Community and Social Development Journal : CSDJ
*Formerly known as* Rajabhat Chiang Mai Research Journal
Vol 25 No 1 January – April 2024 : TCI 1, ACI

# Development of Fabric Surface Texture and Design Natural Dyed Hand-Woven Patterns in the Northern Region

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*(Received: 8 March 2023, Revised: 4 September 2023, Accepted: 7 September 2023)*
https://doi.org/10.57260/rcmrj.2023.264128

## Abstract

This article aims to 1) Study the potential production, structure and consumer demand of hand-woven products with natural dyed fabric. 2) Develop the surface texture of fabric and design patterns of hand-woven fabrics that are suitable for textile manufacturing and meet the lifestyle of consumers. 3) Produce the prototypes of hand-woven fabrics which developed surface texture and pattern. 4) Assess consumer satisfaction with prototype product. The target group of this study is entrepreneurs of hand-woven fabrics using natural dyes in the northern region, there are 5 groups with 110 people in total, including the Ampan cotton group, Dao Mang Hemp Fabric Community Enterprise Group, Ban Pa Ngiu Karen Weaving Group, Ban Na Hang Karen Weaving Group, and Ban Huai Ta Community Enterprise Group. The research methods utilized in this study were focus groups, questionnaires, and collaboration with community entrepreneurs in developing and producing woven fabrics. The results show that the 15 woven fabrics developed by the researcher had better surface textures, with a soft touch and good recovery against wrinkles. Additionally, the new weaving structures resulted in new patterns. The researchers designed and produced 21 styles of contemporary casual wear, folk costume, and dress, which meet the requirements of consumers who value eco-friendliness, culture, healthy lifestyles, and minimalism. Furthermore, textile products such as bags, satchels, and hats were also designed and produced, emphasizing the fineness of sewing and the community product standards. Finally, the satisfaction of consumers with the prototype products was assessed, with an average satisfaction level of 4.84 out of 5.

**Keywords:** Fabric surface texture, Natural dyed hand-woven fabric, The weave patterns

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## Introduction

The One Tambon, One Product (OTOP) project is guideline to create prosperity and increase the living standard of community residents by producing or utilizing local resources and wisdom to develop high-quality products which are unique to each local culture. The Government is prepared to support communities to access modern knowledge which link to concept of creative economy with local lifestyle and culture. And develop the productive capacity for domestic and international markets. (Community Development Department, 2015 ; Patranid et al., 2014). Enhancement of Lanna fabrics and textiles by adding value for sustainable competitive market is a part of the OTOP policy. Local woven fabrics are processed by community producers which made from raw materials in community. Looms, waist looms and short looms are adopted. These are a traditional producing process and weaving techniques that are unique to the producer. It is considered one of the most valuable of cultural products in Thailand. Woven fabrics of each region have different characteristics according to type and source of fiber in northern provinces. (Komonsirichok, 2015) The pattern on fabric is weaving in according with the traditional wisdom of the weaver, and the natural environment of each region. Hand woven fabric from natural dyed fabric is more valuable and attractive than synthetic dyed fabric that produced in the industrial systems. (Donchai & Wimolphusit, 2008) Consumers in Thailand and other countries are consuming natural, cultural and healthy products which involve preservative environment or support the community. Consumers, who admire to eco-friendly and use a fashionable Thai product, give an opportunity to preserve and inherit local wisdom communities. A lot of women's weaving groups in northern provinces modify the original dyed method by using natural fiber dyeing and weaving, then change the yarn dyeing mode. (Komonsirichok & Woraphodpornchai, 2018) The distribution of natural dyed fabrics include other products can add value to higher prices than synthetic dyed fabrics. Furthermore, cotton fiber is mainly used for weaving in the north of Thailand due to the benefits such as comfortable to wear, easy for laundry, good water absorption, and easy staining. (Paliwanit,1999) There are beautiful fabric patterns resulting from the weaving techniques of producers such as hemp fibers, which are natural fibers that the Hmong tribe used to weave into cloth. It is a rare fiber that is very oily like linen. It is tougher and stronger than cotton and linen fibers, high level hygroscopicity and good alkali resistance. (Sustainable Arts and Crafts Institute of Thailand, 2018) According to the preliminary interview with the local textile entrepreneurs about the problem of the production and natural fiber products. It was found that product uniqueness such as shawls or scarves made of hand woven cotton and hemp fibers are very valuable and charming. The price of hemp textile is 9,000-10,000 Baht. Consumers are willing to pay for this fabric because of it is natural fiber and has a large woven fiber. It has a unique Mhong style and is a delicate and beautiful candle pattern. With high durability and fine embroidery technology, each gown needs more than 30 days of production time. Problem of the texture of cotton products is also found that after dyeing and weaving, the skin will become rough. Not too soft. When wrinkles are difficult to recover, the fabric is not flexible. The problem of Hemp fabrics was the surface texture of the fabric would rough, hard and difficult to restore wrinkles. because of the large fibers. Although, the producer said that the fabric will gradually softens if washed frequently. In addition, the problems of cotton fabric and hemp fabric also found that the fabric was not flexible, and the processing and sewing of tailors were limited. The pattern formed by the weaving structure is the same pattern. The entrepreneur processes the fabric products into ready-made shirts. 1 piece of fabric The cost is high, but the sales are cheap,

