

SYSTEM FOR STYLING APPARELS THAT MATCH WITH OCCASION WEARING VIA E-
COMMERCE CHANNEL USING MACHINE LEARNING

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A Thesis Submitted in Partial Fulfillment of the Requirements
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ระบบการเลือกซื้อเครื่องแต่งกายเหมาะสมกับกระแสนิยมตามโอกาสของการสวมใส่ผ่านช่องทางอี
คอมเมิร์ซด้วยเทคนิคการเรียนรู้ของเครื่อง

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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Field of Study	Technopreneurship and Innovation Management
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ยงพฤทธิ์ เยี่ยงอร่ามกุล : ระบบการเลือกซื้อเครื่องแต่งกายเหมาะสมกับกระแสนิยมตาม
โอกาสของการสวมใส่ผ่านช่องทางอีคอมเมิร์ซด้วยเทคนิคการเรียนรู้ของเครื่อง. (
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งานนี้ศึกษาปัจจัยที่มีผลต่อการเลือกชุดแต่งกายตามแฟชั่นผ่านแพลตฟอร์มอีคอมเมิร์ซ
ของลูกค้า เพื่อสร้างระบบอัตโนมัติสำหรับเสนอแนะชุดแต่งกายที่เหมาะสมกับความชอบในด้าน
ต่าง ๆ ของลูกค้า ปัจจัยความชอบจากการสัมภาษณ์ผู้เชี่ยวชาญในสายงานเครื่องแต่งกายแฟชั่น
พบว่า รายการเครื่องแต่งกาย (Cloth Items) สีเครื่องแต่งกาย สีผิวของผู้สวมใส่ และรูปร่างของผู้
สวมใส่เป็นปัจจัยหลักที่มีผลต่อการเลือกชุดแต่งกายตามแฟชั่นผ่าน แพลตฟอร์มอีคอมเมิร์ซ ปัจจัย
ที่ค้นพบนี้นำไปแบ่งชุดแต่งกายในกลุ่มชุดต่างกายที่ทดสอบรวมทั้งไปสร้างกฎการแนะนำชุดแต่ง
กายตามค่าต่าง ๆ ของแต่ละปัจจัยเหล่านี้ ผลการทดลองโดยการให้ลูกค้ากำหนดค่าของแต่ละ
ปัจจัยที่กำหนดสรุปได้ว่า ชุดแต่งกายที่เสนอแนะตามปัจจัยและกฎที่สร้างขึ้นให้ความถูกต้องตรง
กับชุดแต่งกายที่ลูกค้าชอบมากกว่า 80%

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Yongplut Yeing-aramkul : SYSTEM FOR STYLING APPARELS THAT MATCH WITH OCCASION WEARING VIA E-COMMERCE CHANNEL USING MACHINE LEARNING. Advisor: Prof. CHIDCHANOK LURSINSAP, Ph.D. Co-advisor: Assoc. Prof. PATCHA U-TISWANNAKUL, Ph.D.

This work studies the factors effecting the selection of apparels according to fashion styling via an e-commerce platform in order to build an automatic system for suggesting proper apparel concurred with the customers' preferences. The factors obtained from interviewing experts in the fashion area found that cloth items, apparel colors, skin colors, and body shape are the main factors effecting the selection of fashion styling via an e-commerce platform. These discovered factors were used to partition a set of experimental fashion styling apparel and also to construct a set of suggesting rules based on different values of each factor. The experimental results based on various values of each factor concluded that the accuracy of suggested apparel according to the factors and suggesting rules concurred with the customers' preference more than 80%.

Field of Study: Technopreneurship and
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CHAPTER 1 INTRODUCTION

1.1 Thesis topic

ระบบการเลือกซื้อเครื่องแต่งกายเหมาะสมกับกระแสนิยมตามโอกาสของการสวมใส่ผ่านช่องทางอีคอมเมิร์ซด้วยเทคนิคการเรียนรู้ของเครื่อง

SYSTEM FOR STYLING APPARELS THAT MATCH WITH OCCASION WEARING VIA E-COMMERCE CHANNEL USING MACHINE LEARNING

1.2 Background and importance of the topic

The advance of information technology makes customer behavior change. The customers trend to purchase via the online channel. The businesses have to adapt to this change. The digital transformation is one of the musts for business to survive. The online official platform enhances the company sales volume. It can open 24 hours 7 days. Their customers can purchase a product from everywhere in the world. So, the businesses, which applied the digital transformation, can grow even faster than before. In 1997, the values of the E-commerce business are about \$2 trillion. It was forecast to reach \$4.8 trillion in 2021. (Statista, 2018)

The high refund rate is one of the main problems of any e-commerce platform. Purchasing products from e-commerce, customers can only read, see the image(s), and see the price. The received items do not look alike the items shown in the platform. So, the customer refunds the received items back to the platform.

Fashion is the highest refund rate category. (Barry, 2000) The products in the fashion category are about to look and feel. The products have to fit with the body. The color has to be the same or very similar as shown in the display.

The refund rate is increasing the operation cost of e-commerce, especially for the fashion category. It also decreases customer lifetime value. The unsatisfied customer will be switching to purchase from the company direct competitors.



Many researchers have tried to solve the refund rate problem. They found out that the correctness of the color display and real color is the one important factor effect on customer satisfaction, retention, and refund rate. (Nitse, Parker, Krumwiede, & Ottaway, 2004) But the only color factor is not enough to purchase the fashion product(s).

There are explicit factors and implicit factors to be considered before purchasing fashion products. Explicit factors concern trends and personality. The fashion trend involving silhouette, prints, style, and color keeps changing in every season. But personality involves only the figure, skin color, hair color, and eye color. Implicit factors are about the style that represents oneself.

Waring fashion apparel, it has to match with personality, (TAOKA, 2015) self, and society's perception. (Solomon & Schopler, 1982) That is why fashion product purchase is complicated than just color matching and similar style present.

There is a rising demand for the fashion recommendation system. The fashion e-commerce industry has rapidly grown during the past years. To survive the competitiveness in fashion world, the capability of fashion e-commerce must be enhanced and implemented as an intelligent system which can provide the virtual consultant to its customers. The fashion recommendation system can help provide the preferred items for each customer to increase conversion rate. It also helps decrease the refund rate. So, it is a high opportunity to develop a fashion recommendation system that helps the styling's customer one by one via e-commerce, which finally leads to an increase in the conversion rate from visitors.

The targeted customers for this system are the people in generation Y whose ages are around 22 – 39 years old. People in Generation Y are mostly in the middle of the career path. They have the potential to be at a higher level. To compete with others in the same career, they always have to look the best in the other eye. With



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their high purchasing power and society's perception, this group tends to purchase according to influencer recommendation. (สุทัศน์วิบูลย์, 2018)

People want to be unique in their style. So, they match the influencer recommendation with their style to show the other who they are. (Ladhari, Gonthier, & Lajante, 2019) Our target group prefers to purchase online as the convenience to purchase anytime and anywhere. They have a high budget for dress-up to compete with others in the workplace.

This research is scope to study only for the autumn/winter (A/W) 2019 fashion trend. Even though there are differences between each fashion trend, this research can be applied to the future fashion trend.

The above reasons are the point that leads to developing a system for styling apparels that match with occasion wearing via e-commerce channel using machine learning.

For the fashion industry, several Fashion recommendations are existing as the rapid growth in the sales volume of fashion e-commerce. Even though there are already many fashion recommendation systems available, there is still room for new models (Lü et al., 2012).

We are grouping the existing fashion recommendation system into 4 similar concept groups namely Collaborative filtering system, Content base recommendation system, and Image related recommendation system.

Collaborative filtering systems use user profile and related data to recommend. Using the factors of previous purchase apparel, fashion trend, and combining the online and offline data, and rating them with time-discount association score to build the architecture (Hwangbo, Kim, & Cha, 2018). However, this method is focused on the factor of previous purchase and replace clothing. Fashion items, including apparel items, is also changing as the seasonal change.

There are 3 sub-categories in the Content-based recommendation system. There are Image extracted data, Cross-media, Rating. Content-based recommendation system with Image extracted data is recommended fashion items by text that derived from product image. It is labeling text input by machine. Then, this method uses K-Nearest Neighbor similar items to recommend matching or similar apparel (L. Liu, Du, Zhu, Shen, & Huang, 2018). This recommendation system is suitable for classic apparel stores that focus on their repeated customers, but not for the fashion product. Cross media's fashion recommendation system combines apparel items, colors, textiles, and matching apparel as the input. It trains the CNN to categorize each factor into the semantic meaning group. Then, the rating of the match-and-match score algorithm (Zhou et al., 2019). The last one, the rating is similar to cross-media and increase the text review to recommend similar fashion items (Y. Liu & Shen, 2018). This method is not suited for the Thailand context. Thai people tend to review only to complain. So, the result of the rating recommendation system will not be accurate.

1.3 Objective

1. To select the starting factor(s) to apply in the fashion recommendation system
2. To develop a system for styling apparels that match with occasion wearing via e-commerce channel by using the method of machine learning
3. To plan the commercialization of this fashion recommendation system to the fashion e-commerce platform

1.4 Research scope

1. To study Generation Y, age 22 – 39 years old, who work or live in Bangkok
2. To study the autumn/winter 2019 fashion trend
3. To study to apply for styling apparels via the e-commerce channel



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1.5 Research method

1. Set hypothesis

H_0 : If there is a certain factor(s) to be the starting point for fashion's apparels styling via e-commerce, the target customer, Generation Y who works or lives in Bangkok, will have more interest in the recommended apparels. This leads to an increase in the conversion rate of fashion e-commerce, which uses this model to choose the preference style and to recommend their customers.

2. Scope of work

2.1. To study Generation Y, age 22 – 39 years old, who work or live in Bangkok

2.2. To study the autumn/winter 2019 fashion trend

2.3. To study in order to apply for styling apparels via the e-commerce channel

3. Literature review

3.1. Fashion recommendation system

3.1.1. Collaborative filtering system

3.1.2. Content base recommendation system

3.1.2.1. Image extracted data

3.1.2.2. Cross-media

3.1.2.3. Rating

3.1.3. Image related recommendation system

3.1.3.1. Color related recommendation system

3.1.3.2. Fashion items related recommendation system

3.1.3.3. New design recommendation system

3.2. Machine learning

3.2.1. Supervised learning

3.2.2. Unsupervised learning

3.2.3. Semi-supervised learning

3.2.4. Reinforcement learning

3.3. Fashion



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- 3.3.1. Fashion elements
- 3.3.2. Apparels items
- 3.3.3. Fashion VS Style
- 3.3.4. Fashion trend for the Autumn/Winter 2019
- 3.4. Psychology
 - 3.4.1. Color
 - 3.4.2. Color and feeling
 - 3.4.3. Skin color
 - 3.4.4. Implicit need
- 3.5. Customer behavior
 - 3.5.1. Generation
 - 3.5.2. Decision making
 - 3.5.3. Technology acceptance model
- 4. Find the fashion Dataset
- 5. Clean the dataset
- 6. Conduct qualitative research

Conduct qualitative research employed the purposive sampling method to collect the analytical data. Each selected sample is from a fashion specialist who has been working in the fashion industry more for than 10 years and has a high potential influence on others by their styling.

There is a fixed-alternative question to find the main factors that affect to fashion styling. Together with open-ended questions about the other factors that suggest using in the model to make the model more precise.

The main factors in the fixed-alternative questionnaire are as follows.

- 6.1. Skin color
- 6.2. Style
- 6.3. Fashion trend, focusing in the autumn/winter 2019
- 6.4. Occasion

6.5. Fashion product items

6.6. Customer figure

7. Build the fashion styling recommendation model for the autumn/winter 2019 fashion trend from the combination of main fashion factors, and psychological factors.

8. Test hypothesis by interactive quantitative questionnaire to target group to test.

8.1. The amount of apparel purchased from the recommendation by using a precision-recall method.

9. Measurement

9.1. The ratio of apparel purchased from the recommendation system versus a random system.

10. Research summary

11. Further study

1.6 Expected outcome

1. An automatic recommender system for serving apparel purchasing on e-commerce capable of providing appropriate styling to customers according to their preferences and the fashion trend. The system must achieve high customer satisfaction via the e-commerce platform and increase the conversation rate.

2. A recommending algorithm based on the method of the decision tree.

3. A new preference similarity measure. To apply the model into a fashion e-commerce platform.

1.7 Definition

1. Styling

The styling is the way matching apparels using their personality, occasion, and fashion trend. The styling result is different for each person.

2. Fashion trends

The representativeness of the trend applied in fashion during the period of time. The fashion trend is inspired by the surrounding event, whether social, environmental, cultural and own interest.

3. Fashion specialist

The persons who have a deep knowledge of fashion. They have to know how to styling apparels within specific fashion trends for Thai people. The fashion specialists must work in the fashion industry for more than 10 years.

1.8 Limitation

1. Only 16 main and widely used colors are considered. The colors that do not match these 16 colors will be changed to the closest one.
2. The image resolution depends on the user's display device platform.
3. There is a complicated factor that can affect fashion recommendation. In this research, the starting factors to build the fashion recommendation system are selected from the result of qualitative questionnaire.
4. Selected and recommended apparels, as well as styles, are based on the current 1-year trend.

1.9 Procedures

1. 28 February 2019 proposes a research outline.
2. 28 February 2019 sends the paper to compete in "Innovation in higher education competitor 2019" at the "Thailand Research Expo 2019".
3. 1 – 8 March 2019 conducts qualitative research.
4. 31 March 2019 sends the paper to attend in the "UTCC ACADEMIC DAY 2019" conference.
5. 7 – 9 April 2019 presents the research porter in the "Innovation in higher education competitor 2019" at the "Thailand Research Expo 2019" event.
6. 1 – 15 April 2019 sends the document to invite the Thesis Proposal Examination Committee to present the thesis.



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7. 18 – 30 April 2019 conducts the IOC for quantitative questionnaire and revised a suggestion
8. 1 – 15 May 2019 collects the quantitative question round 1.
9. 1 – 7 May 2019 sends the thesis session 1 – 3 to all committees.
10. 13 May 2019 presents the thesis to the committees.
11. 15 May 2019 sends the paper to attend in the “InCIT2019” conference.
12. 22 May 2019 the late day of acceptance date of the “UTCC ACADEMIC DAY 2019” conference.
13. 31 May 2019 presents the paper at the “UTCC ACADEMIC DAY 2019” conference. (If accepted)
14. 15 - 30 June 2019 sends the document to invite the Thesis Proposal Examination Committee to present the final thesis.
15. 30 June 2019 sends the full thesis.
16. 13 July 2019 presents the final thesis to the committees.
17. 15 July 2019 the acceptance date of the “InCIT2019” conference.
18. 24 – 25 October 2019 presents the paper at the “InCIT2019” conference. (If accepted)



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CHAPTER 2 LITERATURE REVIEW

Customer purchasing patterns is a shift from offline to online because of the advance in information technology and the changing in customer behavior. Online shopping provides the customer the convenience to shop every time and everywhere. However, they are no longer get advice before purchase, especially fashion and lifestyle products, like in-shop purchase. The e-commerce owner looking for the solution that provides the lookalike in-shop experience to their online customer. The recommendation system is one of the best choice for them. So, the recommendation system is becoming more and more popular for the fashion and lifestyle e-commerce platform.

The recommendation system is one of the marketing tools which help show the items that each customer prefers. The main objective of the recommendation system is increasing the conversion rate. The recommendation system factors are different by the key success factor. So, every well-known e-commerce platform for instant Amazon, Alibaba, Agoda, Booking, eBay, Lazada, and TripAdvisor has to have their own recommendation system.

Understanding the input and the output wanted is a first step to create the recommendation system. The input is the factor(s) that related to the product wanted to be recommended. The output is the result from the recommendation processes. After knowing the input and output, we have to find the processes that can turn the input to preferable output.

In general, the framework of the recommendation system is shown in Figure 1.



