International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 5 Issue: 3
ISSN: 2454-4248
01 – 08

# The Design of Traceability System for Exporting of Thailand's OTOP Products

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***Abstract*—**This research aims to study an exporting pattern of Thailand's community enterprises (OTOP product), prototyping an appropriate traceability system of the product in Thailand community enterprise and create the manual of traceability system for community. This research use method in Participatory Action Research (PAR), The system development consist of Thai entrepreneurs who export to abroad, merchant middle man/ export company and abroad customer . The process is based on SDLC standard process. The result of this research is a model of the product exporting from community enterprises, which can be divided into 2 approaches: (1) exports through export company and (2) exports through merchant middleman; also a prototype of product traceability system was developed for Thailand's community enterprises. The web-based system consists of 6 sections, there are (1) information traceability page, (2) member system, (3) product addition system, (4) label printing system, (5) register system for entrepreneur and (6) super admin system. In this research, the development of product label that supporting for the traceability system also achieved. The satisfaction of users overall satisfaction level is 4.41 of 5 in the good level and the standard deviation is 0.08. The Manual book of traceability system for community products was also created, the satisfaction of users overall satisfaction level is 4.35 of 5 in the good level and the standard deviation is 0.34.

***Keywords*-***Traceability system; OTOP; Export*

*****

## I. INTRODUCTION

Thailand has more than 365,901 community enterprises with more than one hundred billion baht per year in annual sales of community enterprise products. [2]. The value of Thailand OTOP exporting has a small proportion, comparing between the value of products sale per unit with the same products in the country, export product will have a worth value many times of sales per unit in abroad and still have a larger market volume than within the country, causing the community enterprise increase the opportunity to find new markets. OTOP products in Thailand are derived from folk wisdom of people in the community and all production process is handmade which create a unique identity for the only product in the world that is more valuable than machine production. When considering the current market, the market is focused on the story of the product. If there is supporting for customer to able to create brand awareness that can add the value of the product and able to convey the identity of the community to outside.

The survey result of community entrepreneurs such as Nong Bua-Dongkamed, Women's community, Muang district, Surin province and Bronze Craft Handicraft Center which is on Phaholyothin road, Ladyao sub district, Chatuchak district, Bangkok, which is a community enterprise that exports products to abroad, found out the exporting pattern from the original that would have a relationship with the customer in pattern of just to sell and then get the money only, found out the problems as follows, (1) Entrepreneurs cannot publish the wisdom of products, also there is no successor to produce the wisdom products in the community, which may cause disappearance in such wisdom. (2) There is a copy of the product and copied products are lower quality than the entrepreneur's products, causing lack of confidence in the products of Thai entrepreneurs. (3) The currently selling products are just selling products, therefore adding stories or history background of the product would help to increase more value to the product. (4) There is no system for collecting geographic maps in the collection of knowledge and wisdom in each area, causing the analysis system in the development of future OTOP products is difficult. (5) Lacking of feedback system from customer in order to increase the development to meet with customer requirement. (6) There is no interesting on product label, lacking of beautiful design.

Entrepreneurs need to develop an exporting system for data links, by bringing the information technology to create relationships with customers in abroad and to solve the problem of linking data between the community entrepreneurs and customers in abroad. As above problems, then there is a concept development of Traceability System for exporting of Thailand's OTOP products that helps to solve problems about communication to customers, not just through the production label or the product only in previous time. This system is a part of logistic process that help to increase the strengthen of Thai entrepreneur to export the product to customer in abroad, by increasing the trust of abroad customer and help them to understand the product stories, such as history background, product wisdom, wisdom history background, production procedure, and achieved production standard, which increasing the value of the product to be different from other industrial products. There is a system that allows customers to feedback about recommendations or defects of products, enabling entrepreneur to improve their products according to market demand, and able to use the satellite coordinates of the location of wisdom products in order to use as a geographic information for the community's wisdom in the future. In 2011, there was the Traceability system by using RFID. Case study: Traceability system of fruit wine, by using technology of RFID and only traceability within an organization, there is no traceability to external customer.[10] In 2010, There was a development of traceability system for Thai beef according to international traceability system which defined by the organization using the GS1 standard that is accepted and used internationally, such as European, United States of America, etc. Including a survey of the best practicing of entrepreneurs in Thailand to create standards suitable for entrepreneurs at all levels in Thailand and the prototyping of traceability of Thai

