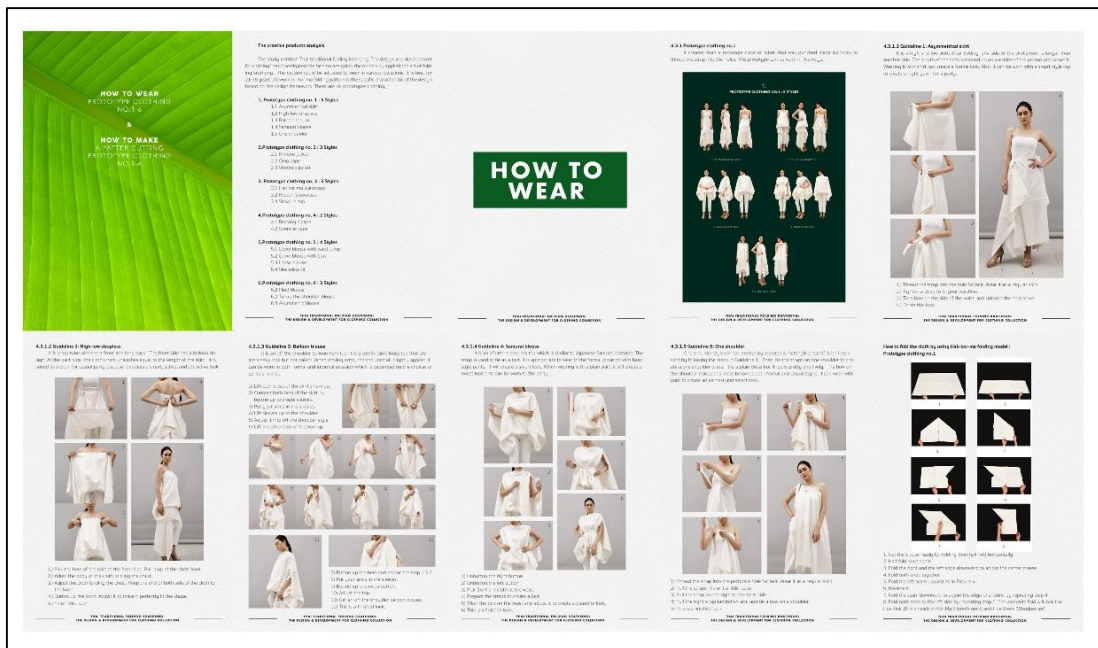


Figure 148 Content for Part 2 of the guideline book P.1-10

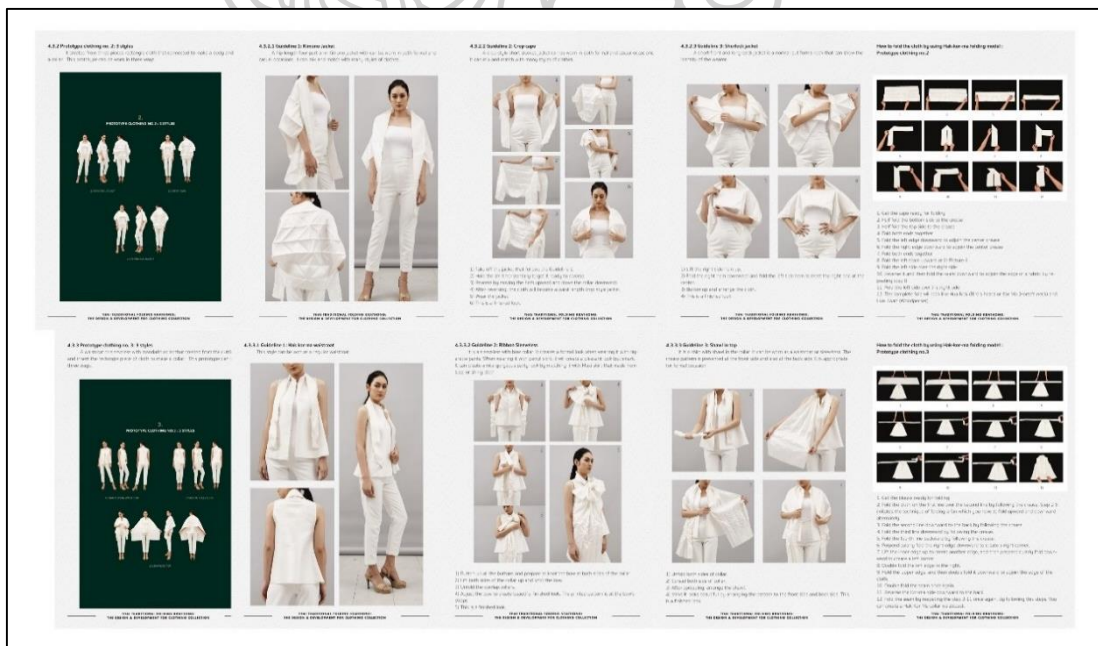


Figure 149 Content for Part 2 of the guideline book P.11-20



Figure 150 Content for Part 2 of the guideline book P.21-30



Figure 151 Content for Part 2 of the guideline book P.31-35



Figure 152 Guideline book: Part 2: The manual for wearing, customizing, and folding the costume

