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The Development and Evaluation of Cosmetics ManufacturingOrder System

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Abstract

This paper discussed a web-based application of cosmetics manufacturing order system aiming to 1) study, analyze, and design the Cosmetics Manufacturing Order System; 2) develop the system; and 3) evaluate the users' satisfaction by focusing on a current manufacturing order system for cosmetics so as to improve the existing work system in an offline format to be able applicable online via the internet. Research methodologies consisted of problem formulation, system analysis, program design, system development, users' satisfaction assessment, and system manual preparation. The program was developed in a web application form with the computer languages, such as PHP, HTML, CSS, JavaScript, and Bootstrap 5.0 applying MySQL as database. There were three groups of the system users, including: business owners, membership customers, and general customers. The findings revealed that the system related users were able to manage details information on cosmetic products (Formula Characteristics, Product Highlights); they were able to add, view, delete, and edit information of membership customers, products, product types, product formulations; they were able to order product production, notify payment for production orders and shipping information; and they were able to issue reports and access reports related. In relation to the overall system performance evaluation by 5 experts, it showed that the system was at a high level ($\bar{x}$=3.75, S.D.=0.66), whereas the overall satisfaction evaluation from 30 users was at very high level too ($\bar{x}$=4.49, S.D.= 0.27). Thus, the system could practically function and respond to the needs of users well.

Keywords: Cosmetics Manufacturing Order System, Cosmetics Production Order, Web Application, System Satisfaction.

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Introduction

Nowadays, websites have become a very important medium applied in public relations and advertising purposes. Because a website is a medium that can present and disseminate news without limits in terms of time and distance, people can access and use it 24 hours a day; no matter where they are in the world. With such advantages of websites, almost every company, store, and establishment, both public and private, as well as the general public, want to create websites as a new form of communication channel and to gain benefits from disseminating information to target groups. For instance, the websites are created for advertising the sale of goods and services in various forms with a business purpose and are used as a channel for disseminating information about the organization to publicize the organization to be known in hopes of creating an image of the organization.

A web browser is used to access a web application on a computer network either via the internet or intranet. Because websites can be launched immediately in a web browser without any need to install any extension on a user's computer, web applications are very popular. The system's data is constantly available online. As a result, it is appropriate for tasks that call for real-time data, just like when accessing a website. Most needs of the agency or department stores will be satisfied by the established system. Unlike ordinary software programs, it often develops systems in a way that does not fulfill the needs of the users. Customers or real-time service users can be impressed by interacting with the system. It is not necessary for the machine to install any additional programs (Thaiware, 2022). Many jobs that used web applications to increase work efficiency include an online food ordering system using a web application that created convenience in ordering food for customers in the study by Chavan, Jadhav, Korade, & Teli (2015); A system for providing production and product development services through a web application that allowed for the rapid receipt of production orders from customers in the study by Lan, Ding, Hong, Huang, & Lu, (2004); E-Taylor sales design system via web application in the study by Pramudita, Doni, & Putro, (2021); and cooperative store product sales system through the web application in the study by Tenzin. , Lhamo, & Dorji, (2022)

Sea Sand Sun Cosmetic & Spa Company is a contract manufacturing factory for cosmetics. There is a development of specific formulas for each brand of customers, including ready-made product formulas that customers can attach to their brands. Previously, products were ordered offline. Customers contacted to order production via

telephone or make an appointment to discuss the details of the production order. The contract production model of business is known as Original Equipment Manufacturer (OEM), in which the company will be hired to produce products for various brands according to the designs specified by the customers, and the brand name is attached. The products may or may not be branded depending on the customer's requirements. The Original Design Manufacture (ODM) model is a contract to design and produce products for companies to sell under their own brand by developing their own product formats and bring that product design to offer for sales. Customers who already have a brands or are designing in collaboration with customers will go for ODM. They are, mainly responsible for selling and distributing products to the market. In addition, there are additional services in many aspects as a one-stop service both product design and packaging, registration of cosmetics, services for importing cosmetics from abroad and modern and comprehensive cosmetic production technology from abroad.

In the past, the old order system still has problems and shortcomings in contacting the production order via telephone or making an appointment to discuss the details of the production order. In order to increase the total outsourcing of cosmetics production, adding a channel to order online production via the Internet can help. The new system would be able to provide contact of the customer's production orders, help store product information, improve better classification of products, and search for products faster and easier. Also, the new system can act as a medium for advertising and connecting information directly to targeted customers as well as promoting the store. Therefore, the sales volume expects to increase due to ability to capture wide range of market via the development of Cosmetics Manufacturing Order System from this research.

Research Objectives

1. To study, analyze, and design the Cosmetics Manufacturing Order System.
2. To develop the Cosmetics Manufacturing Order System.
3. To evaluate the users' satisfaction of the Cosmetics Manufacturing Order System.

Related research and theory

The research and development of the Cosmetics Manufacturing Order System was carried out and the data were collected from the relevant research and theories as follows:

Manufacturing Order System: There are types of manufacturers depending on where business clients' sourcing from, including an OEM, ODM, and OBM. An Original Equipment Manufacturer (OEM) is essentially the "handyman" of business owners' operation. Business clients provide the ideas, and an OEM provide the labor and expertise. Once business owners have produced a blueprint or preferably a functioning prototype of the clients' product, they can then contract an OEM to begin production. An Original Design Manufacturer (ODM) operates differently from an OEM as they have their own designers and manufacturers. They operate on the principle of white-label manufacturing, in which they lease out ready-made prototypes of their own products to other business clients to alter or rebrand for their own purposes. Business clients can take advantage of this to shave off R&D time and start selling as soon as possible. Another form of ODM manufacturing is private labeling, in which the ODM designs and sells a finished product exclusively to a retailer. All ODMs and OEMs ultimately aim for the final stage of evolution to become an Original Brand Manufacture (OBM) (Thaiware, 2022). This type of manufacturer typically produces high-end or very niche products that demand high expertise (BBCIncorp, 2021). Cosmetic businesses are always growing and dealing with a variety of management issues, and businesses must improve customer's satisfaction. The interaction between production and sales, inventory resources, and financing must also be balanced. Data can be alarmed at any time in a company to prevent possible significant losses. Putting cosmetic production into practice, Enterprise Resource Planning (ERP) software can raise the standard for business management. ERP is a software used by a company to manage key parts of operations, including accounting and resource management. Without the system, business owners will discover that the organization's on-site management is quite difficult to understand. The documents are fluttering, making it difficult to figure out many processes. While everyone uses a common computer platform, the ERP system boosts efficiency. According to the unified approach, the management is standardized; and the productivity will increase (Bassam Infotech, 2019). Cosmetic products are widely available in Thailand and have a huge potential with high possibilities to emerge on the global stage due to several benefits. Based on the report (TNP Cosmeceutical Company, 2023), Innovation, quality, image, and brand name are essential success elements for exploiting the opportunity given by globalization. Thai cosmetics have a tremendous opportunity of entering the global market, but some factors, such significant investment, cutting-edge technology, and marketing expertise, still need to be improved (Hiranrithikorn, 2022).

Web applications are computer programs that a user accesses through a web browser rather than directly running on their own machine. Web browser provides the Graphical User Interface (GUI) (often in the form of Hyper Text Markup Language (HTML)), the web server, the web browser, and both server and browser are used to process all of the application's data. The development of network-based applications, including server-side (i.e., on the web server) and client-side (i.e., on the web browser) programming, represents what web application development essentially involves (University of Cape Town, n.d.).

PHP: Hypertext Preprocessor (PHP) is the most commonly used language related to working on the server side. It is flexible with good performance and has a framework that supports the operation of PHP. Recursive acronym for Hypertext Preprocessor is PHP. PHP is a widely-used open-source general-purpose scripting language that is especially suited for web development and can be embedded into HTML.PHP is mainly focused on server-side scripting, so a programmer can do anything any other Common Gateway Interfaces (CGI) program can do, such as collecting data, generating dynamic page content, or sending and receiving cookies. One of the strongest and most significant features in PHP is its support for a wide range of databases. Writing a database-enabled web page is incredibly simple using one of the database specific extensions, such as MySQL (PHPGroup, n.d.).

