A Creation of Bamboo Products to Add Values for Namsong Community in Payuhakiri District, Nakhon Sawan Province

Pennapa Manee-oud

Department of Industrial Technology, Faculty of Agricultural Technology and Industrial Technology
Nakhon Sawan Rajabhat University, No. 398 Moo. 9, Sawanwithi Road, Muang District, Nakhon Sawan 60000
Corresponding author. E-Mail address: pennapa@nsru.ac.th
Received: 16 January 2018; Accepted: 14 June 2018

Abstract

The main objectives of this research were to study information of bamboo; to create bamboo products adding more values for Namsong Community, Payuhakiri District, Nakhon Sawan province; and to assess the satisfaction of people interested in those bamboo products. The tools used in the research were interview forms and questionnaires. The documentary analysis was conducted by summarizing aspects of product trends, product property and use of co-materials. The data analysis was presented as percentage, Mean and Standard Deviation. The results of the research revealed that Sie-Sook bamboo was generally grown in the area and sold as stalks. The use of bamboo shoots and stalks appeared in working utensils, furniture and household materials used in daily life. The bamboo products consist of two kinds: products made from thin bamboo stripes and those made from stalks and branches. The demands of bamboo products are measured by interviewing 246 samplings who indicated that daily household utensils were mostly needed.

Following the Creative Thinking process in accordance with the 'Think outside the Box' theory, together with the thinking assessment, the new conceptual idea transformed the product into a bamboo bicycle. The work was value-added-based research which combined an old bicycle with bamboo together with ideas of people in the community to produce a bamboo bicycle prototype.

As Namsong Sub-District has interesting historical stories, natural resources and roads connected to other areas, it could promote a bicycle route for tourism, health and recreation. This not only adds values to bamboo products by creating bamboo bikes, but also promotes income from tourists for local people. Regarding the satisfaction of people interested in bamboo products, the sample size was at 95% and the population proportion at 0.20. The sampling group was 246 people and the average satisfaction was at a high level.

Keywords: Bamboo product, Creative Thinking, Value addition, Products

Introduction

According to issues on research strategy in 2015, the biodiversity-based economic development, following the Biodiversity Research Plan to develop a new business or new-trend business based on the research framework in the 2015 budget year (National Research Council of Thailand, 2015), together with Free Trade Area (FTA) which reduces taxes and prices of import goods, this has an indirect impact on purchasing power of people. Also, the reduction of import tariffs helps decrease the price of similar products, substitute products made in the country and result in higher competition. The reduction of tariffs also leads to the import of new products that have never been imported due to high tariffs in previous years. Although an optional opportunity for people increases, the impact of trade liberalization makes several domestic manufacturer groups to adjust themselves for more intense competitions.

Local wisdom products are generated from knowledge, belief, ability and experience continuously transferred, inherited and applied by people in the community. Therefore, the products have high cultural cost, having values in terms of conservation and development and remaining important in the community.

The area of Namsong Sub-District, Payuhakiri District, Nakhon Sawan Province, has generally used bamboo for a long time. Bamboo can be grown easily and fast, providing several benefits. Bamboo wood has hardness,

stickiness, enduringness and resilience, which are unique features of bamboo. Nevertheless, its weaknesses are moth, mold, difficulty in applying stalks and variety of co-material types used with bamboo for product design (Sikka, Sikka and Chiarakul, 2015).

Nowadays, the livelihood of Namsong villagers has been changed as it focuses on large-scale farming which leads to a reduction of bamboo plantations and a decrease of income. In case of wildfire, the recovery of soil quality would take at least seven years. Additionally, the knowledge of bamboo processes is probably not transferred to the next generation. Therefore, if the community can develop and add values to their traditional products for creative economy, it will be beneficial to the community as an intellectual asset, especially for various Thai wisdom products, and as a great example to others.

Based on the reasons above, it leads to the study of bamboo in Namsong Sub-District, Payuhakiri District, Nakhon Sawan Province to collect its features, characteristics and qualities to create products created for career establishment and higher income in the community.