- The manual for tailoring the six prototypes

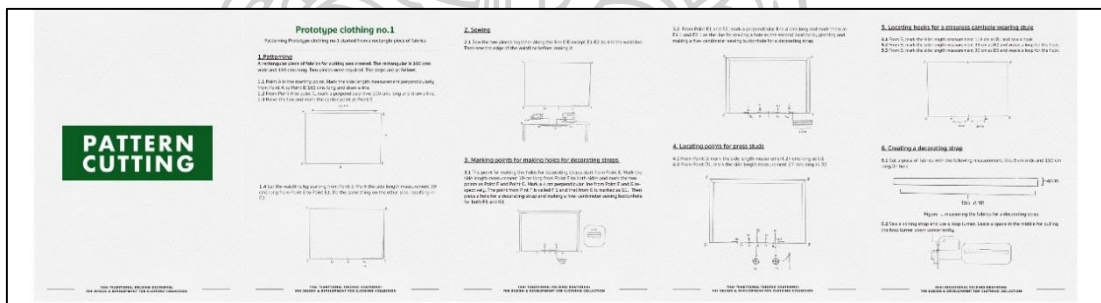


Figure 153 Content for Part 2 of the guideline book P.36-40

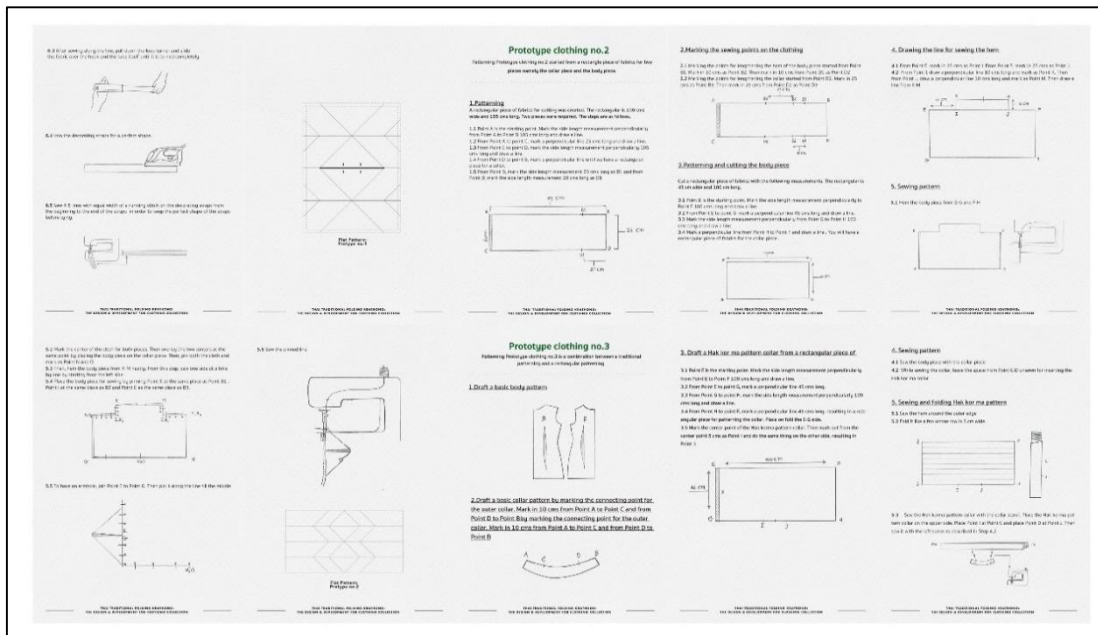


Figure 154 Content for Part 2 of the guideline book P.41-50

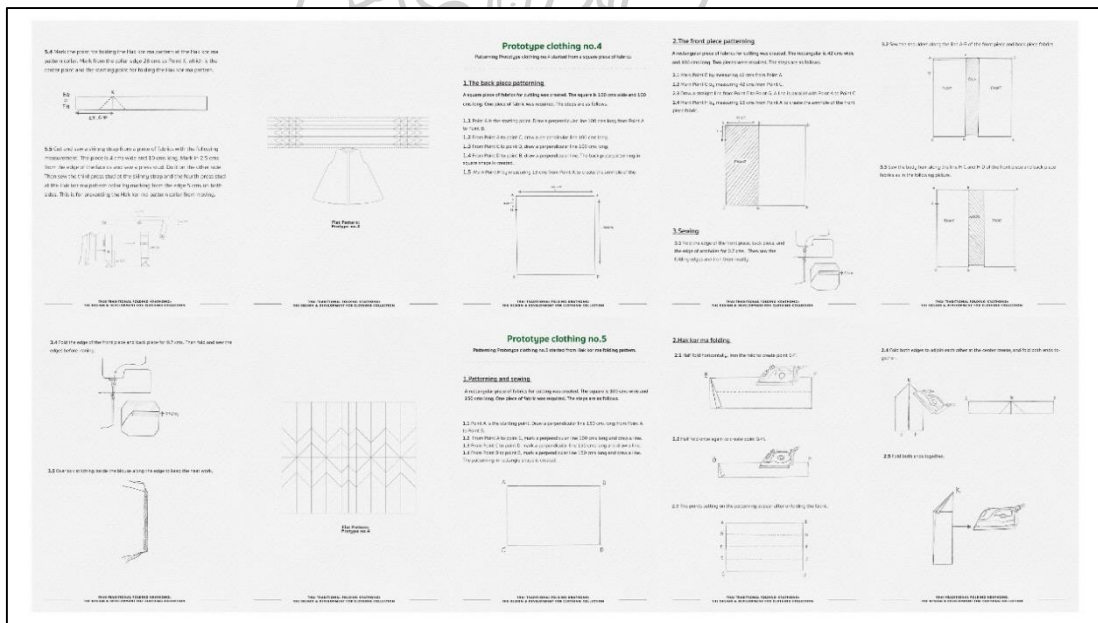


Figure 155 Content for Part 2 of the guideline book P.51-60

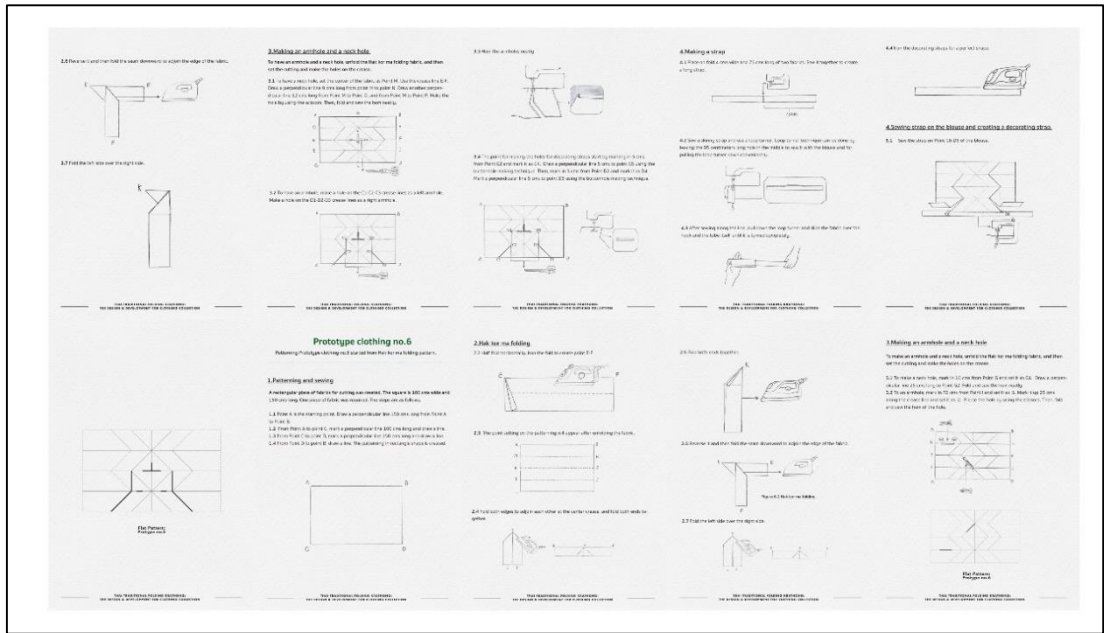


Figure 156 Content for Part 2 of the guideline book P.61-70

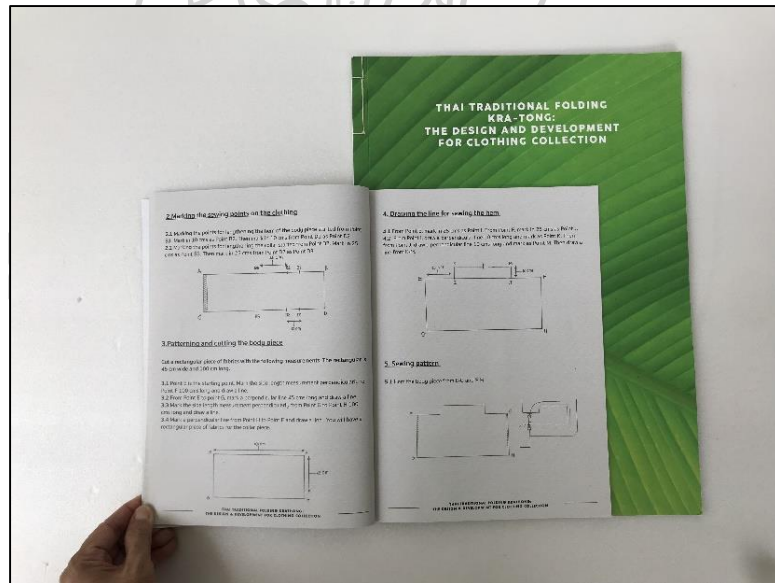


Figure 157 Guideline book: Part 2: The manual for tailoring the six prototypes