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beef in order to extend to entrepreneur who already had the traceability system but lack of budget and staffs to develop their own information system which the developed information system has ability to access to internet system and telephone systems.[1] In 2013, bar code technology has been applied for product identification in production factory of automotive parts, by developing bar codes instead of labels on automotive parts instead of writing paper ,which causing to decrease of labor costs and can track automotive parts accurately and quickly.[5] In 2015, the traceability process in the supply chain of halal meat industry in Thailand to support the opening of the ASEAN Economic Community which studied the factors that are related to the traceability of the meat industry to prepare for future development of the system, by conducting a survey of related systems and then analyze the related factors that support the opening of the ASEAN community.[4] As previous researches, they are only a source of product research, there is no research that use the traceability system for tracing the product wisdom that can increase the value of product.Therefore, there is the idea to develop the traceability system of product wisdom. This research create the traceability system in order to meet the requirement of entrepreneurs who exported to abroad, by using Web- base that customers will be able to access very easily from everywhere and anytime, has a user friendly style and also using the QR code technology as a tool to trace the data, including develop the product labels that can support the traceability system..

## II. RESEARCH METHODOLOGY

The research operation of "The design of Traceability system for Thailand's OTOP export product" use Participatory Action Research (PAR) method, The system development consist of Thai entrepreneurs who export to abroad, merchant middle man/ export company and abroad customer . The process is based on SDLC standard follow as Fig. 1. The operation details as follows,

### *A. Planning and collecting the community data*

Development of traceability system for community enterprise which export to abroad is currently collected all data and specific random from communities enterprise, such as bronze craft product from Pradit Torakarn Community, Bangkok and herb product from Nong Buadang community, Surin province. Then collect the data of flowing in logistic system in community enterprise, including the data of exporting requirement in community enterprise and all problems which found in exporting. As from focus group and interviewing the entrepreneurs found out that there were problems and requirement of entrepreneurs as below, Entrepreneurs cannot publish the wisdom of products, also there is no successor to produce the wisdom products in the community, which may cause disappearance in such wisdom.

- There is a copy of the product and copied products have lower quality than the entrepreneur's products, causing lack of confidence in the products of Thai entrepreneurs.
- The currently selling products that are just selling products, if adding stories or background of the product that help to increase more value to the product.
- There is no interesting on product label, lacking of beautiful design.

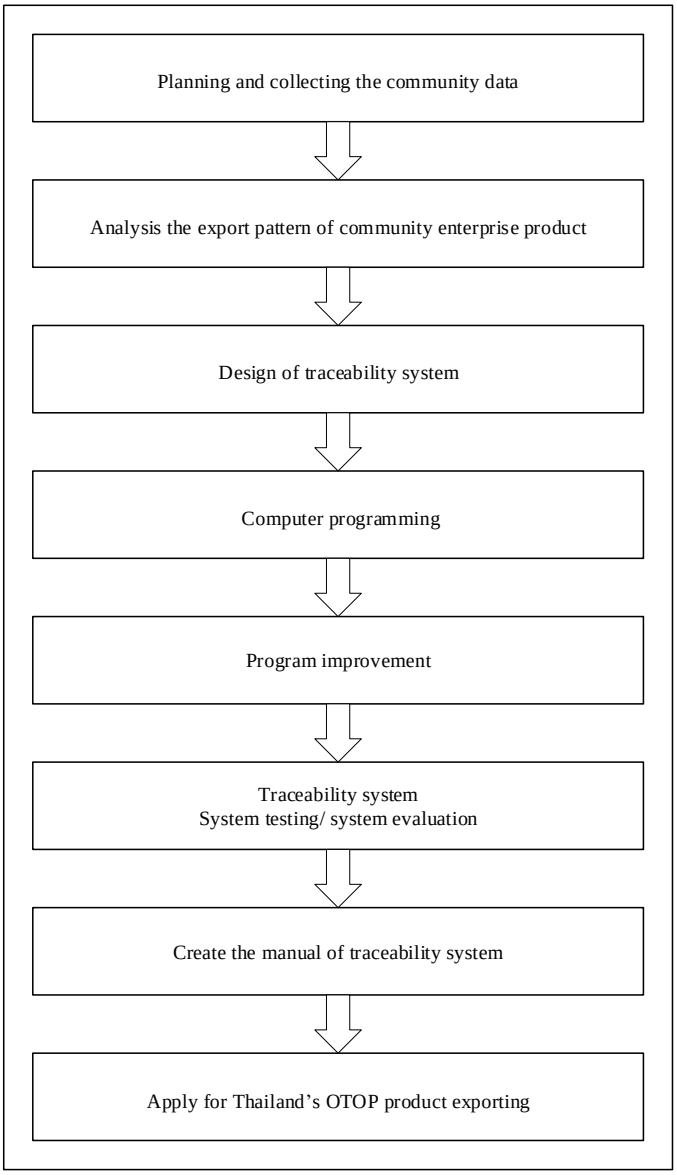


Figure 1. Operation chart

- There is no system for collecting geographic maps in the collection of knowledge and wisdom in each area, causing the analysis system in the development of future OTOP products is difficult.
- Lacking of feedback system from customer in order to increase the development to meet with customer requirement.