Aims of Research

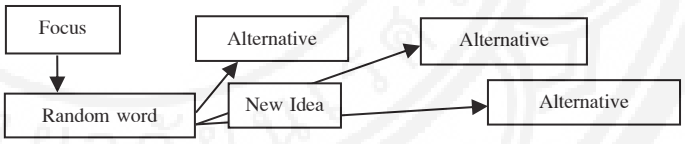
1. To study the information of bamboo in the area of Namsong Sub-District, Phayuhakhiri District, Nakhon Sawan Province.

2. To create value-added bamboo products for Namsong Sub-District, Phayuhakhiri District, Nakhon Sawan Province.

3. To assess the satisfaction of people interested in bamboo products in Namsong Sub-District.

Conceptual Framework

Table 1 Conceptual framework of research

To search for information	- product - material - demand of bamboo product
To generate a new way of thinking	- follow the thinking concept of Lateral Thinking (Lt) (De Bono, 2010) 
To evaluate a thinking concept	- evaluate David Perkins's principal (Phuvipadawat, 1994) such as - objective - structure - model - reason and agrument
To design working steps	- product design

Scope of Research

1. Studying and collecting the information of bamboo characteristics from text books, research reports and on the internet

2. Interviewing local old people on the topics of community context, local resources, local artifacts and wisdom established in the past, developed and existed in Nakhon Sawan Province. Two subjects were selected from each village and totaled 22 people.

3. Interviewing present local manufactures on the topics of raw materials, production processes and bamboo product development. One subject was selected from each village and totaled 11 villagers

4. Creating a value-added bamboo product for the community

5. The sample size was 246 people for demand and satisfaction assessment on bamboo products. The sample size of unknown population was determined by W.G. Cochran's formula (Koonkaew, 2017) and confirmed at 95 percentage of confidence, and proportion of population was 0.20.

Research Tools

The instruments used in this study are:

1. A structured interview form for interviewing the local elderly and current manufacturers

2. A questionnaire on demand for bamboo products: The questionnaire was a rating scale which was divided into two parts. The first part was general information of the respondents and the second part was questionnaire on demand and problem of utilization of bamboo products. The questionnaire was examined by three experts for the content validity and appropriateness of the language used in accordance with the objectives of the research to improve and correct the IOC 0.90

3. A satisfaction assessment form for those interested in bamboo products: The questionnaire was the rating scale which was consisted of two parts. The first part was general information of the respondents and the second part was satisfaction questionnaire on bamboo products. The questionnaire was examined for the content validity and appropriateness of the language used in accordance with the objectives of the research to improve and correct the IOC 0.81 by three experts.

Data Collection

1. Study the documentary data: The study was based on articles, journals, research papers and information searched from the Internet on bamboo products.

2. Go on the location to interview with elders and bamboo product manufacturers in Phayuhakhiri District, Nakhon Sawan province: The structured questionnaire was used and the data was recorded.

3. Collect the information from the questionnaire on the demand of bamboo products. People on the walking street and at the flea market at Jira Prawat Army Camp in Nakhon Sawan were randomly interviewed.

4. Collect the data from the questionnaire for satisfaction assessment with the bamboo product prototype: The samples were people on the walking street and at the flea market at Jira Prawatta Army Camp in Nakhon Sawan.

Analysis of Data

1. An analysis of the information from documents focusing on the concepts, theories and related research: The information was summarized in terms of product trends, product property, and co-material utilization.

2. An analysis of information derived from the interviews and the obtained data were synthesized in various aspects to be used in the product design.

3. An analysis of information from questionnaire, demand, and consumer satisfaction on bamboo products, using Mean and SD (standard deviation) of satisfaction level of those interested in bamboo products on each aspect and overall.

Research Results

1. The information of bamboo in Namsong Sub-District, Nakhon Sawan Province

1.1 According to the study of information on diversity of bamboo cultivar/species from text books, reported researches and on the internet, it revealed that at least five bamboo species were found in the area of Namsong Sub-District, Phayuhakhiri District, Nakon Sawan as follows:

1. *Phai-Dum* (in Thai) - This bamboo is a small ornamental plant. Its shape is a tight bush, 1-2 meters in height but thin. Each segment is 20-30 cm in length. Its leaves are smooth with green-purple color, small and similar to fern leaves. The young bamboo is green but black after growing for longer time.