HTML is short for Hypertext Markup Language which is the foundation of any website. It is the backbone that makes up the content of web pages and allows us to present information on the internet in a structured and organized manner (WEBDODEE, 2020). HTML is a markup language that uses a set of tags to structure content and add meaning to the text, such as headings, paragraphs, links, and images. Without HTML, a website simply cannot exist (Wijitbunyarak, n.d.). In today's digital age, the ability to create and maintain a website is an essential skill for anyone looking to establish an online presence (Computer-pdf, n.d.).

Cascading Style Sheets (CSS) is an essential tool for web developers. It allows web developers to control the visual presentation of their web pages, including layout, colors, fonts, and more. With CSS, web developers can make websites look professional and visually appealing, which is essential for attracting and retaining visitors (Computer-pdf, n.d.).

JavaScript is an object-oriented scripting language used in conjunction with HTML language to make the website developed with movement, more responsive to the work of users, and able to work across platforms (Mindphp, 2022).

Bootstrap is a front-end framework used to develop the display of websites which supports all smart devices in the form of responsive web (Medium, 2017).

MySQL is a relational database management system, using the structured query language (SQL). It has functions that support data types; including numbers, dates, times, and characters. It interfaces with other development languages to access the functionality of the MySQL database (SVGroup, n.d.).

A Likert scale is a rating scale used to measure opinions, attitudes, or behaviors. It consists of a statement or a question, followed by a series of five or seven answer statements. Respondents choose the option that best corresponds with how they feel about the statement or question. Likert scales are great for capturing the level of agreement or their opinions or feelings regarding the topic. The format of a typical five-level Likert question, could be: 5-very high, 4–high, 3-moderate, 2–low, and 1-very low. The data were analyzed with mean statistics and standard deviation (Fleetwood, n.d.). The results were interpreted according to the average criteria as shown in Table 1:

Table 1: Table showing a comparison of the calculated results

Range-Value	Mean description equivalent	Verbal Interpretation	
	Level	Performance	Satisfaction
4.21 – 5.00	very high	excellent	extremely satisfied
3.41 – 4.20	high	good	very satisfied
2.61 – 3.40	moderate	average	satisfied
1.80 – 2.60	low	below the average	slightly satisfied
1.00 – 1.79	very low	bad	not satisfied

Source: Penkhae et al., 2008, p. 25; Bhandari and Nikolopoulou, (n.d.)

Research methods

The study was carried out according to the system development life cycle (SDLC). The purpose of an SDLC methodology is to provide the tools to ensure successful implementation of systems that satisfy the system objectives. The process provides the visibility of design, development, and implementation status needed to ensure delivery on time and within budget. SDLC altogether includes 5 steps (Prachayagringkai & Srisod, 2018; Udomthanatheera, 2022) as follows:

1. Defining the problem was a step in setting the clear goals of system development. When using information technology systems, such as grouping, prioritization which made it possible to select the appropriate development to solve the problems that arose with the organization appropriately.

2. System Analysis was the process of collecting the problems that had come to design the system by analyzing the operation of the original system and the requirements of the new system with a context diagram, a data flow diagram, and a model used to explain the structure of the database (Entity Relation Diagram).

3. Program Design was the process of designing the operation of the technical system, including the use of equipment, technology, database, proper network design, and user interface (UI).

4. System Development was a programming process to develop the system as the program had been designed. After that, the system was tested by experts with system performance assessment form. The 5-level rating scale (with a value between 1-5) consisted of 4 questions: the ability to work according to the user's system, the results obtained from the system, the usability of the system, and efficiency and safety in order to be ready for actual implementation. The data were analyzed by using mean and standard deviation statistics. The results were interpreted according to the average criteria as follows: The average score was 4.21-5.00 meaning excellent, 3.41-4.20 meaning good, 2.61-3.40 meaning average, 1.80-2.60 meaning below the average, and 1.00-1.79 meaning very low.

5. Assessment of system related users' satisfaction was the process of introducing the "Cosmetics Manufacturing Order System" developed for trial use by 30 samples from system related users and business owners with a satisfaction questionnaire

with rating scale (value between 1-5). The questionnaires included 3 aspects: the ability to work according to the user's system, satisfaction in using the system, and the design and operation of the system. The data were analyzed by using mean and standard deviation statistics. The results were interpreted according to the average criteria as follows: extremely satisfied (4.21-5.00), very satisfied (3.41-4.20), satisfied (2.61-3.40), slightly satisfied (1.80-2.60), and meaning not satisfied (1.00-1.79).

Research results

1. Results of problem formulation. The researchers studied the working process of the original system of Sea Sand Sun Cosmetic & Spa Company in 3 related issues as follows.

1.1 Study results of Sea Sand Sun Cosmetic & Spa Company's operations. In order to produce products, customers from the past had to contact to order production via telephone or made an appointment to discuss the details of the production order. It took a long time and was inconvenient to contact customers to order products. Business owners took long time to provide details of products to customers. Customer service representatives were not enough to support those customers, including information sharing about the sale of products. Information about product sales, for example whether the customer has notified payment or whether the customer has received the product ordered. Delays in coordinating with customers result in customers being dissatisfied with the company's services.

1.2 Analyze the use of technology in Sea Sand Sun Cosmetic & Spa. It was found that the Microsoft Excel program was used to record product information and record production orders without recording customer database. This caused usability problems, such as accidental deletion or modification of data resulting in data loss or error. In order to view the status of each cosmetic manufacturing contract, a summary of the work would be written on the job summary board or copied the job status on paper. This made business owners inconvenient to see the status of tasks which could be wrong.

1.3 Evaluate the related data management including product data stored in the form of document files. As a result, data files with Microsoft Excel package made it possible to search for a product list. It was difficult to display detailed product information. If users wanted to publicize the store to be known to the target customers, it was difficult to do so because there was no website that was like a medium for advertising and connecting information to a direct target customer group.

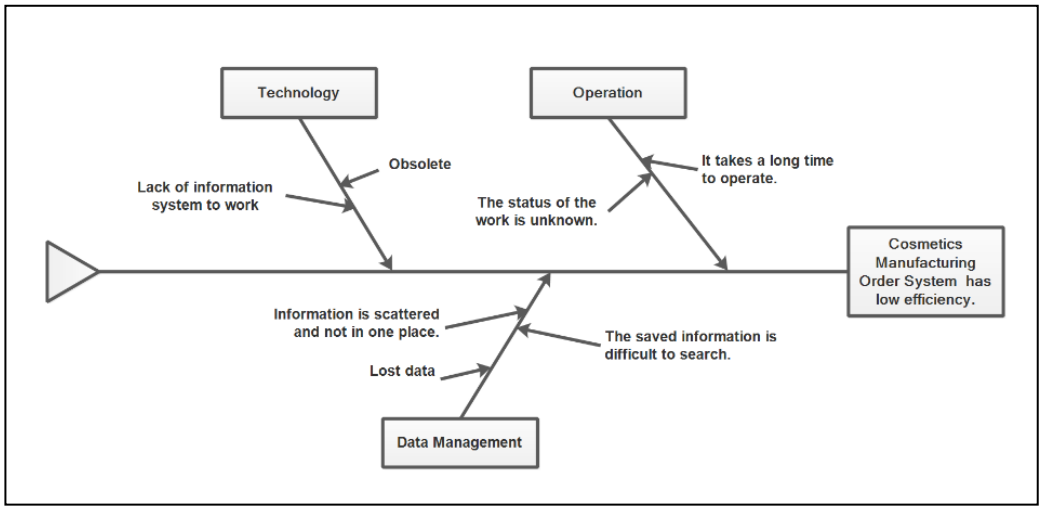

Figure 1 Fishbone diagram showing problems in the old system of Sea Sand Sun Cosmetic & Spa

After being aware of the problems of the original work system, the researchers collected information related to the problem and all the basic information used to analyze and design a new system for Sea Sand Sun Cosmetic & Spa Company which could be summarized in Figure 1.