Part III Lookbook

- The sketching images of the six prototypes

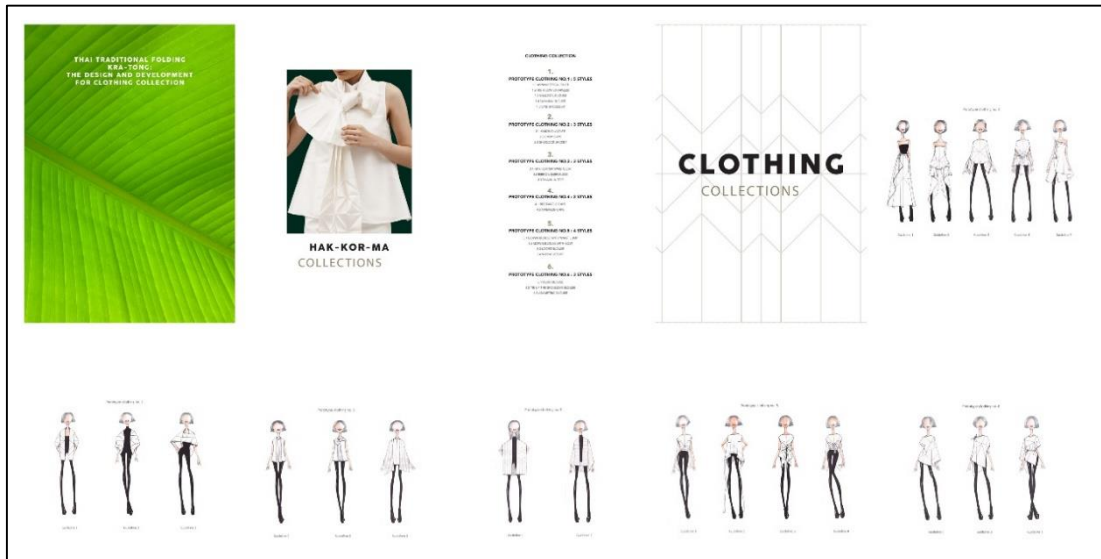


Figure 158 Content for Part 3 of the guideline book P.71-80

- The sketching images of customizing costumes lookbook

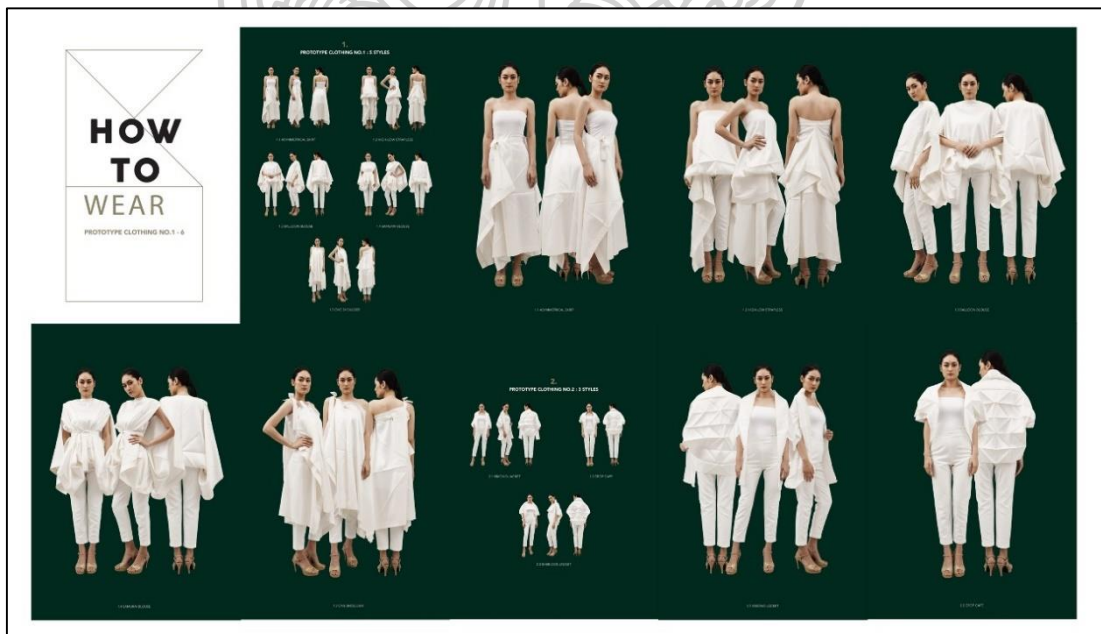


Figure 159 Content for Part 3 of the guideline book P.81-90



Figure 160 Content for Part 3 of the guideline book P.91-100



Figure 161 Content for Part 3 of the guideline book P.101-110

Overall images of Thai traditional folding Krathong: the design and development for clothing collection