### *B. Analysis the exporting pattern of community enterprise in Thailand*

All information obtained from actual area and focus group about exporting procedure that consist of entrepreneurs, merchant middleman or Export Company and abroad customer. The researcher team used analytical tool called "Business flow" that easily helps to understand the procedure and related work, which help for development of exporting pattern.

### *C. Design of Traceability system*

The researcher team had developed questionnaire and focus group by bringing to entrepreneurs to fill out the form and

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interview to search out other topic which able to know their requirement, design of traceability can be described as follows,

- Structure design of traceability system which based on requirement of entrepreneur that can be divided into 6 main sections, there are (1) information traceability page (2) member system (3) product addition system which identify the store location and connect to Google map, and create QR code to link to the product information. (4) label printing system which able to print out into paper or package. (5) register system for entrepreneur (6) Super admin system which using for data management of user and all data of entrepreneur. For development of traceability system that is developed in the pattern of Web-base which helps entrepreneur to easily communicate to customer for within country and abroad in everywhere and anytime.
- Website design, in this research Website designed as User friendly and based on user requirement. The example as shown in Fig. 2


Figure 2. Website design

- Data base development which connect to user and client server model by create the web server. Based on the development of PHP language, connecting with the database management program in My SQL, using JavaScript to increase security of system and website in order to protect from hacker. WordPress is used as a publishing section to Friendly website, supporting the expansion of growth

*D. Computer programming*

Computer programming is developed the code and using base program as follows,

- PHP 5 , base program to link function to support Html
- JavaScript, to increase security for system and website in order to protect from hacker.
- WordPress , to use as a publishing section to Friendly Website, supporting the expansion of growth

*E. Program improvement*

As developed the program, the program is tested for improvement and suitable for user of community enterprises. There are assessment from 6 experts in related skill to work as focus group, consist of 1 expert of program development, 2 experts of product design, 1 expert of marketing, and 2 experts of community enterprise that can be summarized as follows,

- Traceability system should be designed to print out the label, then add more menu for printing in the product addition page.
- Should have a respond email in order to verify a new registration from website www.tracotop.com/entrepreneur.
- Show the name of store when logged in to system.
- Able to specific the GPS location by setting as default to show store location.

*F. System testing and evaluation*

Entrepreneur has to test the system for 2 months and create for satisfactionquestionnaire of actual users and then use statistical analysis as follows,

*Finding " Mean " and standard deviation* by using formula as below

$$\bar{X} = \sqrt{\frac{\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2}{n-1}} \qquad (1)$$

$\bar{X}$ = Mean

$\sum_{i=1}^{n} X_i$ = Total score

n = Total of sample

*Finding standard division*

$$S.D. = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n-1}} \qquad (2)$$

S.D. = Standard deviation

$X_i$ = Data (i = 1,2,3…n)

$\bar{X}$ = Mean

$\sum x$ = Total score

n = Total of sample

The level of satisfaction which is divided into 5 levels as follows,

- 4.51-5.00 means that the respondents were satisfied with a very good level
- 3.51- 4.50 means that the respondents were satisfied with a good level
- 2.51-3.50 means the respondents were satisfied at a moderate level
- 1.51-2.50 means the respondents were satisfied at a fair level
- 1.00-1.50 means the respondents were satisfied that the level should be improved.

*G. Creation of manual book of traceability system*

In order to create a manual book of traceability system, brings all analysis data and development data as above to summarize as a manualbook of traceability system which consist of 7 structures as below,

- Objective
- Scope
- Definition
- Export procedure of community enterprise
- Detail of traceability of community enterprise
- Procedure of traceability system for community enterprise
- Reference

*H. Apply for Thailand's OTOP product exporting*

Giving the knowledge to entrepreneur by workshop activity to access the system.