2. *Phai-Nual* (in Thai) - This bamboo is a perennial and clumping plant. The clump composts of multiple trunks, and the shrub can be both small and large size. The clumping bamboo has about 20-25 plants, and the stalks are internodes about 5-15 meters in height. Its skin is smooth and solid with green or yellow color. The strip is green. The size and color depend on the breed and species. The leaves are simple about one or two inches in width and about 5-12 inches in length. The bamboo flowers is sprang as a bunch on the top. After flowering, the bamboo will die. The villagers usually call this as bamboo death. Its fruit or seed are similar as those of rice.

3. *Phai-Siesook* (in Thai) - This bamboo is tall and large in size wiht freshly green stalks. The shoots are greyish-green and large with brown hairs, up to 3-4 kilograms in weight. The segment with 7-10 cm in diameter and 10-30 cm in length, having branches sticking out as pricks. As this bamboo is thick, hard, durable and sticky, it is more popular than other breeds and normally used for making furniture and scaffolding for construction. The base of stalks is also used for making a carrying pole.

4. *Phai-Leing* (in Thai) - This bamboo has medium-size straight stems and green color without thorn. The stalks are about 8-10 meters in length and 3-8 cm in width, and the branch springs at the top of the trunk. The stems look fine and strong, usually used for wind protection. Young shoots are wrapped by yellow or yellowish-green shells. As the bamboo trunks are very hard and thick, they can support heavy weight.

5. *Phai-Ruak* (in Thai) - This bamboo has small stalks. Its diameter is 2-7 cm and height is about 5-10 meters. The clump looks like a tight bush. Its trunk is used as materials for building construction, crutches to support trees and paper pulp. The shoots are edible or kept as preserved bamboo shoots. This bamboo is usually found in the north of the country. The stalks are dark green color and smooth, 4-7 cm in diameter, 23-30 cm in length and 10-15 meters in height.

6. *Phai-Whan* (in Thai) - This bamboo has small up to medium size. Its clump is a tight bush. The young stalks are green whereas the elder ones become deep green. The stalks are usually bent about 3-5 cm in diameter and 5-8 meters high. The branch is bloomed every 2-5 stem. There are white rings and aerial roots around the stalks. The simplest observation of this bamboo is its unequal size and different shape of flap fins whereas other bamboo types have the same or similar size.

1.2 The result of interview with the local elders and current manufacturers on raw materials for production and product development revealed that Phai-Siesook is a common specie found in Namsong Sub-District, both in bamboo plantation areas for sale and other non-agricultural areas. The fire in bamboo forest is a significant problem which decreases soil quality and makes the land useless for at least seven years. Most utilization of bamboo is from two great parts: shoots and stalks to make some working tools such as cattle pen, *gong* trap, rat trap; furniture such as tables and litter; and daily households stuffs such as threshing basket and incense sticks.

2. The creative value-added bamboo products in Namsong Community

2.1 Information of Namsong bamboo

The information of available products collected from the two markets revealed that the manufacturing process of bamboo products consists of two methods: 1) the process based on utilization of bamboo stalks and branches to makes containers, measuring instruments, household furniture, mats, shelters or materials related to belief, tradition and religion; and 2) the production of bamboo products from trunks and branches to make lamp, furniture and jewelry.

2.2 Bamboo characteristics and co-materials used in product design

Bamboo can be grown easily and fast in all weather conditions on all types of soil. It provides both direct and indirect benefits. Bamboo wood's unique characteristics are hardness, stickiness, enduringness and resilience. However, its disadvantages are moth, mold and difficulty in controlling different dimensions of stalks. Many co-material types can be used with bamboo for product design such as wood, steel, plastic and leather.

2.3 Demands for bamboo products

According to the 246 questionnaires, the results are shown in Table 2 and Table 3 below.