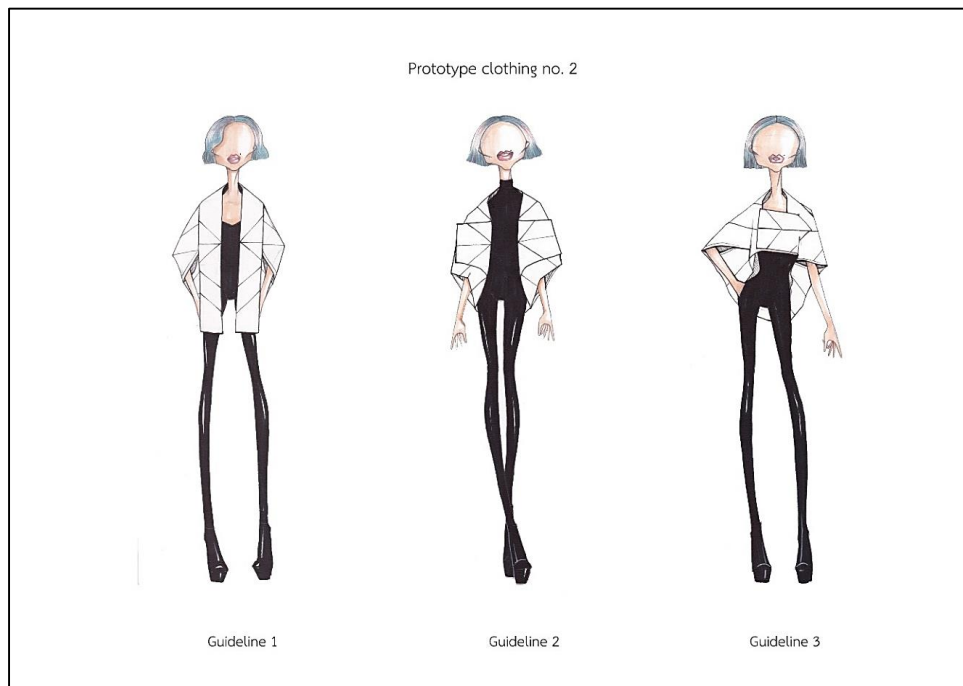


Figure 162 Pototype clothing no.1

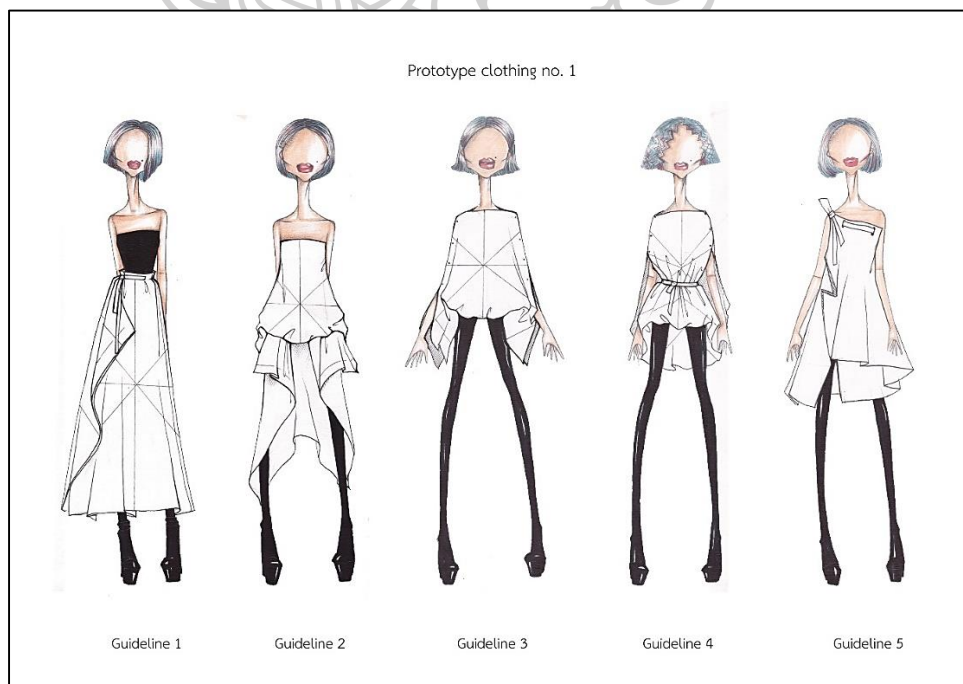


Figure 163 Prototype clothing no.2

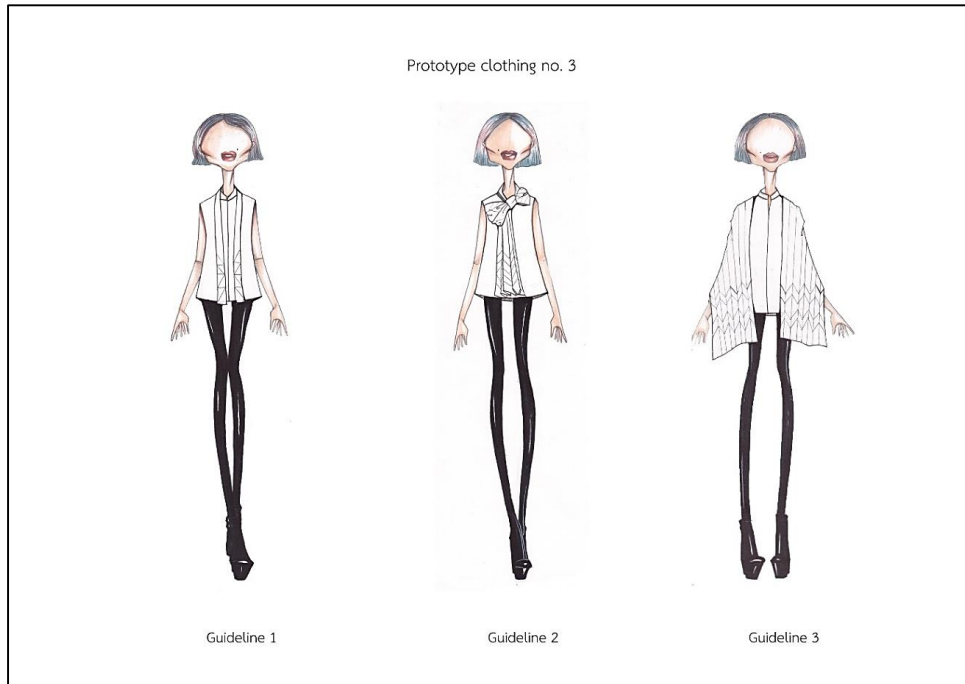


Figure 164 Prototype clothing no.3

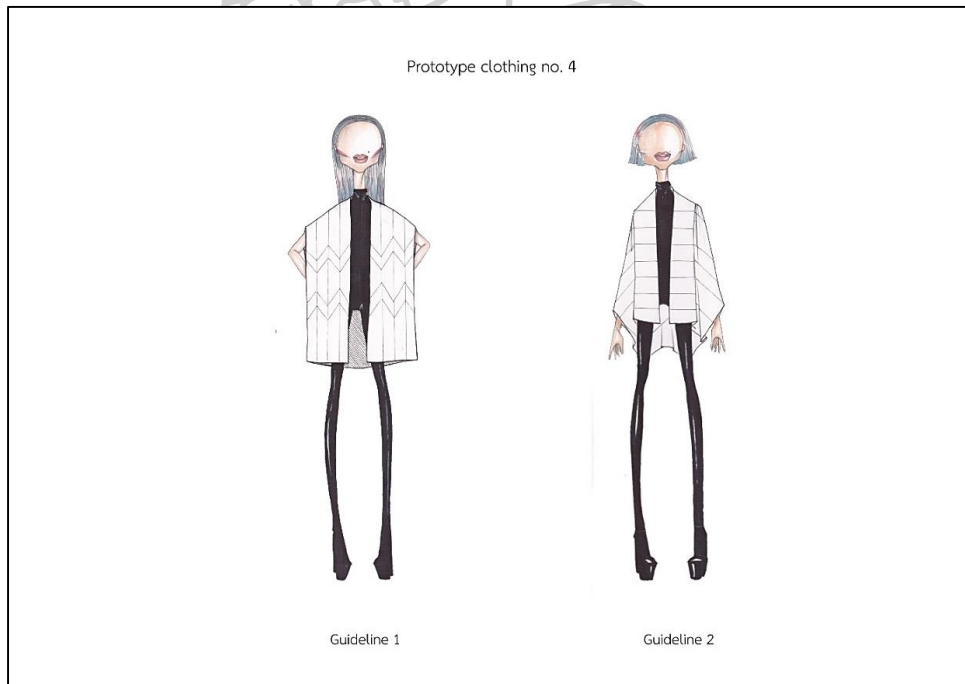


Figure 165 Prototype clothing no.4

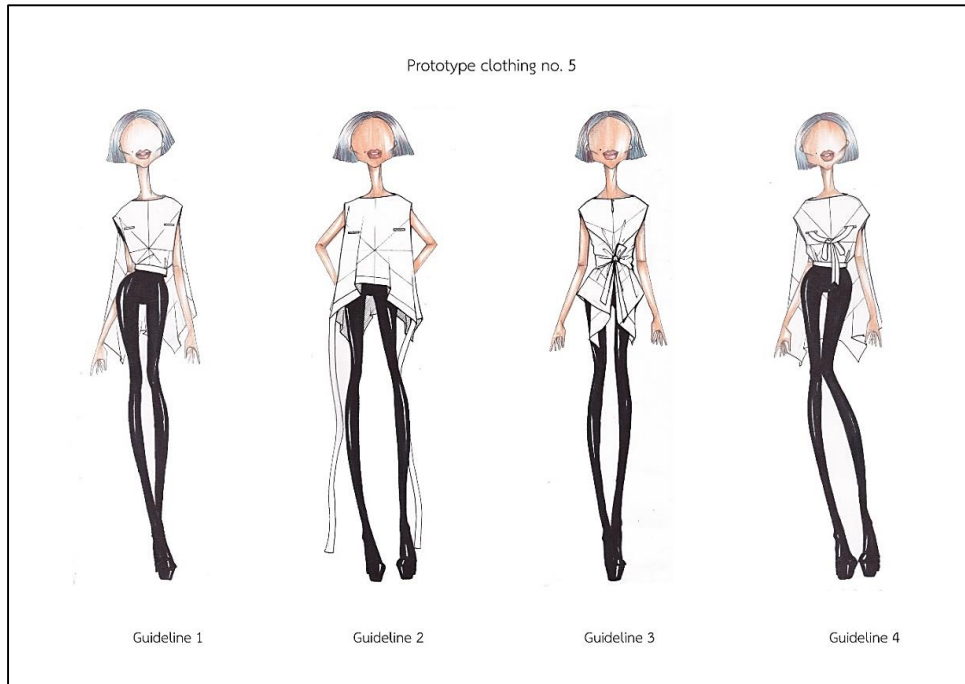


Figure 166 Prototype clothing no.5

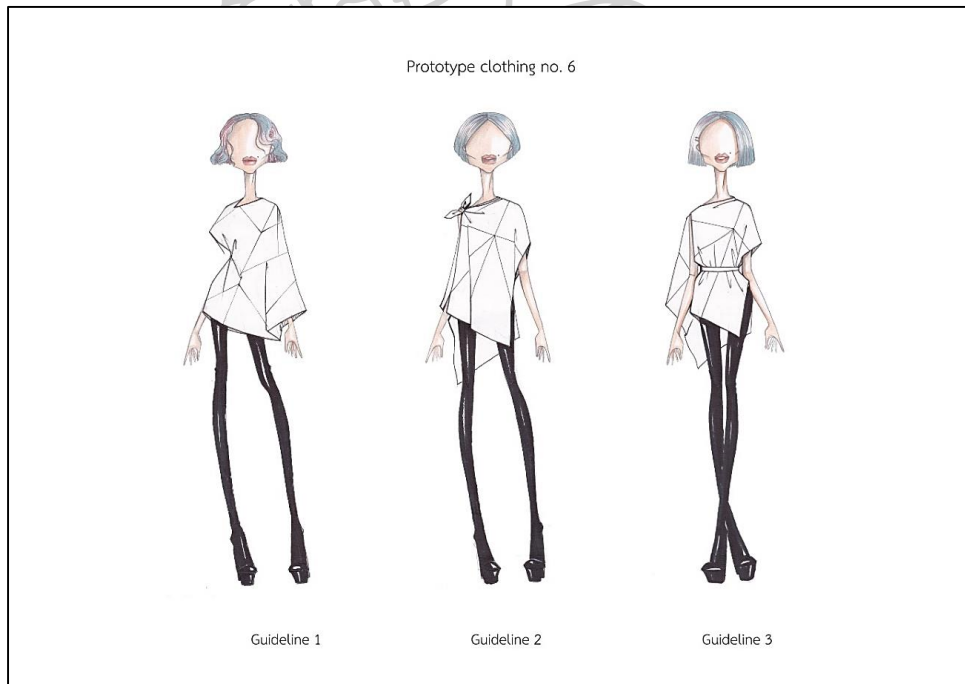


Figure 167 Prototype clothing no.6

Part3 : The results from the experts' evaluation form and consumer's questionnaire toward the application of the Thai traditional Krathong folding to the design and development for clothing collection

The experts' evaluation form toward the Thai traditional Krathong folding: the design and development for clothing collection analysis results

The objective of this evaluation form is to retrieve the experts' opinions toward the prototype clothing based on the experts' experience and vision. The criteria of evaluation were mentioned in chapter 3. The results are presented as follows.

Table 25 Target group: Which target group is appropriate for the clothing pattern in this study?: Gender

Data	Frequencies	Percentages
Gender		
Male	0	0.00
Female	15	100.00
Total	15	100.00

Table 25 shows that the experts all agreed that the clothing pattern in this study was appropriate for women (100%).

Table 26 Target group: Which target group is appropriate for the clothing pattern in this study?: Age

Data	Frequencies	Percentages
Age		
21-38 years old	6	40.00
39-53 years old	8	53.33
54 or more years old	1	6.67
Total	15	100.00

Table 26 shows that the experts agreed that the clothing pattern in this study was appropriate for 39-53 years old people (53.33%), 21-38 years old people (40.00), and 54 or more years old people (6.67%) respectively.