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## III. RESULT

As conducting research on the subject of traceability system of Thailand community enterprise who export to abroad, by finding an exporting pattern of Thailand community enterprise and then develop the system through a web-base which allows users for entrepreneur and customers to access it anywhereand anytime. The research results as follows,

### *A. Finding the exporting pattern of Thai community enterprise products to abroad*

As interviewing entrepreneurs, merchant middleman/ export company and abroad customer, can be summarized the export pattern called "Business flow" that shows the related person in each activity and shows the flow path in the activity of logistic system to abroad that can be divided in to 2 patterns, there are:

1) *Product exporting system of community enterprise via Export company* which has a flow path of Business flow as shown in Fig. 3

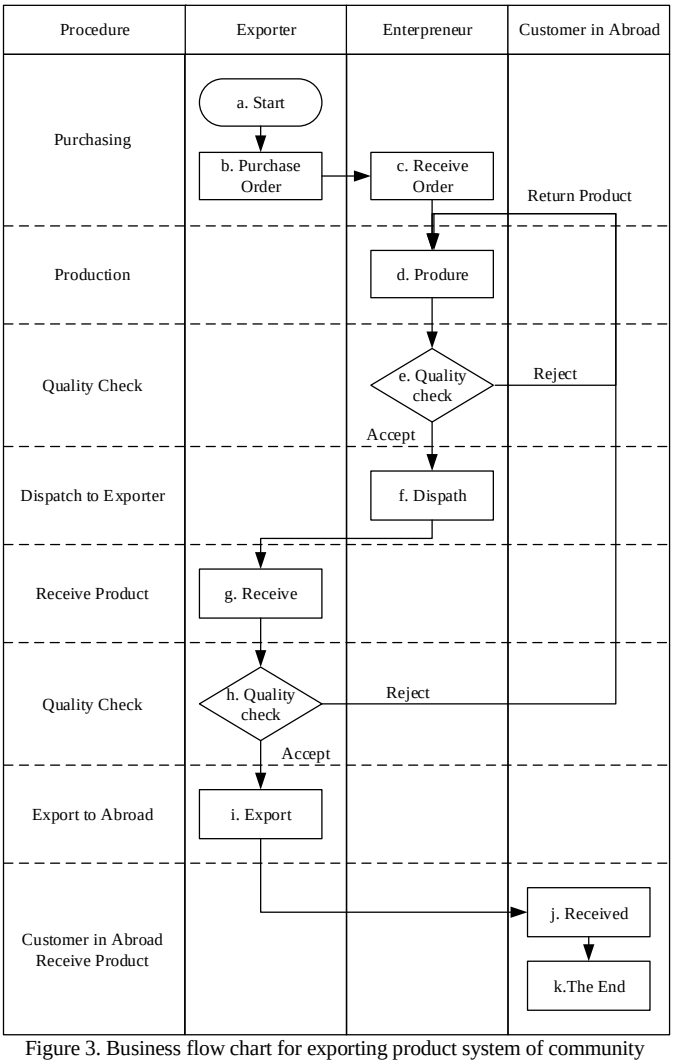


Figure 3. Business flow chart for exporting product system of community enterprise via export company

As Figure 3. Details of the export procedure as follows

a) Exporter specify the order requirement.

b) Exporter sends the purchasing order, by informing the product name, product type, amount of product and the pattern of the product to the entrepreneur.

c) Entrepreneur received the purchasing order

d) Produce the product according the purchasing order

e) Entrepreneur proceed with quality checking which can be divided into 2 processes as follows,

- In case the product passed the quality checking (accept), then allow to dispatch the product to exporter.
- In case the product is rejected from the quality checking, then return the product to re-produce to new product.

f) Entrepreneur proceed to dispatch the accepted products to exporter according to their requirement such as type, amount, and pattern.

g) Exporter received the product

h) Exporter proceed with quality checking which can be divided into 2 processes as follows,

- In case the product passed the quality checking (accept), then allow to dispatch the product to customer in abroad.
- In case the product is rejected from the quality checking, then return the product to re-produce to new product.

i) Exporter proceed to dispatch the product to customer in abroad.

j) Abroad customer received the product.

k) End of process

2) *Product exporting system of community enterprise via merchant middleman* which has a flow path of Business flow as shown in Fig. 4

As Figure 4, details of the export procedure as follows

a) Start

b) Production plan, entrepreneur has to plan for the production such as type of product, amount of product for both selling within country and abroad.

c) Entrepreneur produce the product

d) Entrepreneur proceed with quality checking which can be divided into 2 processes as follows,

- In case the product passed the quality checking (accept), then allow to dispatch the product to merchant middleman.
- In case the product is rejected from the quality checking, then return the product to re-produce to new product.

e) Entrepreneur proceed to dispatch an accepted products to merchant middleman according to their requirement such as type, amount, and pattern.

f) Merchant middleman received the product.

g) Merchant middleman proceed with quality checking which can be divided into 2 processes as follows,

- In case the product passed the quality checking (accept), then allow to dispatch the product to customer in abroad.
- In case the product is rejected from the quality checking, then return the product to re-produce to new product. Merchant middleman proceed to dispatch the product to customer in abroad

h) Abroad customer received the product.

