Accessible Upland Rice Packaging Design for Consumers and Visually Impaired People

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ABSTRACT

There is a lack of research that considers designing products' packaging which concerns people with visual impairment. Therefore, this research will focus on this gap. This research aimed to: 1) investigate the requirements of consumers, visual impairment; and Ban Huai Luek Agricultural Community Enterprise members; 2) design the new packaging to meet consumers' requirements; and 3) evaluate 402 consumers' satisfactions and 30 visually impaired people about the upland rice packaging prototype. The results showed that consumers required the new packaging that consists of easy to remember brand, product label that contains important information, good inner packaging, and environmentally friendly outer packaging. Visually impaired people required information that can be perceived by touch, recognized from tests, perceived from mind and with access to information on the package. The new design consists of brand, three types of products' labels, vacuum inner packaging, two styles of outer packaging, braille indicating products' name, QR-code for audio data and link to traditional of growing upland rice video. The results of consumers' opinions evaluation on the packaging prototype for upland rice products found that all participants, both consumers and visually impaired consumers, were more satisfied with the new packaging than the original packaging. The 402 customers agreed that the new packaging was better than the original packaging, statistically significant at .001 level both overall and each aspect. Overall, 30 visually impairment agreed that the new packaging is very helpful in making their shopping choices free and equal.

1. INTRODUCTION

Package design plays an important role in every product. The essence of packaging should be to maintain the quality of the product, promote marketing, and distribution to offer good and attractive packaging shape. Packaging design is also an integral part of attracting customers to purchase. However, customers are diverse, and their needs are diverse and constantly changing. For this reason, operators need to work closely with their customers to ensure that their products truly meet and fulfill customers' needs. This is in line with Hamlin [1] who focus on producing products that meet the needs of specific customers. It focuses on producing products that meet the needs of a very specific group. The customers will be more involved in designing and manufacturing. Products will be created according to the needs of the customer, especially with the present variety of products and higher production costs. There are many companies producing rice to distribute as can be seen in the market. The packaging used is also more diverse according to the size of the product and the needs of each group of customers. The rice packaging that is sold by many brands is not suitable for moving or transporting as expected. Thus, this affected the decreased efficiency in transporting the product, and also affected logistics costs, especially transportation, moving, and storing costs [2]. Moreover, the outer packaging is not concerned to be environmentally friendly.

The Central Registration Office, Department of Provincial Administration [3], as of 31 December 2019, reported that Thailand has 191,965 people with visual impairment or 9.47 % of all disabilities in Thailand. However, although the proportion of people with disabilities is a small proportion compared to the total population, they have the same rights and freedoms as others in a society, every life receiving equal information in accordance with the Convention on the Rights of Persons with Disabilities. However, people with visual impairments still have problems and obstacles in accessing product information because they cannot access the products that are sold in the market. At present, only five products in Thailand have packaging designs with Braille on them: Maggie seasoning sauce, ZACT toothpaste,

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SALZ toothpaste, SYSTEMA toothpaste, and KODOMO toothbrush [4]. However, the packaging of these products only contains braille to display the product name. For other products, there is no access to information on the packaging for people with visual impairments. It does not show product details such as price, features, usage, date of manufacture, or expiration date, which are important for deciding which product to buy. This paper presents the original work on the elements required by entrepreneurs, consumers, and people with visual impairment, and proposes methods for designing upland rice packaging to meet those requirements, along with the results of consumers' satisfaction and those with visual impairments on the new upland rice packaging prototype. It is notable that there are only a few research studies concerned with designing packaging for visually impaired people.

2. LITERATURE REVIEW

Packaging

Definition of packaging

Packaging means packaging management to suit the marketing strategy, costs, and transportation [5]. Packaging refers to promotional techniques and the synergies between products and containers with the aim of protecting products during transportation and storage [6]. It can be concluded that packaging refers to the handling of packaging or the packaging of products designed to not break, damage, or deteriorate in quality during transportation and throughout the service life.