Table 27 Target group: Which target group is appropriate for the clothing pattern in this study?: Marital status

Data	Frequencies	Percentages
Marital status		
Single	6	40.00
Married	5	33.33
Both single and married	4	26.67
Total	15	100.00

Table 27 shows that the experts agreed that the clothing pattern in this study was appropriate for single people (40.00%), married people (33.33%), and both single and married people (26.67%) respectively.

Table 28 Target group: Which target group is appropriate for the clothing pattern in this study?: Educational background

Data	Frequencies	Percentages
Educational Background		
Lower than Bachelor degree	1	6.67
Bachelor degree	4	26.67
Master degree	9	60.00
Doctoral degree	1	6.67
Total	15	100.00

Table 28 shows that the experts agreed that the clothing pattern in this study was appropriate for people who graduated in a Master degree (60.00%), a Bachelor

degree (26.67%), and a doctoral degree and lower than bachelor degree (6.67%) respectively.

Table 29 Target group: Which target group is appropriate for the clothing pattern in this study?: Occupations

Data	Frequencies	Percentages
Occupations		
Company employee	6	40.00
Business owner	6	40.00
Government officer	2	13.33
State enterprise officer	0	0.00
Freelance	1	6.67
Total	15	100.00

Table 29 shows that the experts agreed that the clothing pattern in this study was appropriate for people who work as a company employee and business owner (40.00%), a government officer (13.33%), and a freelance (6.67%) respectively.

Table 30 Target group: Which target group is appropriate for the clothing pattern in this study?: Income

Data	Frequencies	Percentages
Income (baths per month)		
0-10,000	0	0.00
10,001-30,000	0	0.00
30,001-50,000	8	53.33
50,001 or more	7	46.67
Total	15	100.00

Table 30 shows that the experts agreed that the clothing pattern in this study was appropriate for people who earn 30,001 – 50,000 baths a month (53.33%), and 50,001 or more baths per month (46.67%) respectively.

Table 31 Target group: Which target group is appropriate for the clothing pattern in this study?: The products' design

Data	Frequencies	Percentages
Does the target group purchase the product based on its design?		
Yes	15	100.00
No	0	0.00
Total	15	100.00

Table 31 shows that the experts all agreed that the target group purchased the product based on the design (100%).

Table 32 Target group: Which target group is appropriate for the clothing pattern in this study?: The cultural product

Data	Frequencies	Percentages
Does the target group purchase the product based on its cultural influence?		
Yes	15	100.00
No	0	0.00
Total	15	100.00

Table 32 shows that the experts all agreed that the target group purchased the product based on its cultural influence (100%).

Table 33 Target group: Which target group is appropriate for the clothing pattern in this study?: the habit and personality of the target group (3 items selected)

Statement	Frequencies	Percentages
Which statements best describe the target group's habit and personality? (Please select 3 items)		
- They are a discipline people. They planned and aimed to be successful.	6	13.33
- They want to be accepted by the others. They choose the high quality, reliable, and expensive product.	3	6.67
- They are risk-takers, active, challenged people, and quick decision makers.	4	8.89
- They are creative people. They are open-minded especially with new things. They can get along with people easily.	14	31.11
- They are simple and peaceful. They do not like confusion. They are unambitious	6	13.33
- They are a self-confident, and good at persuading others.	4	8.89
- They like change and don't clinch on something. They listen to people's opinion.	1	2.22
- They are interested in the cultural art. They like handicraft and unique objects.	6	13.33
- They are interested in technology and modern things.	1	2.22
Total	337	100.00

Table 33 shows that the experts were agreed that the consumers are those who are creative, and open-minded with new things the most (31.11%). The experts thought that the consumers are discipline, aimed for success, simple, peaceful, and unambitious moderately (13.33%). Last, the experts agreed the consumers are those

who like changes, do not clinch on something. They listen to people's opinion and interested in technology and modern things the least (2.22%).

Table 34 The prototype clothing: Designing

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Designing	3.36 \pm 0.56	67.20	Very satisfied
The cloth can be adjusted to increase the wearing opportunities.	3.47 \pm 0.52	69.33	Very satisfied
The cloth has an interesting pattern.	3.40 \pm 0.51	68.00	Very satisfied
The cloth's pattern is suitable for the body shape of the target group.	3.27 \pm 0.70	65.33	Very satisfied
The cloth has a balanced pattern. (Equally balance, asymmetrical, prominent in the middle)	3.20 \pm 0.41	64.00	Very satisfied
The clothes in the collection are related to each other.	3.47 \pm 0.64	69.33	Very satisfied

Table 34 shows that the expert's' highest satisfaction on the designing was related to the adjustable design of cloth that could increase the wearing opportunities, and the clothes in the collection are related (3.47 \pm 0.52). The second highest satisfaction was the interesting pattern of cloth (\pm 3.40 0.51). Last, the least satisfaction was related to the balanced pattern of cloth (\pm 3.20 0.41).

Table 35 Prototype clothing: Texture

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Texture	3.18 \pm 0.53	63.56	Very satisfied
The choice of fabric is appropriate with the design and folding pattern (2 ply yarn silk).	3.20 \pm 0.56	64.00	Very satisfied
The folding pattern is the texture's decoration.	3.13 \pm 0.52	62.67	Very satisfied
The folding pattern increases the values of the cloth.	3.20 \pm 0.56	64.00	Very satisfied

Table 35 shows that the expert's' highest satisfaction on the texture was related to the appropriate choice of cloth that enhance the folding pattern (± 3.20 0.56). The second highest satisfaction was related the cloth values that increased by the folding pattern (3.20 \pm 0.56). Last, the least satisfaction was related to the folding techniques that created a pattern on the fabric (± 3.20 0.41).

Table 36 Prototype Clothing: Colors

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Colors	3.18 \pm 0.53	63.56	Very satisfied
The choice of color is appropriate with the design of the prototype clothing.	3.07 \pm 0.70	61.33	Very satisfied
The choice of color highlights the folding crease on the fabric.	3.20 \pm 0.56	64.00	Very satisfied
The color represents the habit and personality of Thai people that they are gentle, honest, and kind.	3.47 \pm 0.64	69.33	Very satisfied
The selected color can match with other color well.	3.67 \pm 0.49	73.33	Very satisfied

Table 36 shows that the expert's' highest satisfaction on the colors was related to the choice of color that can match with other colors well (3.670 ± 0.49). The second highest satisfaction was related to the representation of Thai habit and personality that they are gentle, honest and kind (3.47 ± 0.64). Last, the least satisfaction was related to the choice of color that matches the design of the prototype clothing (3.07 ± 0.70).