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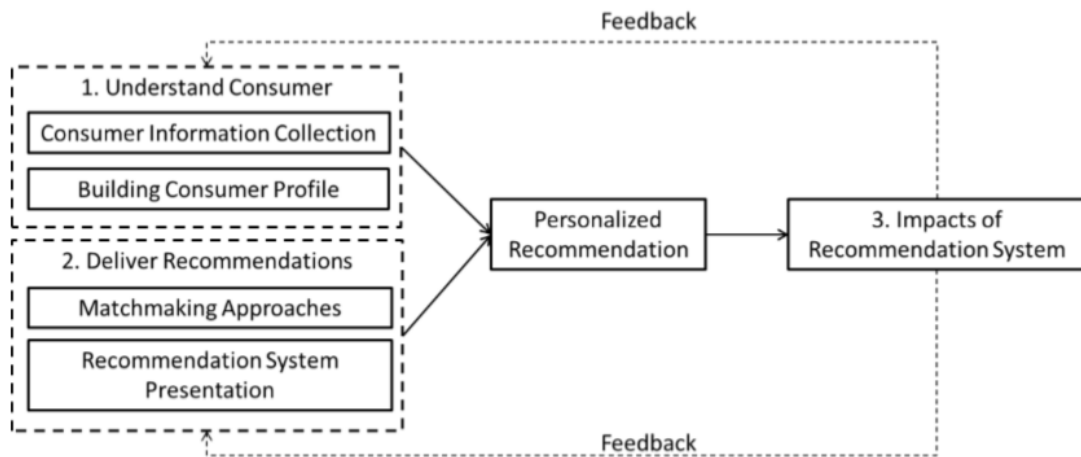


Figure 1 : Three Stages of the Recommendation Process from the work of Li Seth Si yuan and Karahanna Elena (Li & Karahanna, 2015).

The recommendation system normally starting from gathering the historical data. Then, grouping it to make a logarithm pattern. When the new user visits the front-end, either website or application, the system will see any relevance to the pattern and presenting the recommended product(s). The system is built as a back-end system to increase visit performance that leads to conversion, shown in figure 2 (Gorgoglione, Panniello, & Tuzhilin, 2019) .

The continues gathering data is required. The more data have, which contain the input factors, the more precise output will be.



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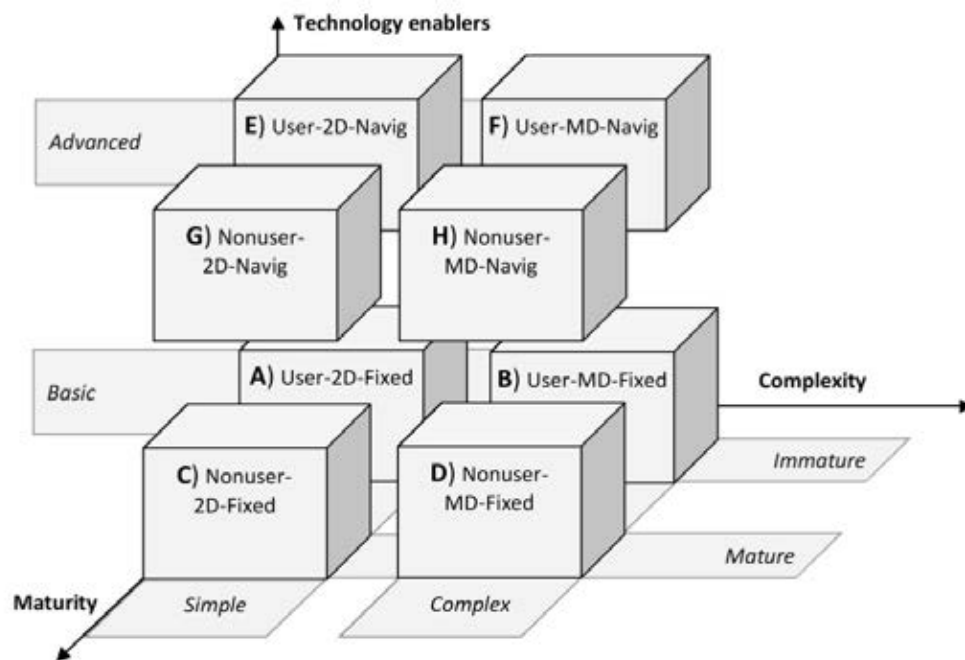


Figure 2 : Framework of recommendation strategy from the work of Gorgoglione Michele, Panniello Umberto, and Tuzhilin Alexander (Gorgoglione et al., 2019).

2.1 Fashion recommendation system

With the rapid growth in the sales volume and growth rate of the fashion e-commerce industry, there are several fashion recommendations existed.

To build the fashion recommendation system that can recommend the apparel in trend, we have to understand the knowledge of both computer science and social science. The knowledge from computer science is to build the recommendation system. And the knowledge from the social science part is to find the factor(s) using in the system.

Even though there are already many fashion recommendation systems available, there is still room for the new fashion recommendation system. (Lü et al., 2012) The previous fashion recommendation systems were focused on historical data. The systems use the historical data of each customer to recommend the new

items to the same customer or a similar behavior group of customers. So, the first room for us is to build fashion recommendation system that can recommend customer(s) since their first visit.

In addition, fashion does have a trend which changes season by season. The historical data alone might not enough to recommend the new coming fashion trend item(s). The fashionistas choose to purchase the in-trend apparels items. They want to be someone who in the trend, in the style, and in the eyes of others. So, the trend is another consideration's factor in this research.

We separate the fashion recommendation system from the literature review as below.

2.1.1 Collaborative filtering systems

Collaborative filtering systems use user profile and related data to build the recommendation system. This method gathering the information both online and offline. So, the main factors of this method are customer purchased data, both online and offline. Then, this method will rate each data with the time-discount association score to build the architecture as the below figure. This method is trying to increase the click-through rate and conversion rate, shown in figure 3. (Hwangbo et al., 2018)

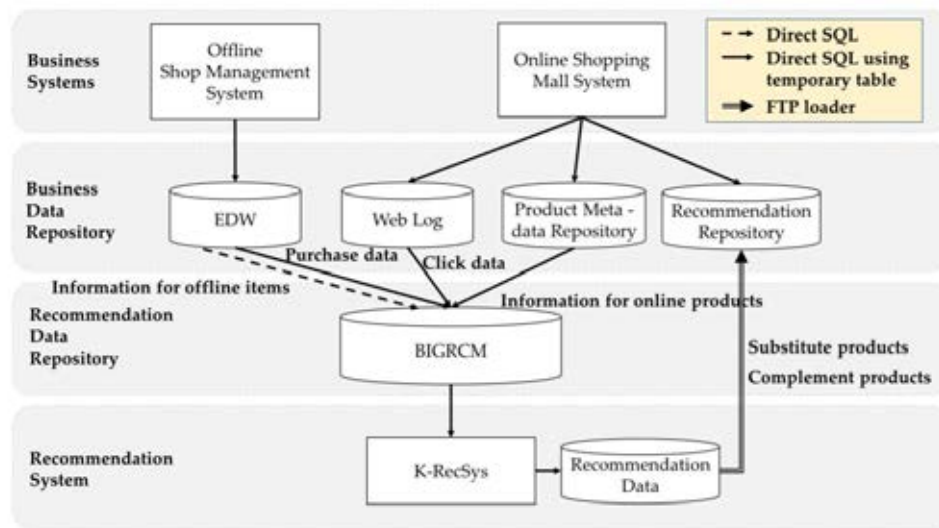


Figure 3 : K-RecSys architecture from the work of Hwangbo, Hyunwoo, Kim, Yang Sok, and Cha, Kyung Jin (Hwangbo et al., 2018).

Even though this research said fashion is changing, it still focuses on the historical data and its replacement. Fashion items, included apparels items, are changing as the seasonal change. So, in our research, we do combine customer preference apparels items and fashion trend items as one of our factors.

Using historical data is also one of the disadvantages of new and purely e-commerce. We concern about this issue. So, our algorithm has to have something that can help recommend each customer from the first time they visit.

2.1.2 Content base recommendation system

Content base system can be sub-categorized be following.

2.1.2.1 Image extracted data

The Image extracted data is one of the recommendation systems that get input from the product image(s). The text input comes from both text processing of the product description and the extraction from the product image. This method is labeling the text automatically by machine. The text of each input will classify as a product hashtag.

After getting the input, the K-Nearest Neighbor similar items are used to recommend the items. This method can recommend matching items or similar apparels items (L. Liu et al., 2018). The method suit for traditional apparels store which focuses on the repeat customers. The hashtag factor alone cannot build the fashion styling pattern to train the machine that can provide the most relevance recommends to each customer.



Figure 4 : An example of fashion recommendation by Discrete Supervised Fashion Coordinates Hashing (DSFCH) from the work of Y. Liu and Y. Shen (L. Liu et al., 2018).

2.1.2.2 Cross media

Fashion has many details. Using only the relevance apparel product, as the above method, is not enough. Cross media's fashion recommendation system combines apparels items, colors, textiles, and matching apparels as the input, shown in figure 5. Then, there needs training of the CNN to categorize each factor into the semantic meaning group. There is a rating of match-and-match score algorithm to match apparels. Finally, select the 3 – 4

highest score from top relevance categories to recommend to customers, shown in figure 6 (Zhou et al., 2019).

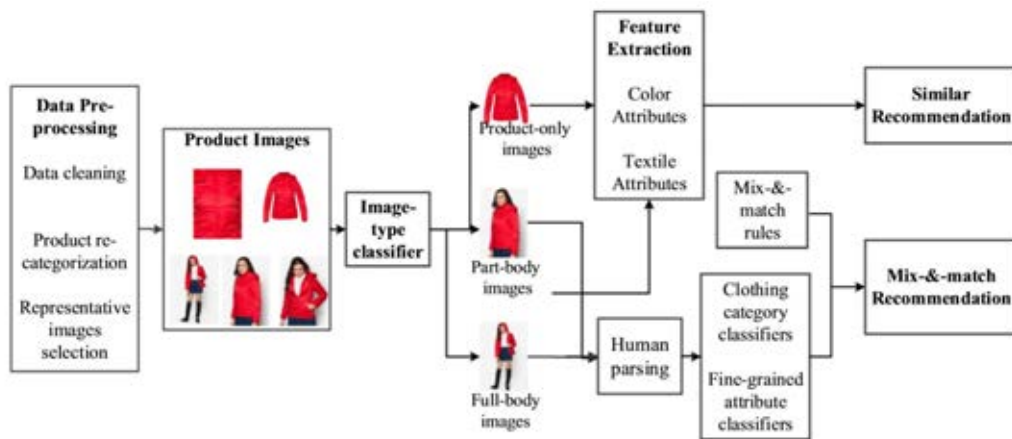


Figure 5 : Cross media framework from the work of Zhou Wei, Mok P.Y., Zhou Yanghong, Zhou Yangping, Shen Jialie, Qu qiang, and Chau K.P. (Zhou et al., 2019).

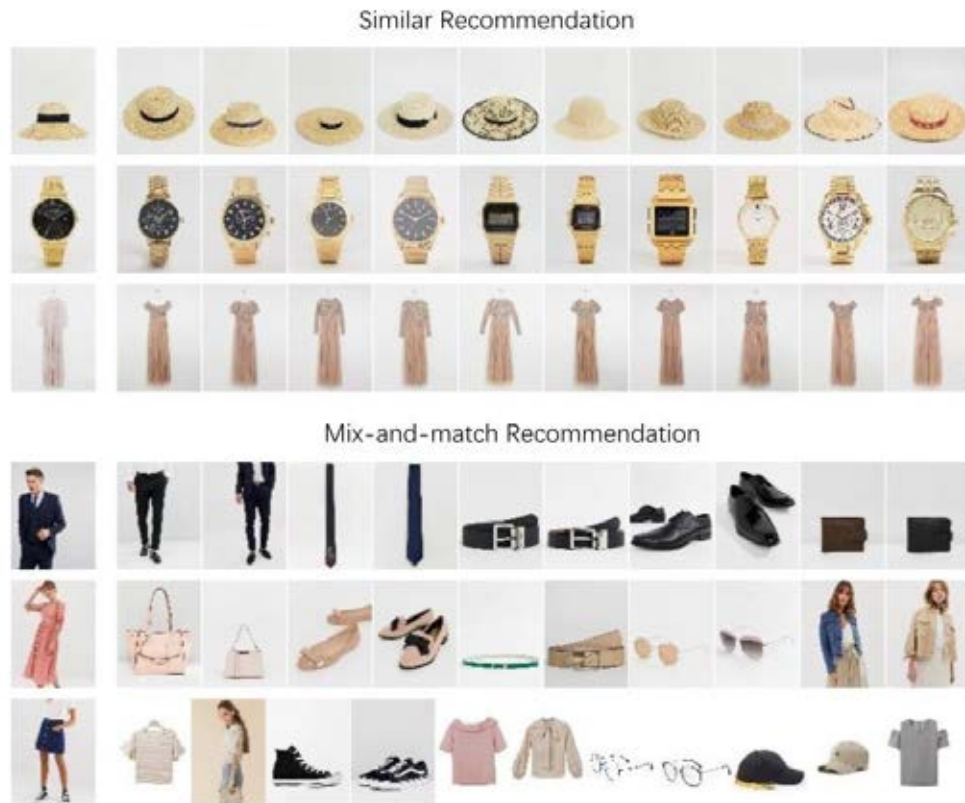


Figure 6 : Similar recommendation and Mix-and-match Recommendation from the work of Zhou Wei, Mok P.Y., Zhou Yanghong, Zhou Yangping, Shen Jialie, Qu qiang, and Chau K.P. (Zhou et al., 2019).

2.1.2.3 Rating

This method is combining visual factors and non-visual factors. It combines text in the rating system with text derived from customer interesting apparel. (Y. Liu & Shen, 2018).

The visual factors are the extracted information from the product image(s). Then use the CNN method to see the similarity.

Non-visual is mainly referring to comment customers wrote in the rating system after purchased the product(s). It has to use text-processing to learn the meaning in each comment in the rating system. Then, combine the text extract from the image(s) with the text extract from the rating system to build the input in the recommendation system.

This rating method might not suit the Thai context. Thai people normally write the comment for reward or complain. So, the data derived from the rating system are less meaning.

2.1.3 Image related recommendation system

The fashion is about the presentation. Many fashion recommendation systems use a product image as the input. The output is depending on the previous apparel(s) image that customers had been clicked, viewed, or purchased. This system will learn the pattern, then provide similar apparels at the first, Index, webpage. The pattern can also apply to other people who have the same or similar behavior.

The different image related recommendation system is depending on the output each researcher wants.

2.1.3.1 Color related recommendation system

This method uses K-Mean to navigate a color palette by the attribute-based query. Then, the system will recommend the image that brighter or darker than the input image.

This recommendation system has the possibility to present apparels matching the perceive feeling such as recommend apparel that has “a little bit more cheerful”, shown in figure 7 (Yeongnam Chae, 2018).