Packaging design

Packaging design has an important role in trade and service in terms of transportation by protecting products to be safe from damage. Transportation packaging design can be divided into 3 areas as follows [6]:

1) Retail packaging is the packaging that is designed to facilitate delivery to consumers. It has an eye-catching design as an internal advertising medium. The main function of packaging is to protect the product. It has an ergonomic shape and marketing promotion.

2) Wholesale packaging is a packaging that divides products into sets for convenient distribution, such as 6 pieces, 12 pieces, or 24 pieces. It serves the main function of keeping the product from being damaged by transportation or keeping the product in the warehouse. It is convenient to deliver products to retailers or wholesalers.

3) Outer packaging or shipping packaging is a packaging designed to be used in packing products that can be arranged or placed to have the most usable space. It needs to be designed to be in a strong condition to prevent products from damage. It could be packed in containers such as wooden crates or pallets, etc.

Graphic design

Graphic design elements are essential to enable graphic design to communicate meaning and create value. There are elements to consider as follows [7]:

1) Letters are responsible for giving details of the information to be presented. Using the letters in the design makes it beautiful and attractive. The selection of letters is divided into two parts: i) the title part focuses on highlighting the prominence and ii) text or content that emphasizes simplicity and ease of reading.

2) Illustrations are used in the design to achieve aesthetics, attract attention, and communication, with easily understandable meanings, etc.

3) The choice of colors in packaging design or commercial designs should consider the following:

a. Use bright colors to create intense vision
b. Colors can be used independently for beauty but should also consider the suitability.
c. Some works may not always require color. Use of color should consider the suitability and how much to use.
d. The selection of colors should be suitable for the age of the target consumers.
e. Do not use too much ink as this will reduce the appearance of the work.
f. Using contrasting colors will make it look clear, lively, and make it more interesting.
g. When designing work with a lot of space, using a basic color might make the work stand out.
h. The use of text colors should be clear and consider the use of color that could affect eyesight and vision.

Universal design

The 7 principles concept of universal design is [8]: 1) Equitable use; 2) Flexibility in use; 3) Simple and intuitive use; 4) Perceptible information; 5) Tolerance for error; 6) Low physical effort; 7) Size and space for approach and use. However, Universal Design can also be implemented to the concept of packaging design. There are nine principles [9]: 1) It is easy to identify product; 2) It can be conveniently held; 3) It can be opened easily; 4) It can be easily removed from the package; 5) The product can be easily understood; 6) It is easy to use; 7) It is easy to keep; 8) It can be easy to dispose of; 9) It can prevent any danger in use.

Visually impaired problems with shopping

Shopping is one of the common activities in their daily lives for people with and without disability. People with disability need more planning for shopping than people without disabilities. This is because they might have barriers for their shopping such as physical environment, infrastructure, and services [10-11]. The main problems of visual impairment in shopping are reading difficulty in printed product labels, price tags, sale promotion brochure, and product details [12]. The results from the interviews found that most visually impaired shoppers in Thailand hardly go shopping on their own. They prefer asking family or friends to buy familiar products for them because

they found travelling on public transportation is not convenient or taking taxis are very expensive for them. They also require personnel shopping assistant service which is not commonly available in Thailand. However, different persons preferred different requested experience when shopping. As for the sellers, it was expected by visually impaired shoppers to get a good service from them. In conclusion, people with visual impairment require having some kind of technology that could assist them to access to important information on the product freely and equally.