i) End of process

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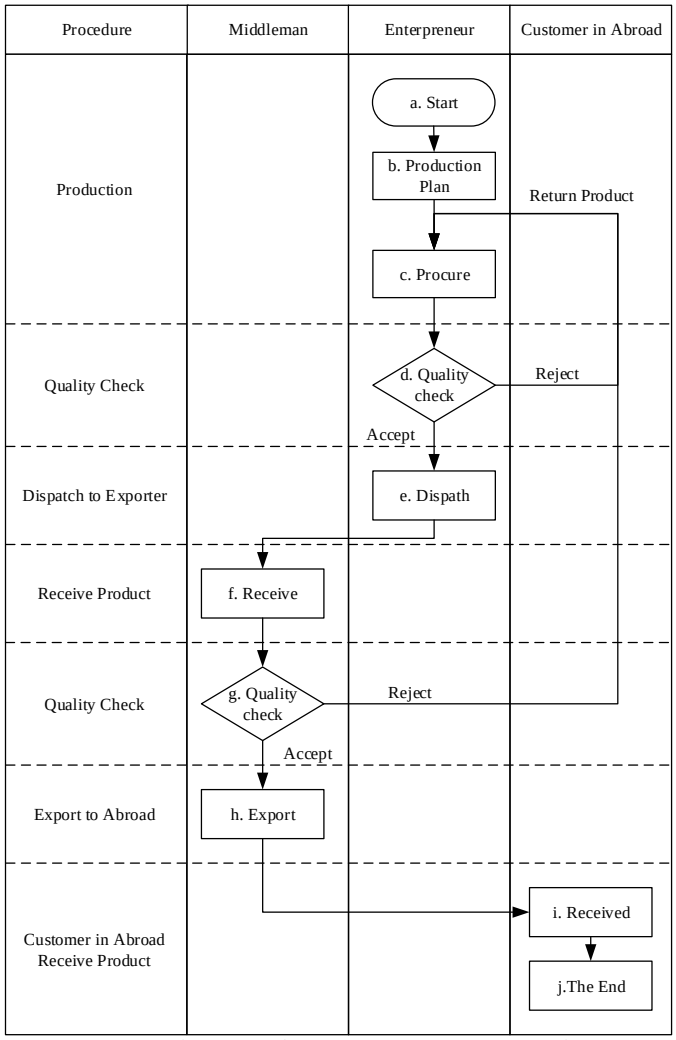


Figure 4. Business flow chart for exporting product system of community enterprise via merchant middleman

## B. *Prototyping of traceability system*

Prototyping of traceability system which is developed in the pattern of web base and using PHP 5 program as a base program supporting for Html, using JavaScript to increase the security of system and website in order to protect from hacker. WordPress is used as a publishing section to Friendly website, supporting the expansion of growth. Customer who wants to trace back the OTOP product, can access through website www.traceotop.com, then the camera popped up and customer can scan the QR code from the label as shown in Fig. 5

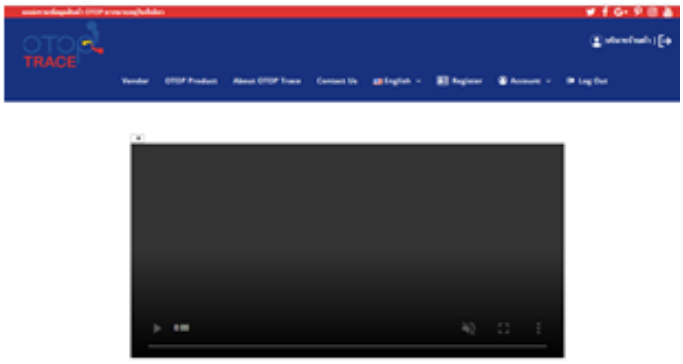

Figure 5. Main page of system

In addition, there are also a development in product labels that can be traced the product data. As the original product label which shows information for the customer only. Therefore has the idea to develop the packaging labels that are able to support the product traceability system, with the following process,

*1) Collect data on the requirement of entrepreneurs in label improvement, according to the demand questionnaire for product improvement, which can be summarized as follows.*

a. Want to upgrade the label to be able to sell at the department store.
b. Add barcode or QR code system to the label to be able traceability the product data.
c. Add standard logo to the label

2) Design of product label, which is designed base on requirement of entrepreneurs and support to the OTOP product traceability system. Design of product label as shown in Fig. 6. Product label comparison before improvement and after improvement as shown in Fig. 7.