which makes the income low. Finally, the researchers aim to reduce the business weaknesses of natural dye entrepreneurs through creative processes that add value and upgrade community woven fabrics according to specified standards and OTOP policies. By using mix fibers and different types of yarns to weave the same fabric, new fabric structures can be created that improve fabric performance, texture, and weaving patterns for a variety of purposes, meeting consumer trends and lifestyles, and generating higher prices that help the community earn more income and improve residents' quality of life.

**Objective**

1) Study the potential production, structure and consumer demand of hand-woven products with natural dyed fabric.

2) Develop the surface texture of fabric and design patterns of hand-woven fabrics that are suitable for textile manufacturing and meet the lifestyle of consumers.

3) Produce the prototypes of hand-woven fabrics which developed surface texture and pattern.

4) Assess consumer satisfaction with prototype product.

## Methodology

**1. Scope of content** This research is a Participatory Action Research. The researchers cooperated with textile producers. All groups participated in all activities related to the fabric producing process in the region. The literature review involved: Natural fiber is used in textile development, the principle of natural dyes and woven fabrics, the quality development of dissected products, and the principle of mixed fiber as a mixed fiber fabric. Standard fabric testing methods: fabric pattern design, fabric and textile product development and design, fashion design materials and technology, Design thinking process.

**2. Population** Target group are woven entrepreneurs in the northern region. There are 5 groups, totaling 110 people : are as follow

2.1 Ampan cotton group, Nakorreu sub-district, Hot district, Chiang Mai province, consists of 20 people.

2.2 Dao Mang Hemp Fabric Community Enterprise Group, Pongyang sub-district, Mae Rim district, Chiang Mai province, consists of 25 people.

2.3 Ban Pa Ngiu Karen Weaving Group, Tha Nuea sub-district, Mae On district, Chiang Mai province, consists of 20 people.

2.4 Ban Na Hang Karen Weaving Group, Mae Pak sub-district, Wang chin district, Phrae province, consists of 20 people.

2.5 Ban Huai Ta Community Enterprise Group, Nangphaya sub-district, Thapa district, Uttaradit province, consists of 25 people.

**3. Research Methodology** Researchers used a focus group. There are 15 participants representing 5 groups in the discussion, consisting of 1 group chairman and 2 group members each. Then developed the fabric surface texture of hand-woven cotton fabrics and hemp fabrics by following the steps below:

3.1 Studied the potential production of 5 target groups.

3.2 Surveyed and analyzed consumers' demand for hand-woven fabrics and textiles in terms of characteristic and texture of the fabrics in online and offline markets.

3.3 Determined a method to develop cotton and hemp fabric texture that suitable for fabric production by using the principle of blended fiber (Paliwanit, 1999) that used different

types of yarns to weave blended fabrics. In order to improving the performance of the fabric and made it more attractive, the fabric has been better texture, suitable for processing, soften texture and good wrinkle recovery. Then, adjusted the types of vertical yarn, weft yarn and woven fabric structure for adaption to the different weaving methods of the target group, that is, weaving with looms. Waist looms, local looms/hand looms and Mhong nationality looms. Mixed fiber woven structure design. Weaving pattern design after that let the weaver produce the fabric according to the design. (Chunthone, 2019 ; The Support Arts and Crafts International Centre of Thailand (Public Organization), 2014)

3.3.1 Tested the tensile strength of the fabric according to ASTM D 5034-2009.

For the hardness of the fabric according to ASTM D 1388-1996. (2002 report) Option A:

For the tear strength of the fabric according to ASTM D 2261-07a.

For the thickness of the fabric according to ASTM. D 1777-1996 (revised in 2007) Option 1:

For the hair growth on the fabric surface using a Random Tumble Pilling Tester according to ASTM standards. D 3512-2007

For perform fold restoration test according to AATCC 66. Then analyzed and summarized the test results. (Kosiyanon, 1998)

3.3.2 Designed and produced prototypes of woven fabrics that have been developed for texture. in the form of clothing, apparel and textile products. By using the principles of design and development of textile products. As well as the design thinking process, (Charungchittsunthorn, 2005 ; Phitchayasoontorn, 2012) including the use of conceptual frameworks of New products with the identity and wisdom of the group It is contemporary fashion to the consumer market that is popular with cultural products. Bringing the spirit of the local people to the people in the urban society, which is the cultural capital that is the potential of the group. to increase production. Create value-added quality products according to community product standards.