Technology enhancement for visually impaired people

QR Codes have been used widely around the world. They are used in industrial, transport and product markets as they have the ability to store data in multiple languages with a data storage capacity of 4,000 characters. The data can be read and decrypted quickly. A common use is in marketing promotion, application, advertising in various media such as product labels, billboards, magazines, or websites, etc. [13]. However, nowadays there is a new technology called "SnapTag" which is similar to QR codes in term of scanning images that give access to additional information. The SnapTag allows companies to use any image or a company logo and then surrounds it with a "Code Ring". This code ring can store information on each unique code which is better looking than using a QR Code [14]. Near Field Communication (NFC) tags are one of the new tools that could possibly replace QR codes. NFC chip technology is already built into the modern smartphone and so do not require an extra application which is great advantage for users. NFC is being used most frequently for mobile payments i.e. Google Wallet and Apple Pay because it is safe and reliable. It is also a lot easier to make changes and edit NFC tags compared to QR codes [13]. In addition, people with visual impairment can also use a mobile application called "Be My Eyes" which is available free on both Android and IOS platform around the world. When visually impaired people need help through this app, Be My Eyes will send notifications to multiple volunteers. The app will match visually impaired users with visually impaired volunteers based on the language used and the time zone in which they both live. The first volunteer to accept the request is connected to the user via a video call. The use of audio for conversations between the user and the volunteer will be able to help solve problems arising [15].

Related Works

The survey results of 31 different brands of local rice found that none of them consider packaging for visually impaired people. Most local rice packaging consisted of logo, product's name, nutrition, quantity, date of manufacture, cooking method, nutritional value, FDA number, contact detail, price, and barcode etc. There is only one product that contained a QR Code to link to information. Table 1 shows the literature review about rice packaging design. It was found that only 2 out of 11 research studies considered designing packaging for visual impairment. Most of the research undertaken in Thailand is more concerned with graphic design and value added on the products and packaging structure, followed by brand design with using 4P theory in designing products' packaging without using technology to provide information. Therefore, this study identified a research gap in designing packaging for visually impaired people.

Table 1. Literature review on rice packaging design

Author	Brand design	Emotional design	Local material	4P	Friendly environment	Packing Structure	Community identity	Graphic design	Protect	Value added	Visually Impairment	Ergonomics design	Braille	Universal design
Kongprasert [16]	P							P						
Narongwit and Pinjurai [17]				P			P							
Jeerasin [18]						P	P							
Paladsongkram et.al. [19]								P						
Urairat [20]								P	P	P				
Ananchaitawat [21]	P							P		P				
Sinthavalai and Ruengrong [22]								P		P				
Pradit [23]	P			P		P		P		P				
Wanchitcharoon [24]						P					P			P
Klamnak [25]											P	P	P	P
Wannarat et al. [26]					P									
Soiraya et al. [27]					P									

3. RESEARCH METHODOLOGY

The triangulation method was used in this research to confirm results. For objective 1, information was obtained from literature reviews and interviews with 10 consumers, 10 visually impaired people, and 10 members of Ban Huai Luek Agricultural Community Enterprise to get their requirements in designing upland rice packaging. The samples used a specific random method to select people who have previously bought rice products from the community enterprise. For objective 2, researchers have designed packaging prototypes, then showed them to the same 10 consumers, 10 visually impaired people, and 10 members of Ban Huai Luek Agricultural Community Enterprise in order to ask their opinions about the packaging prototypes. For objective 3, 402 consumers were selected using a specific random method to select those who have previously bought rice products or healthy food [28] to evaluate a new packing prototype by answering a questionnaire. An interviewing method was used to interview 30 visually impaired people after their experiment in touching and using their phone to get information from the new packaging. This group of people was selected using a specific random method to select those who have previously bought any products in the market. Ten members of the community enterprise were asked to join a focus group in order to confirm the results with consumers as shown in Figure 1.

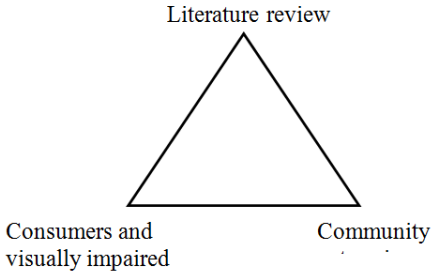

Fig.1. Triangulation method

Questionnaires were piloted with a small sample group (N=30) to assess its reliability using Cronbach's Alpha. A questionnaire about original packaging had a score of Cronbach's Alpha = .946 and a questionnaire about new packaging has a score of Cronbach's Alpha = .968.