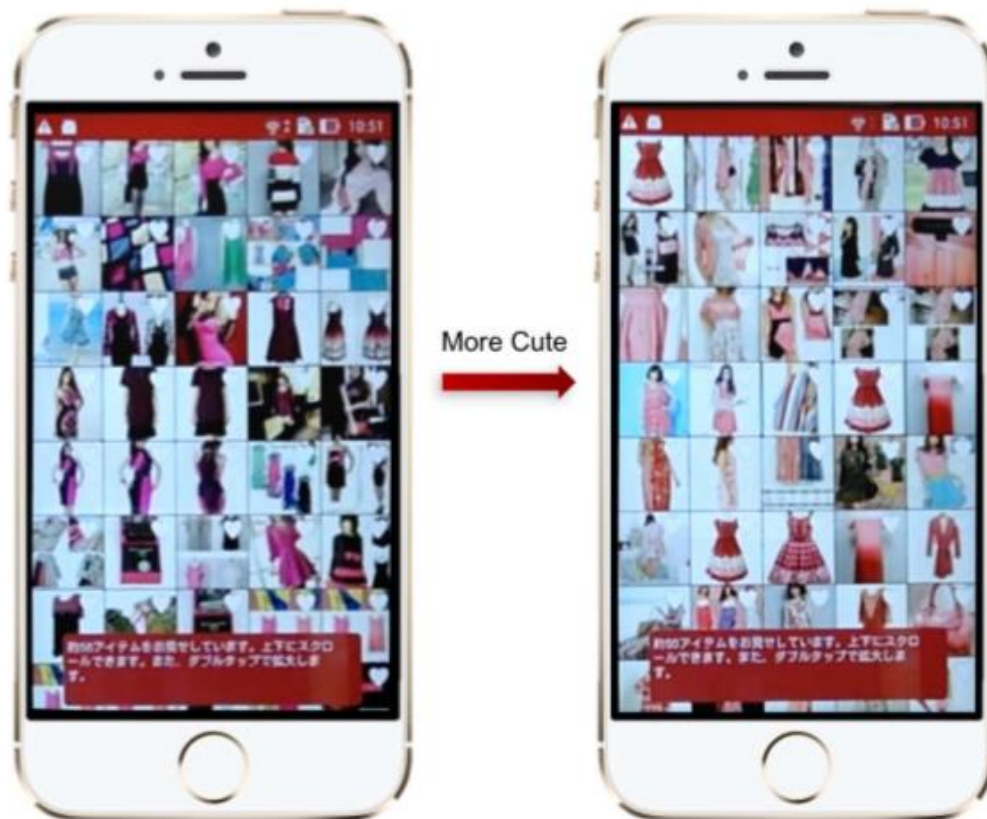


Figure 7 : Color navigated recommendation from the work of Yeongnam Chae, Jiu Xu, Bjorn Stenger, and Soh Masuko (Yeongnam Chae, 2018).

2.1.3.2 Fashion items related recommendation system

Many of styling's fashion images do not show only apparels. They show the complete look, apparels with the accessories. This recommendation system helps categorize each part of the fashion image(s). Then, it will recommend similar fashion items.

This method uses semantic to categorize by separated each fashion item from the image. Then, use the neural network as a base to recommend the result, shown in figure 8 (Verma, Anand, Arora, & Rai, 2018).

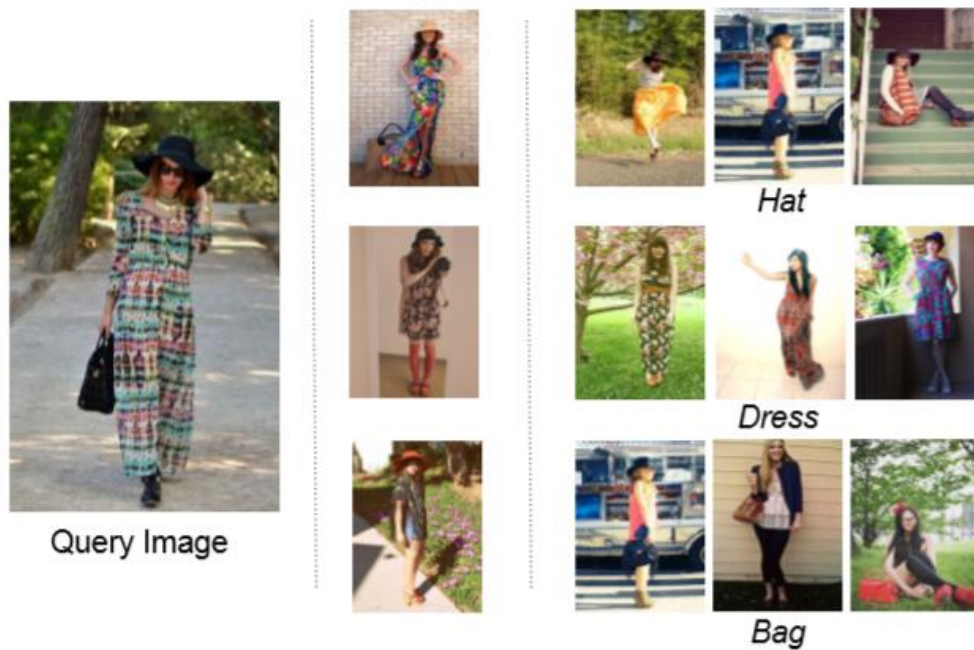


Figure 8 : Fashion items related recommendation from the work of S. Verma, S. Anand, C. Arora, and A. Rai (Verma et al., 2018).

2.1.3.3 New design recommendation system

This recommendation system has a similar idea of the color-related recommendation and fashion items related recommendation. The difference is this method tries to generate new fashion items from the historical data.

It uses the Siamese-CNC framework with Bayesian Personalized Ranking as a learning base to generate input. Then, calculate the user's preference score to present the output. Moreover, this method tries to help design the new product from customer preference, shown in figure 9.



Figure 9 : Image related recommendation apparel from K-Nearest Neighbors method from the work of Kang Wang-Cheng, Fang Chen, Wang Zhaowen, and McAuley Julian (Kang, Fang, Wang, & McAuley, 2017).

It seems to have a high similarity in each main consideration to develop the fashion recommendation system. However, there are differences in terms of input factors and output to be considered.

We will focus on the method, procedure, and techniques used to make the recommendation system that affects increasing the conversion rate.

The popular technique used to build recommendation systems is Artificial Intelligence (AI), or Machine Learning (ML). In this research, we are going to build the fashion recommendation system for styling apparel that matches with occasion wearing via e-commerce channel using machine learning.

2.2 Machine learning

We have to set the learning pattern for Machine Learning (ML) algorithm. Then, we have to gather the data to feed in the ML to generate the output. The

accuracy of the recommendation system depends on the pattern and the amount of data in the ML database.

The data using in the ML have to separate into 2 groups that are 1. Training data 2. Testing data. Training data are the set of data that be set as the algorithm pattern. Testing data are the one to test the correctness of the algorithm.

There are 4 main categories for ML algorithm. 1. Supervised learning 2. Unsupervised learning 3. Semi-supervised learning 4. Reinforcement learning.

2.2.1 Supervised learning

Supervised learning requires a set of complete data to be trained and tested. When the new data are collected, a new training process must be repeated by using those previously trained data and the new data set.

2.2.2 Unsupervised learning

Unsupervised learning is used for the data that do not have a training set. Normally use for finding the data pattern.

2.2.3 Semi-supervised learning

Semi-supervised learning is a combination of supervised learning and unsupervised learning. This method uses when the training set are not fully filled.

2.2.4 Reinforcement learning

Reinforcement learning is an algorithm that learns from external feedback.

We need to know the input factors used to train the data to select the ML logarithm. The input factors, to develop our fashion recommendation system, can be separated into the fashion factors and the psychological factors. The fashion factors are a fashion trend, fashion items, silhouette, fabric texture, color, prints, look and feel, and accessories. (Arnold, 2009) Psychological factors are the need for uniqueness, self-monitoring, and the sense of extended-self. (Seo & Lang, 2018)



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The fashion recommendation system in this research is built from the fashion factors and psychological factors derive from the interview of the fashion specialists. The qualitative research is conduct to find the factors. The fashion trend and psychological were reviewed and summarized.

2.2.5 Precision-Recall

Precision-recall is one of the evaluation measurements for the ML experiment. The result of the ML will separate to 4 classifications. The 4 classifications are a true-positive, a false-positive, a true-negative, and a false-negative.

The positive or negative indicates the experiment that is the same or different from the concept test. The true or false indicates the correctness of the result. True indicates the correct. False indicates the incorrect. The framework of the precision recall is shown in Figure 10.

	+R	-R	
+P	tp	fp	pp
-P	fn	tn	pn
	rp	rn	1

Figure 10 : Precision Recall.

Preference : (To & David, 2007).

When we get all results from the system, we can use this method to calculate our fashion recommendation system performance. Precision shows the preciseness of predicting the concept. Recall shows a proportion of the correct concept test out of all the true concept tests available (To & David, 2007).

The equation of precision-recall is shown as below.

$$\text{Precision} = \frac{TP}{TP+FP}$$

$$\text{Recall} = \frac{TP}{TP+FN}$$

2.3 Fashion

Fashion is about the social phenomenon in a specific period of time derived from changes in society, environmental, economic, and even political. If the particular fashion was accepted from fashion influencer, such as branded fashion, it will be recognized as a trend and be spread to other societies. That means the trend can be applied for only small groups of people or can be applied to the worldwide population. The period of trend also variety from the very short period as a couple of days to a very long period as it becomes a classic fashion (Sproles, 1974).

Fashion online shopper tends to be interested in purchasing from the websites or applications that can help recommend them for the matching style fitted with their personalization. (Sebald & Jacob, 2018) There is a need to understand the factors to use as the input factors of the fashion recommendation system. Then, we have to select the most effective factor that can display apparels that matches customer style within the fashion trend.

2.3.1 Fashion elements

Fashion elements are complicated, from the very tiny detail as the fiber used to make the fabric to the overview image as the silhouette of some part of the appeal. It also changes when there is a new fashion trend. To extract each detail to use as a system's factors, it might take a long time to complete. So, in this research, we are grouping those details in the easy to understand which high influenced factor.

2.3.2 Apparels items

The group of apparels is categorized by the visualized silhouette and popular among fashion retail stores ("Womenswear Product Mix," 2019) and by the category as displayed on one of the most popular websites namely www.amazon.com.

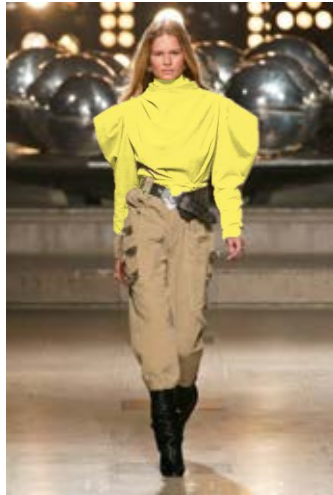
The apparel items can be categorized as table 1 and table 2.

Top	Bottom	One piece	Accessory
Tank-top	Pants	Mini dress	Shoes
Jackets	Skirt	Maxi dress	Belt
Blouse	Mini skirt	Jumpsuit	Hat
Shirt	Shorts	Coat	Bag
Blazer	Jean		
Suit	Legging		
T-shirt			
Sweater			
Knitting			
Roll-neck			
Hoddie			
Vest			

Table 1 : Apparel items.

 <p data-bbox="331 864 584 958"><i>Agnes B, A/W 2019</i> <i>Ready to wear</i></p>	 <p data-bbox="707 864 949 958"><i>Chanel, A/W 2019</i> <i>Ready to wear</i></p>	 <p data-bbox="1082 864 1315 958"><i>Celine, A/W 2019</i> <i>Ready to wear</i></p>
<p data-bbox="422 981 496 1014">Dress</p>	<p data-bbox="762 981 895 1014">Suit/Blaze</p>	<p data-bbox="1139 981 1259 1014">Sweaters</p>
 <p data-bbox="300 1601 624 1686"><i>Stella McCartney, A/W 2019</i> <i>Ready to wear</i></p>	 <p data-bbox="691 1601 967 1695"><i>Nina Ricci, A/W 2019</i> <i>Ready to wear</i></p>	 <p data-bbox="1035 1601 1359 1695"><i>Louis Vuitton, A/W 2019</i> <i>Ready to wear</i></p>
<p data-bbox="320 1718 600 1751">Hoodies & Sweatshirt</p>	<p data-bbox="791 1718 868 1751">Pants</p>	<p data-bbox="1054 1718 1342 1751">Jumpsuits & Playsuits</p>

		
<p><i>Louis Vuitton, A/W 2019</i> <i>Ready to wear</i></p>	<p><i>Hermès, A/W 2019</i> <i>Ready to wear</i></p>	<p><i>Haider Ackermann, A/W 2019</i> <i>Ready to wear</i></p>
<p>Skirts</p>	<p>Shorts</p>	<p>Leggings</p>
		
<p><i>Givenchy, A/W 2019</i> <i>Ready to wear</i></p>	<p><i>Balmain, A/W 2019</i> <i>Ready to wear</i></p>	<p><i>Giambattista Valli, A/W 2019</i> <i>Ready to wear</i></p>
<p>Suits & Blazers</p>	<p>Coat</p>	<p>Jackets & Vests</p>



Isabel Marant, A/W 2019

Ready to wear

Shirts & Blouses

Table 2 : Apparel items with image and yellow's highlight

Reference : ("Fall 2019 Ready-to-Wear," 2019), ("Womenswear Product Mix," 2019),
www.amazon.com.



2.3.3 Fashion VS Style



There are 3 main fashion types. First, the Fed fashion, the fashion style that comes in trend and out of trend very fast. Second, the Fashion, the fashion style that stays in trend for some period of time. The last one, the classic fashion, the fashion style that stays always is (Kennedy, Calderin, & Stoehrer, 2013). In this research, we use 10 classic styles to label the sub-factor of style.

2.3.3.1 Fashion style timeline'




Each fashion style occurs from the special event in the history shown in table


3.



Year	Event	Style	Image
1850s	Charles Frederick Worth opens in Paris. First Haute couture.	Haute Couture	 <p>Reference : (Trubert-Tollu, Tétart-Vittu, Martin-Hattemberg, Lacroix, & Olivieri, 2017)</p>
1910s	Paul Poiret opens in Paris by arrival of Ballets Russes. With an additional of traditional dress from far East country especially Japanese and Chinese. Change the way female dress from corset to gown.	Oriental-Paul Poiret	 <p>Reference : (Koda, 2008)</p>



Year	Event	Style	Image
1920s	<p>Outbreak of WWI. Most of the males died in the war. So, females had to work outside the house. They had to have more comfortable cloth for work. The military cloth had influenced the style. This period is a starting point for females to wear practical cloth.</p>	<p>Military</p>	 <p>Reference : (Co)</p>
1920s	<p>Females had more power to design their life after WWI. They tended to push themselves from traditional. Females started to smoke, drink alcohol, wore short hair, and dress sexier. The ideal shape for females in the period is very skinny, the lean column body shape.</p>	<p>Flapper</p>	 <p>Reference : ("Actress Alice Joyce, 1926," 1926)</p>





Year	Event	Style	Image
1920s	<p>Chanel opened in Paris. This brand was one of the brands that can keep its style when most of the boutique was occupied by the Nazis. This brand had very successful to create a combination of the male jacket and the female pleated skirt. This period is the first time that females wore pants.</p>	Androgyny-Chanel	 <p>Reference : (Sobel, 2017)</p>
1930s	<p>Surrealism style was designed by surrealism artist. The famous designer in this period was Elsa Schiaparelli. She well-known as the designer who used vivid colors and strange decoration. This period started to design cloth that fit with females' curves and shapes.</p>	Surrealism	  <p>Reference : (zoowithoutanimals, 2013)</p>



Year	Event	Style	Image
1940s	<p>The fall of Paris during WWII. There was a lot of limitation to design new apparel in the period of war. The military-style came back. The government had the policy had a direction to make new apparel from reuse clothes. The top and bottom cloth became shorter as they want to use the cloth for military purposes. However, the military-style during this period was more feminine. The apparel showed females curve and shape, the hourglass shape.</p>	<p>Military WWII</p>	 <p>Reference : (Agarwal, 2017)</p>
1950s	<p>After the end of WWII, people wanted to have a peaceful life. The females during this period had 2 ideal. One became a good housewife. The other wanted to become a Hollywood superstar. Christian Dior's Corolle line, with supported by Marcel Bousac, becomes the New Look that represents the luxurious look. The female showed more curve, full hourglass shape.</p>	<p>New Look</p>	 <p>Reference : (Chanel, 2011)</p>

Year	Event	Style	Image
1960s	<p>It is a Baby boomer period. The teenager became an influencer instead of the elites and the celebrities. Females had equal rights to males. The global trend during that period changed very fast. The Mod style with Mini-skirt and Hot Pants was in this period. Twiggy tomboy's look is ideal for styling.</p>	Mod	 <p>Reference : (RetroWaste)</p>
1960s	<p>It was the first time that humans stepped on the moon. Fashion was inspired by the advanced in high-technology. Ready-to-wear was a new fashion segment. Brand and trademark became important to export clothes worldwide.</p>	Space Age	 <p>Reference : (Lutyens, 2019)</p>