3.3.3 Created consumer satisfaction assessment form. to prototype clothing products and prototype textile products. It is a 5-level Rating Scale according to the Likert Scale method that inquires about satisfaction with the prototype product in 3 aspects: 1. Design aspect 2. Functional aspect 3. Material and quality. After that, collected data from the sample group 150 people, derived from purposive sampling are consumer who come to buy clothes at trade fair and exhibition of craft products.

**4. Research Tool:** The tools used to collect data according to the research procedures were as follows: Unstructured Interview, Fabric test, Consumer Satisfaction Assessment, and testing content validity.

## Results

**First, objective result:** studied the potential production, structure and consumer demand of hand-woven products with natural dyed fabric.

The results of the analysis of the potential of the 5 target groups and the structure of the woven fabrics of each group found that

1. Ampan cotton group is a group of weavers dyed with natural dyes, traditional looms and native looms. There are 20 members of the group. The yarn used for woven fabrics is cotton warp yarn number Ne40/2 and weft yarn number Ne10/1. The weave structure is plain weave 1-1, number of warp threads in 1 inch. = 44 strands, the number of weft threads in 1

inch = 44 strands. After weaving, it will be sold in the form of fabric and processed into applied traditional costumes. But the fabrics that the group still uses in weaving are not diverse yarns and textures.

2. Dao Mang Hemp Fabric Community Enterprise Group is a Mhong tribe with 25 members. This is a group that grows hemp trees and weaves them into fabrics with Mhong looms. The lifestyle is related to the hemp fabric for writing candles. The fabric is a narrow fabric, which is dyed into dark blue with Hom or indigo, but the dye is not durable. The fabric produced and sold is about 4.5 meters long, and the price of each piece is 3,500 - 4,500 Baht. It is processed into various products, such as skirts. Shirts, coats, hats and bags are sold at relatively high prices, because the production process of hemp fiber takes more than 30 days.

3. Ban Pa Ngiu Karen Weaving Group. It is a group of weaving cotton with a back strap loom. There are 20 members and producing fabrics woven from artificial silk threads dyed with synthetic dyes. Before dyeing, they tied warp yarns with Mudmee pattern, then weaved onto the fabric alternating with the ground-dyed yarn to make a sarong. As for Karen shirt, they made from artificial silk yarn and cotton yarn number Ne10/1, dyed with synthetic colors as well. Woven into fabrics and woven into patterns with the technique of Jok. Then be embroidered and decorated with artificial silk threads and spikes to add beauty. In addition to sarongs and shirts, the group also produces scarves. Shawl and bags. The group has the ability to dye natural colors and has government agencies to promote the dyeing process according to academic principles. Including having sufficient and diverse natural resources that provide natural colors in different shades.

4. Ban Na Hang Karen Weaving Group. It is the Sa-kow (Paka-kyaw) ethnic group There are 20 members of the group, producing fabrics from artificial cotton and silk threads dyed with synthetic dyes using an ancient hand-woven loom. There is a mudmee pattern dyed with the color of Morinda coreia buch, which is the traditional color of Karen's wisdom, unique and beautiful. But now it is more convenient to use synthetic dyes instead of natural dyes. Fabrics that are processed and sold within the group and acquaintances in the form of sarongs, shirts and bags are decorated with embroidery threads and millets to add beauty.

5. Ban Huai Ta Community Enterprise Group. This group was produced fabrics from artificial silk dyed with synthetic dyes. There were 25 members of the group weaving with traditional looms in the form of 4 heddles patterns that have been promoted by the Arts and Crafts Center. The group was produced and sold as sarongs, fabrics, shawls and scarves. The products were exquisite but used synthetic yarns and dyed with synthetic dyes in their production. causing the fabric to ventilate moisture poorly.

The study result of hand woven structure showed that there were 4 entrepreneur groups of cotton and artificial silk yarn weaving. The structure of woven fabrics was plain weave 1-1 and, Twill weave. And also found another group is Hemp weaving group, there woven hemp fabric structure was plain weave 1-1 as shown in Table 1.