Packaging design process

In designing upland rice packaging, the researcher used an agile method that can change with the experiments to get the best design.

The packaging design process consisted of four main steps which were:

1) The packaging design has two important objectives (i) to use and (ii) to communicate information to consumers in order to understand the product and attract consumers.

2) The key components that the upland rice packaging should include are product name, brand, product description, promotional details, picture, product composition, quantity, manufacturer and supplier name, contact information, date of manufacture, expiration date, price, and cooking method.

3) The researchers also took into account information that should be included on packaging for people with visual impairments, including braille, audio date of manufacture, and QR code technology that facilitates access to audio data, and the shape of the packaging that can be easily recognized.

4) Packaging design objectives and goals which can be analyzed by 5W + 2H were as follows: [29- 30]

a. WHY is an analysis of the rationale of the design? What is the packaging for?
b. WHO is a target analysis of who the product is designed for.
c. WHERE analyzes where the product will be sold to be able to design packaging suitable for the area in which it will be sold.
d. WHAT is the purpose of the design? What are the limitations? What is the selling point or the strength of the product?
e. WHEN by analyzing the design period, when it started? When is it done? And when will it be released? Taking into account the appropriate time and festival.
f. HOW to use the designed packaging? How can it meet the usage? Is it easy to use?
g. HOW MUCH does the packaging design cost with expenses?

5) Packaging design planning consists of the following steps:

a. Brand design, inner packaging and outer packaging design planning
b. Collection of information, including marketing information, strengths, weaknesses, opportunities and barriers, SWOT Analysis, demand, and consumer behavior in packaging production and related new technologies
c. FDesign sketch by developing ideas into three prototype drafts to present to the community enterprise groups, and then make improvements according to suggestions to be made as a packaging prototype (Model)
d. A focus group of members of the community group about prototype analysis, and select the best prototype

Research questions

There are three research questions answering the research objective.

1) Do consumers, visual impaired people, and the community entrepreneurs require similar or different requirements about upland rice packaging design?

2) How to design upland rice packaging prototypes

that meet the needs of consumers, visual impairment, and community entrepreneurs?

3) Are consumers, visually impairment people, and entrepreneurs satisfied with the upland rice packaging prototypes? In what way?

4. RESULTS

The results are presented following the order of research questions as follows:

Results of research question 1

The data were collected from literature review, theories, and related works. The researcher then analyzed and synthesized the data in order to create a guideline in designing upland rice packaging. The results found that consumers, visual impairments, and Ban Huai Luek Agricultural Community Enterprise have different requirements as follows:

1) Designing packaging for consumers should contain consumer value, price, comfort, and communication.

2) Designing packaging for visual impairments should contain touch perception, test perception (sound, smell, taste), perceive from the mind and access to information on packaging without giving priority to color or image of the product. However, they will focus more on perceived information from the packaging.

3) Designing packaging for entrepreneurs should contain the 4P principle: product, price, place, and promotion.

The results from interviewing 10 members of the community enterprise found they wanted inner packaging with a thick transparent plastic that could withstand impact and not cause the bag tear. While clearly seeing the rice grains packaging design should be modern and attractive to consumers. It should preserve the quality of the rice for a long time. The packaging should explain the production process. If the packaging can convey local identity and be environmentally friendly that would be great. The designed packaging should promote sales for community enterprises to earn more income. The packaging should also indicate the price and weight of the product. Moreover, 100% of community enterprise members would like to increase the value of upland rice by selling them in gift boxes at various occasions.

Interviewing 10 visually impaired people found they required similar information about the product as consumers. However, the difference was that 100% of people with visual impairments agreed that they did not require the colorful packaging because they cannot see. They required an easily recognizable packaging shape and texture of the packaging. If it is possible, they want a packaging that has a unique smell to be easily recognizable. These elements are essential in building the perception of touch, smell, and taste. Consumers with disabilities prefer affordable products because they have low income.