2. Result of System Analysis. Based on the analysis of the operations of old system, the study results of the cosmetics manufacturing order system and the requirements of the new system were as follows:

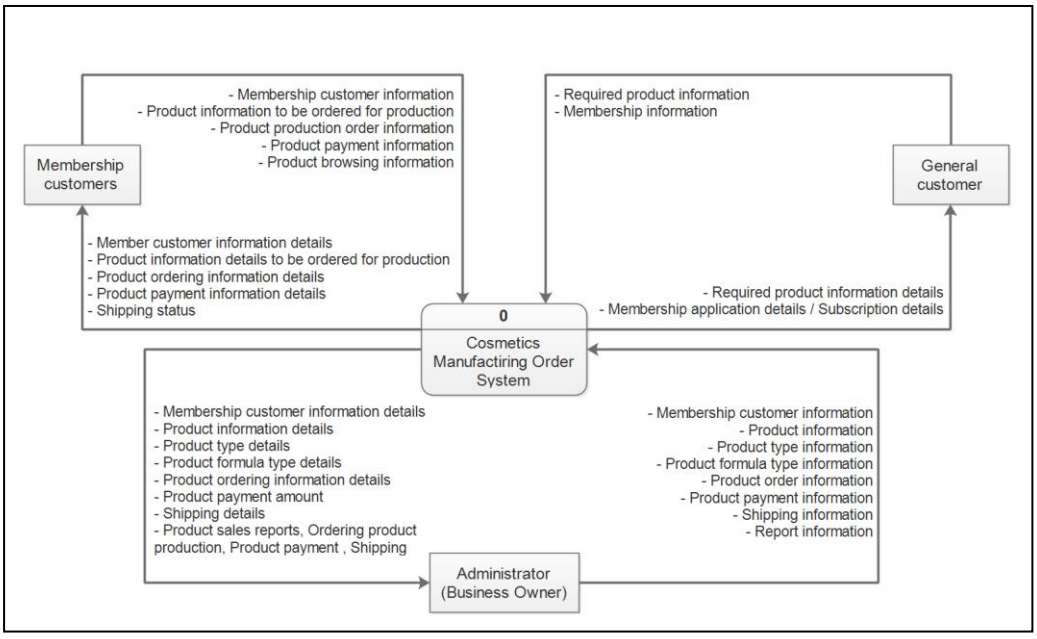

Figure 2 Contextual diagram of contract manufacturing system for cosmetics

2.1 System Analysis Results with Context Diagrams "Cosmetics Manufacturing Order System" associated with 3 groups of users: business owners, membership customers, and general customers. It could describe the overall operation of the system related to those involved in the system (Figure 2).

2.2 Results of Data Flow Diagram Analysis "Cosmetics Manufacturing Order System", the operation of the system consisted of 9 processes, including sign up, login, manage product type information, manage product formulation information, manage product information, order to produce products, notify payment for the product, and deliver the goods and print the reports. Each process could be summarized as the following diagrams (Figure 3 – 11):

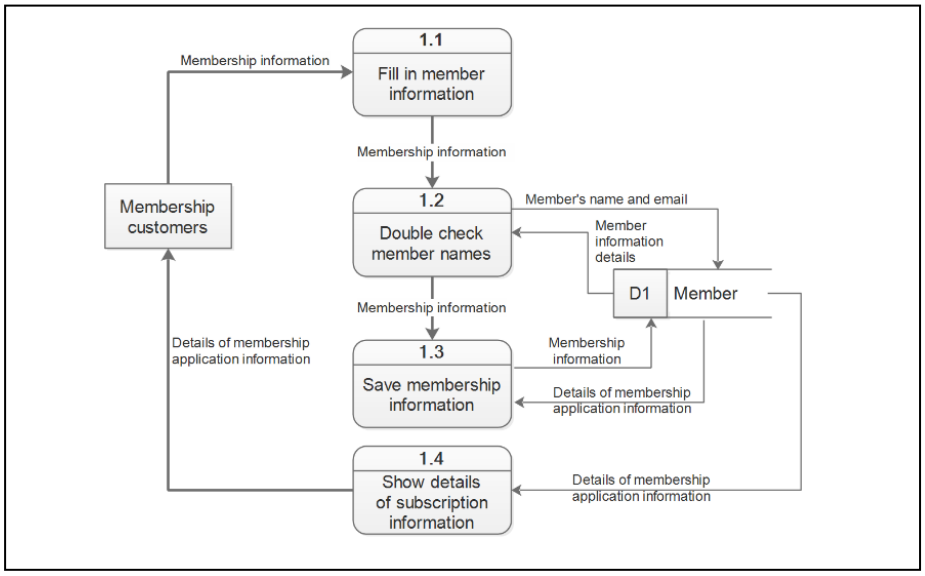

Figure 3 Level 2 data flow diagram, Process 1 Sign up

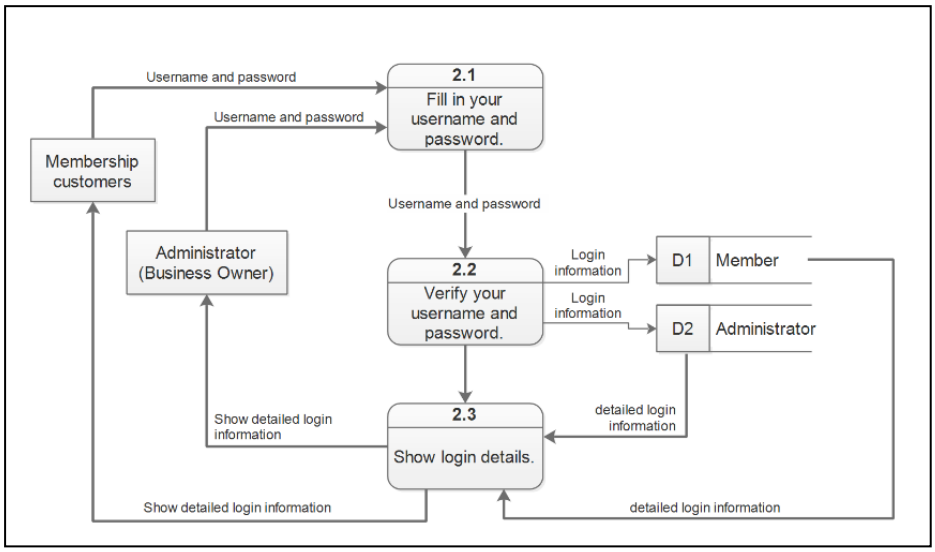

Figure 4 Level 2 data flow diagram, Process 2 Login

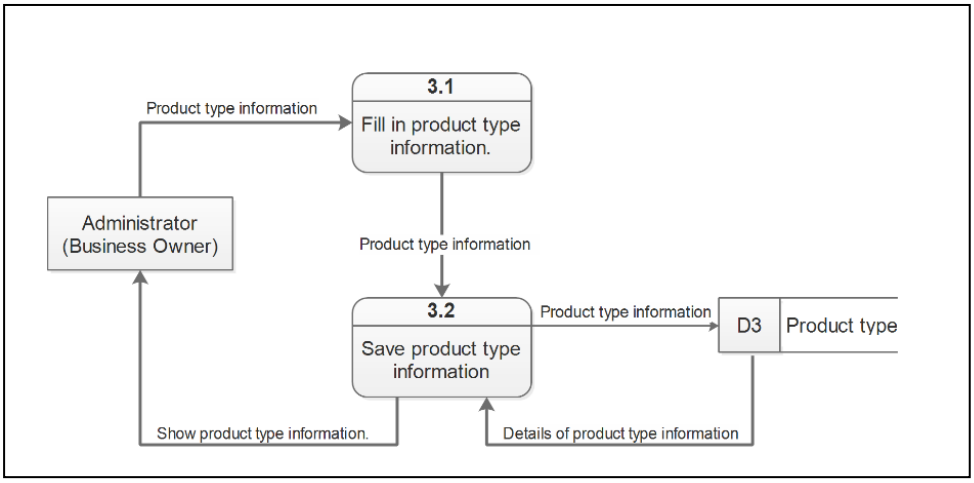

Figure5 Level 2 data flow diagram, Process 3 Manage product type information

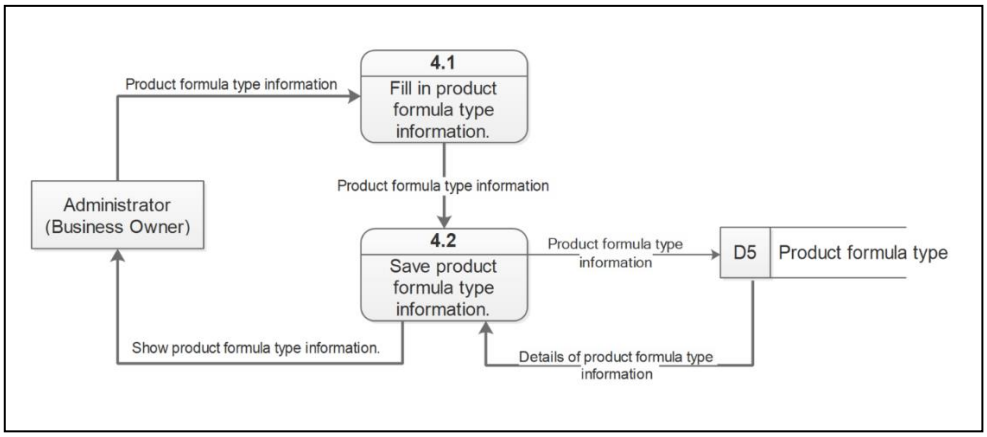

Figure 6 Level 2 data flow diagram, Process 4 Manage product formulation information