**Table 1** An analysis of the hand-woven fabric structure of the target group

| Entrepreneur group | Hand-woven fabric structure | Warp yarn type / No. | Weft yarn type / No. | Number of Warp thread per inch | Number of Weft thread per inch | Characteristic of the loom |
|---|---|---|---|---|---|---|
| 1. Ampan cotton group | Plain weave 1-1 | Cotton yarn Ne40/2 | Cotton yarn Ne10/1 | 44 | 44 | loom & Traditional loom |
| 2. Dao Mang Hemp Fabric Community Enterprise Group | Plain weave 1-1 | Handspun hemp yarn | Handspun hemp yarn | 20 | 20 | Traditional weaving loom of the Hmong |
| 3. Ban Pa Ngiu Karen Weaving Group | Plain weave 1-1 | Cotton yarn Ne10/1 | Cotton yarn Ne10/1 | 30 | 34 | Back strap loom |
| 4. Ban Na Hang Karen Weaving Group | Plain weave 1-1 | Cotton yarn Ne40/2 | Cotton yarn Ne10/1 | 54 | 72 | Back strap loom |
| 5. Ban Huai Ta Community Enterprise Group | Twill weave | Artificial silk yarn Ne40/2 | Artificial silk yarn Ne40/2 | 48 | 110 | 4 heddles Traditional loom |

From exploring the consumers' demand for hand-woven fabric products. In terms of the texture of natural dyed hand-woven fabrics both online market and offline market. It found that the consumers of natural dyed handmade fabrics were 35 years old women who love nature, culture, and health with simple dressing. In the offline market., best seller products were dresses, pants, shirts, coats, bags and hats. The characteristics of clothing fabrics and hat fabrics are soft, light and comfortable. Dyed with natural colors. And the characteristics of bag fabrics required thick fabric, which remained in shape. In the online market, best seller products were short-sleeved shirts, coats, dresses, skirts, casual trousers and quads. In addition to the design to meet customer needs, consumers also like comfortable, loose, not fit, free size, comfortable fabric, solid color or micro pattern, suitable for daily wear, excellent sewing technology. And also found that the story of the store and the unique features of the product were part of attracting consumers' attention.

**Second, objective result:** Developed the surface texture of fabric and design patterns of hand-woven fabrics that were suitable for textile manufacturing and meet the lifestyle of consumers.

The researcher found the ways to develop the texture characteristics of woven fabrics that were cotton fibers and hemp fibers (naturally dyed fibers such as indigo, hemp, ebony, Morinda coreia buch and shallac to be suitable for the production of fabric products. By using the principle of blending fibers, it was a blended fabric, i.e. using different types of yarn to weave into the same fabric (mixture) to increase the properties of the fabric. to be more usable The fabric had a better texture suitable for processing, soften touch and good recovery against

wrinkles. Then, Modified the type of warp yarn, weft yarn, and weaving fabric structure to suit different weaving methods of all 5 target groups, such as weaving with woven loom, back strap loom, native/hand loom. and the loom of Hmong tribe. In the structure of the weaving patterns of Ban Pa Ngiu Karen weaving group and Ban Na Hang Karen weaving group. The researcher designed the weaving pattern with Mudmee technique, so that each group of fabrics has three contemporary patterns, as shown in Figure 1.


1) Na Hang Karen Weaving Group 2) Pa Ngiu Karen Weaving Group
**Figure 1** Woven pattern with Mudmee technique
(Source: Researcher, 2023)

And woven by producers according to the new structure designed by researchers. 15 kinds of natural dyed hand woven fabrics with new surface texture are obtained, as shown in Table 2

**Table 2** The characteristics of the fabric of the target group develop the fabric surface texture according to the principle of blended fabrics.

| Fabric Code | Fabric Structure | Warp yarn type | Weft yarn type | Number of Warp thread per inch | Number of Weft thread per inch | Target group | Weaving Method | Characteristic of the fabric and weaving pattern |
|---|---|---|---|---|---|---|---|---|
| 1 | Plain weave 1-1 | Cotton Ne40/2 | Hand spun cotton yarn | 24 | 24 | Ampan cotton group | Hand loom |  |
| 2 | Plain weave 1-1 | Cotton Ne40/2 | Hand spun cotton yarn (thin thread) | 24 | 40 | Ampan cotton group | Hand loom |  |
| 3 | Plain weave 1-1 | Handspun cotton yarn (thin thread) | Hand spun cotton yarn (thin thread) | 32 | 22 | Ampan cotton group | loom |  |