Figure 6. Labels that support to traceability system

(a) (b)

Figure 7. Product label comparison before improvement (a) and after improvement (b)

The design of the traceability system consist of 6 main sections, there are

1) Information traceability page which shows all information of product such as picture, background, achieved production standards and production location as shown in Fig. 8

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Figure 8. Product information page

2) Member system is a basic information page and management that entrepreneur trace the product data as shown in Fig. 9

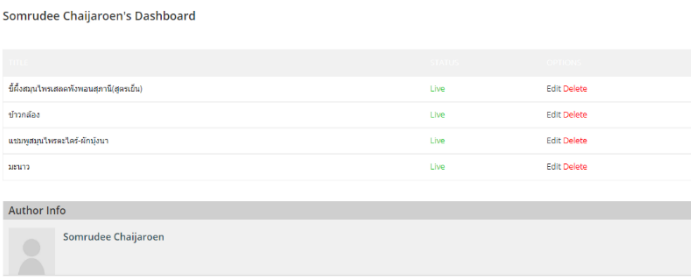


Figure 9. Product management page of entrepreneur

3) Product addition page for entrepreneur as shown in Fig. 10

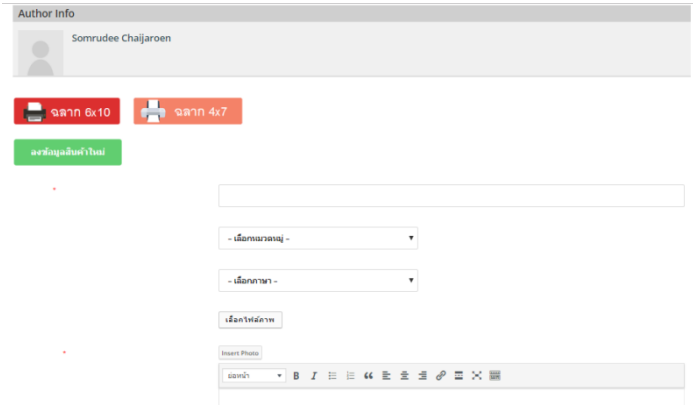


Figure 10. Product addition page

4) Label printing system, able to print out the product labels that have QR codes and available to traceability system as shown in Fig. 11

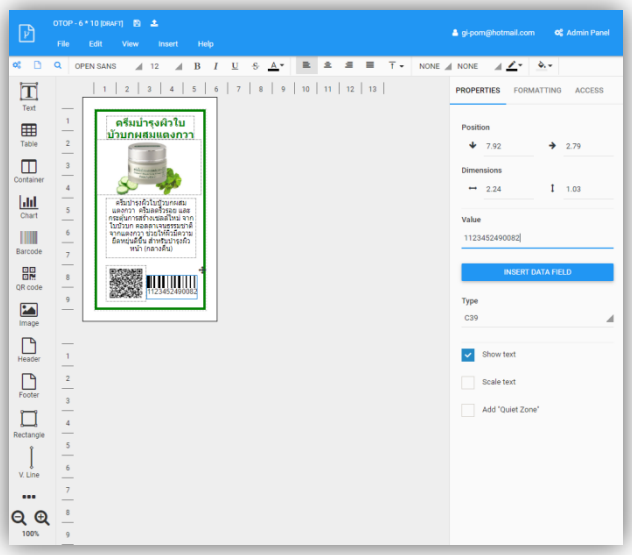

Figure 11. Label printing system

5) Register System for entrepreneurs, entrepreneur who want to register to traceability systemas shown in Fig. 12

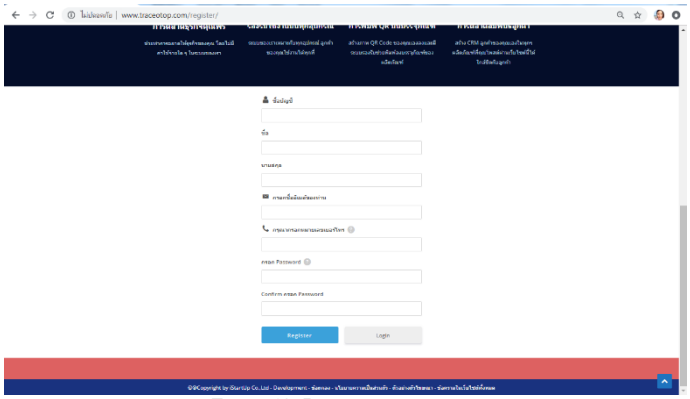

Figure 12. Registration system

6) Super admin system which using to manage the website of webmaster for traceability system, consist of

a) Admin Back End System and Main Dash Board(Login/Security system)

b) Data management system / data's user management system

c) System to view product information for entrepreneur

## IV. EVALUATION OF SYSTEM SATISFACTION

As testing the development system, users evaluate thesatisfaction of system in terms of design, system usage, and data integrity. Based on the satisfaction evaluation of using a traceability system, specific information consists of10 Entrepreneurs, 8 Merchant middlemen, and 30 abroad customers, which can be described as below,

### *A. Satisfaction evaluation in term of design*

Satisfaction evaluation in term of design consist of the beauty of font, suitability of the font color, suitability of background and beauty of button menu. The details as shown in Table 1.