Results of research question 2

An upland rice packaging design prototype was carried out according to the requirements of related people and design theories. The original brand and packaging of the community enterprise are shown in Figure 2. The results of designing new upland rice packaging showed that packaging includes: 1) logo 2) product label 3) the inner packaging was a vacuum seal plastic bag, and 4) the outer packaging was a kraft paper bag and a kraft paper box. There were two sizes of packaging development: 1 kilogram and 500 grams. There were three styles of product labels design of three kinds of rice; Sangyod rice, Hom Bon rice, and Dokkha rice. There were two types of outer packaging: a paper bag with handle (Figure 4) and gift boxes (Figure 5). Braille characters appeared on the packaging on the front of the box indicating the product's name. The top back of packaging had braille with a QR code to scan to get a link to audio data about product details (which consisted of rice name, nutrient, benefit, price, quantity, cooking method, date of manufacture, and expired date.) The top back of packaging had braille with a QR code to scan to get a link to audio information and video about upland rice planting tradition (Figure 6).

Fig. 2. Original brand and packaging

A B C

Fig. 3. Logo of new brand.

Ninety percent of community enterprise members agreed that the logo “A” (Figure 3), inner packaging, and outer packaging are attractive and provide all necessary information about the product descriptions. The product label Type II (Figure 7) was their favorite. Moreover, 80% of consumers agreed that voice information was appropriate, and 70% of consumers said that the video was appropriate and compelling. The majority of consumers (70%) and the member of the community group (80%)

chose both sizes of packaging in buying and selling. Ninety percent of the community enterprise members chose logo "A" in Figure 3 for their brand. The majority of consumers (70%) and 80% of the members of the community enterprise agreed on the same style as shown in Figure 8. The majority of consumers (80%) and 90% of the members of community enterprise agreed on both outer packaging styles. Eighty percent of the 10 visually impaired people interviewed agreed that the new packaging was very helpful in making free and equal shopping choices in society. Seventy percent of of those with visual impairments interviewed said that the braille on the packaging was meaningful, and 80% commented that the QR Code can be scanned to access information well but need to tell the distance between mobile phone and QR Code, and 70 % of those with visual impairments thought that the QR Code link was correct.

Fig. 4. New packaging in a bag.

Fig. 5. New packaging in a box.

Front Back

Fig. 6. Outer packaging.

Hombon

Sangyod

Dokkha

Fig. 7. Label Type II.

Results of research question 3

Questionnaire results

The results from collecting data from 402 consumers found that the majority of respondents were female (67.16 %), in the range of 21-30 years (47.51%), held a bachelor's degree (58.96 %) and earned less than 10,000 baht (32.34 %). Most of them used to buy Hom Bon Rice, Sangyod Rice, and Hom Pratum rice. Consumers' opinions about five aspects of the new packaging design were obtained: 1) functional form of packaging, 2) graphic design on package, 3) information on packaging, 4) voice information, and 5) video information. From the first three aspects, the participants were asked to rate the score 1-5 to rate their satisfaction of original packaging and compare the scores with the new packaging design. For voice and video information aspects, the participants only rated the new packaging design because those elements which did not exist in the original version of packaging.

1) Functional form of packaging

From Table 2, the majority of consumers agreed that the overall score of new packaging ($\bar{x}$ = 4.19) was greater than the original packaging ($\bar{x}$ = 3.62). The results of the analysis of Paired Sample t-test on packaging functions overall found that consumers had a statistically significant difference in functional packaging satisfaction towards the new packaging and the original packaging at .001 level. The majority of consumers agreed that the new packaging performs better in overall packaging function than the original packaging. The two groups of data were related (r = .556) at the .001 significance level. When considering an individual factor, it was found that consumers' satisfactions

with the new packaging and the original packaging in terms of functional form of packaging were significantly different at the .001 level. Consumers were generally more satisfied with the new packaging than the original packaging in every individual factor. The two groups were related (r = .382 - r = .475) at the .001 significance level. The most relevant information was that packaging can support the contained product from being damaged, followed by packaging can keep product quality intact. The least was the packaging has an attractive design, stimulating the urge to buy.