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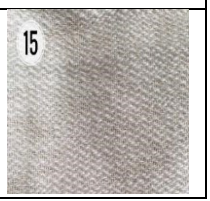
| Fabric Code | Fabric Structure | Warp yarn type | Weft yarn type | Number of Warp thread per inch | Number of Weft thread per inch | Target group | Weaving Method | Characteristic of the fabric and weaving pattern |
|---|---|---|---|---|---|---|---|---|
| 4 | Plain weave 1-1 | Cotton Ne40/2 | Cotton Ne10/1 | 44 | 40 | Ampan cotton group | loom |  |
| 5 | Plain weave 1-1 | Cotton Ne40/2 | C10/1 + R20/2 | 44 | 44 | Ampan cotton group | loom |  |
| 6 | Plain weave (1-1) | Cotton Ne40/2 | Cotton Ne3 | 24 | 20 | Ampan cotton group | loom |  |
| 7 | Plain weave (1-1) | Cotton Ne40/2 | Cotton Slub yarn Ne4.5 | 44 | 35 | Ampan cotton group | loom |  |
| 8 | Plain weave (1-1) (1piece = 3 meters) | Cotton Ne10/3 | Cotton Ne10/3 | 36 | 36 | Ban Pa Ngiu Karen Weaving Group | Back strap loom |  |
| 9 | Plain weave (1-1) (1piece = 3 meters) | Cotton Ne10/1 | Cotton Ne10/1 | 30 | 28 | Ban Pa Ngiu Karen Weaving Group | Back strap loom |  |
| 10 | Plain weave (1-1) | Cotton Ne40/2 | Cotton Ne10/1 | 40 | 30 | Ban Na Hang Karen Weaving Group | Traditional loom / hand loom |  |
| 11 | Plain weave (1-1) | Cotton Ne40/2 | Cotton Ne10/1 | 54 | 64 | Ban Na Hang Karen Weaving Group | Traditional loom / hand loom |  |
| 12 | Plain weave (1-1) | Hemp | Hand spun cotton yarn (thin thread) | 20 | 30 | Dao Mang Hemp Fabric Community Enterprise Group | Traditional weaving loom of the Hmong |  |
| 13 | Plain weave (1-1) | Hemp with reyon Ne2.8 | Hemp | 20 | 20 | Dao Mang Hemp Fabric Community Enterprise Group | Traditional weaving loom of the Hmong |  |

| Fabric Code | Fabric Structure | Warp yarn type | Weft yarn type | Number of Warp thread per inch | Number of Weft thread per inch | Target group | Weaving Method | Characteristic of the fabric and weaving pattern |
|---|---|---|---|---|---|---|---|---|
| 14 | Twill weave | Cotton Ne40/2 | Cotton Ne10/1 | 48 | 56 (Weft yarn merge 2 strands) | Ban Huai Ta Community Enterprise Group | Loom |  |
| 15 | Twill weave | Cotton Ne40/2 | Hand spun cotton yarn (thin thread) | 48 | 52 (Weft yarn merge 2 strands) | Ban Huai Ta Community Enterprise Group | Loom |  |

In addition to developing fabric surface texture and weaving patterns according to the new weaving structure, the researchers were also designed a new pattern of contemporary hemp candles, preserving the traditional identity of the Dao Mang hemp fabric community enterprise group. When the fabric was processed into a product, it was modern, as shown in Figure 2

**Figure 2** Hemp fabric candle pattern, new style,
Dao Mang Hemp Fabric Community Enterprise Group
(Source: Researcher, 2023)

**Result of Fabric Surface Texture Test**

After the producers weaves 15 kinds of blend fiber fabrics, the appearance of the structural fabrics were thick, medium thick and thin according to the type of warp yarn and weft yarn. Then, the researchers were tested all 15 kinds of fabrics according to the principle of textiles, which tested both warp yarns and weft yarns, by testing as follows:

1. Tensile strength test according to ASTM D 5034-2009 standard
2. Fabric hardness test according to ASTM D 1388-1996 (Reprove 2002) Option A standard
3. Tear strength test according to the standard ASTM D 2261-07a
4. Test for fabric thickness according to ASTM D 1777-1996 (Reapproved 2007) Option 1
5. Test for hair growth on the fabric surface. Using Random Tumble Pilling Tester according to ASTM D 3512-2007 standard.
6. Recovery against wrinkles test according to AATCC 66 standard.

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The test results showed that the fabrics with the strongest tensile strength were No. 8 and No. 4, while the fabrics with lower hardness were fabrics. No.1. No.2, No.4, No.5, No.6, No.9 and No.11. The most tear resistant woven fabrics were No.14 and No.15, because it was a twill weave structures. The thickness test results of twill fabric showed that No.8 is the thickest fabric because it used vertical yarn and large cotton yarn. The medium thickness fabrics were No.15, No.13, No.12 and No.1 respectively. The fabric with the most facial hair was No. 1. The fabric with the least facial hair was No. 4, No. 8, No. 9, No. 10 and No. 11. The results of recovery against wrinkles test showed that the fabrics with the most wrinkle recovery along the warp thread and the most weft were No.1, No.5, and No.4, respectively.