Year	Event	Style	Image
1960s	Rock style is influenced by Marlon Brando. They liked to wear a leather jacket with a t-shirt inside together with straight jeans.	Rock	 <p>Reference : (FASHION.HAV.MY, 2011)</p>
1960s	Hippy is a community of American teenagers who questions about their life. Hippy's philosophy is about love and freedom. Most of them used drugs and had free sex to social ivory. They tried to be back to nature. Flowers was one of their symbols.	Hippy&Bohemian	 <p>Reference : (Gragert, 2016)</p>

Year	Event	Style	Image
<p>Late 1960s – early 1970s</p>	<p>The African-ethnic style was influenced by the claim of civil rights in American, Black pride. Traditional African cloths and accessories were worn by many African-Americans. The rectangle outside line became popular.</p>	<p>Ethnic-African</p>	 <p>Reference : (Monet, 2017)</p>
<p>1970s</p>	<p>Giorgio Armani presented the men collection that can wear both male and female. This was the beginning of the unisex concept onwards. New York Dolls and David Bowie were the influencers for Glam Rock and Unisex style. They mixed male and female clothes, accessories, and makeup to become a new look.</p>	<p>Glam Rock, and Unisex</p>	 <p>Reference : (Beresford, 2015)</p>

Year	Event	Style	Image
1970s	<p>The disco style was influenced by The Studio 54, the popular night club in New York. The club had allowed only people worn twinkling and vivid cloth to enter the club. The clothes had to fit with the body with the swaying bottom.</p>	Disco	 <p>Reference : (Syke Makaris, 2018)</p>
1980s	<p>Punk is a slang word to call foolish things or people. Punk had a perspective against traditions and political. The punk style was influenced by underground music such as Sex Pistols and The Clash.</p>	Punk	 <p>Reference : (REVERON, 2014)</p>

Year	Event	Style	Image
1980s	<p>From this period, fashion was not influenced by teenagers anymore. Fashion returned to the past, Retrospective style. Women began to have a higher role in society. Margaret Thatcher, Prime Minister of the United Kingdom, and Princess Diana was the ideal women of the period.</p>	<p>Power Dressing- Retrospective</p>	 <p>Reference : ("20 80s Power Suits That Cannot Be Stopped,")</p>
1980s	<p>The avant-garde style was a conceptual design lead to a new way of thinking especially in art, culture, and politics. It exaggerates the norm and status quo. The designer who influence in style were Issey Miyaki, Kenzo Takada, and Rei Kawakubo.</p>	<p>Avant Garde</p>	 <p>Reference : (Ventus, 2012)</p>


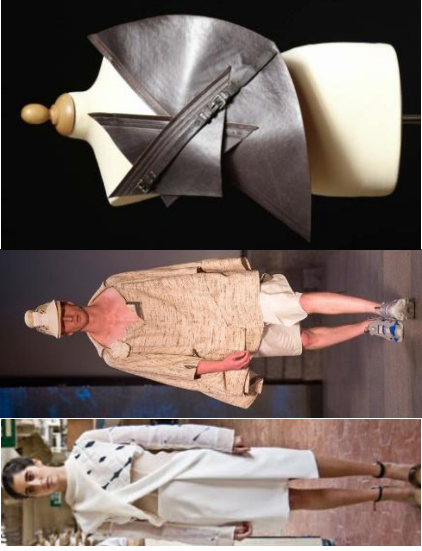
Year	Event	Style	Image
1990s	<p>"Less is more" is one of the definitions of Minimal style. Minimal style presents simple but outstanding. It uses a monotone color.</p>	Minimal	 <p>Reference : (OLIVA, 2017)</p>
1990s	<p>Deconstruction shows the imbalance silhouette. It focuses on the process more than the end product. Deconstruction's designers like to test the new thing.</p>	Deconstruction	 <p>Reference : (Pijak, 2015)</p>

Table 3 : Fashion style timeline'.

Reference : (อุทิศวรรณกุล, 2558)

2.3.3.2 Fashion styling

Fashion styling makes a fashion collection complete look. It represents the story of each fashion's collection, trend, and brand image. Good styling also increases the sales volume of that collection. In the part styling is a duty of fashion magazine editor. But now there are many types of fashion styling depend on the work.

1. Editorial styling or photographic styling

This position will help control the mood and tone of fashion look book in fashion magazines.

2. Personal styling or image consulting or personal shopping

This position suggests the individual purchase fashion items that match their personality.

3. Costume or wardrobe designer

This position supports the movie maker with their fashion knowledge.

4. Commercial styling

This position helps create the look for brand ambassador.

5. Corporate styling

This position helps suggest the corporate uniform.

6. Catalog styling or merchandise styling

This position works with the designer to create marketing material.

7. Show styling

This position helps controls the mood and tone in the fashion show.

The table 4 shows the selected 10 styles.

 <p><i>Thom Browne, A/W 2019 Ready to wear</i></p>	 <p><i>Vivienne Westwood, A/W 2019 Ready to wear</i></p>	 <p><i>Olivier Theyskens, A/W 2019 Ready to wear</i></p>
<p>Dandy</p>	<p>Punk</p>	<p>Fetish</p>
 <p><i>Yohji Yamamoto, A/W 2019 Ready to wear</i></p>	 <p><i>Alexander McQueen, A/W 2019 Ready to wear</i></p>	 <p><i>Comme Des Garcons, A/W 2019 Ready to wear</i></p>
<p>Grunge</p>	<p>Postmodern</p>	<p>Deconstructivist</p>

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 <p data-bbox="311 869 611 1014"> <i>Stella McCartney, A/W 2019 Ready to wear</i> </p>	 <p data-bbox="707 869 951 958"> <i>Hermes, A/W 2019 Ready to wear</i> </p>	 <p data-bbox="1031 869 1369 958"> <i>Paco Rabanne, A/W 2019 Ready to wear</i> </p>
<p data-bbox="392 1039 525 1070">Minimalist</p>	<p data-bbox="783 1039 877 1070">Classic</p>	<p data-bbox="1134 1039 1262 1070">Romantic</p>
 <p data-bbox="336 1664 584 1753"> <i>Lacoste, A/W 2019 Ready to wear</i> </p> <p data-bbox="416 1778 504 1809">Sporty</p>		

Table 4 : Fashion style.

Reference : ("Fall 2019 Ready-to-Wear," 2019), (Kennedy et al., 2013)

2.3.4 Fashion Trend for Autumn/Winter 2019

For the apparels items, the dresses, tops, and knitwear are the apparels items that still in the Autumn/Winter 2019 (A/W2019) since last season. The forecasted popular apparels items focus for A/W2019 is a hoodie, roll-neck, cargo pants, pleated skirt, and leather skirt.

		
<p><i>Thom Browne, A/W 2019</i> <i>Ready to wear</i></p>	<p><i>Sacai, A/W 20198</i> <i>Ready to wear</i></p>	<p><i>Ann Demeulemeester, A/W</i> <i>20198</i> <i>Ready to wear</i></p>
<p>Hoodie</p>	<p>Roll-neck</p>	<p>Cargo pant</p>



	
<i>Louis Vuitton, A/W 2019</i> <i>Ready to wear</i>	<i>Hermès, A/W 2019</i> <i>Ready to wear</i>
Plated skirt	Leather skirt

Table 5 : Apparel details for A/W2019.

Reference : ("Fall 2019 Ready-to-Wear," 2019), ("Womenswear Product Mix," 2019)

The fashion trend for A/W2019 was inspired by the spiritual, purpose of life, and freedom. The women's lifestyle is target-oriented. They have to find a way to achieve their target. With the strained in work, they want to free themselves either from spiritual or nature (Jane Boddy, 2019).

The animal printed, bow decoration, bottom decoration is the popular detail for A/W2019. Silk, satin, leather, and wools are the focus fabrics use in this season.

Brown and yellow color tones are the trendy colors for A/W2019. The green color tone is an essential color shown in figure 11.

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Figure 11 : Purpose full theme for A/W2019 fashion trend; WGSN

Reference : (Jane Boddy, 2019)

2.4 Psychology

2.4.1 Color

The color is a wavelength of light that visible to our eyes. We normally can see the color of red, orange, yellow, green, blue, and violet from the wavelength of light, shown in figure 12 and figure 13 (Eliassen, 2017).

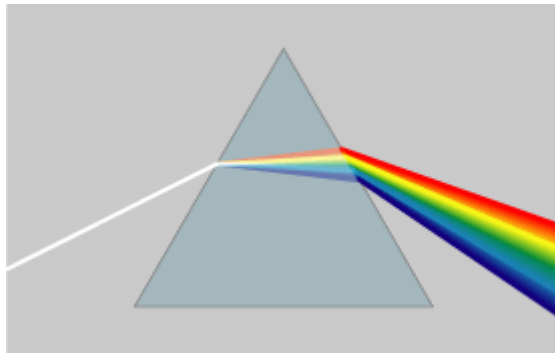


Figure 12 : Light & Optics from the work of Joanjoc (Joanjoc, 2005).



Figure 13 : Color wheel with wavelengths from the work of Tem5psu (Tem5psu, 2017).

There are 3 main color tones to consider. They are cool color tones, warm color tones, and neutral color tones, shown in figure 14. The cool color tones have blue and green as the main mixed colors. The warm color tones have yellow and

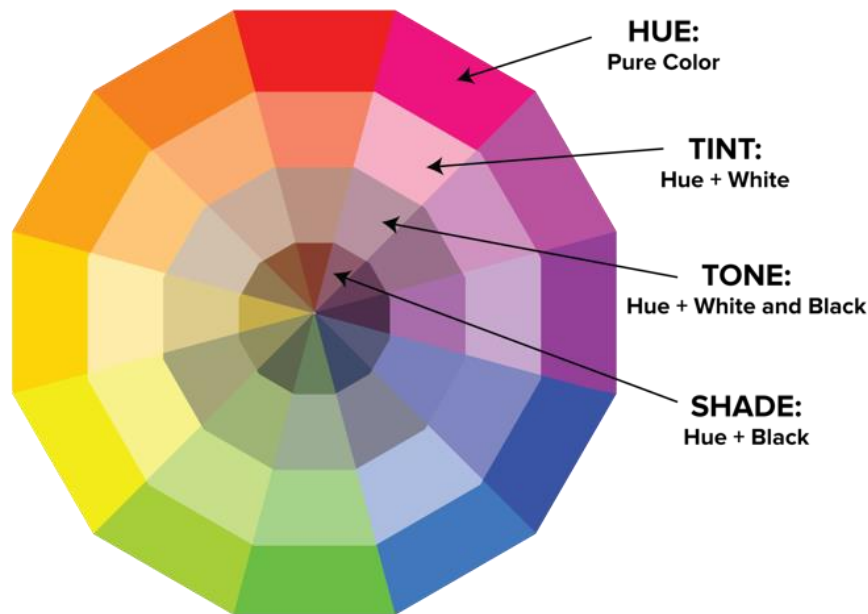
red as the main mixed colors. The neutral color tones are white, black, and gray. The neutral color tones are the base color that can be mixed with any other colors.



Figure 14 : Warm and cool color in color wheel from the work of Stephen Hill (Hill, 2011).

2.4.2 Color and feeling

The color is one of many factors that directly affect to viewer feel. Vice versa, the viewer feeling also effect on color recognizing. (Kay, Carmichael, Ruffell, & Simner, 2015) In a normal situation, the color can make us feel something. The degree of feeling depended on the hue-related factor, lightness-related factor, tine-related factor, color tone related factor, and chroma-related factor shown in figure 15.



*Figure 15 : Hue, Tint, Tone, and Shade color in color wheel
from the work of Bethany Cartwright (Cartwright)*

In general, warm colors make the viewer feel warm, and cool colors make the viewer feel cool. The color with a high saturated, high hue, will make the viewer feel the power, the movement. It has a very high psychological effect. But when the hue, pure color, mix with the white or black, it will create more meaning of it. The lighter color, mixing hue colors with white, will make the viewer feel light, free, and fine. In contrast, a darker color, mixing hue colors with black, will make the viewer feel uncomfortable, weightily, and serious.

Not only mixed the pure colors with neutral colors to create a new feeling, but pure colors can mix with the other pure colors to create new meaning as well. Mixing the colors with the same color tone, and the same saturated color will create harmony colors (Ou, 2015).

Each color has its own effect on the human subconscious. The effect will be received by the human subconscious within 90 seconds. The psychological effect of

colors to a human does also follow the subconscious effect, shown in table 6 (Dash, 2018).

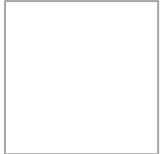

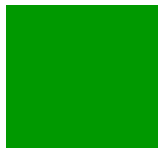
	Color name	Psychological meaning
	Black	Powerful, mystery, charm
	Blue	Peaceful, stability. sincere, clean, the power within
	Brown	Friendship, reliability, stability
	Gold	Wealthy, rich, premium
	Grey	Middle path Help to enhance the other color nearby
	Green	Natural, fresh, peaceful, growth, plentiful
	Orange	Bright, vivid, fun, warmness
	Pink	Gentle, sweet, feminine, safe
	Purple	Honest, dignity, spirit If there is a lot purple in, it will feel fake

	Red	Passion, excitement, strength
	Silver	Glory, frigid About scientific
	White	Cleanness, pure
	Yellow	Joy, happiness, warmness, brightness

Table 6 : Psychological meaning of basic colors.

Preference : (Dash, 2018)

Besides the psychological effect of the colors to the viewer, the different culture also is a factor that makes color interpretation variations upon it, shown in table 7 (Aslam, 2006).

Cross-cultural meanings and association of color					
Color	Chinese	Japanese	Korean	Thailand	Asean
White 	Death Mourning	Death Mourning	Death Mourning	Death Purity	Death Mourning
Blue 	High quality Trustworthy	High quality Trustworthy	High quality Trustworthy	Freedom Peace Lively Hope	Cold Evil (Malaysia)
Green 	Pure Reliable	Love Happy	Pure Adventure	Fresh Bright	Danger Disease (Malaysia)

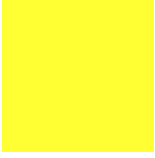


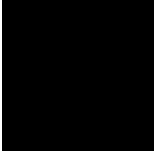
Cross-cultural meanings and association of color					
Color	Chinese	Japanese	Korean	Thailand	Asean
Yellow 	Pure Good taste Royal Authority	Envy Good taste	Happiness Good taste	Royal	Depend on country
Red 	Love Happiness Lucky	Love Anger Jealousy	Love Adventure Good taste	Love Buddhism	Depend on country
Purple 	Expensive Love	Expensive Sin Fear	Expensive Love	Mourning	Depend on country
Black 	Expensive Powerful	Expensive Powerful Formal	Expensive Powerful Mystery	Death Powerful Mystery	Depend on country

Table 7 : Cross-cultural meanings and association of color

Reference : (Aslam, 2006), (อรัญนารถ, 2558)

Skin color

Human skin color is different from race to race and their habitat location. Von Luschan classifies human skin color into 36 types shown in figure 16.