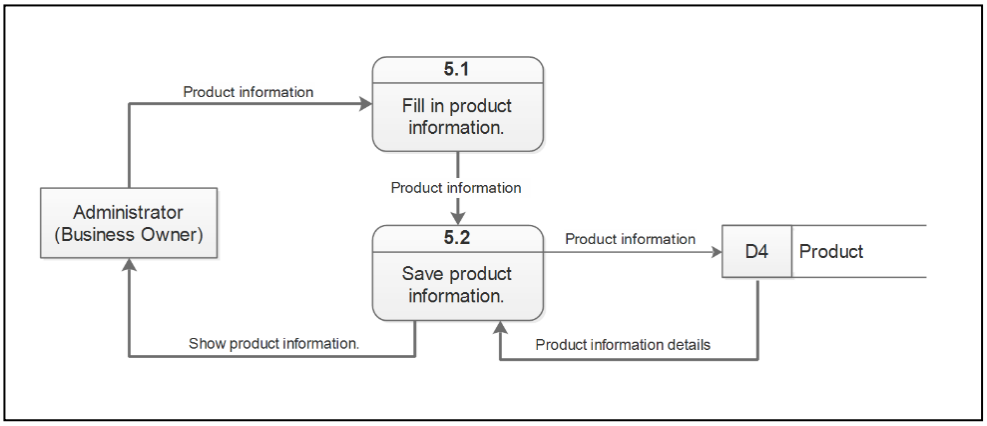

Figure 7 Level 2 data flow diagram, Process 5 Manage product information

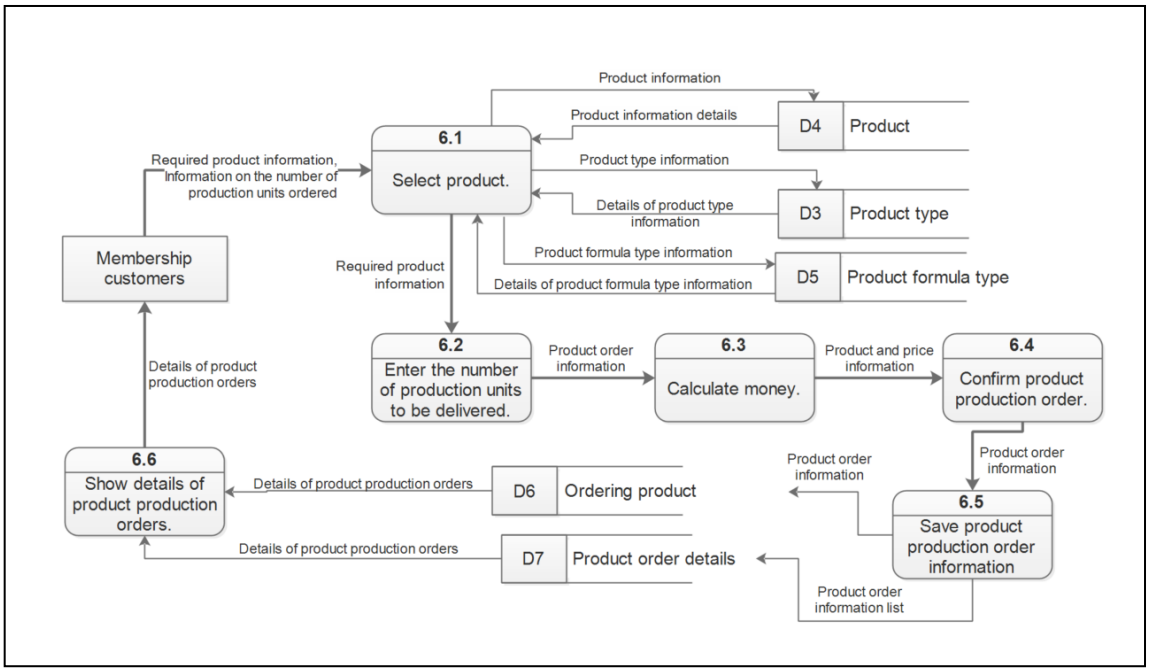

Figure 8 Level 2 data flow diagram, Process 6 Order to produce products

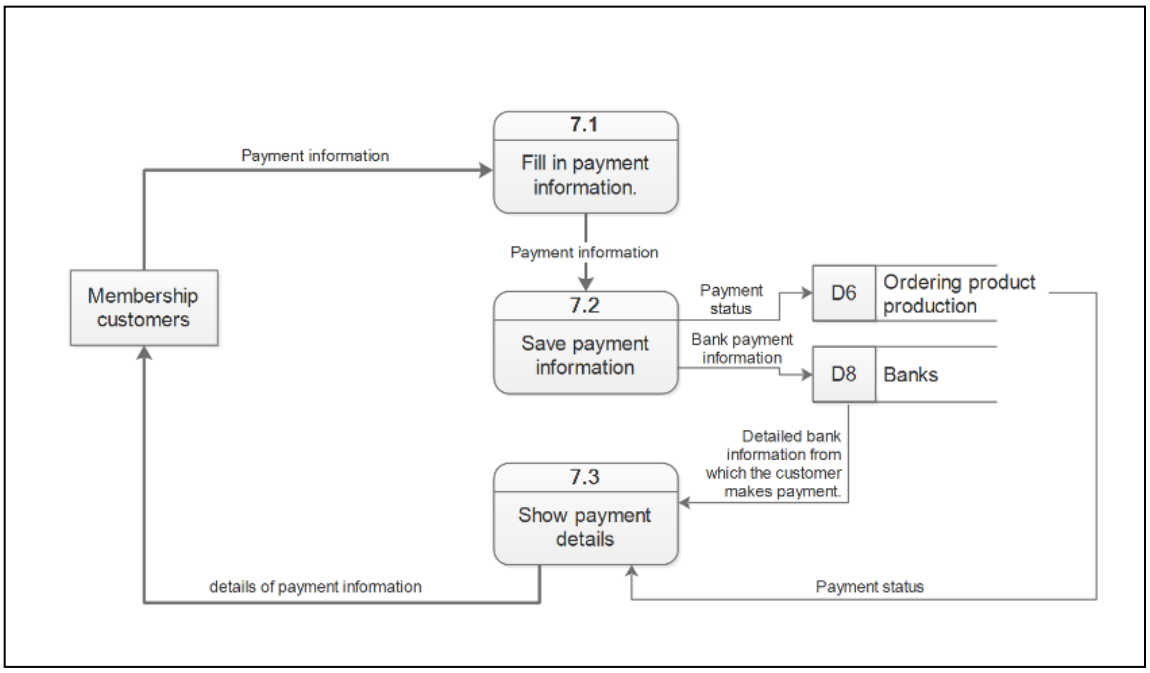

Figure 9 Level 2 data flow diagram, Process 7 Notify payment for the product

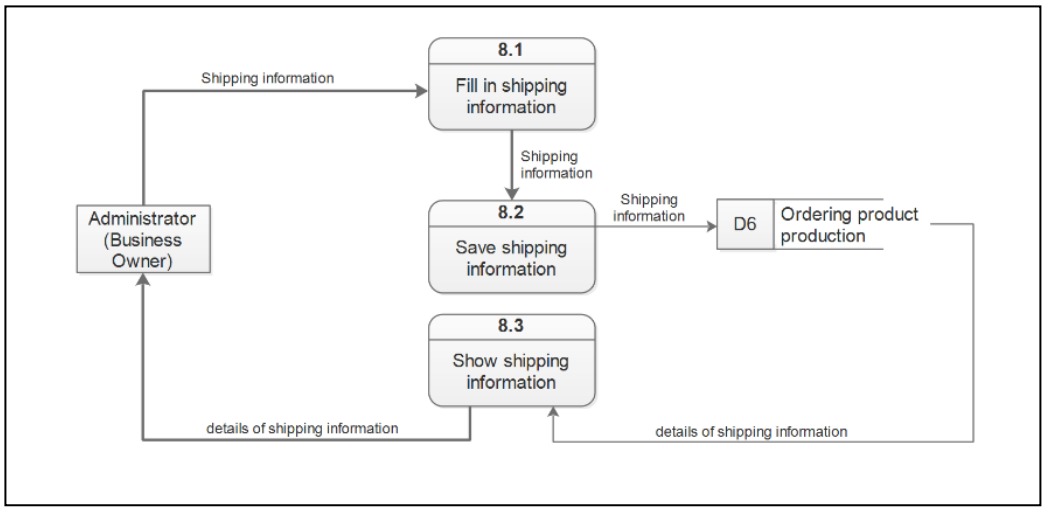

Figure 10 Level 2 data flow diagram, Process 8 Deliver the goods

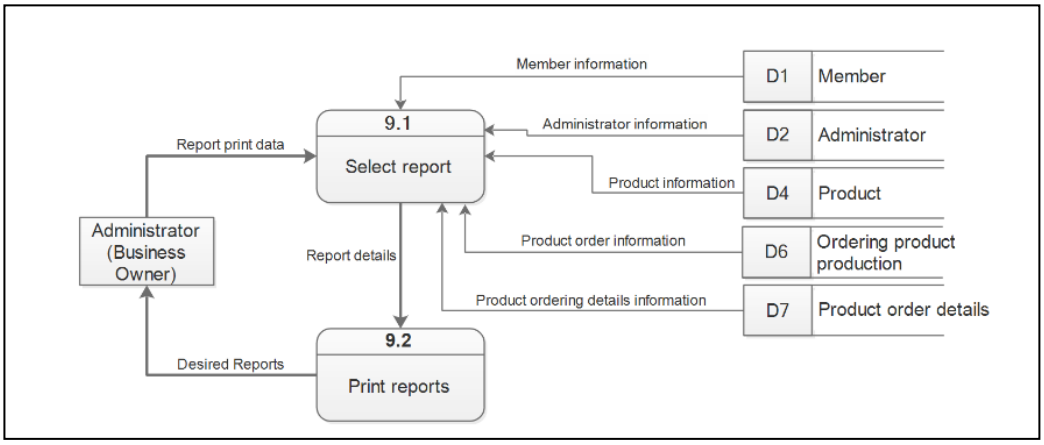

Figure 11 Level 2 data flow diagram, Process 9 Print the report

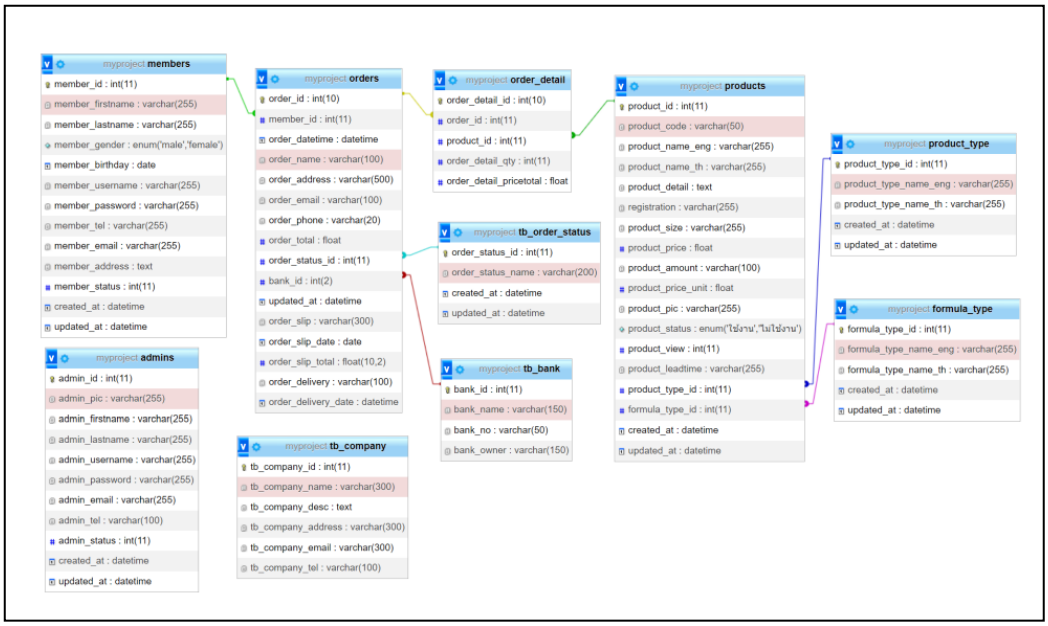

Figure12 Database structure model of “Cosmetics Manufacturing Order System"

2.3 Results of system analysis with Database Structure Model "Cosmetics Manufacturing Order System", the structure of the database is designed, consisting of 8 main data tables and 2 related data tables by which the administration data table is created to provide information for checking the administrator's access to the system, and tb_company is a data table for displaying the address information of cosmetic manufacturing companies only (Figure 12) as follows:

3. Program design results. "Cosmetics Manufacturing Order System" was designed to work in the form of a web application that could be run via a web browser, and it was designed to be responsive for the users via both computers and smart phones.

4. Results of system development "Cosmetics Manufacturing Order System" was prepared in the form of a web application using computer languages such as PHP, HTML, CSS, JavaScript and Bootstrap 5.0; MySQL database. The system was divided into 3 parts: business owners (See section 4.1), membership customers (See section 4.2), and general customers (See section 4.3). Then, the system was tested with test data by the researchers. The evaluation of system performance by 5 experts, overall, was at a high level ($\overline{X}$=3.86, S.D.=0.51). The results of system development were as follows:

4.1 Business owners could access the system to work, including managing product type information, product formulation information, product information; checking production order, notification of payment for the product; informing delivery details, and printing reports (Figure 13 - 16)