The testing result could be summarized that the developed 15 fabric characteristics included fabric thickness, softness, touch and strength. Each fabric was suitable for processing into different products. In addition, the pattern made of woven structure, such as Mudmee pattern and frosted pattern was a new pattern but still retains the identity of the original weaver, as shown in table 3

**Table 3** Result test of Characteristic fabric and Suitability in processing to make product

| Fabric Code | Result test of Characteristic fabric | Suitability in processing to make product |
|---|---|---|
| 1 | Medium thick fabric, soft to touch, high tear resistant, Low tensile strength and has good recovery against wrinkles. | Clothing, Textile products : hat, bag |
| 2 | Thin fabric, soft to touch, medium tear resistant, low tensile strength and has good recovery against wrinkles. | Clothing |
| 3 | Medium thick fabric, soft to touch, low tear resistant, medium tensile strength and has good recovery against wrinkles. | Clothing, Textile products : hat, bag |
| 4 | Thin fabric, soft to touch, low tear resistant, low tensile strength and has good recovery against wrinkles. | Clothing |
| 5 | Thin fabric, very soft to touch, low tear resistant, medium tensile strength and has good recovery against wrinkles. | Clothing , Scarf |
| 6 | Medium thick fabric, soft to touch, low tear resistant, low tensile strength and has good recovery against wrinkles. | Clothing, Textile products : hat, bag |
| 7 | Medium thick fabric, soft to touch, medium tear resistant, medium tensile strength and has good recovery against wrinkles. | Clothing, Textile products : hat, bag |
| 8 | Very thick fabric, hard to touch, medium tear resistant, high tensile strength and has good recovery against wrinkles. | Textile products : Bag |
| 9 | Medium thick fabric, soft to touch, medium tear resistant, high tensile strength and has good recovery against wrinkles. | Clothing, Textile products : bag |
| 10 | Medium thick fabric, soft to touch, medium tear resistant, medium tensile strength and has good recovery against wrinkles. | Clothing |
| 11 | Thin fabric, soft to touch, medium tear resistant, medium tensile strength and medium recovery against wrinkles. | Clothing |
| 12 | Medium thick fabric, hard to touch, low tear resistant, high tensile strength and low recovery against wrinkles. | Clothing (Overcoat) Hat, Bag |

| Fabric Code | Result test of Characteristic fabric | Suitability in processing to make product |
|---|---|---|
| 13 | Medium thick fabric, hard to touch, medium tear resistant, high tensile strength and low recovery against wrinkles. | Clothing (Overcoat) Hat, Bag |
| 14 | Medium thick fabric, soft to touch, high tear resistant, medium tensile strength and medium recovery against wrinkles. | Clothing , Overcoat |
| 15 | Medium thick fabric, soft to touch, high tear resistant, medium tensile strength and low recovery against wrinkles. | Clothing ,Overcoat |

**Third, objective result :** produced prototypes from hand-woven fabrics which developed surface texture and pattern.

Designed results of clothing and textile products : Researchers were considered various using by changing the use of products or designs, reduced the wearing of clothing in daily life, and used local culture. Used the concept that can felt the seasonality, or brought the surrounding things, emotions and nature into the design of beauty. The shape of the product was attracting customers or affecting the purchase. It was safe, strong, easy to use and reasonable in price. Local materials, manual and buoy production, transportation from producer to consumer. Researchers were used the principles of textile design and development, and designed thinking process, sketched design, then selected patterns, produced prototype and modify it, and further decorated them to obtain high-quality and beautiful products. The final step was made prototypes. All 15 fabric designs were 21 styles of clothing for adults such as casual wear and applied folk costume and 10 styles of contemporary textile products such as bags, satchels and hats. According to the community product standards, the sewing fineness was considered, which is suitable for the quality requirements of community products and trustworthy. To be accepted and built the credibility with consumers to buy products, researchers were also focused on the sustainable development. To improve the quality of community products according to the specified standards and OTOP policies. 31 kinds of clothing and textile product designs, as shown in Figure 3-7

**Figure 3** Clothing and Casual wear prototype products from the canvas Code 1-11
(Source: Researcher, 2023)

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**Figure 4** Clothing, Casual wear and applied folk costume prototype products from the canvas Code 1-11 (Source: Researcher, 2023)

**Figure 5** Clothing prototype products from the canvas Code 12-13 (Source: Researcher, 2023)

**Figure 6** Clothing prototype products from the canvas Code 14-15 (Source: Researcher, 2023)

**Figure 7** textile product prototype : bags, satchels and hats Code 1, 3, 6-9, 12 and 13 (Source: Researcher, 2023)

**Forth, objective result :** Assess the consumer's satisfaction with the prototype product.

Product were tested to find out the satisfaction of consumer 150 people, who would like to consume cultural products, and use fashionable Thai products. In terms of style, utility and material, and quality of the cloth. There were found that consumers were satisfied with the overall product at the most level with an average of 4.84 as shown in Table 5.