Table 2 Demands for bamboo products

Detail		Frequency	Percentage
Have you ever bought the product?	Yes	204	82.90
	Never	42	17.10
	Total	**246**	**100.0**
In what kind of bamboo products are you the most interested?	Souvenirs	49	19.90
	Household materials used in daily life	138	56.10
	Home decorations	44	17.90
	Containers	13	5.30
	Other	2	0.80
	Total	**246**	**100.00**
What is the reason for buying bamboo products?	To give as a souvenir	59	24.10
	To use by yourself	161	65.40
	To keep as collections	2	0.80
	Cheap price	22	8.90
	Other	2	0.80
	Total	**246**	**100.0**

In Table 2, 82.9% of the subjects have purchased bamboo products whereas 17.1% have never done it. In terms of interesting bamboo products, those used in households in daily life (56.1%) was the highest. The reason for buying them "To use by yourself" was 65.4%, higher than other reasons.

Table 3 Problem of bamboo product usages

Detail		Frequency	Percentage
Problem of bamboo products	Moth	119	48.40
	Mold	83	33.70
	Difficult for cleaning	16	6.50
	Splinter	11	4.50
	Short-shelf life	10	4.10
	Difficult to fix	6	2.40
	Others	1	0.40
Total		**246**	**100.00**

In Table 3, the most frequently encountered problems of bamboo products were moth at 48.4%, followed by molds at 33.7%. According to the demands of bamboo products of 246 people in the two markets, Nakhon Sawan walking street and Jira Prawatta flea market, it was concluded that tools made of bamboo were mostly required. As tools are varied, it is necessary to analyze a method to create a product in the next step.

2.4 The conclusion of Lateral thinking (Lt), a new way of thinking, provided a guideline for product design as shown in **Figure 1**.

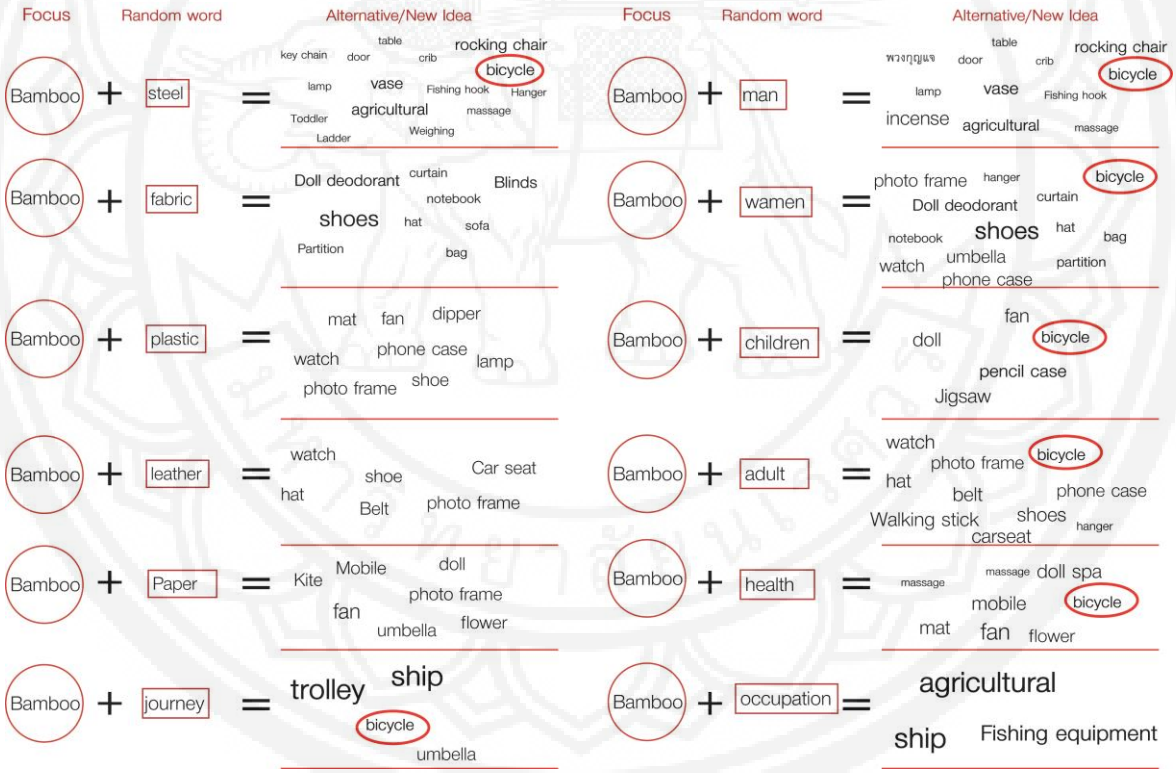


Figure 1 The thinking process with Lateral thinking (Lt)