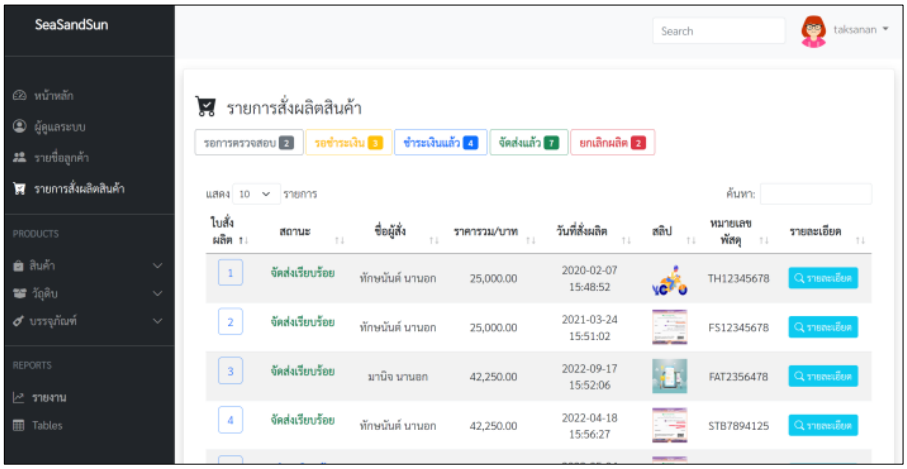

Figure 13 Production order list screen of business owners

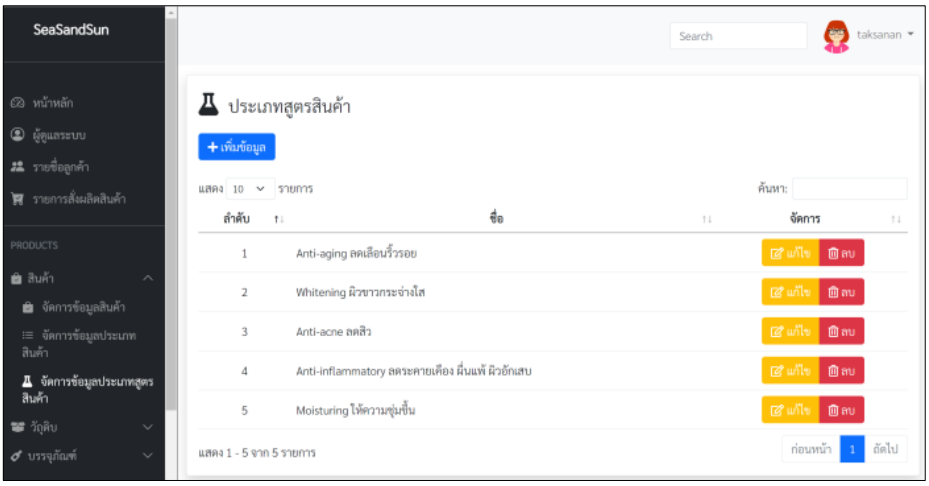

Figure 14 Product formulation management screen for business owners

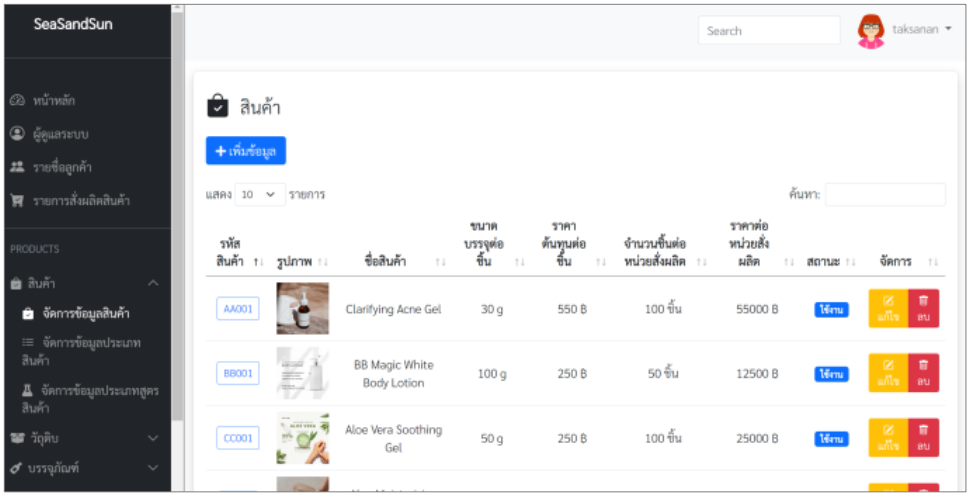

Figure 15 Product management screen for business owners

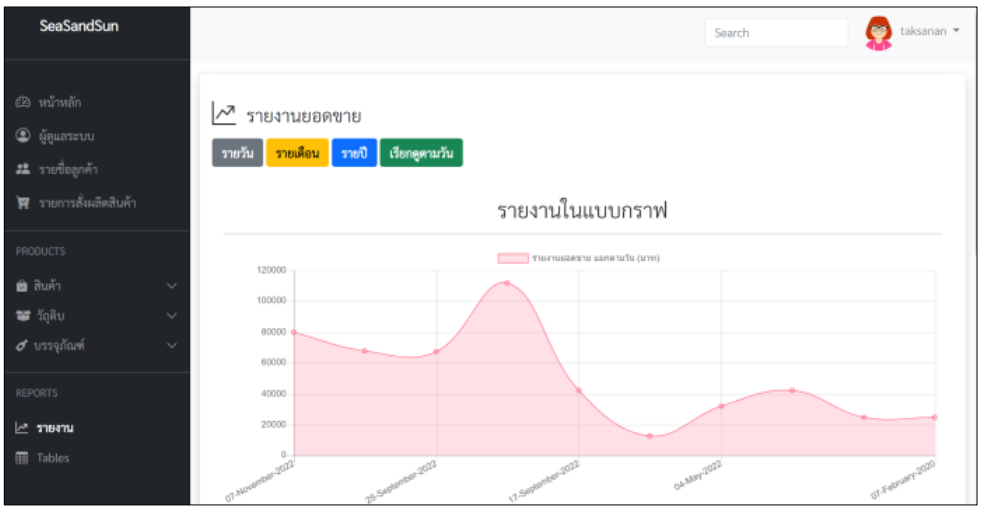

Figure 16 Sales report screen for business owners

4.2 Membership Customers' work section Membership customers could access the system, including applying for membership, registering for use, viewing product details, ordering to produce products (Figure 17 - 24)