**Table 5** Average satisfaction of customers toward prototype products

| Item | Level of Satisfaction | | | | | Mean | Interpret |
|---|---|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 | | |
| **Model / Pattern** | | | | | | | |
| 1. Fashion style, Modern | 110 | 40 | 0 | 0 | 0 | 4.73 | Very good |
| 2. Different from market /competitor | 88 | 45 | 17 | 0 | 0 | 4.47 | Good |
| 3. The design is beautiful and meet the need of customer | 140 | 10 | 0 | 0 | 0 | 4.93 | Very good |
| 4. Unique and eye-catching , reflecting local identity | 134 | 16 | 0 | 0 | 0 | 4.91 | Very good |
| **Utility** | | | | | | | |
| 1. Suitable for various occasions. Suitable for various purposes. | 140 | 10 | 0 | 0 | 0 | 4.93 | Very good |
| 2. Suitable for the buyer's characteristics and style | 135 | 15 | 0 | 0 | 0 | 4.90 | Very good |
| **Material and Quality** | | | | | | | |
| 1. Characteristics of natural dyed fabrics is suitable for the model | 132 | 18 | 0 | 0 | 0 | 4.88 | Very good |
| 2. Exquisite tailoring, Fabric is soft and comfortable. | 133 | 17 | 0 | 0 | 0 | 4.89 | Very good |
| 3. The fabric pattern, the decoration on product is appropriate. | 140 | 10 | 0 | 0 | 0 | 4.93 | Very good |
| **Overall mean satisfaction** | | | | | | **4.84** | **Very good** |

It showed for the consumer style, the most satisfied were the design which beautiful and met their needs with an average of 4.93, followed by unique designs. Representing local identity with an average of 4.91 and fashion style. It was modern with an average of 4.73 respectively. In terms of usability, consumers were most satisfied about suitable for various occasions and suitable for various purposes. with an average of 4.93 and suitable for the characteristics and style of the buyer with an average of 4.90 in terms of materials and quality. Consumers were most satisfied with the fabric pattern, the decoration on product is appropriate with an average of 4.93, followed by exquisite tailoring, the fabric was soft and comfortable, average 4.89, and the nature of the fabric dyed naturally. It was suitable for the model with an average of 4.88, respectively, for overall product satisfaction. Consumers were satisfied at the most level with an average of 4.84. Furthermore, the researchers were also interviewed entrepreneurs for all 5 target groups on the subject. Satisfaction with the design and tailoring of prototype products. according to the unstructured interview form the results of the interview revealed that all entrepreneurs were satisfied with the design and original product. Including clothing, apparel and textile products as a whole, at the most level.

## Discussions

The current study investigate the recombination effect of handmade fabrics dyed with natural cotton and hemp fibers used different types of yarns to weave the same fabric. Changing the type of vertical yarn. Straight yarn. The fabric structure was suitable for different weaving methods of all 5 target groups, creating a new fabric structure. The total number of hand woven fabrics developed by researchers were 15. According to the type of warp and weft, thick fabric, medium thick fabric, thick fabric and thin fabric were tested. The test results showed that these 15 fabric surface texture were thin, thickness, soft surface, high strength and good wrinkle recovery. Therefore, each fabric was suitable for processing into different products. In addition, Dao Mang hemp fabric group get new structural weave pattern. They were also get new hemp candle design. And also, Ban Pa Ngiu karen weaving Group and Ban Na Hang karen weaving Group were got contemporary weaving patterns, Mudmee techniques 3 patterns per group, which maintained the traditional identity of the group. The results of this study were consisted with the study of Umasin & Tonyalae (2020). On the development of Koh Yor creative woven patterns which found the development of Koh Yor woven patterns by combining different sizes of yarn materials and knitting technology, a woven pattern and size texture were formed. By weaving the yarn into fancy yarn, the fabric had independent color patterns and raised textures. The yarn was mixed with yarns of different sizes to made the fabric that relief texture of different degrees, and the fiber yarn was used to made the fabric fluffy. Special fiber yarns were used to mix and weave the fabric, which had luster and texture, and forms a raised pattern in the same fabric.