The result showed that a bamboo bicycle was selected as a value-added product with a combination of old bicycles' damaged parts and local bamboo. Meanwhile, the guideline presented that people in the community had an ability to utilize bamboo stalks rather than thin bamboo-stripes for basketry.

2.5 Summary of thinking evaluation

The analysis of the design led to an advanced modification: Bamboo bicycle

2.5.1 Purpose: To be used for cycling to exercise

2.5.2 Structure: Two-wheel vehicle, one wheel is in the front and the other is in the rear. There is a steel frame connecting the front wheel to the rear one. The manually controlled handle is installed on the front wheel. The bike is powered by the pedal force.

2.5.3 Simulation model

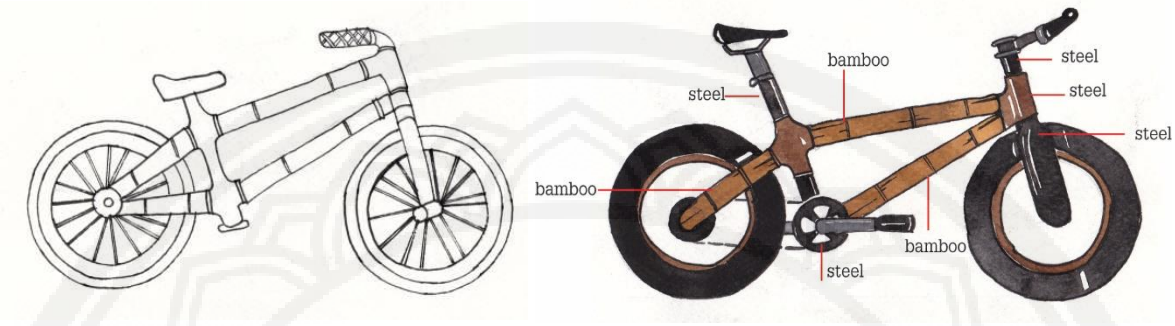


Figure 2 Simulation of model bicycle

2.5.4 Reason: The vehicle uses mechanical energy or manpower to ride for saving energy like gas and petrol. The modification of old bicycles' parts and local bamboo stalks created a value-added product.

2.6 The Conclusion of Action Plan

To get a bamboo bicycle prototype, the researchers and the villagers in Namsong Sub-District, started from outlining its pattern derived from the creative-thinking process and thinking evaluation by applying the structure of the old bicycle with bamboo stalks grown in the community(See Figure 2).

Figure 3 A demonstration of production processes of bamboo bikes by the community

Figure 4 A demonstration of satisfaction assessment of the sampling group

3. Summary of satisfaction of interested people

After generating the bamboo bicycle prototype derived from the cooperation of the research team and the community, the product was examined by measuring users' satisfaction and general information as shown in Table 4. Here, the respondents were male 59% and female 41%

Table 4 Gender of the respondents

Gender	Number (person)	Percentage
Male	145	58.94
Female	101	41.06
Total	**246**	**100.00**

Table 5 Age of the respondents

Age	Number (person)	Percentage
Less than 20 years old	55	22.36
20-25 years old	83	33.74
26-30 years old	35	14.23
31-35 years old	21	8.52
36-40 years old	10	4.07
41-45 years old	12	4.88
46-50 years old	6	2.44
51-55 years old	6	2.44
56-60 years old	6	2.44
Over 61 years old	12	4.88
Total	**246**	**100.00**

In Table 5, the respondents were less than 20 years, 20-25 years old and 26-30 years, respectively.