Table 2. Opinion on functional form of packaging

Aspects	Original		New	
	$\bar{x}$	S.D	$\bar{x}$	S.D
1. Packaging can support the contained product from being damaged.	3.72	0.93	4.11	0.83
2. Packaging can keep product quality intact.	3.74	0.94	4.15	0.83
3. The packaging has an attractive design, stimulating the urge to buy.	3.49	1.06	4.27	0.90
4. Packaging adds value to the product.	3.58	1.04	4.32	0.85
5. The packaging is durable for handling and transportation.	3.59	0.95	4.11	0.87
Total	**3.62**	**0.98**	**4.19**	**0.85**

2) Graphic design on packaging

Table 3. Opinion on graphic design on packaging

Aspects	Original		New	
	$\bar{x}$	S.D	$\bar{x}$	S.D
1. The placement of information elements and graphics on the packaging is beautiful and appropriate.	3.35	0.99	4.20	0.87
2. The use of color on the packaging is beautiful, consistent and draws attention.	3.34	0.98	4.21	0.88
3. The font size is easy to read and clear.	3.30	0.99	4.14	0.90
4. The graphic design is unique and different from the market.	3.15	1.00	4.16	0.91
5. The overall graphic design is attractive, stimulate the urge to buy.	3.31	1.07	4.24	0.90
Total	**3.29**	**1.00**	**4.19**	**0.89**

From Table 3, the majority of consumers agreed that the overall score of the new package on graphic design ($\bar{x}$ = 4.19) was greater than the original packaging ($\bar{x}$ = 3.29). The results of the analysis of Paired Sample t-test on graphic design on packaging overall found that consumers had a statistically significant difference in graphic designing on packaging satisfaction towards the new packaging and the original packaging at .001 level. The majority of consumers agreed that the new packaging performs better in overall graphic than the original packaging. The two groups of data were related (r = .556) at the .001 significance level. The majority of consumers were generally more satisfied with the new packaging than the original packaging in every individual factor. The two groups were related (r = .231 – r = .343) at the .001 significance level. The most relevant information was that the overall graphic design is attractive, and stimulates the urge to buy, followed by the use of color on the packaging was beautiful, consistent and draws attention. The least was the graphic design is unique and different from the market.

3) Information on packaging

Table 4. Opinion on information on packaging

Aspects	Original		New	
	$\bar{x}$	S.D	$\bar{x}$	S.D
1. Information contains all necessary product descriptions.	3.49	1.07	4.23	0.89
2. Information helps ensure the quality of the product for consumers.	3.56	1.07	4.23	0.88
3. Information contains sufficient information to make decisions on purchasing a product.	3.49	1.02	4.22	0.88
4. The information comes from reliable sources.	3.64	0.95	4.22	0.84
5. There is a clear display of contact information.	3.68	0.94	4.30	0.84
Total	**3.57**	**0.99**	**4.24**	**0.87**

From Table 4, the majority of consumers agreed that the overall score of information on packaging ($\bar{x}$ = 4.24) was greater than the original packaging ($\bar{x}$ = 3.57). The results of the analysis of Paired Sample t-test on information on packaging overall found that consumers had a statistically significant difference in information on packaging satisfaction towards the new packaging than the original packaging at .001 level. The majority of consumers agreed that the new packaging performed better in overall information on packaging than the original packaging. The two groups of data were related (r = .417) at the .001 significance level. The majority of consumers were generally more satisfied with the new packaging than the original packaging in every individual factor. The two groups were related (r = .307 – r = .427) at the .001 significance level. The most relevant information was that the information comes from reliable sources, followed by information helps ensure the quality of the product for consumers. The least was information contains sufficient information to make decisions on purchasing a product.