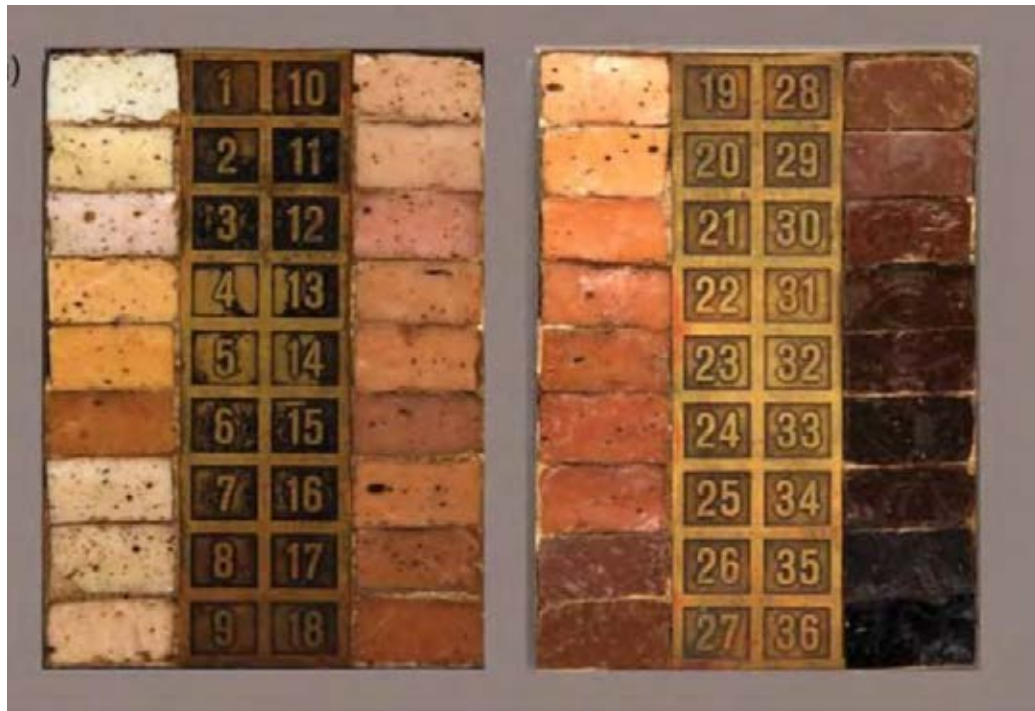


Figure 16 von Luschan tiles from the work of Swiatoniowski A.K., Quillen E.E, Shriver M.D. and Jablonski N.G. (Swiatoniowski, Quillen, Shriver, & Jablonski, 2013).

The method to measure the human skin color starts from match the Von Luschan tile with skin color around the forehead, and inside part of the arm. However, this method is hard to analyze. The result keeps changing. It depends on the analyst situation and experience. So, the analyst changes the method to measure human skin by using Spectrophotometry. This method measures skin color by using the ratio of absorbing and dispersing color from melanin element (Swiatoniowski et al., 2013).

Besides, there is a questionnaire method using sun-reactive to classify skin color. The higher score represents darker in skin color, shown in figure 17 (Fitzpatrick, 1988).

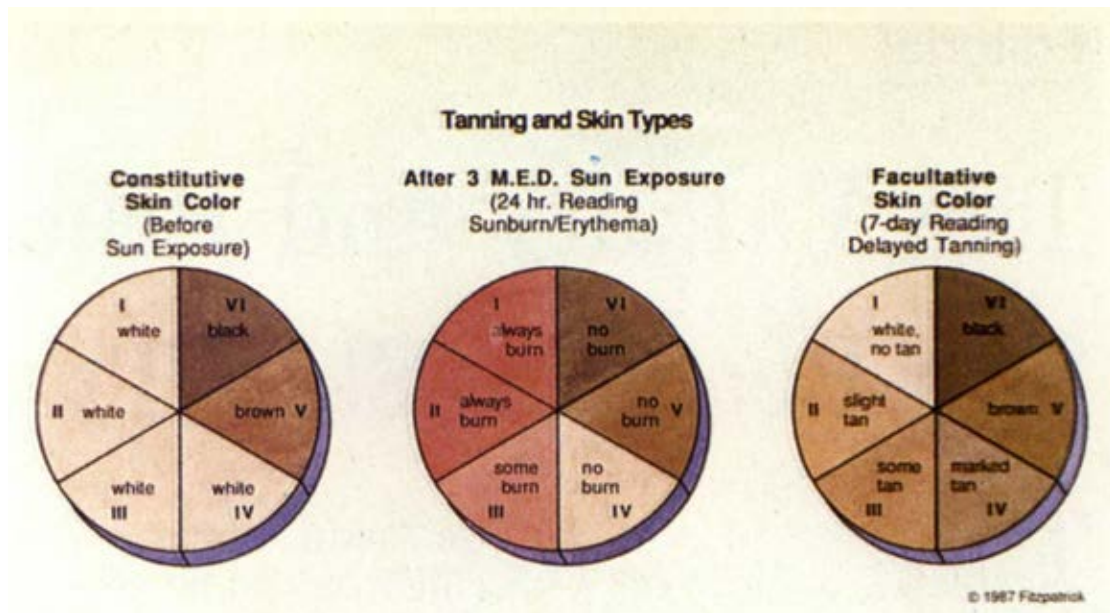


Figure 17 : Tanning and Skin Types
from the work of Fitzpatrick Thomas B. (Fitzpatrick, 1988)

Due to the determination of skin color in the system for styling apparels that matches with occasion wearing via e-commerce channel using machine learning, focusing for Thai skin color. So, we do not need the high accuracy of all skin color analysis. In the research, we use skin color classification of Von Luschan tiles and select only skin color in group V Asian (Jablonski & Chaplin, 2000), skin colors range from 13 – 24 in Von Luschan tiles, to be our area of study.

To make the model understand the skin color selected, we have to change the skin color from Von Luschan tiles to be the digital skin color in RPG type. The digital skin colors are numbered shown in figure 18.










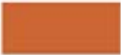


13		cc6666	19		ffcc99
14		cc6633	20		ffcc66
15		996633	21		ff9933
16		cc6633	22		ff9966
17		996633	23		cc6633
18		993333	24		cc6633

Figure 18 RPG code for Skin color.

Preference : (Jablonski & Chaplin, 2000), (Swiatoniowski et al., 2013)

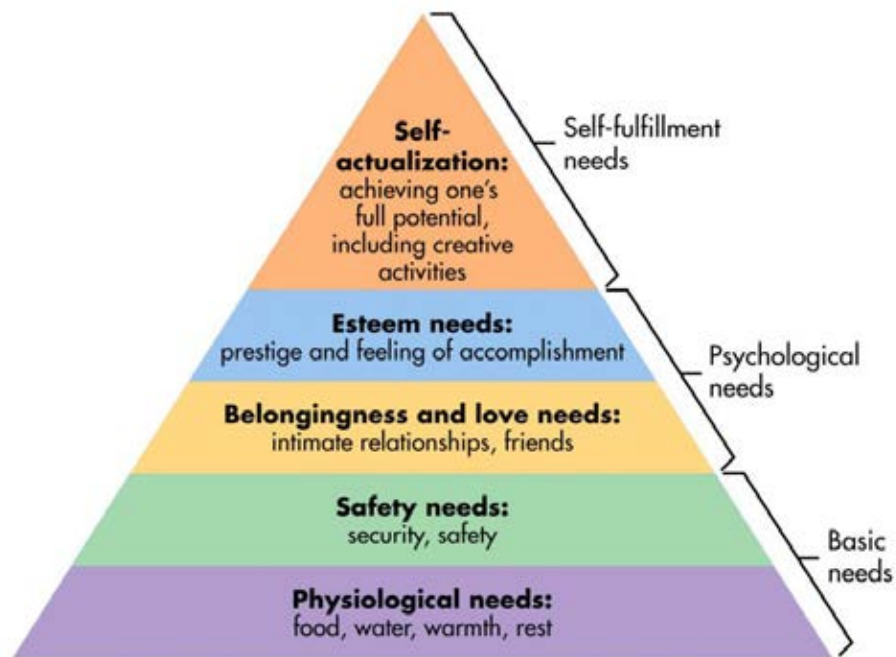
There is a limitation from changing color from real color to digital color. The above figure shown the duplicate color occurred. The skin color numbers 16, 17, 23, and 24 have to cut out from this research. So, the skin colors use in this study count only 8 skin colors.

2.4.3 Implicit need

Referring to Maslow's hierarchy of needs, when human's basic need is satisfied, we are looking forward to satisfy from a psychological need. The self-fulfillment need is required to be satisfied once all below hierarchy needs were satisfied shown in figure 19 (Aanstoos, 2018).



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*Figure 19 : Maslow's hierarchy of needs
from the work of Saul McLeod (McLeod, 2018).*

The word “satisfies” in this theory does not mean that a person has to fill something from their lacking. It means the fullness feeling of one person. So, it is different from person to person about feeling fullness depending on their past experience and perception. For an instant, within the same situation, one person might feel fullness, another might not.

Fashion is not a basic need like cloth. We need the cloth to cover our body. However, fashion is about representing oneself to another. So, it is about belonging and esteem needs, the psychological need.

For the sense of belonging, people tend to listen to what the other says, especially from the people in their society. As we are now in the digital age, we have friends both offline and online. Interestingly found that we are now making a decision to purchase apparels from the one, well known, in online society than the one nearby you in reality (Bashir, Lodhi, & Mahmood, 2017).

Not only belonging in the group, but people also want to be the ones who stand out of the group. Wearing the in-trend apparels, help them to be different and stand out from the other. The apparels has to match the occasion. It also has to show how oneself unique (Seo & Lang, 2018). In the result of getting attraction from the other.

2.5 Customer behavior

This study does not focus only to build the system, but we also study how to apply this research to the fashion e-commerce platform. We have to know the target customer who suits our system in order to apply the research. There are many ways to segment the target customers. Generation is one of the popular segmentation.

2.5.1 Generation

Generation is a segmented customer by age. The age range in each generation has their own perceived value and behavior. Each generation has its age and behavior by following

1. People born during 1883 – 1900 (Lost Generation)
World War I era. People born during this generation were lost.
2. People born during 1901 – 1924 (Greatest Generation)
Before the World War II era. In the recovery era. Recover from war, both of building and economic.
3. People born during 1925 – 1945 (Silent Generation)
World War II era. The changing era. The first time that a female has the right and ability to work outside. People born during this era have high loyalty.
4. People born during 1946 – 1964 (Baby Boomer)
Post World War II era. The fighting era. People born during this era have high cautions, high tolerate, and high conserve. They have to prepare for an unfortunate event to survive.

5. People born during 1965 – 1979 (Generation X)

The peaceful era. People born during this era starts to use more technology in daily life. They began to have their own and freedom thought.

6. People born during 1980 – 1997 (Generation Y)

The technology era. People born during this era, born along with technology. They tend to have high creativity, uniqueness. As the continual advance of information technology, they spend a lot of time online. They also have their own social society, convenience addicted. Their behavior change from offline shopping to online shopping.

7. People born during 1998 (Generation Z)

The automated era. People born during this era, born with advance technology that can provide basic accommodate in daily life. They have a high ability to adapt to new technology. They really want to be unique and different from the other.

After considering each generation, Generation Y, who born only from 1980 to 1997, is the best target for this system. This generation spends a lot of time online. They are used to purchase a product via the online channel. They also want to make themselves different from the other, within their society.

2.5.2 Decision making

Facebook, as the highest engage social media for Thai people, has an impact on apparel decision making. People on Facebook try the new style from their influencer and society. (Olajide, Folake, Oladele, Olabode, & Olayinka, 2018) But they are no more follow the suggestion from the page liked or page reviewed by friends. (Kawaf & Istanbuluoglu, 2019)



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The decision to purchase products online is influenced by influencers from Facebook and other channels (สุทัศน์วิบูลย์, 2018). Even though they are often purchased online, they still want someone to suggest a product that suits their lifestyle (Ladhari et al., 2019).

Fun (Sundström, Hjelm-Lidholm, & Radon, 2019), variety (Jain, Rakesh, Kamalun Nabi, & Chaturvedi, 2018), and customization are the key success to increase conversion.

2.5.3 Technology acceptance model

To commerce our fashion recommendation system, we have to understand how our technology will be accepted by the users.

The technology acceptance model (Fred, Richard, & Paul, 1989) is the one model that can help to understand. This model starts by asking people to try new technology. Then see whether they will continue to use, accepted, or discontinue.

The factor the effect the continues use of technology is the usefulness and how easy it is. The framework is shown in figure 20.

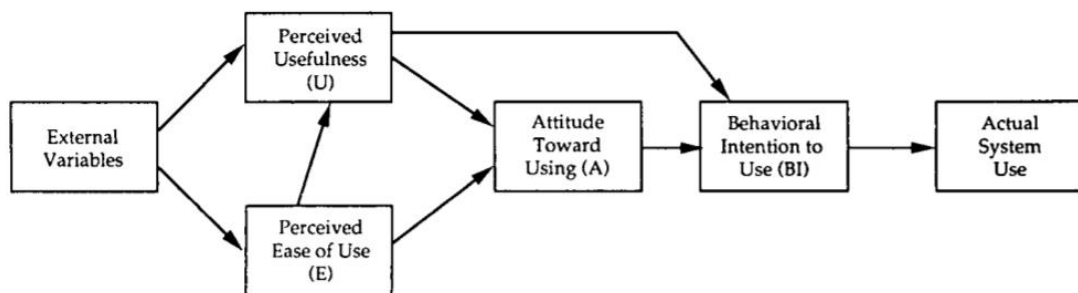


Figure 20 : Technology Acceptance Model (TAM).

Preference : (Fred et al., 1989)

As our fashion recommendation system is a back-end system, it is not changing the user interface at the front-end. That is the perceived ease of use (E)

from the user. The user might notice the changing in the product sequence. The platform that applied our system will present more preferred items to each user. From the decision making reviewed, platform users will be more interest more in the platform if that platform provides them the product they want (Ladhari et al., 2019) with the variation of them (Jain et al., 2018).

The perceived of usefulness (U) from the user toward our system is positive. The perceived of usefulness (U) from the platform that applied our fashion recommendation system will also have a positive effect. The user will have more interested in the platform which lead to a higher conversion rate. So, the platform owner will likely to continue using our fashion recommendation system.

In the emerging Asian market, there are in need to adopt the e-commerce platform to each culture (Ashraf, Narongsak, & Seigyoung, 2014). Our system is built within the Thai specific context. So, it is easy to adopt this system to e-commerce that has Thai people as their target customers.

Actual system use will depend on the continue to use our fashion recommendation system as their backend, as long as our system can provide the platform with a higher conversion rate.

CHAPTER 3 RESEARCH METHODOLOGY

In order to conduct the research, we set the methodology guild line as follows.

3.1 1st research process: Set hypothesis

H_0 : If there is a certain factor(s) to be the starting point for fashion's apparels styling via e-commerce, the target customer, Generation Y who work or live in Bangkok, will have more interest in the recommended apparels. And lead to an increase in the conversion rate of fashion e-commerce, which uses this model to style, recommend, their customer.

3.2 2nd research process: Research scope

As fashion is a big content with many details which seasonal changed, we have to scope our study to the following area.

1. To study Generation Y, age 22 – 39 years old, who work or live in Bangkok.
2. To study female fashion.
3. To study the autumn/winter 2019 fashion trend.
4. To study in order to apply for styling apparels via e-commerce channel.

3.3 3rd research process: Literature review

There are 3 main topics that have to review, which are recommendation system technique, fashion content, and psychological content.

There are many kinds of recommendation system, we are a focused study in the fashion recommendation system. Then, we have to understand the current technique used to find out any room left for us to study the research.

1. Fashion recommendation system

To overview the current fashion recommendation system approach. We have to understand its process, efficiency, and drawback to find the opportunity to create the new fashion recommendation system.

1.1. Machine learning

We have to understand the current machine learning algorithms using to build a recommendation system. Then, we will select the algorithm that suit our creating fashion recommendation system.

1.2. Precision-recall

We will use the precision-recall to test the result of our fashion recommendation system. The true positive is the purchasing apparels that be recommended by the system.

After review the fashion recommendation system, and machine learning, we found that there is still room for us to improve fashion recommendation system.

Then, we have to understand the fashion content using as the input for the system. The fashion is not just a cloth to wear, but the thing that fashionista wants to present themselves to another.

2. Fashion

The main content used in this study is fashion as we are going to build the fashion recommendation system. We have to understand the basic information about fashion in order to derive the factors that affect customer decision making. There are the following topics that need to review to get the first set of fashion factors using in the system.

2.1. Fashion element

Fashion is a combination of the elements, concept and inspiration. We have to know the main element(s) that will be selected to build our fashion recommendation system.

2.2. Style

There are many fashion styles to be considered. We can know how to extract style elements to use in our system. The style has to scope for the Thai female context.

2.3. Fashion trend

As fashion keeps changing each season, we have to study a specific fashion trend to be the starting point to get the factor(s). For this research, we study the Autumn/Winter 2019 fashion trend as a starting point.