The target group's satisfaction on bamboo-prototyped products was evaluated in different aspects presented in Table 6 below with five levels of satisfaction: 4.50-5.00 referring to the most satisfied, 3.50-4.49 meaning the more satisfied, 2.50-3.49 means the average satisfaction, 1.50-2.49 means the less satisfaction, and 1.00-1.49 means the least satisfaction.

Table 6 Evaluation of satisfaction

Detail	Level of Satisfaction					Mean	S.D.	Level of Satisfaction
	The most	Most	Medium	Less	Least			
1. Function						**3.99**	**0.10**	**Most**
1.1 respond to requirement	53	143	42	8	0	3.98	0.72	Most
1.2 suitable for all ages/gender	41	93	63	9	0	4.00	0.86	Most
2. Beautiful						**3.71**	**007**	**Most**
2.1 outstanding/beautiful	19	76	119	Most	0	3.67	0.80	Most
2.2 attractiveness	40	105	88	Most	0	3.70	0.80	Most
2.3 Indication of bamboo work	75	49	114	8	0	3.78	0.92	Most
3. Comfortable						**3.88**	**0.21**	**Most**
3.1 ease for usage	109	120	15	Most	0	4.37	0.64	Most
3.2 suitable for physiology	36	64	111	Most	3	3.40	0.93	Most
4. Safety						**3.82**	**0.07**	**Most**
4.1 strength of material	63	104	66	Most	0	3.88	0.85	Most
4.2 strength of structure	62	107	68	9	0	3.90	0.82	Most
4.3 support for heavy weight	55	87	74	30	0	3.68	0.96	Most
5. Materials and Production Process						**4.15**	**0.20**	**Most**
5.1 strength of material	63	87	87	9	0	3.83	0.85	Most
5.2 uncomplicated structure	116	121	9	0	0	4.43	0.57	Most
5.3 using local materials	128	52	49	17	0	4.18	0.98	Most
Total Average						**3.91**	**0.13**	**Most**

Table 6 showed Mean and Standard Deviation of satisfaction level of people interested in bamboo bicycle products in terms of function, beauty, safety, materials and production processes. The results were tested by the sampling group interested in the product and by the questionnaire with 246 people. The overall satisfaction was at the high level ($\bar{x}$ = 3.91). The first two satisfactions on products were material and production process ($\bar{x}$ = 4.15) and function ($\bar{x}$ = 3.99), showing the high level of satisfaction.

A suggestion acquired from the production of bamboo bikes with the community was the technique of connecting bamboo parts with epoxy resin. This technique can be applied with other works such as shipbuilding for flooded areas, making fishing boats in Num-Song swamp and the Chao Phraya River. Moreover, the production generates the technique of wrapping robes and coating for knife making. As the community has an interesting historical story, natural resources and connected routes, it is an appropriate area to be promoted as a cycling route for tourism by using bamboo bicycles in terms of health and recreation.

Discussion

Most parts of Namsong Sub-District are flat, having Chao Phraya River flow through with many natural canals and swamps, the area is ideal for agriculture. The climate condition is generally warm but not too warm because of Chao Phraya River's flow. The Sub-District's interesting natural place is Numsong swamp, a large pond with several fish species.

Bamboo species found in the area of Namsong District are Phai-Dum, Phai-Nual, Phai-Siesook, Phai-Leing, Phai-Ruak and Phai-Whan. The bamboo shoots can be sold after growing three years or more. In case of fire in bamboo forests, it will take seven years to be recovered. The price of bamboo stalks is 40-60 baht.

At present, the bamboo forest area in the community decreases due to the change of other agricultural activities, a very low purchase of bamboo products, a problem of forest fire and a theft of large bamboo shoots. These situations result in small-size shoots left which provide small bamboo stalks.

The benefits gained from bamboo shoots and stalks are: working tools such as cattle, *gong* trap, rat trap; furniture such as tables and litters; and household tools in daily life such as basket, incense sticks. The manufacturing process of bamboo products consists of: 1) generating products from the thin bamboo stripes and 2) producing products derived from bamboo stalks and branches.