The study also investigate the product processing results were met the purchase needs of female customers aged 35 and above, and their lifestyles like natural Thai products and cultural Thai products that were contemporary products. According to the design and development of textile products and the design thinking process, were enhanced and increased the product value. 21 styles of clothing have been developed, which was a new modern style with the uniqueness of the group. Entrepreneur's sewing process was exquisite. Compared with the community product standard, and OTOP entrepreneur's products. All five target groups have reached more consumers and increased opportunities to compete with other brands. It could be seen that entrepreneurs were improved in design and pattern making/Reskill sewing

embroidery emphasizes delicacy aimed at community product standards. This finding was similar to the research of Sutakcom & Komosirichok (2021), which found that fabric creation was a product that created value and improved products. In order to attract customers' attention, producer must focus on the meticulousness sewing according to the community product standard to raise the level of the group's products. Moreover, the researchers have also increased interference with the sustainable protection of identity and local lifestyle based on nature and culture. A production chain is formed through the design and development of 10 contemporary textile products, including bags and hats. When the products produced meet the market demand, the fabric quality and sewing process meet the community product standards. Entrepreneurs can sell at higher prices, which will help communities earn more income (Prachakul et al., 2019) and improve the quality of life of community residents.

## Conclusion and suggestions

1. Restructuring of naturally dyed hand-woven fabrics that are cotton and hemp fibers. with the principle of blend fibers by using different types of yarn to be woven into the same fabric Modify the type of warp yarn, weft yarn and woven fabric structure to suit the different weaving methods of the 5 target groups, resulting in a new woven fabric structure, that increase the properties of the fabric to be more usable. Researchers developed the fabrics surface texture 15 woven fabrics. And tested the appearance of thick. Medium thick, very thick and thin according to warp yarn type. and weft yarn type The fabric test result show that The characteristics of all 15 fabrics are thick, thin, soft touch, be strong and has different good recovery against wrinkle. Therefore, each fabric is suitable for processing into different products.

2. Product processing results that meets the purchasing needs of women customers aged 35 years and over, who have a lifestyle that likes natural products and cultural products which is a product of Thailand that is not an outdated. It is an upgraded and value-added product. According to the principles of design and development of textile products. and design thinking process Developed into 21 styles of clothing, which are new products. contemporary style have a group identity The sewing workmanship of the entrepreneur is exquisite. Compared to community product standards As a result, the products of OTOP entrepreneurs in the category of fabric products and local textiles for all 5 target groups reach more consumers Increase the opportunity to compete with other brands. It can be seen that entrepreneurs have been upskilled in designing and making patterns / reskilling sewing and embroidery that emphasizes refinement aiming at community product standards. Researchers further disrupt product production chains by designing and developing 10 more contemporary textile products. There are bags, satchels and hats. The quality of the fabric and sewing craftsmanship are comparable to community product standards. When the products produced are in line with market demands. Entrepreneurs will be able to sell at a higher price. This will help the community earn more income. and improve the quality of life of community residents.

**Suggestions from Research results**

1. In order to created new woven patterns and fabric textures, the producers should constantly adjust the woven structure and the production of fabrics. Moreover, they should focus on the quality of weaving according to community product standards and fabric production for reaching high quality products.

2. There should maintain the quality of weaving process and pass on knowledge of weaving structure, new weaving patterns including how to dye yarn with natural colors to the youth in the community to continue inherit.

**Suggestions for further Research**

1. There should study and extended developing fabrics with new surface for processing into different types of textile products. By using different types and different size of yarns.

2. There should study various fabric structure and design the development product to obtain new patterns and new uniqueness.

## New knowledge and the effects on society and communities

The obtained result from this research were as follow :

1. The research has enabled entrepreneurs to improve their skills in design, pattern-making, reskilling, sewing, and embroidery, emphasizing the delicacy of workmanship and targeting community product standards. As a result, locally produced fabrics and textiles have reached more consumers, increasing the opportunity to compete with other brands. This has paved the way for a new generation of marketing entrepreneurs.

2. The production process has resulted in the formation of a network that has increased the welding size of the entire fabric and textile supply chain. This has encouraged the natural dye business to establish a solid foundation and a strong group that can create added value and quality for products. For instance, the Ampan cotton group has integrated production with a loom that can operate as a small weaving factory, enabling the hiring of more weavers for the network group. Additionally, the networked Karen weaving groups need not invest in machine tools and can produce unique products using their own wisdom faster. Regarding high-quality natural dyes, these can be sent across the network at a fair price, or the knowledge of the natural dyeing process can be exchanged so as to enable self-reliance in the future.

## Acknowledgments

The researchers would like to thank Program Management Unit on Area Based Development (PMUA) for supporting the funding for this research. Thank you to Rajamangala University of Technology Lanna for supporting personal, places, and tools used in conducting research Including, regrading to all the groups of entrepreneur who participated in the research until it was successfully completed.

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