Please note that in this research, we want to find out the main effected factor(s) that derived from fashion trend. After we have knowledge and method to get the main effected factor(s), we can change the factors detail suiting to the next fashion trend.

3. Psychology

Apparels purchased is not only a purchase want you like, but it also a purchasing of what you want the other to see you.

The color is an explicit factor that's easily understandable and effect to many people. We are studying it in 3 angles which are colors, colors and feelings, and skin colors.

We also need to understand how people satisfy their needs. In this research, we study Maslow's hierarchy of needs to understand and get the factor out of it.

4. Customer behavior

There are many ways to segment customers. In this study, we want a segmented customer who usually purchases apparels online, wants to be in trend, and want to be unique.



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One of the popular segmentations is segmented by Generation. We have to understand which segmentation is the best to be our target customer.

3.4 4th Framework and concept

This research aims to create an automatic recommendation system for serving apparel purchasing on e-commerce. To do that, we have to understand each customer preference. So, we start by gathering customer information. In this research, we focus on customer preference style, preference color, and body shape. All the information will be flow in our fashion recommendation system. Then, the system will recommend the apparel items related to each customer preference shown in figure 21.

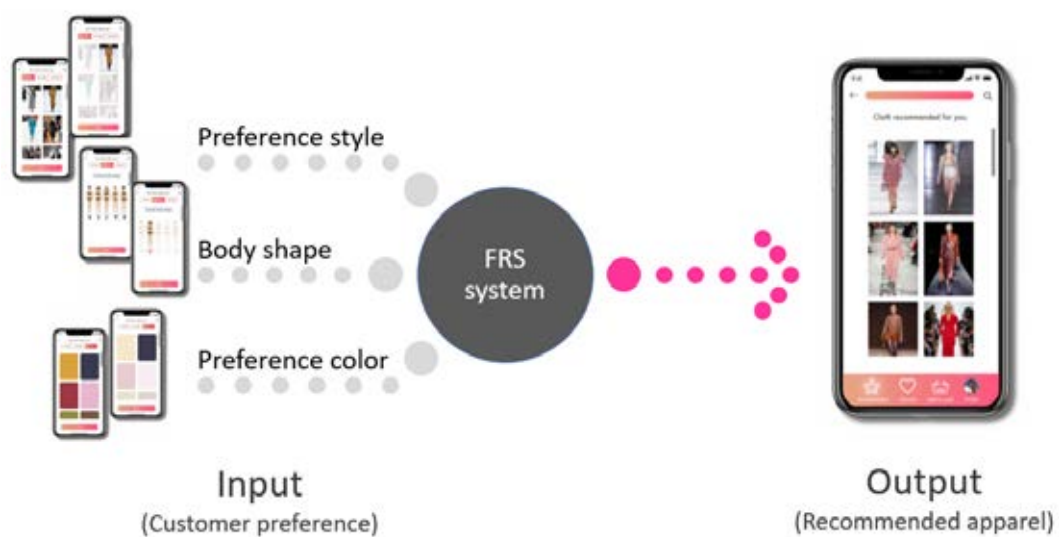


Figure 21: Framework

We use runway looks as customer preference style. Each image contains many details inside. Each detail is equal to one factor. When each image is clicked there are many details to consider. The figure 22 and figure 23 shows the detail of each after clicked.



Figure 22 : Extracted factors

Preference : ("Fall 2019 Ready-to-Wear," 2019)



Figure 23 : Selected preference

Preference : ("Fall 2019 Ready-to-Wear," 2019)

When there are multi-images was clicked, we can see the reference pattern for each of them as shown in figure 24 and figure 25.




Image name	Cloth items				Colors			
	Hoodie	Vest	Mini skirt	Roll-neck	White	Black	Brown	Green
Agne01	0	0	0	1	1	1	0	0
Giem12	0	0	0	0	0	0	0	0
Vivien05	1	0	0	0	1	1	0	0

Figure 24 : Multi-selected preference

Preference : ("Fall 2019 Ready-to-Wear," 2019)




Image name	Cloth items				Colors			
	Hoodie	Vest	Mini skirt	Roll-neck	White	Black	Brown	Green
Agne01	0	0	0	1	1	1	0	0
Giem12	0	0	0	0	0	0	0	0
Vivien05	1	0	0	0	1	1	0	0
Hermes1	0	0	0	1	0	0	1	0
Haider1	0	0	0	0	1	1	0	0

Figure 25 : Combine the multi-selected preference

Preference : ("Fall 2019 Ready-to-Wear," 2019)

We use the above pattern to find the image contains the most similar factors, shown in figure 26. Then, we will present those images as the apparel recommended from the system, shown in figure 27.



Image name	Cloth items				Colors			
	Hoodie	Vest	Mini skirt	Roll-neck	White	Black	Brown	Green
Agne01	0	0	0	1	1	1	0	0
Glem12	0	0	0	0	0	0	0	0
Vivien05	1	0	0	0	1	1	0	0
Hermes1	0	0	0	1	0	0	1	0
Haider1	0	0	0	0	1	1	0	0
Total score	1	0	0	2	3	3	1	0

Figure 26 : Scored input factors

Preference : ("Fall 2019 Ready-to-Wear," 2019)



Recommended

Image name	Cloth items				Colors			
	Hoodie	Vest	Mini skirt	Roll-neck	White	Black	Brown	Green
Altu2	0	1	0	1	1	1	0	0
Glem12	0	0	1	1	1	1	0	0
Vivien05	1	0	0	1	1	0	0	0
Hermes1	0	0	0	1	0	1	0	0

Figure 27 : Recommended apparel

Preference : ("Fall 2019 Ready-to-Wear," 2019)

3.5 5th research process: Find fashion Dataset

There are some fashion datasets available such as the Amazon fashion category dataset, and the DeepFashion dataset. Even though these 2 sources have the big set of the dataset, the data in these 2 data sets were out of date. The image in both the data set is not a fashionable apparels image neither. So, we have to find a website that can provide the A/W2019 data set. That website has to allow us to push all data to be our starting fashion data set in study. The following criteria for the selected image are considered;

1. Having to be in ready to wear collection.
2. Having mixed style of apparel.
3. Having A/W 2019 image available.

From the above criteria, we select <https://www.vogue.com> to as the experimental data set.

3.6 6th research process: Clean dataset

The dataset will select the only female image in A/W2019 ready to wear collection. The other image will be removed from the dataset.

We have to extract factors of each image. The data will be grouping to match the main factors confirmed by fashion specialists.

3.7 7th research process: Conduct qualitative research

Conduct qualitative research using purposive sampling. The selected sampling is a fashion specialist who has been working in the fashion industry for more than 10 years. They must have experience in influencing others by their styling.

1. Interview structure
 - 1.1. There is a fixed-alternative question to find the main factors that affect to fashion styling.
 - 1.2. There is also an open-ended question about the other factors that fashion specialist suggests to use in the model to make the model more accurate.

The ML algorithm will work better when there is enough data in the database. However, with a limitation of time, we have to focus on the main factors to start the research. So, the main finding that we want from the interview are the main factors and its' relevant. When we know how to start factor's finding process, we can use this knowledge to continue further study, if any, in the future.

To scope the interview, we want the fashion specialist to tell us about their opinion toward styling general Thai female who ages around 22 – 39 years old, who work or live in Bangkok. The main topic to extract the factors from fixed-alternative questionnaire interview are the following topics.

- I. Skin color
- II. Style
- III. Fashion trend, focusing on autumn/winter 2019
- IV. Occasion
- V. Fashion product items
- VI. Customer figure

2. Sampling

Purposive sampling is our sampling method. Interviewees are specialists in fashion styling who working in the fashion industry for more than 10 years. They also have to have experience influence other people about their styling. With this requirement, we are going to select 3 fashion specialists to interview.

3. Analyze interview data

We will transcript all interviews recorded. Then, we will analyze all the information by the Thematic analysis method. The analysis processes are as follows.

- 3.1. Transcription interview record
- 3.2. Grouping analyze information by Factor and Theme
- 3.3. Ask one of the fashion specialists to confirm the factor and theme whether (s)he agrees with the analyzed information or not
4. Present the analyzed data result
5. Summary of research result



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3.8 8th Factors to consider in the research

Cloth items

Top	Bottom	One piece
Tank	Jean	Mini dress
T-shirt	Pants	Maxi dress
Sweater & Knitting	Legging	Jumpsuit
Blouse	Shorts	
Roll-neck	Skirt	
Hoodie	Mini skirt	
Shirt		
Suit, Blazer & Jackets		
Vest		

Table 8 : Cloth items

Preference : ("Womenswear Product Mix," 2019)

Cloth color

Yellow, Orange, Red, Pink, Violet, Purple, Blue, Light blue, Turquoise, Green, Light green, Light brown, Brown, Black, Gray, and White

Body shape

Inverted Triangle, Lean column, Rectangle, Apple, Pear, Neat hour glass, and Full hour glass

Cloth occasion

Casual, Job interview, Formal, Company party, Cocktail party, Dinner party, Festival, Wedding, and Religious ceremony

Cloth style

Daddy, Hiphop, Skater, Grunge, Punk, Fetish, Goth, Steampunk, Japanese style tribe, Minimalist, Classic, Romantic, Sporty, Urban, Postmodern, Deconstructivist, and Antifashion

Skin color



Figure 28 : Reference skin color

3.9 9th research process: Build a fashion styling recommendation model

Use factor that gets from a qualitative research summary to build the fashion recommendation system.

3.10 10th research process: Test the hypothesis

Test the hypothesis by interactive quantitative questionnaire to the target group to test.

3.11 11st research process: Conduct quantitative research

We want to confirm the performance of our model. The quantitative research will be conducted to evaluate the performance of the proposed model. Our target customers for this research are females whose ages are around 16 – 39 years old and they must work or study in Bangkok.

This quantitative research is using purposive sampling, nonprobability sampling, to select sampling. There are 942,445 population counts as our target customers (Sytstems., 2018). We use the Taro Yamane method to calculate the amount of sampling.

$$n = \frac{N}{1 + Ne^2}$$

Where

n = the sample size

N = the population size

e = the acceptable sampling error

Which 95% confidence level, the sample size of this research is 399.83. So, we round the sample size up to 400.

We distribute a quantitative questionnaire online. There are 3 benefits to distribute questionnaires online.

1. Testing the system
2. Testing questionnaire objective
3. Testing the acceptance

The questionnaire has 3 main parts. In the first part, we are collecting the general information of interviewees. There are some untargeted interviewee's information gathering as we distribute questionnaires online. We use the general information of interviewees for screen targeted interviewees.

In the second part, we are asking each interviewee's preference. This part will generate the inputs flow to the system.

In the final part, we ask each interviewee to decide on each recommended apparel. Interviewees will have 3 choices on the recommendation's page either buy, uncertain, or not buy. There is also a blank block next to the choice of asking the responder to write down the reason. The apparel image shown on this page is the mixing of apparel recommended from the system and apparel randomly shown in the same portion.

We have to pull the responses from the system and filter to see whether there is a questionnaire as the amount we want.

3.12 12nd research process: Set research performance measurement

After getting the targeted questionnaire, only female samples with 22 – 39 years old are screened. Then, the system result is analyzed to see how well our fashion recommendation system performs and which factors mostly affect the decision of the respondents.

Then, we will find the factor(s) that help increase the recommendation accuracy. We screen the response that answers uncertain or not buy to the recommended apparel. Then, we analyze in detail which input factors that respond select will likely lead to uncertain or not buy.

3.13 13rd research process: Research summary

There are summarizing both qualitative research quantitative research.

3.14 14th research process: Further study

There are many further studies to enhance the capability of this model and make it a more precise fashion recommendation.

For instant

- Increase the input data

As fashion changes at all times, the inputs must be added or removed from the model to make it up to date.



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- Plugged-in with image processing system to automate labeling
 - Build a human-like interactive system
- To make visitors enjoy the interface.

CHAPTER 4 DATA ANALYSIS

There are 2 data analyses conduct for this research. First, qualitative research conduct to get the starting factors using in the fashion recommendation system. Second, quantitative research conduct to confirm the research objective.

4.1 Qualitative research

The qualitative research was conduct to find the main factor that influencer the decision making of a Thai fashion buyer. We start from review the literature about the factor that was used in the other fashion recommendation system. Then, we review the fashion-related factors and psychological-related factors.

After we get the starting factor, we create the fixed-alternative questionnaire and open-ended question. The questionnaire aims to confirm the factor selected from the literature review and gain the other factors that fashion specialists might suggest.

Cloth items, apparel color, and skin color are the factors that affect the decision making to purchase fashion items. They are also suggesting to add the body shape factor in the main factors using to create a fashion recommendation system. The fashion specialists give the opinion to each factor by following.

4.1.1 Cloth item

Thailand is in a tropical area. So the cloth item can be anything to mix and match. It can be the same cloth item as the previous season. But the textile used to create the fabric have to mix with wool or other material that make the cloth a little bit warmer.

“Even though there is a winter season, it is not that cold. Thai people can wear a tank top or t-shirt. They just select the one that has a little thicker fabric.”

- Fashion specialist 1

4.1.2 Autumn/Winter 2019 Color trend

The Autumn/Winter 2019 color trend is focusing on an orange color, light blue color, brown color, and black color. However, there might not completely apply to the Thai context. Thai people like to wear colorful cloth. When styling, there are in need of mixing of color trends and color preferred.

“Thai people like color. Even though there is a dark color tone in the trend, they still wear whatever color they like.”

-Fashion specialist 1

4.1.3 Style

The fashion specialists have a similar opinion about the Thai dress-up style. They said Thai people like Minimalist, Classic, Romantic, Sporty, Urban, and Postmodern.

Thai people do not have their style. They tend to wear as someone they like, especially influencer. Europeans and Americans have their style. They can mix and match the cloth items in their way. So, they can represent themselves in the new trendy look within their style.

The online influencers have a high effect on decision making to purchase new apparel. Thai people like to dress like the influencer that they followers. They even purchase the apparel recommended by influencer without really wearing that recommendation apparel.

“European people have their style. When the new season comes, they purchase the cloth items. Then they mix and match the cloth items to suit

their style. It is totally different from the Thai people. Thai people do not have their style. They purchase as recommended by an influencer or someone they follower.”

-Fashion specialist 2

4.1.4 Occasional wearing

Thai people like to wear a dress to a party. The party can be a causal party among friend, formal party for business, or a wedding celebration party. These kinds of the party have a direct effect on the need for purchasing new apparel. After they received the party invitation, they will find the new apparel according to the party theme.

The relationship between party owner and invitee also affects decision making. Thai people tend to purchase new apparel to go to their close friend party. But, they might consider renting apparel to someone party.

“In the part, Thai people purchase new apparel for an important day. However, they are now changing. They purchase the new apparel when there are in trend. They might consider purchasing new apparel to go to the party of their important people. Otherwise, they will rent the apparel.”

-Fashion specialist 3

4.1.5 Cloth color

There is a different opinion to choose cloth between fashion specialists from European and fashion specialists from Asian. Fashion specialist from European thinks the lighter skin color people have more limitation for them to choose cloth color. People with light skin color should wear cloth with shard color tones. People who have a little bit dark skin color can wear any cloth color tone, except a gray color tone.

However, fashion specialists from Asian think the opposite way. The whiter skin people have the more cloth color they can wear. But people who have darker skin color do not suit the cloth with a blue color tone and purple color tone.

The cloth with brown color tone is the only cloth color that fashion specialists from both European and Asian agree not to choose for people with dark skin color.

“Most of Thai people have a honey skin color. It is very beautiful. They can wear whatever they want. But the European people have a pale skin color. They do not suit the cloth with a light color tone. So they have less cloth color choice to choose.”

-Fashion specialist 2

“Thai people like very colorful cloth color. But it very contracts with their skin color. Only a few Thai people look good in that kind of cloth color.”

-Fashion specialist 1

4.1.6 Body shape

There is a recommendation from a fashion specialist. Besides the first 5 factors asked in the questionnaires, the body shape is the one interesting factor have to consider. The body shape in rectangle shape, apple shape, and pear shape are the shapes that difficult to styling. There is a need to have more careful suggestion apparel to the people with having those body shapes.