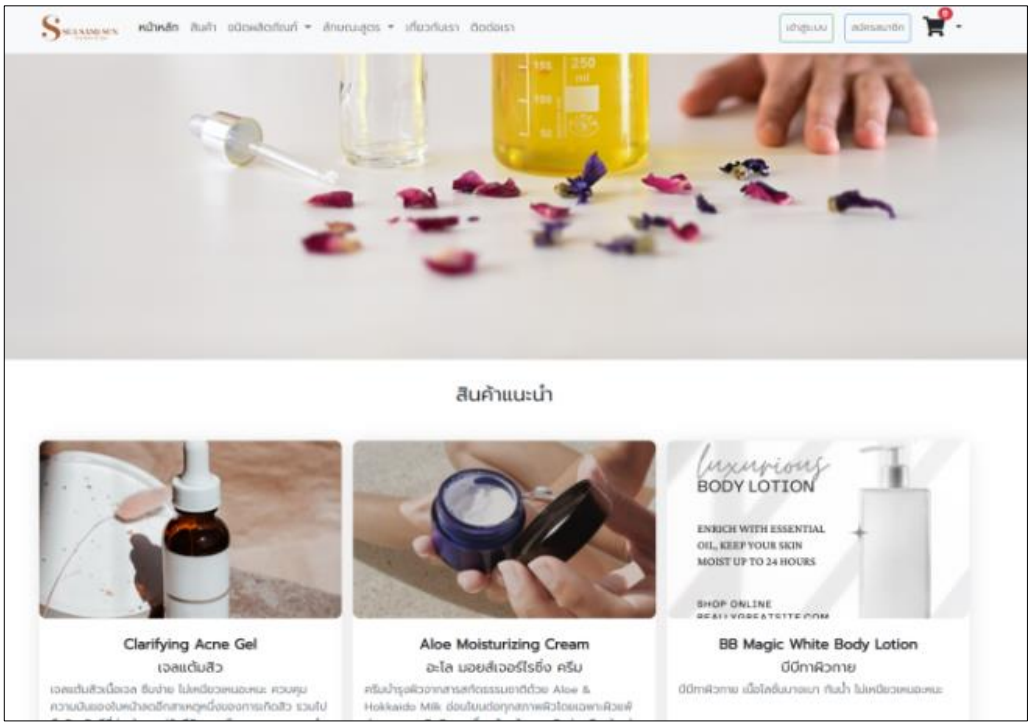

Figure 17 Home page screen of the website

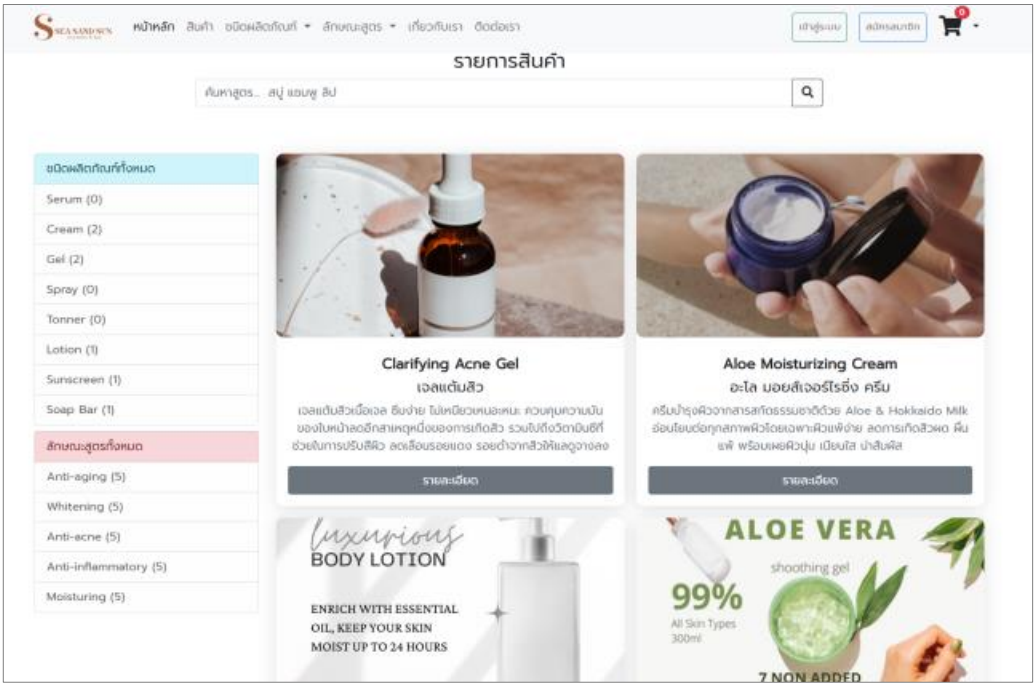

Figure 18 Customer's product list screen

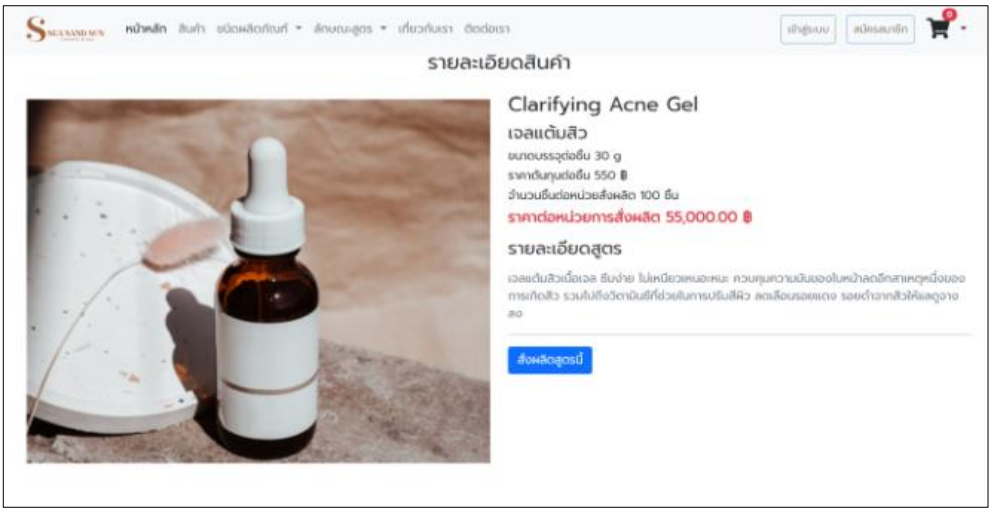

Figure 19 Customer's product details screen

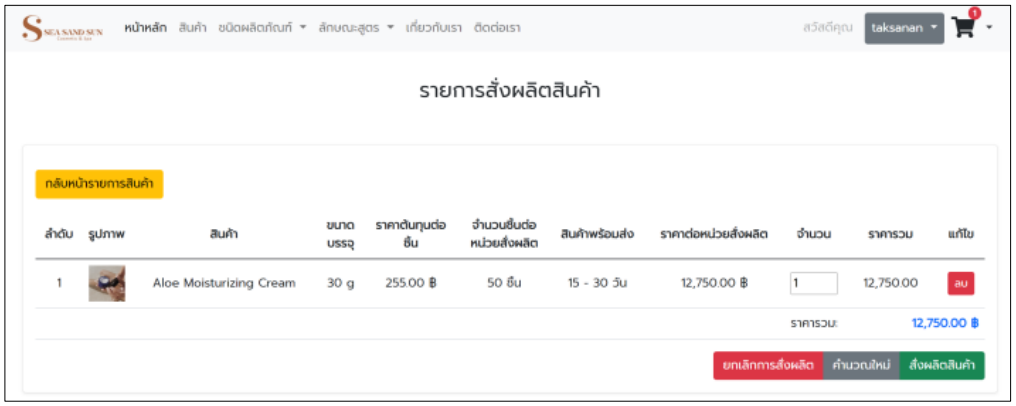

Figure 20 Product ordering screen for customers

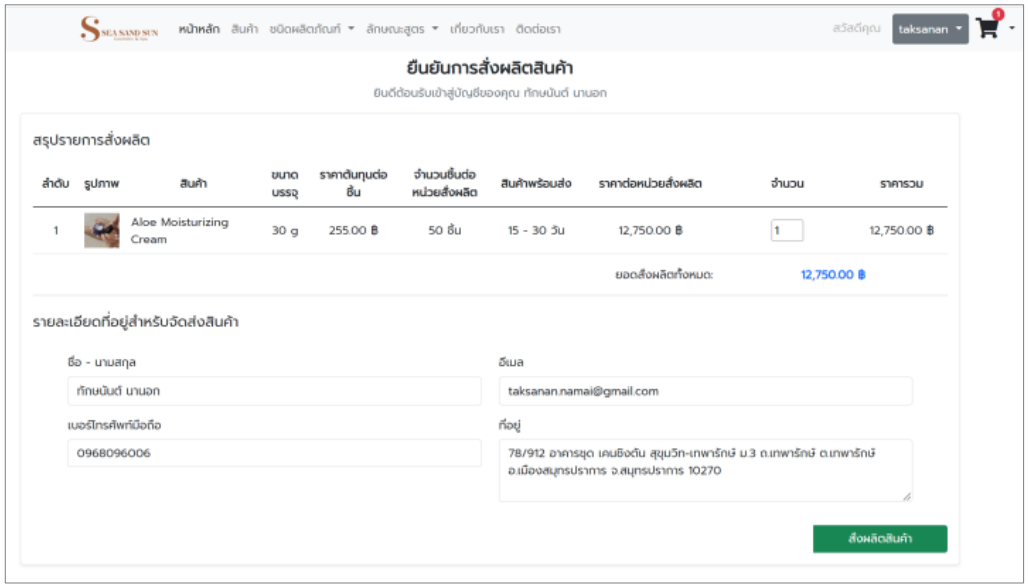

Figure 21 Order confirmation screen for customers

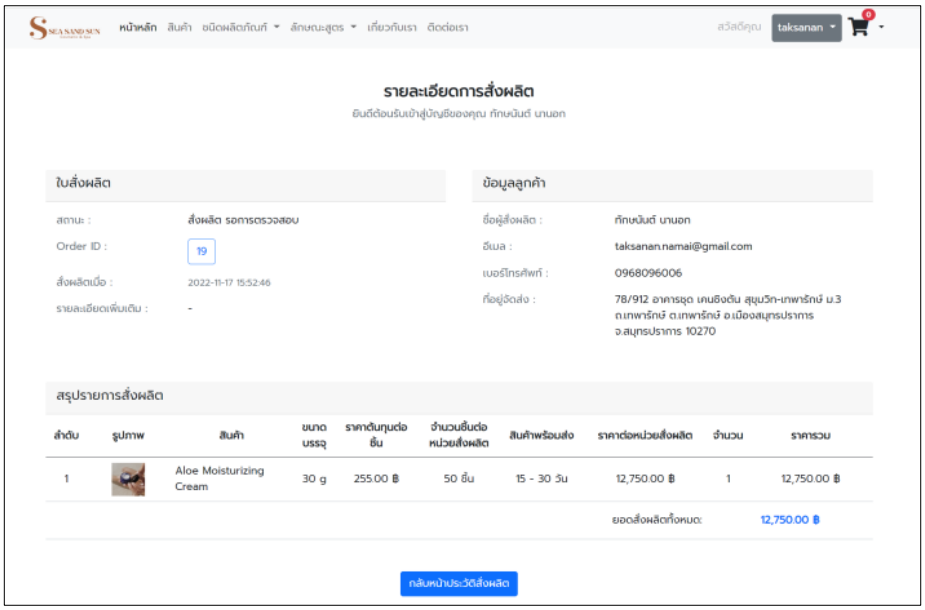

Figure 22 Production order details screen for customers

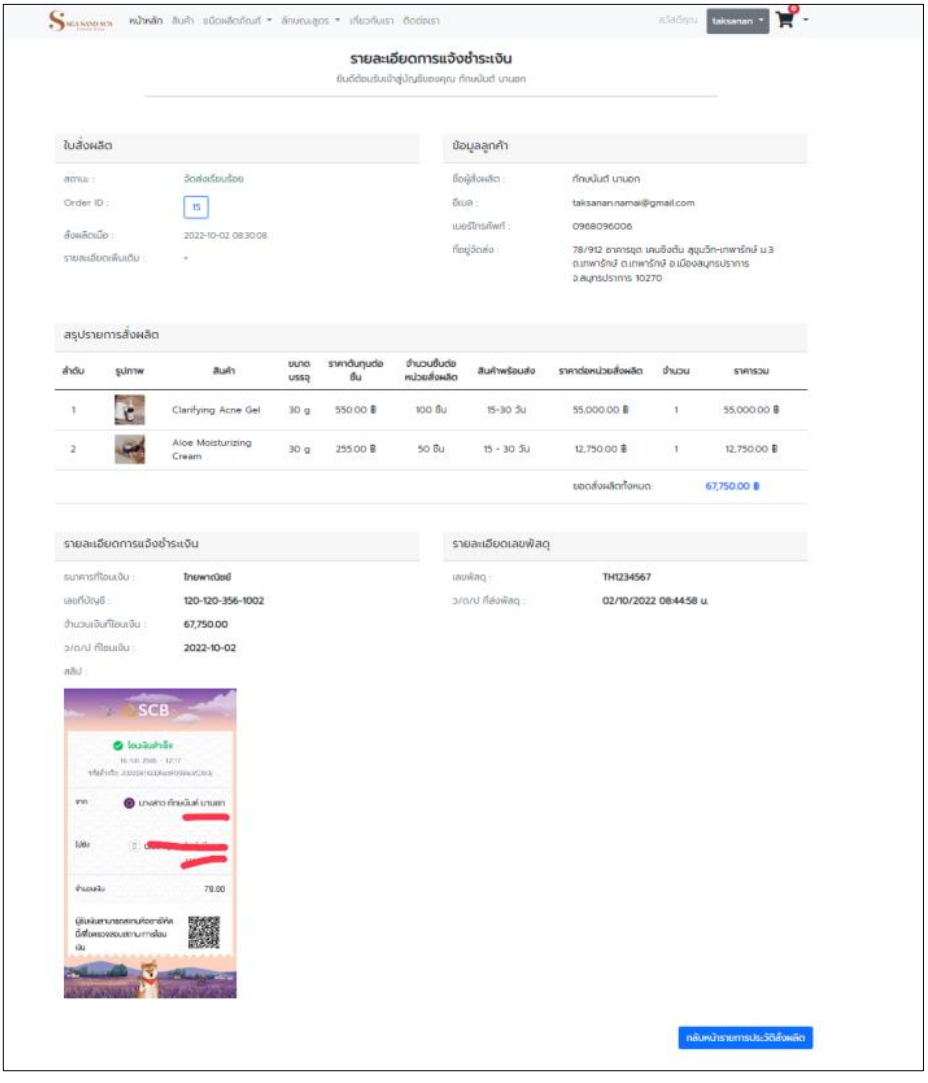

Figure 23 Payment notification details screen for customers

4.3 General customers' work section, the general customers browsed to view the website which allowed them to apply for membership, view product details and various information on the website (Figure 24)

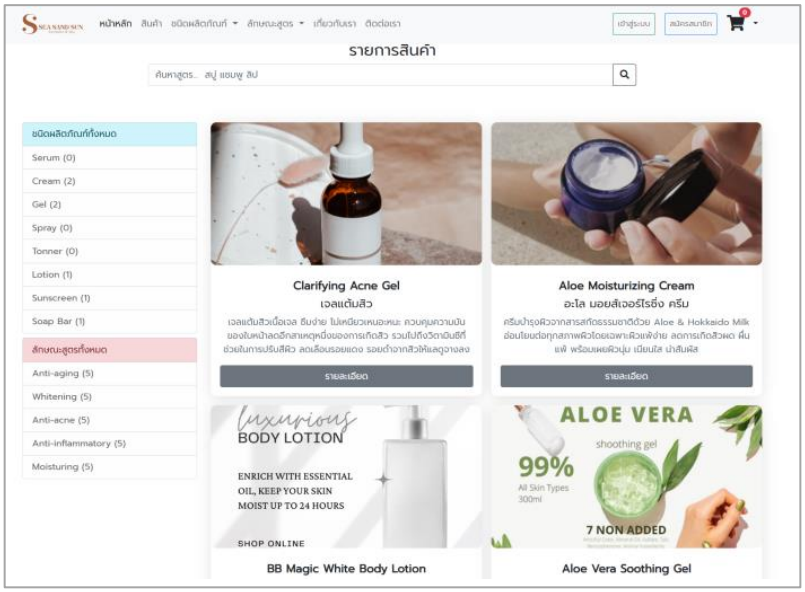

Figure 24 General merchandise list screens

5. Satisfaction evaluation results of system related users

Based on the results of the contract manufacturing cosmetics system's user, satisfaction survey, users of the cosmetic contract production system who were both business owners and customers, were generally satisfied with the usage of the "Cosmetics Manufacturing Order System" at very high level ($\overline{X}$= 4.49, S.D. = 0.27). Users generally agreed that the system performs well to operate in accordance with user requirements, users' satisfaction, and design of the system operation as shown in Table 2. The results of the efficiency evaluation by the five experts were shown in Table 3.

Table 2. Table showing results of system related users' satisfaction assessment

Assessment list	$\overline{X}$	S.D.	Interpretation
capacity to operate in accordance with user requirements	4.58	0.50	extremely satisfied
Users' satisfaction	4.46	0.17	extremely satisfied
Design of the system operation	4.44	0.14	extremely satisfied
total average	**4.49**	**0.27**	**extremely satisfied**

Table 3. Table showing results of system related to performance evaluation by experts

Assessment list	$\overline{X}$	S.D.	Interpretation
Efficiency and safety	4.20	0.45	Very satisfied
System operations	4.13	0.44	Very satisfied
Ability to work according to the user's system	3.66	0.68	Very satisfied
Results obtained from the system	3.45	0.48	Moderately satisfied
total average	**3.86**	**0.51**	**Very satisfied**

Summary

According to the existing work system, it is found that the company would publicize or provide product information by having employees contact customers via telephone. As for data management in the walking system, data was stored in the form of Excel documents that makes it easy to find product information, but it will be very difficult if we need to list detailed product information. In addition, if the user would like to promote the store or product to be known to target customers, it will be difficult because there is no website that serves as a medium for advertising and linking information to target customers.