Bamboo grows easily and fast in all weather conditions and in all types of soil. According to the important benefits of bamboo, it provides both direct and indirect utilization. The unique characteristics of bamboo are hardness, stickiness, flexibility and bendability (Sikka, Sikka and Chiarakul, 2015). The positive point of bamboo is a natural material but the negative points are moth, mold and its stalks with different sizes. The recycled materials to be used with bamboo in product design are wood, leather, steel, plastics or paper.

The demands of bamboo products tested by sampling 246 people from the two markets, Nakhon Sawan walking street and the Jira Prawatta flea market, are corresponded to Chanawangsa and Samannachart (2014) in terms of consumer behaviors, demands and opinions on products. The product mostly needed was daily-used household tools.

Regarding the diversity of household tools, the new thinking process to determine the new product was conducted by using the thinking evaluation of Von Oech (1993) for aspects of purposes, structure, model design and reason, and discussion. The analysis concluded that a bamboo bicycle could be the value-added product of the community. The design analysis led to the improvement of bamboo bicycles based on value-added modification by combining of the old bicycle with bamboo stalks to create the value-added product. The creation of the prototype was derived from the participation of the researchers and the community. This stage involved the creative thinking process and thinking assessment by using the structure of old bicycles and bamboo parts grown in the community.

The satisfaction evaluation of people interested in bamboo bicycle includes aspects of function, beauty, safety, materials and production processes generated from creative thinking processes. According to the results reported by 246 people who answered the questionnaire, the overall satisfaction was at the high level. The first two satisfactions of bamboo products were 'materials' and 'manufacturing process and functional property,' as Comwong (2013) mentions. Regarding a product design's principle, the issue to be considered is that all products must present its functions in accordance with objectives to meet the users' needs efficiently and comfortably. As Khunprab, Saributr and Khiaomang (2015) point out, five important factors are contemporary product design, worthy mind and folk art, functionality, cost of products and value addition.

As Num-Song Sub-District has an interesting history, natural resources and roads connecting to other communities, it would be appropriate to promote bicycle routes for tourism in the area with bamboo bicycling for health and recreation. As Bunyarit (2017) states, a study of cycling routes for community tourism not only help add values to bamboo products by creating a bamboo bike, but also raises income of local people.

References

Bunyarit, C. (2017). *Bicycle Route Development for Promoting Tourism in Songkhla Municipality by Participation Process. MUT Journal of Business Administration, 14*(1), 198-227.

Chanawangsa, T., & Samannachart, S. (2014). A Study on the Potential Development and Evolution of Handicrafts Made from Jute within a Community in Northeast Thailand. *Journal of Industrial Education, 13*(1), 63-70.

Comwong, C. (2013). *Documentation of Training Courses Designed Silk Products Processing* (Research report). Retrieved from http://qsds.go.th/newqsds/file_upload/2013-12-26-course2_5.pdf

De Bono, E. (2010). *Think! Before It's Too Late* (N. Nateprasertsri, Trans.). Bangkok: Nation books.

Khunprab, P., Saributr, U., & Khiaomang, K. (2015). Study and Development Contemporary Product from Bulrush Residue. *Journal of Industrial Education, 14*(3), 352-359.

Koonkaew, A. (2017). *Statistics for Research.* Bangkok: Chulalongkorn University Printing House.

National Research Council of Thailand. (2015). *Research Framework for Fiscal Year 2015.* Retrieved from http://www.nrct.go.th/research/framework/framework58.aspx#.WmLdpX8UnIU

Phuvipadawat, S. (1994). *Creative Promotion Techniques.* Bangkok: Thai Watana Panich.

Sikka, S., Sikka, P., & Chiarakul, T. (2015). Development of Bamboo Handicraft in ISAAN. *Art and Architecture Journal Naresuan University, 16*(1), 110-120. Retrieved from http://archmis.arch.nu.ac.th/arch_ajnu/journal/article_file/article_2015_96.pdf

Von Oech, R. (1993). *A Kick in the Seat of the Pants* (P. Sitthiamnuay, Trans.). Bangkok: SE-Education.