4) Voice information on new packaging

From Table 5, overall, consumers agreed on sound information at the highest level. The original packaging has no information in this section. When considered

individually, it was found that the participants agreed that there is an appropriate sequence of content at the highest level, followed by the audio data is clear and has the right volume at the highest level. The least is the tone of voice has a rhythm in reading at a high level.

Table 5. Opinion on voice information

Aspects	$\bar{x}$	S.D
1. The audio data is clear and has the right volume.	4.22	0.84
2. The voice information is correct pronunciation.	4.19	0.85
3. Sound effects match the contents.	4.22	0.83
4. Tone of voice has interesting rhythm for reading.	4.15	0.90
5. There is an appropriate sequence of content.	4.28	0.83
Total	**4.21**	**0.85**

5) Video information on new packaging

Table 6. Opinion on video information

Aspects	$\bar{x}$	S.D
1. Videos have appropriate order of content.	4.15	0.86
2. Content conveys the traditional cultivation of upland rice.	4.22	0.86
3. The audio narration is consistent with the animation.	4.16	0.92
4. The videos are presented interestingly.	4.12	0.92
5. Video content promotes the experience of growing upland rice for consumers.	4.23	0.88
Total	4.18	0.89

From Table 6, overall, consumers agreed on video information on new packaging at a high level. The original packaging has no information in this section. When considered individually, it was found that the participants agreed with video content promotes the experience of growing upland rice for consumers at the highest level, followed by content conveys the traditional cultivation of upland rice at the highest level. The least was tone of voice has interesting rhythm for reading at a high level. The 402 respondents liked the type II product label the most (46.77%) which is consistent with the members of the community enterprise that chose the same type of product label: followed by the type I product label (43.53%) and the least liked the type III product label (9.70%). The respondents had suggestions regarding packaging design as follows: 1) Local materials should be prepared for packaging; 2) The tone of the video is not natural at some points; 3) The sound of music should be added softly during the information description; 5) The video is too academic; it may not attract public attention; 6) The video should include subtitles; 7) There should be a video or picture showing each strain of rice; and 8) The identity of the community should be increased.

Experiment with visual impairment

The researcher provided the designed packaging prototype to 30 people with visual impairments in order to test the packaging in a simulated shopping scenario. The researcher provides the estimated appropriate distance for visually impaired people to scan the QR-code and also provided a raised QR-code that was easy to feel. People with visual impairments read braille of product's name to get information, then scanned QR Code to hear the product information by using a mobile phone to listen to audio information. They also read braille to get information about the video, and then scanned the QR code to hear the video information of the rice cultivation tradition. After that the participants were interviewed about the new packaging opinions in five aspects which were the same aspects as consumers: 1) functional form of packaging, 2) graphic design on package, 3) information on packaging, 4) voice information, and 5) video information.

The results found that the majority of respondents were male (60 %), aged between 21 and 25 years old (73.33%), graduated from secondary school or equivalent (73.33%), earned less than 10,000 baht per month, blind from birth (60%), and never bought upland rice (63.33%). The results from interviewing participants found that:

1) Functional form of packaging: the majority of respondents said that QR Code can be scanned to access information well (80%), followed by QR Code links are correct (76.67%), QR Code position can be easily scanned (70%), the braille on the packaging conveys the meaning (66.67%), and the least was easily recognizable shapes of packaging (50%).

2) Graphic design on package: the majority of respondents (66.67%) said that the information on packaging provided reliable information on packaging and the manufacturer's contact information is clearly displayed; followed by there is information that helps to assure consumers of product quality such as date of manufacture and expiration date and have sufficient information to make decisions about purchasing products (63.33%). The least was providing necessary information about the products (60%).

3) Voice information: the majority of respondents (90%) said that pronunciation is correct, followed by a nice tone of voice, good rhythm for reading, suitable volume of the sound, and clear (83.33%).

4) Video information: the majority of respondents (80%) said that video content describes the process of growing upland rice, and the video data has the appropriate content sequence; followed by video information helps to know about upland rice cultivation traditions (76.67%). The least was video data presented interesting videos (63.33%).