“The most important thing to styling someone is to really know that person. You have to understand them inside out. That means you have to know their preference, their behavior, their feeling, their mood, and their outlook.

If you really understand, you will be able to style that person in the best way they are.”

-Fashion specialist 3

4.2 Quantitative research

The quantitative research was conducted to confirm the recommendation's factor retrieved from qualitative research. This quantitative research was hosted online. We use convenience sampling to select the respondents. We sent the questionnaire URL to a female who is in our scope of work. Our research is focusing on Generation Y, age 22 – 39 years old, who work or live in Bangkok. The answer to the audience who answer the questionnaire but do not meet the criteria above will be removed.

We ask the responder to fill their personal information, prefer fashion style, body shape, and preferred color in the quantitative questionnaire. They have to fill all the questions then click submitted to get the recommended apparel.

There are 10 apparel images shown on the fashion recommendation page. Those 10 images are mixed with recommended fashion apparel and random apparel. This page asks responders to select whether to buy, not buy, and uncertain to answer.

4.2.1 Respondents personal information

The background of our respondents is as below.

Most of our responders' age is around 28-33 years old, shown in figure 29. They are monthly purchase fashion items online, shown in figure 30. The fashion article channel that they read is Instagram, Facebook Fanpage, and fashion website, shown in figure 31. They read a fashion article at least once a week, shown in figure 32.

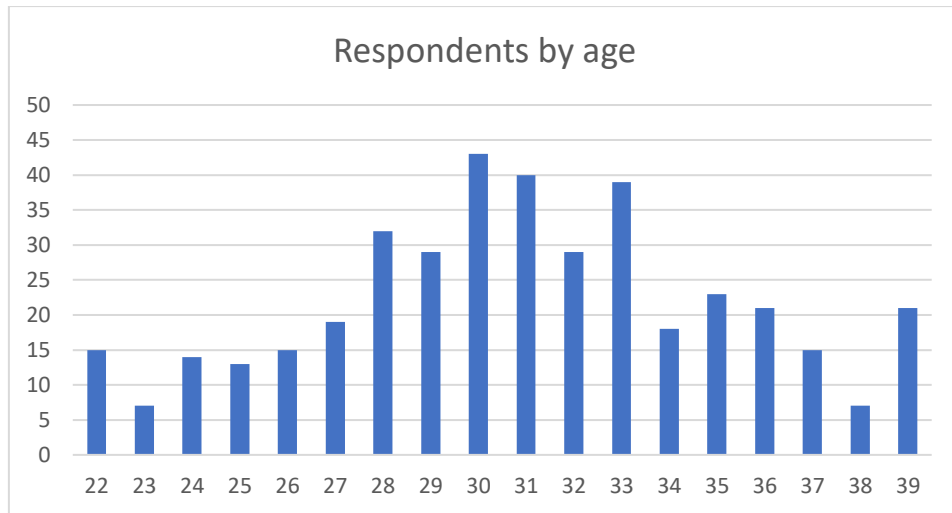


Figure 29 : Responder by age

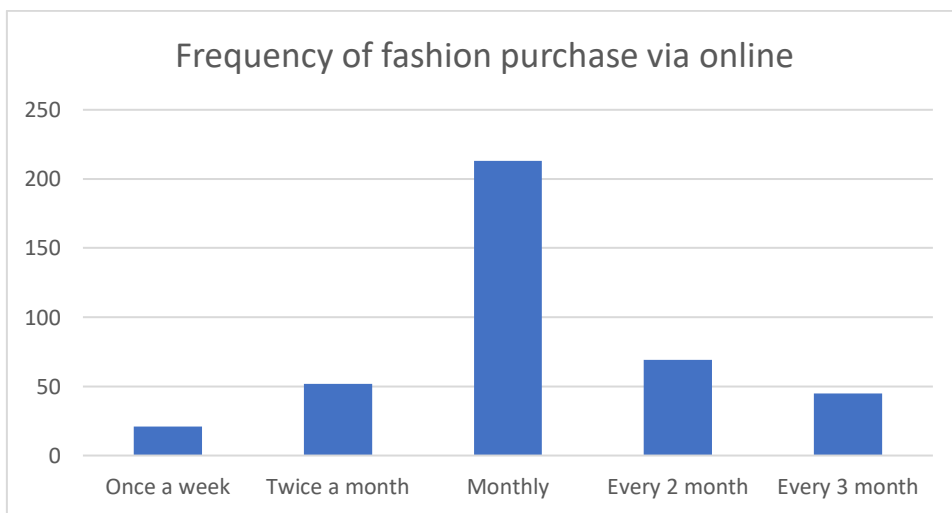


Figure 30 : Frequency of fashion purchase via online



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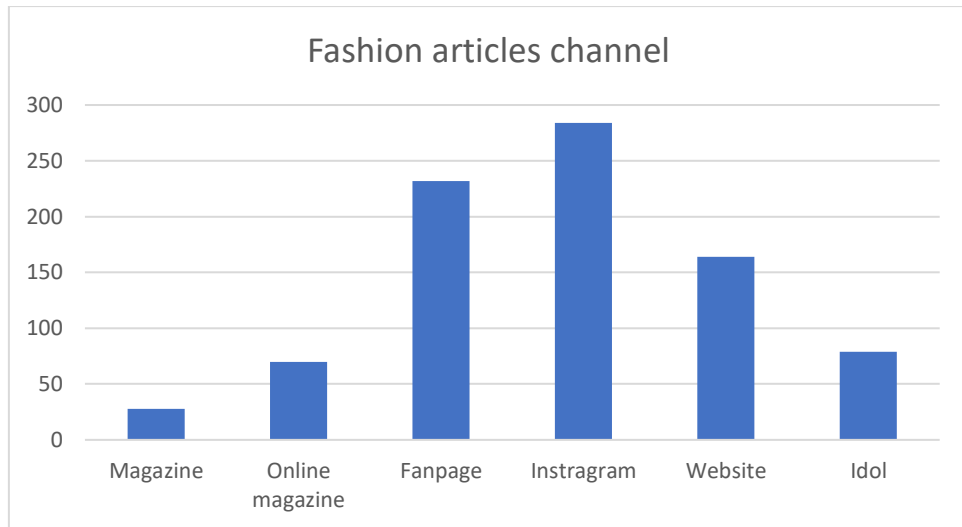


Figure 31 : Fashion articles channel

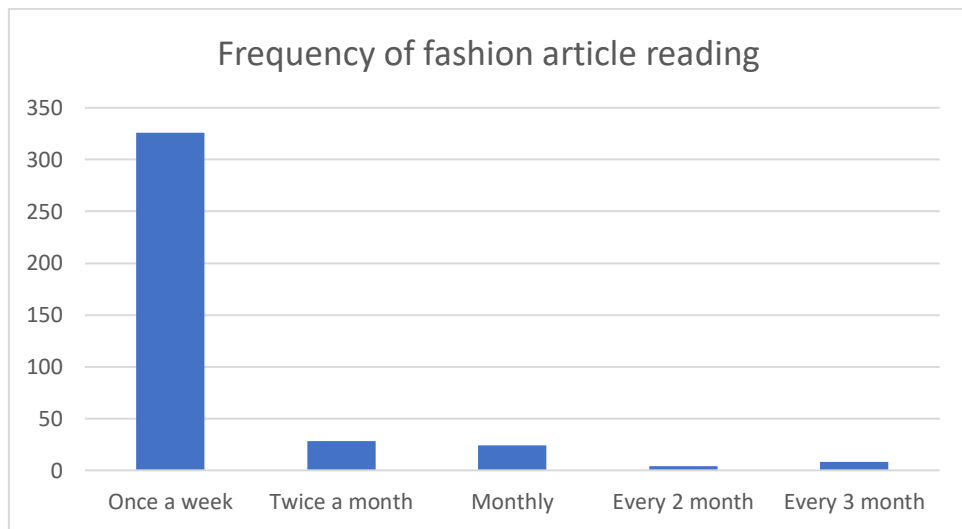


Figure 32 : Frequency of fashion article reading

4.2.2 Precision

We want to know the preciseness of our recommendation system. So, we use a precision model to test the result. The result is in table 9 and table 10.

The precision of recommended to buy

Buy	The similarity factor with customer preference (5 = The most similarity, 1 = The less similarity)				
	5	4	3	2	1
If; FP = uncertain + not buy	68%	64%	57%	50%	44%
If; FP = not buy	81%	76%	72%	66%	55%

Table 9 : The Precision of recommended to buy

The randomly recommended to buy

If; FP = uncertain + not buy	16%
If; FP = not buy	21%

Table 10 : The randomly recommended to buy

The recommended apparel items have about 4 times higher in conversion rate compared with the random apparel.

The quantitative research shows that the more similarity factor with customer preference performs better. The true positive of this research is buy. The false positive of this research are uncertain and not buy.

If consider false positive both uncertain and not buy, the result will be as follows. The highest precision is 68%. The least is 44%.

However, the precision rate will increase if we consider false positive only not buy. The highest precision will change to 81%. The least is now 55%.



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4.2.3 Improve precision rate

There is some factor in the apparel image that might not enough relevance image show in our fashion recommendation system. After removing this image, shown in table 11 and table 12, the precision rate will be increasing by 5%.

The precision of recommended to buy after removing images

	The similarity factor with customer preference (5 = The most similarity, 1 = The less similarity)				
	5	4	3	2	1
If; FP = uncertain + not buy	72%	69%	60%	51%	46%
If; FP = not buy	85%	80%	76%	68%	57%

Table 11 : The precision of recommended to buy after removing images.

The % change of number of respondents after removing images

	The similarity factor with customer preference (5 = The most similarity, 1 = The less similarity)				
	5	4	3	2	1
If; FP = uncertain + not buy	-17%	-15%	-17%	-19%	-19%
If; FP = not buy	-33%	-33%	-34%	-26%	-24%

Table 12 : The % change of number of respondents after removing images.

The removed apparel images are in figure 33.





Figure 33 : Removed apparel images

Preference : ("Fall 2019 Ready-to-Wear," 2019)

CHAPTER 5 PROTOTYPE FROM MODEL

The fashion recommendation system that developed in the research is the back-end which can apply to any platform. To apply the model, the developer of the platform has to connect to our API. The front-end can be both of website and application platform. The platform has to apply the tracking or labeling of fashion detail to generate the input factors, then send the recommendation, output, to each visitor.

The working process from input gathering to output presenting can be illustrated as below steps.

5.1 1st step: fashion preference selection

The system will present a random fashion style for each visitor. Then ask the visitor selects all the apparel that they like, shown in figure 34.

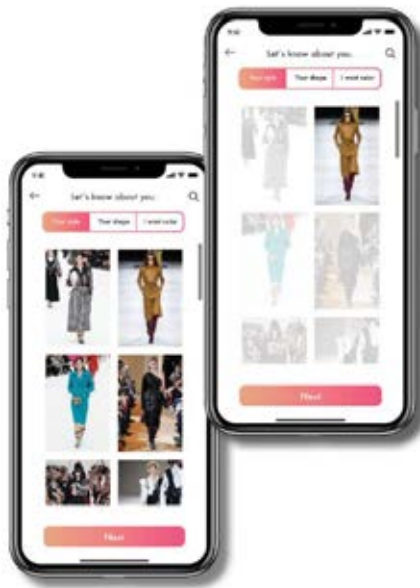


Figure 34 : 1st step: fashion preference selection

5.2 2nd step: personality preference selection

This step will ask the visitor to select the image that can represent their external personality, shown in figure 35.

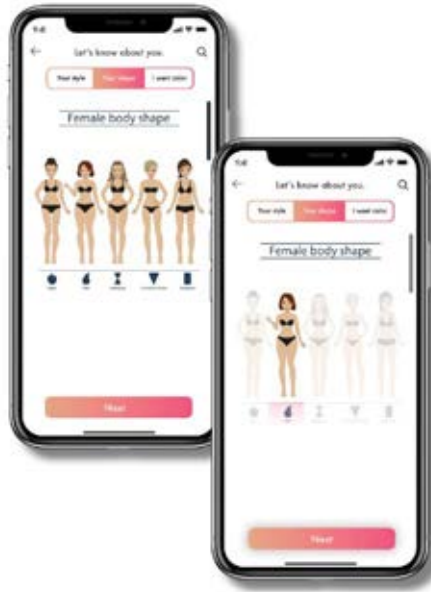


Figure 35 : 2nd step: personality preference selection

5.3 3rd step: color preference selection

This step will ask the preferred color of each visitor, shown in figure 36.



Figure 36 : 3rd step: color preference selection

After all the input, fashion, personality, and color were selected, the model will generate the apparel that matches with the visitor input the most, shown in figure 37.



Figure 37 : Apparels recommended from the model

CHAPTER 6 MARKET ASSESSMENT

The core technology of this thesis is a fashion recommendation system that builds from a machine learning technique. This system can be plugged into any fashion e-commerce back-end to be the recommendation system that helps suggest the best match for each customer from their preference. The objective of this fashion recommendation system is to increase the conversion rate from a visitor who visits the e-commerce website.

Before setting the target market or any business strategy, we have to understand the external and internal business environment. To scope down the assessment, we are focusing on the current Thailand situation.

6.1 PEST

PEST is one method to help understand the external environment in the industry, we are going to do business in.

6.1.1 Political

10 s-curve is one of the government strategies start from 2016. The digital industry is one of the new s-curve. Because of this strategy, there are many supports from the government department, both direct and indirect.

Direct government supports units are Digital Economy Promotion Agency, DEPA, and BOI. DEPA can help digital companies to get funding to start their own business. There are varies funds provided by DEPA. The amount of funding can be small as 10,000 THB up to 10 million THB. BOI is providing many benefits for a new startup company that matched their requirements. The digital industry is one of the industry that BOI support. The most interesting benefit is the 0% tax for the first 7 operating years.

Indirect is a digital-related project from National Electronics and Computer Technology Center, NECTEC, one agency of National Science and Technology Development Agency, NSTDA. NECTEC research the base technology that helps



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digital businesses reduce development time by purchasing the API's license to plug into the system.

6.1.2 Economic

There is an increase in the policy interest rate by 0.25% since 2018. So, the cost of the loan is increasing. However, there are the coming venture capital companies, VC, that interest to invest in the Thai digital company.

As the uncertain situation in America, Thai Bath is strong against US\$. And, the well-known fashion brand uses US\$ to exchange. So, It affects the price of imported fashion products.

6.1.3 Social

As a social change, there is a shift purchase from offline to online. E-commerce marketing in Thailand is continued growth. The volume of this market at US\$4,375M in 2019, shown in figure 38. ("eCommerce Thailand," 2019)

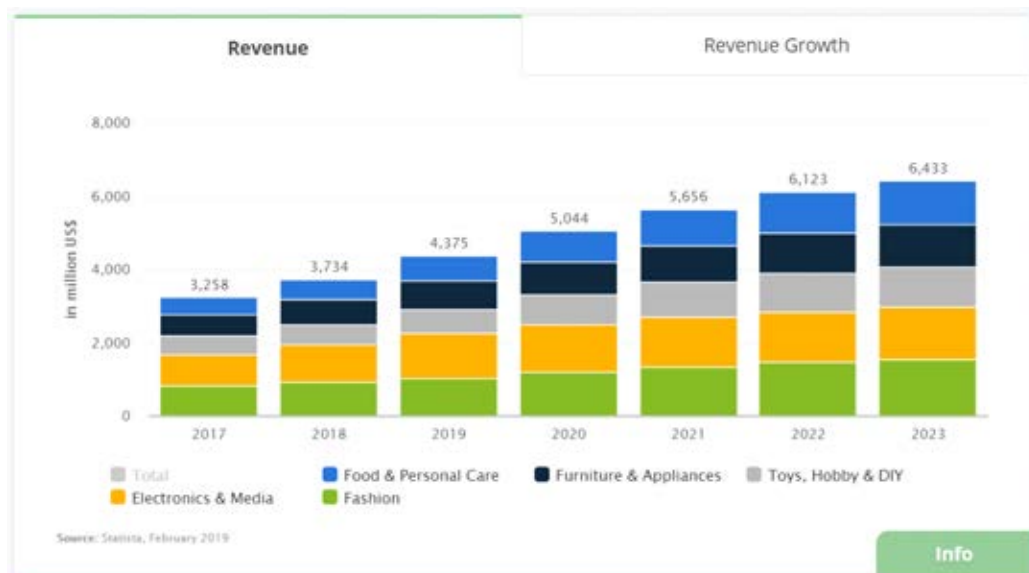


Figure 38 : E-commerce revenue

Preference : ("eCommerce Thailand," 2019)

The factors that make the shift is convenient, 24/7 purchase, and a variety of product. So, the people now used to search and purchase a product from online

People tend to believe online influencer who recommends the product to purchase. Otherwise, they will purchase upon the uniqueness of the product, that can help them to belong in some society. The thing that can help boost the fashion purchasing decision is price. Thai people are price sensitive to the following word Sales, half price, and free.