Table 37 Prototype clothing: Pattern design

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Pattern design	3.16 ± 0.64	63.20	Very satisfied
The cloth can be adjusted to increase the wearing opportunities appropriately.	3.33 ± 0.62	66.67	Very satisfied
The design is interesting.	3.13 ± 0.74	62.67	Very satisfied
The design fit the target group's body shape.	3.13 ± 0.52	62.67	Very satisfied
The fabric is appropriate with the clothing design.	2.93 ± 0.70	58.67	Very satisfied
The folding crease on the fabric is an appropriate decoration.	3.27 ± 0.59	65.33	Very satisfied

Table 37 shows that the expert's' highest satisfaction on the pattern design was related to the adjustable design to increase the wearing opportunities (3.33 ± 0.62). (The second highest satisfaction was related to the appropriate decoration made from the folding pattern (3.27 ± 0.59). (Last, the least satisfaction was related to the choice of fabric that matches the design of the prototype clothing (2.93 ± 0.70 +

Table 38 Prototype clothing: Overall

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Overall	3.30 \pm 0.47	66.00	Very satisfied
The overall benefits of the prototype clothing	3.27 \pm 0.46	65.33	Very satisfied
The overall look of the prototype clothing	3.30 \pm 0.49	66.67	Very satisfied

Table 38 shows that the expert's' highest satisfaction was on the overall look of the prototype clothing (3.30 \pm 0.49). The second highest satisfaction was on the overall benefits of the cloth (3.27 \pm 0.46).

Table 39 Prototype clothing: Elements

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Element	3.35 \pm 0.60	66.93	Very satisfied
The folds on the cloth are the favor.	3.47 \pm 0.52	69.33	Very satisfied
The design of cloth began from the rectangle shape which is similar to the Krathong folding methods. It is the innovation in the field of clothing design which has its outstanding pattern.	3.47 \pm 0.64	69.33	Very satisfied
The clothing design instruction is easy to follow.	3.00 \pm 0.65	60.00	Very satisfied
The positions on the cloth's parts such as collar, embrace, stripe's hole, the hook for clinging, and etc. are appropriate.	3.40 \pm 0.63	68.00	Very satisfied
The sizes such as the width, the length, the waist line, the neck line, and etc. are appropriate.	3.40 \pm 0.63	68.00	Very satisfied

Table 39 shows that the expert's' highest satisfaction on the elements was on basic design of cloth that started from the rectangle shape of fabric which is similar to the method of folding Krathong. It is the innovation in the field clothing design and the design was really outstanding ($3.47 + 0.52$ and $3.47 + 0.64$ respectively). The second highest satisfaction was on position of the cloth's parts (3.27 ± 0.46). (Last, the least satisfaction was on the comprehensible clothing design instructions ($3.00 + 0.65$).

Table 40 The art of folding Krathong and the Thai tradition: Value

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Value	3.48 ± 0.58	69.56	Very satisfied
By applying the art of folding Krathong in the designing of cloth help raising awareness of Thai people in terms of traditional value.	3.60 ± 0.63	72.00	Very satisfied
The arts of folding Krathong can be applied in other designing fields.	3.53 ± 0.64	70.67	Very satisfied
The cloth has a unique style.	3.47 ± 0.64	69.33	Very satisfied
The traditional art creates a contemporary cloth that can be worn as an everyday look.	3.40 ± 0.52	68.00	Very satisfied
It helps people to learn the Thai culture and history.	3.47 ± 0.52	69.33	Very satisfied
The new generation people understand the values and want to protect Thai cultural arts.	3.40 ± 0.63	68.00	Very satisfied

Table 40 shows that the expert's' highest satisfaction on the traditional value of the prototype clothing was on the application of folding Krathong to design cloth which raise awareness of people in terms of Thai traditional value ($3.60 + 0.63$). The second highest satisfaction was on the application of the art of folding Krathong in other fields of designing (3.53 ± 0.64). Last, the least satisfaction was on the

contemporary look originated from the Thai traditional arts that can be worn in daily life. Also, the new generation gets a better understanding of and sees the value of the Thai traditional arts (3.40^{0.63 ±}).

Conclusion: The experts' evaluation form toward the Thai traditional Krathong folding: the design and development for clothing collection analysis results

The experts' expressed their opinion toward the consumer of the design of the cloth that the cloth was suitable with 39-53 years old single women. They graduated in a master degree and work as a company employee and business owner. They earned 30,001-50,000 baths per month. They preferred buying designed products, and the cultural related products. They were a creative person who open to new things, and get along with people easily.

In terms of the products, the experts were satisfied in the design in the very satisfied level. They were satisfied in the product's texture, color, and pattern design in the very satisfied level. They were satisfied in the overall look and the element of the cloth in the very satisfied level. Last, in terms of the art of folding Krathong and tradition, the experts were satisfied with the value of applying this cultural art in the very satisfied level.

Additional comments from the experts

- The packaging of the cloth should be presented by applying the art of folding Krathong that were used in designing cloth. The wearing manual and the wearing instruction should be written on the packaging. This will help value added the Thai traditional art in the more interesting ways than hanging it in the coat hanger or put it in the bag.

- The design is very creative. It shows the ability in applying the art of folding Krathong in the designing of cloth quite well. The outcome of the design is really interesting.

- The used of other colors of cloth is suggested to provide more options to the consumers.

The consumers' questionnaire analysis results toward the Thai traditional Krathong folding: the design and development for clothing collection

The objective of employing the consumers' questionnaire is to investigate the opinion and satisfaction of the consumers toward the prototype clothing in terms of design, usability, value, and overall. The subjects of this questionnaire were 141 women and transgender. The results are presented as follows.

Table 41 The results after watching the picture of the prototype clothing in the Lookbook: Pattern design

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Pattern design	3.98 \pm 0.76	79.69	Very satisfied
The cloth can be adjusted to increase the wearing opportunities appropriately.	4.23 \pm 0.59	84.68	Very satisfied
The design is interesting.	4.08 \pm 0.73	81.56	Very satisfied
The design fit the target group's body shape.	3.67 \pm 0.88	79.48	Very satisfied
The fabric is appropriate with the clothing design.	4.03 \pm 0.71	80.57	Very satisfied
The folding crease on the fabric is an appropriate decoration.	3.90 \pm 0.74	78.16	Very satisfied

Table 41 shows that the consumer's highest satisfaction on the pattern design was related to the adjustable design to increase the wearing opportunities (± 4.23 .0.59). The second highest satisfaction was related to the interesting design of the cloth (± 4.08 0.73). (Last, the least satisfaction was related to the folding crease on the fabric as the decoration of the cloth (3.90 ± 0.74).

Table 42 The results after watching the picture of the prototype clothing in the Lookbook: Usability

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Usability	4.09 \pm 0.72	81.76	Very satisfied
After adjusted the styles, it can be worn in various occasions.	4.24 \pm 0.69	84.82	Very satisfied
The consumers can follow the instruction on how to adjust the style of cloth.	4.11 \pm 0.69	82.27	Very satisfied
The adjustable instruction is appropriate with the style of cloth.	4.13 \pm 0.69	82.55	Very satisfied
It is convenient to use.	3.98 \pm 0.75	79.57	Very satisfied
It can be folded and kept as suggested in the instruction.	3.98 \pm 0.75	79.57	Very satisfied

Table 42 shows that the consumer's highest satisfaction on the usability was related to the adjustable design to increase the wearing opportunities (4.240. \pm 0.69). The second highest satisfaction was related to the instruction of how to adjust the cloth (4.13 \pm 0.69). Last, the least satisfaction was related to the convenient use and the folding process to keep the cloth (3.98 \pm 0.75).