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TABLE 1. SATISFACTION EVALUATION IN TERM OF DESIGN

| No. | Evaluation list | Satisfaction average score (Max = 5) | Standard deviation |
|---|---|---|---|
| 1 | The beauty of font | 4.80 | 0.45 |
| 2 | Suitability of the font color | 4.40 | 0.89 |
| 3 | Suitability of background | 4.60 | 0.55 |
| 4 | Beauty of menu button | 4.20 | 0.84 |
| Average | | 4.50 | |
| Standard deviation | | 0.26 | |

From Table 1, it was found out that satisfaction evaluation in term of design which satisfy in term of the beauty of font was at 4.80 (Max = 5) and standard deviation was at 0.45, suitability of the font color was at 4.40 (Max =5) and standard deviation was at 0.89, suitability of background was at 4.60 (Max = 5) and standard deviation was at 0.55, the beauty of menu button was at 4.20 (Max = 5) and stand deviation was at 0.84, which shows that the satisfaction evaluation of the design has a satisfaction score was at 4.50 at a good level and the standard deviation was at 0.26

### *B. Satisfaction evaluation in term of system usage*

Satisfaction evaluation in term of system usage consist ofthe speed of traceability system, convenience of using the various menus, system integrity, convenience of using the traceability system, beneficial to the organization system, response information to the user, categories of the traceability system and reliability of the traceability system, with evaluation results as shown in Table 2.

TABLE 2. SATISFACTION EVALUATION IN TERM OF SYSTEM USAGE

| No. | Evaluation list | Satisfaction average score (Max = 5) | Standard deviation |
|---|---|---|---|
| 1 | The speed of traceability system | 4.80 | 0.45 |
| 2 | Convenience of using the various menus | 4.00 | 0.71 |
| 3 | System integrity | 4.00 | 0.71 |
| 4 | Convenience of using the traceability system | 4.40 | 0.89 |
| 5 | Beneficial to the organization | 4.60 | 0.89 |
| 6 | response information to the user | 4.60 | 0.55 |
| 7 | Categories of the traceability system | 4.40 | 0.55 |
| 8 | Reliability of the traceability system | 4.20 | 0.45 |
| Average | | 4.38 | |
| Standard deviation | | 0.29 | |

As shown Table 2, it was found that satisfaction evaluation in term of system usage which satisfy in term of the speed of traceability system,was at 4.80 (Max = 5) and standard deviation was at 0.45, convenience of using the various menus was at 4.00 (Max = 5) and standard deviation was at 0.71, system integrity was at 4.00 (Max = 5) and standard deviation was at 0.71, convenience of using the traceability system was at 4.40 (Max = 5) and standard deviation was at 0.89, beneficial to the organization system was at 4.60 (Max = 5) and standard deviation was at 0.89, response information to the user was at 4.60 (Max = 5) and standard deviation was at 0.55, categories of the traceability system was at 4.40 (Max = 5) and standard deviation was at 0.55, reliability of the traceability system was at 4.20 (Max = 5) and standard deviation was at 0.45,which shows that the satisfaction evaluation of the traceability system usage has a satisfaction score was at 4.38 at a good level and the standard deviation was at 0.29

### *C. Satisfaction evaluation in term of data integrity*

Satisfaction evaluation in term of data integrity consist of the integrity ofdata searching,the integrity of data improvement,the integrity of the results from the processing in the system and reliability of data in database system, with evaluation results as shown in Table 3.

TABLE 3. SATISFACTION EVALUATION IN TERM OF DATA INTEGRITY

| No. | Evaluation list | Satisfaction average score (Max = 5) | Standard deviation |
|---|---|---|---|
| 1 | The integrity of data searching | 4.80 | 0.45 |
| 2 | The integrity of data improvement | 4.20 | 0.84 |
| 3 | The integrity of the results from the processing in the system | 4.40 | 0.55 |
| 4 | Reliability of data in database system | 4.00 | 0.71 |
| Average | | 4.35 | |
| Standard deviation | | 0.34 | |

From Table 3, it was found that satisfaction evaluation in term of data integrity which satisfy in term of the integrity of data searchingwas at 4.80 (Max = 5) and standard deviation was at 0.45, the integrity of data improvement was at 4.20 (Max = 5) and standard deviation was at 0.84, the integrity of the results from the processing in the system was at 4.40 (Max = 5) and standard deviation was at 0.55 and reliability of data in database system was at 4.00 (Max = 5) and standard deviation was at 0.71, which shows that the satisfaction evaluation of the data integrity has a satisfaction score was at 4.35 at a good level and the standard deviation was at 0.34

### *D. Evaluation summary of users'satisfaction*

The Evaluation summary of user's satisfaction in term of design, system usage and data integrity as shown in Table 4.