A summary of the research findings for developing the "Cosmetics Manufacturing Order System," involves three user categories: businesses owners, membership customers, and general customers. The business owner could handle product type information, product formula type information, product information, ordering product production information, payment notification information for the product, delivery information and print reports. Customers could apply for login, register for use, maintain their own information, examine product specifics, order products online to be produced, and explored their order data and history. Additionally, visitors can visit the website to view product information and sign up for membership.

Five experts evaluated the system's performance, and they found that it was generally at a high level ($\overline{X}$=3.86, S.D.=0.51). According to the findings of a satisfaction survey completed by 30 users, the system was used at very high level ($\overline{X}$=4.49, S.D.=0.27). Therefore, it can be said that the developed system can actually be put to use and can function to suit consumers' needs. As a result, the system might be able to improve the effectiveness of the "Cosmetics Manufacturing Order System".

Discussion

The "Cosmetics Manufacturing Order System" was established by the researcher as a web application according to research and development. In addition to creating a management system for contract production, the "Cosmetics Manufacturing Order System"

may accept orders from clients who want to order cosmetics online through a website that makes customers feel convenient. It enables business owners to efficiently spend their time while providing customer service, and it is appropriate for the numbers of clients who come in to place significant orders, including details about this production job, monitoring the operation's progress, and conveniently and swiftly coordinating with clients. This can make the service satisfactory to the customers, providing information management that facilitates product list search, displays product details, and advertises the business so that target clients are aware of it. Because of the existence of a website system, it serves as a platform for advertising and links content to specific target audiences. This was in line with the study by Lan, Ding, Hong, Huang, & Lu, (2004) who brought in a web application to help provide order-to-manufacture and product development services, making it possible to receive production orders from customers quickly and Tenzin, Lhamo, & Dorji, (2022) which could effectively promote products to target customers. It allowed customers to view the store's products anywhere, anytime and receive increased convenience.

Suggestions

The "Cosmetics Manufacturing Order System" should be covered in the following study, and data should be prepared to give customers options for selecting raw materials and packaging so that customers can modify the formula and advertise the product to be highlighted in developing their own brand. Customers can utilize the "Cosmetics Manufacturing Order System" to cover most of their orders, as well as can modify the recipes to make them their own. This will enhance the efficiency of how work is handled inside the system. Interested researchers may conduct additional studies on developing a flexible system. The system may allow users to improve formulas mixed into products and present results of formula improvements that can show the results obtained from the development in the properties of cosmetics created, such as new formulas helping users to have more radiant skin, etc.

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