Table 43 The results after watching the picture of the prototype clothing in the
Lookbook: Value

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Value	4.05 \pm 0.79	80.96	Very satisfied
The cloth has a unique style.	3.87 \pm 0.93	77.45	Very satisfied
The traditional art creates a contemporary cloth that can be worn as an everyday look.	4.11 \pm 0.76	82.13	Very satisfied
By applying the art of folding Krathong in the cloth design, it helps people to learn the Thai culture and history.	4.09 \pm 0.72	81.70	Very satisfied
The new generation people understand the values and want to protect Thai cultural arts.	4.13 \pm 0.72	82.55	Very satisfied

Table 43 shows that the consumer' highest satisfaction on the value was related to new generation in terms of traditional and cultural awareness and desired to preserve the culture (4.13 \pm 0.72) .(The second highest satisfaction was related to the contemporary look that can be (4.13 \pm 0.69 and 4.11 \pm 0.76) .(Last, the least satisfaction was related to the uniqueness of the cloth (3.87 \pm 0.93) .(

Table 44 The results after watching the picture of the prototype clothing in the
Lookbook: overall

Prototype clothing's information	$\bar{x} \pm S.D.$	Percentages	Level of satisfaction
Overall	4.17 \pm 0.66	83.40	Very satisfied
The overall benefits of the prototype clothing	4.19 \pm 0.63	83.83	Very satisfied
The overall look of the prototype clothing	4.15 \pm 0.69	82.98	Very satisfied

Table 44 shows that the expert's' highest satisfaction was on the overall benefits of the cloth ($.0.63 \pm 4.19$). The second highest satisfaction was on the overall look of the cloth ($.0.69 \pm 4.15$).

Conclusion: The consumers' questionnaire analysis results toward the Thai traditional Krathong folding: the design and development for clothing collection

The consumer expressed their opinion toward the design in the very satisfied level. The satisfaction in terms of the usability, color, and pattern design was in the very satisfied level. Moreover, the overall satisfaction was in the very satisfied level.

Additional comments from *the consumers*

- It is the research that provides more options of cloth to the consumers.
- The colors choices should be added.
- The design of cloth is suitable as an everyday look.
- The pattern on should be clearer by printing and sewing on the fabric.
- It is a creative work and concept. The design is beautiful. It is designed for the fashion lovers rather than the general customer.



Chapter 5

Conclusion, discussion and recommendation

Chapter 5 discusses the conclusions and the problems resulting from the creation process and recommendations for future research and development in relation to the topic “Thai traditional folding Krathong : the design and development for clothing”. This part is divided into 3 parts as follows.

Part 1: The summary of the creation process

Part 2: The problems occurring during the creation process

Part 3: Recommendations for future development and further studies

Part 1: The Summary of the creation process

The summary of the creations process under the research topic “Thai traditional folding Krathong: the design and development for clothing collection” reveals the following results which are consistent with the research objectives.

1. The study provides the collection of the art of folding Krathong that has began to disappear over time. The new generations are more aware of the value of Thai crafts, which are traditional arts of Thailand.

.2The study provides the methods of creating clothing inspired by the art of folding Krathong and the behavior analysis of customers as well as their satisfaction to create costume prototypes that can be applied to maximize wearing styles to increase their usability. The results of the questionnaire showed that the experts and the questionnaire participants were satisfied with the prototypes at a highest level, showing the highest level of satisfaction and meeting the needs of consumers.

3. The study provides the knowledge about the fabric that suits the style of clothing. The fabric is considered the key of clothing production since it is beneficial for various utilities. Also, suitable fabric can beautify clothing patterns and wearers' shape. In other words, it can embellish the outstanding shape of wearers and blur their

shape problem. Moreover, the folded creases on Thai silk in this research study help decorate the cloth surface and make the costumes look different and more attractive.

Part 2: The Problems Occurring During The Creation Process

While carrying out the research study, the researcher has encountered some problems during various stages as follows.

1. The problems during the stage of designing

The designing in the study was not from sketching until the most suitable patterns were found but the design was from creating three-dimensional prototypes to come up with sewing guidelines to create the authentic clothing inspired by the art of folding Krathong. As a result, this has required a large amount of budget.

2. The problems during the stage of folding to maintain creases

Folding is the most important element of this research. The researcher has studied and tested a variety of methods to find the optimal method of folding to preserve intended creases by producing several pieces of the same clothing for folding experiment. The researcher had the time constraint so the researcher was not able to conduct an experiment with all types of fabrics, resulting in the experiment with the chosen fabrics.

3. The problems during the stage of fabric selection

During the creation process of the clothing inspired by the art of folding Krathong, it was found that the fabrics containing the polyester fibers yielded the most fruitful result for folding. After being folded, the creases were beautifully formed and sharp especially organza and organdy which are made of 100% polyester fibers. However, these two fabrics are translucent fabrics so they cannot be used to create daily clothing. Moreover, their heat resistance is only to a limited extent. Hence, the researcher turned to search for fabrics that contain polyester fibers and other fibers but the results from the folding experiment with other polyester fibers and fibers were unsatisfactory. The fabric selection process was considered the most time consuming process. Future researchers should set an appropriate time frame for this process.

Part 3: Recommendations For Future Development And Further Studies

After conducting the research entitled “Thai traditional folding Krathong: the design and development for clothing collection, the researcher has come to the following conclusions for future development.

1. The researcher has investigated a variety of methods until finding the creative ways that are not too complicated for ordinary people to understand. By considering the beginning point of the art of folding Krathong, a basic shape of a rectangular has been selected. Likewise, the clothing production has started with the rectangular shape which can be adaptable for design and style changes for maximized utilities. This should be seen as the beginning point for designers who are interested in the art of folding Krathong. They could develop further from this study in their own field.

2. The research study has investigated a variety of folding methods to maintain creases. The experiment of the folding methods ranged from basic folding and ironing of common irons to some ironing technologies such as a fabric pleating machine and a steam-iron pleating machine specially designed and created by a factory specializing in creating pleats. The information about the specially designed machine has not been allowed to be publicized due to its intellectual property of the pleating manufacturer. Additionally, the researcher has been given the help from Rajamangala University of Technology Thanyaburi to try a machine so-called an electric fusing machine. However, the best way to maintain creases on the cloth is to use a steam generator iron because it can reach small areas. Although there is a thick layer of multiple folded creases, the ironing can still be done as needed.

3. Thai silk is the fabric whose creases after folded and pressed tend to remain and not to revert so it is appropriate for any work that needs intended creases.

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