TABLE 4. EVALUATION SUMMARY OF USERS' SATISFACTION

| No. | Evaluation list | Satisfaction average score (Max = 5) |
|---|---|---|
| 1 | Satisfaction evaluation in term of design | 4.50 |
| 2 | Satisfaction evaluation in term of system usage | 4.38 |
| 3 | Satisfaction evaluation in term of data integrity | 4.35 |
| Average | | 4.41 |
| Standard deviation | | 0.08 |

As shown Table 4, it was found that the results of the satisfaction evaluation of the users were at good level.The satisfaction evaluation of the design was at 4.50 (Max = 5), the satisfaction evaluation of the system usage was at 4.38 Max = 5), and the satisfaction evaluation of the data integrity was at 4.35 (Max = 5), which shows that the average of satisfaction evaluation has a satisfaction score was at 4.41 at a good level and the standard deviation was at 0.08

### *E. Creation a manual book of traceability system*

In order to create a manual book of traceability system which consist of 7 structures as below,

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- Objective
- Scope
- Definition
- Export procedure of community enterprise
- Detail of traceability of community enterprise
- Procedure of traceability system for community enterprise
- Reference

Evaluation of the manual of the traceability system by questioning the satisfaction of the user through expert opinion with consists of 1 expert of program development, 2 experts of product design, 1 expert of marketing and 2 expert of community enterprise to work as focus group. The group discussion results showed that

- It easily understand the manual
- There is the completed content
- Language in the manual which the user can easily understand, there is the process with pictures shown in each process.

TABLE. 5 SATISFACTION EVALUATION OF USING A MANUAL

| No. | Evaluation list | Satisfaction average score (Max = 5) | Standard deviation |
|---|---|---|---|
| 1 | Convenience of user for using the manual | 4.40 | 0.45 |
| 2 | Manual integrity | 4.20 | 0.84 |
| 3 | Easily of using the manual | 4.80 | 0.55 |
| 4 | Manual is benefit for using the system | 4.00 | 0.71 |
| Average | | 4.35 | |
| Standard deviation | | 0.34 | |

From Table 5 it was found that the satisfaction evaluation of using a manual has a satisfaction score in term of convenience of using the manual was at 4.40 (Max = 5) and standard deviation was at 0.45, manual integrity was at 4.20 (Max = 5) and standard deviation was at 0.84, Easily of using the manual was at 4.80 (Max = 5) and standard deviation was at 0.55,Manual is benefit for using the system

## V. SUMMARY

This research aims to study an exporting pattern of Thailand's community enterprises (OTOP product), prototyping an appropriate traceability system of the product in Thailand community enterprise and create a manual book of traceability system for Thailand's OTOP product that can be summarized as follows,

- The research can analyze the pattern of product exporting of community enterprise into 2 patterns, (1) export through export company and (2) export trough merchant middleman
- The prototype of the traceability system of the products in Thailand community enterprise consist of 6 main sections, there are (1) information traceability page (2) member system, (3) product addition page for entrepreneurs, (4) label printing system, (5) register system for entrepreneurs) and (6) super admin system. In this research, also has the development of product label to support for traceability system. The satisfaction evaluation of overall user has the score of satisfaction was at 4.41 (Max = 5) at a good level and with standard deviation was at 0.08
- Creation of a manual book of traceability system for exporting of Thailand's OTOP product, which consist of 7 structures as follows, (1) Objective, (2) Scope, (3) Definition, (4) Export procedure of community enterprise, (5) Detail of traceability of community enterprise, (6) Procedure of traceability system for community enterprise, (7) Reference.By collecting data, users can actually use and has the satisfaction score was at 4.35 (Max = 5) at good level and with a standard deviation was at 0.34

## VI. ACKNOWLEDGMENT

We would like to express our special thanks of gratitude to everyone who supporting on this research, thankful to National Research Council of Thailand and Phanakhon Rajabhat University for supporting of research fund. Thankful to Thailand communities enterprise for supporting of all data to do the research of traceability system. Thankful all experts who related in this research for supporting of all data and all opinion, and thankful to everyone who assists and support us on this research.

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