In addition, the respondents gave suggestions on improving packaging design for visually impaired people as follows: 1) There should be cellophane or transparencies for printing braille because paper over time may fade, and be fuzzy in the event of exposure to moisture from the air when exposed to water, there will be no damage (16.67%);

2) Need price information in braille to be displayed on the package and should add the expiry date and contact information (13.33%); 3) There should be instructions to tell the distance between the smart phone and the QR code symbol in order to scan QR Code in the correct position (6.67%); and 4) Details of video content should be more concise: (3.57%).

5. CONCLUSION AND DISCUSSION

The researcher interviewed relevant persons: consumers, people with visual impairments, and Ban Huai Luek Agricultural Community Enterprise members in obtaining the design of upland rice packaging that truly meets the needs of the consumers. They want packaging that is beautiful, modern, lightweight, and able to see the grain. The shape of the package is convenient for transportation. It can keep the quality of the rice for a long time and specify the date of production and expiration date. The packaging design in the aspect of beauty and modern are consistent with the concept of Tangcharoen [8], who stated that "Designing souvenirs is a work of art in applied arts with a combination of creative forms for both beauty and functional benefits and takes into account the needs of consumers as the main". It is also in line with the idea of Hamlin [1] who said that "packaging with appropriate and attractive graphics influences consumers' shopping choices." In addition, consumers want packaging made from environmentally friendly materials. This is in line with the research of Wannarat et al. [26] and Soiraya et al. [27] who studied the development of prototype eco-packaging for souvenir products from natural materials.

In designing packaging, Ban Huai Luek Agricultural Community Enterprise members wanted a thick transparent plastic that could withstand impact for inner packaging and does not cause the bag tear. They could clearly see the rice grains. It could prevent rice from getting damp and prevent rancidity. This is consistent with the research of Pradit [23] who found that in packaging design of brown rice of the Ban Bokor community enterprise group, also used a thick transparent plastic bag in a vertical rectangle shape because it is convenient to display products at the exhibitions. Packaging in a paper box supported the weight of 1 kg of rice as it is suitable for purchase as a souvenir or for eating. It is also consistent with the research of Soiraya et al. [27] who mentioned that the unique packaging is perfect for the product and packaging is suitable for giving as a souvenir and environmentally friendly.

The results of consumers' opinions evaluation on the packaging prototype for upland rice products found that all consumers and visually impaired consumers are more satisfied with the new packaging than the original packaging. This is because the new packaging has been designed to meet consumers' needs. The details of improvement were added necessary product information, creating new brand and focusing on emotional design. It is consistent with the research of Kongprasert [16] and Pradit [23]. Moreover, the new packaging design has added product value by designing as a gift for various occasions e.g., New Year, wedding ceremony, seminar etc. It is in line with the research of Urairat [20]; Sintawalai and Reaungrong [22]; and Pradit [23] that adding value into packaging by using the unique packaging from local material attractive to consumers. Development of upland rice packaging for people with visual impairment is in line with Wanchitcharoon [24] who studied and developed a box type beverage packaging model based on the design concept for people with low vision. The results showed the similar opinion those factors affecting the perception and recognition of packaging patterns of people with visual impairments were shape, texture and size, and universal design theory [24-25]. In conclusion, this research not only benefits consumers in getting more necessary information to make a decision in buying upland rice products but also benefits the Ban Ban Huai Luek Agricultural Community Enterprise members in earning more income for selling the product as packaging is much more interesting for consumers and accessible for visually impaired people.

6. RESEARCH LIMITATIONS

1) Scanning data from a QR code has obstacles for new users. It is because they do not know the scanning distance. Therefore, it is necessary to practice.

2) Due to budget constraints, modern technology cannot be used to help increase efficiency for people with visual impairments to have easier access to information.

3) With equipment restrictions and budget, braille cannot be printed on other materials that are more durable than paper, such as plastic sheets or cellophane.

4) Community enterprises lack funds for packaging production. In the current conditions they will have to rely on government agencies or other organizations in packaging production.

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