6.1.4 Technology

The lower cost of internet usage, faster internet infrastructure, and better performance of affordable mobile models are the technology factor that enhances the time spent online, shown in figure 39.

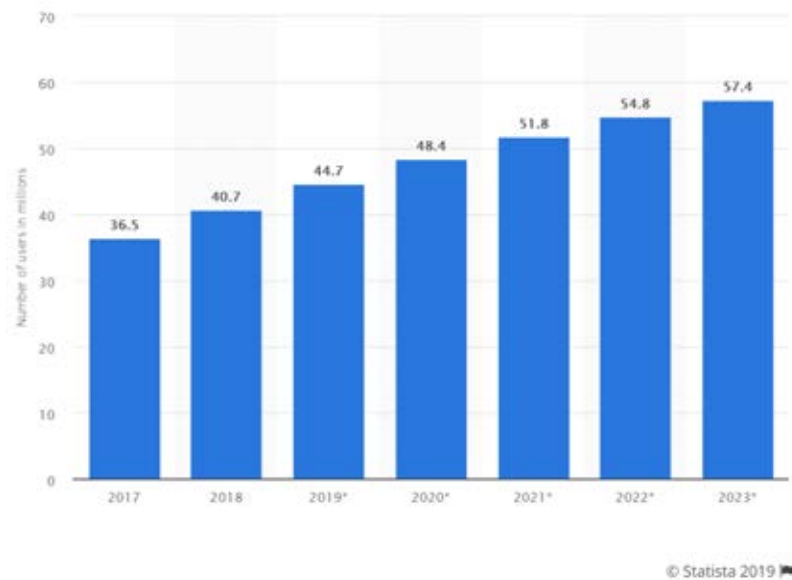


Figure 39 : Number of internet users in Thailand

Reference : ("Number of internet users in Thailand from 2017 to 2023 (in millions)," 2019)

The summary of PESTEL analysis is in table 13.

Political	<ul style="list-style-type: none"> - One of the new S-curve - BOI 0% tax for 7 years
Economic	<ul style="list-style-type: none"> - Increase in interest rate - Thai Baht strong against US\$
Social	<ul style="list-style-type: none"> - Increase in demand to be unique for each person - People used to search and shop online - People tend to purchase apparel that similar to their influencer - People tend to purchase for the price
Technology	<ul style="list-style-type: none"> - The lower cost of internet usage - Faster internet infrastructure - Better performance of affordable mobile model

Table 13 : PESTEL analysis

6.2 SWOT Analysis

After analyzing the external factors, PEST, we also have to understand the internal factors that will be our competitive advantage in the business. Together with the weakness, that we have to improve. Then, the opportunities and threats that will affect to operate a business.

6.2.1 Strengths

Our fashion recommendation system is a combination of the external and internal factors to build the recommendation. It is best for recommending the trendy product or the product that frequency change season to season. This system can recommend the visitor from the first time their visit website or application. The more the user uses the system, the more precise the system will be.

6.2.2 Weaknesses

Our system is working as a back-end. So, this model cannot run as a standalone e-commerce website or application.

There are many factors to consider before styling one person. The factors use in this model are focus only on some factor, the starting factors. There are other factors that can consider for further study.

6.2.3 Opportunities

There is the continued growth of E-commerce sales volume both in Thailand and worldwide. And the fashion category is one of the highest sales volumes via e-commerce. With better infrastructure such as payment gateway and logistic, it enhances the growth of Thai e-commerce.

As digital is one of the New S-curve, government policy, there are many supports from the government. From starting a company, learning-related management subject, consulting support and helping to exit in Market for Alternative Investment, MAI.

Thailand is one of the countries which venture capital would like to settle business in. So, we have a more alternative source of funds to run and expand the business to other countries, generally expend to VC's base country.

There is a continual improvement process as we use machine learning as the base technology. Once we have a new purchase behavior pattern, we can train that pattern in the system to make our system more precise in the recommendation.

We can also plug-in the image processing system for automatic collect the input from the image. When we have a big data, we can also structure the artificial intelligence, AI, to help segment the behavior and automatically set the new pattern in the system.

6.2.4 Threats

The big e-commerce businesses normally have their in-house developers. So the recommendation system will be created in-house rather than using a 3rd party

API recommendation system. And to plug the recommendation system, the customization needs for each client.

The summary of SWOT analysis is in table 14

Strengths	<ul style="list-style-type: none"> - A new fashion recommendation system that suits for recommending the trendy product - Combine both external and internal factors to help the recommendation system recommend more precise
Weaknesses	<ul style="list-style-type: none"> - There are still many fashion factors that do not include in the model
Opportunities	<ul style="list-style-type: none"> - The growth of e-commerce - High sales volume of fashion via e-commerce - Many supports from government - Ability to be funded by VC - Continual improvement model - Plug-in the image processing system to extract more input data
Treats	<ul style="list-style-type: none"> - The recommendation system will be created in-house rather than using a 3rd party API recommendation system - The customization needs for each client

Table 14 : SWOT Analysis

6.3 Competitive Analysis (5 Forces)

6.3.1 The threat of new entrants

The threat of new entrants is low. When a customer selects any 3rd party recommendation system to plug-in in their system, there is a high switching cost to another system by another company. With the advance of ML and AI, it is easier to build a new fashion recommendation system, but there is a need to understand the factors that really affect to styling fashion apparel.

6.3.2 The bargaining power of suppliers

The bargaining power of suppliers is medium. There is a high demand for ML and AI specialists. But, a number of those specialists is low. They have many companies wanting to hire them. However, the suppliers of hardware are many. We can choose anyone that match with our requirement with the lower cost.

6.3.3 The bargaining power of customers

The bargaining power of the customer is medium. There is few companies provide 3rd party fashion, specific, recommendation system. However, the number of e-commerce platforms that big enough to concern about this system is low.

6.3.4 The threat of substitutes

The threat of substitutes is low. The long-term using our model, the more precise of the fashion recommendation system will be. When a client gets a better result from our system, it is hard to switch to use another recommendation provided by another company.

6.3.5 Competitive rivalry

The competitive rivalry is high. There are a few 3rd party fashion recommendation system competes in the market. However, the big e-commerce platforms usually have their in-house developers. That makes the 3rd party system hard to sales its solution to the e-commerce platform.



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CHAPTER 7 BUSINESS PLAN

7.1 Executive summary

Our service is the fashion recommendation system which ready to plug-in to any fashion e-commerce platform. The expected result of this service is to increase the conversion rate from visitors. As the rapid growth of fashion e-commerce platform, this system will help the company who want to transfer their traditional shop to digital can provide that stylist looks like when their customer visits their website.

The target market is medium size fashion e-commerce platform. The small e-commerce platform might not interest to spend the setup fee. The big platform normally has its in-house developers. This system is a software as a service that every company size can require. The website is the main channel to connect to the customers. The customer(s) can contact to our customer service 24/7 via online chat or email.

The company has to have fast adaptation, cost-effective and continual improvement. All employees have to be a team player. They also have to have the ability to work cross-function to create a new project.

The setup and short-term fund come from the owner to create the MVP to validate the market. The long-term fund can come from VC or government grant funds, both in the country, Thailand and outside the countries. The estimated break-even period for this project is 2 years and 4 months. And the payback period is 2 years and 10 months.

7.2 Industry information

The businesses want to have a presence online because of the rapid growth, year over year, of the e-commerce business. So, they start to create the official website and promote it on both online and offline. The thing is, every company



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thinks the same. Then, the acquisition cost continues to increase with the lesser interesting from their potential customer, due to the overload of online advertising.

The need for on-site optimization is needed to provide the thing that the visitor might want. The tool to optimize the on-site is a call recommendation system. The recommendation system is one of the marketing tools in the e-commerce industry to help increase the conversion rate in a specific website or application.

However, to create the recommendation system is required to have a software developer who understands how to build machine learning. Many of the medium size e-commerce is not able to afford the in-house developers' cost.

So, we are in the right time to present our fashion recommendation system as a 3rd party API service that e-commerce platform can plug-in easily in their back-end system.

7.3 Vision

Create an online personal stylist system who is always your customer best friend.

7.4 Mission

- Continue to learn the customer behavior during shopping on online to recommend the thing(s) they want.
- Continue increases the conversion rate for each client.
- Be the partner with medium to the large size fashion e-commerce platform.

7.5 Business objective

- Generate the sales volume via the recommended product at least 100M THB at the end of 2020.
- Increase the precision of at least 10% at the end of 2020.

7.6 Company structure

As a new company, the company structure is a flat organization structure to suit for adaptation to any situation changed. We also decentralized the authority to

enhance the faster response rate. The figure 40 shows the direct report from each department.

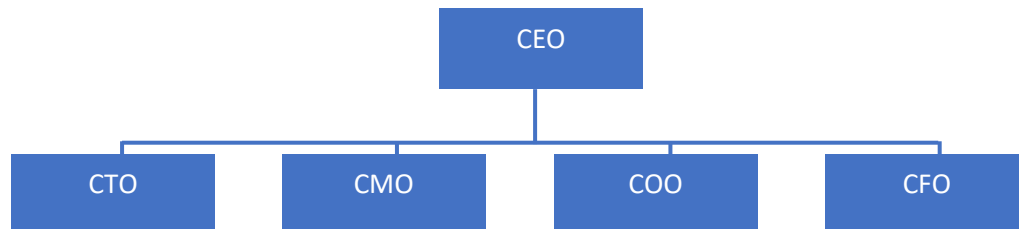


Figure 40 : Company structure

7.7 Corporate strategy

We use the growth strategy to start our business. We have to launch our services in the market. Then, see whether vertical or horizontal growth will suit for our growth strategy.

The horizontal growth strategy is suited to be a partner with other online marketing tools. There are 2 ways to use vertical growth. First, forward integration is to create our own front-end platform. Or, backward integration is to create a software house that specializes in machine learning.

7.8 Business strategy

We have only 1 SBU. The business strategy for this SBU is a differentiation focus, shown in figure 41. Our target client is a medium-sized fashion e-commerce platform. We have to customize our recommendation system according to the client's customers.

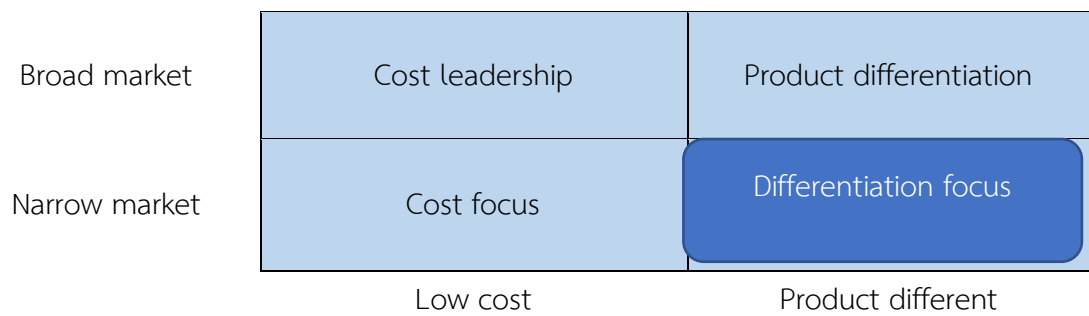


Figure 41 : Porter's Generic Strategy

7.9 Key success factor

1. The increase in conversion rate
2. The sales volume gets from each e-commerce plugged-in the recommendation system
3. The long-term relationship with clients

7.10 Operational strategy

To successfully launch a fashion recommendation system service, we have to have well coordinate and adoptive teamwork. The strategy of each department is as follows.

7.10.1 Marketing strategy

7.10.1.1 Competitors analysis

There are some recommendation system services available namely Prevision.io, yuspify.com, repidminer.com, and turi.com. Our competitors are from Europe and the USA. There are provide many services regarding data science-related.

7.10.1.1.1 Prevision

Prevision is a data scientist service platform. They provide many services related to the use of data. The main service is an automated platform via API. It helps the client reduce the data processing process. The input is client data. After

Prevision gets the data, they will learn client data, analysis for the best model used, and show the output, the details explanations of input data, in the Prevision dashboard.

The result of their data services is Customer Churn Rate Prediction, Credit Scoring, Predictive Maintenance, Recommender System, Sales Forecasting, and Supply Chain Optimization, shown in figure 42.

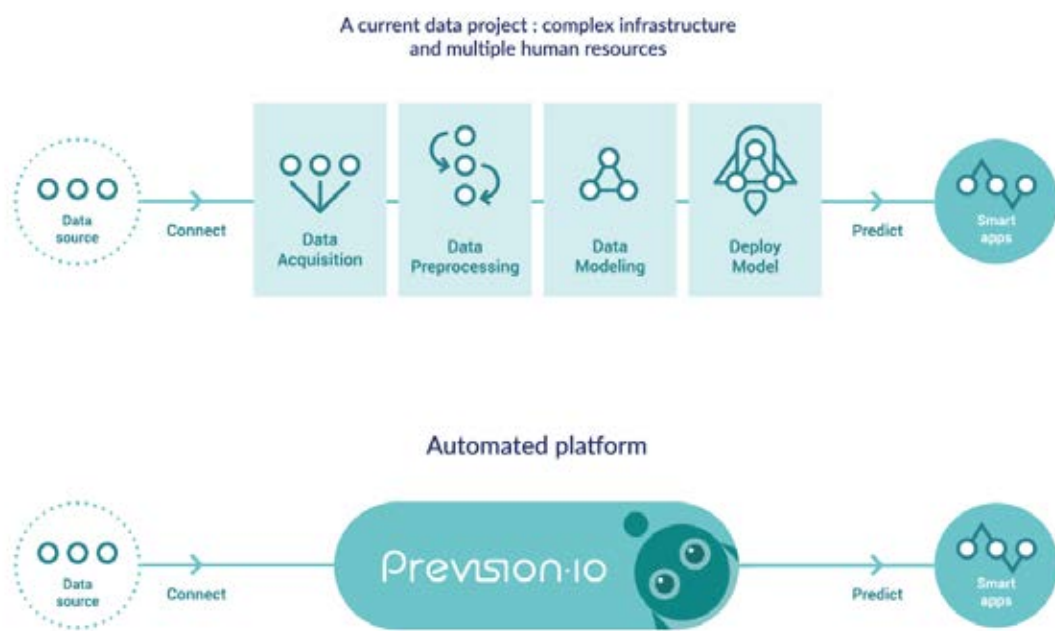


Figure 42 : Prevision Process

Preference : ("Build predictive model in a minutes," 2019)

Prevision charge client by project base. The client has to send require to set an appointment with Prevision customer service. Then they will send the quotation back to the client after getting all requirement need.

The industry that the specialist is Banking, Energy, Healthcare, Retail, Media, and Mobility.

7.10.1.1.2 Yuspify

Yuspify specializes in the recommendation system. They claim to the client that they will have higher engagement, higher sales volume, and higher conversion rates after using their recommendation system.

The starting fee is \$29 per month. Then, there is a commission cost add if there are any products or services purchased from the recommendation.

Yuspify recommendation system can be plugged-in only for an e-commerce website that use CMS to develop. However, there is a customize recommendation system provided.

7.10.1.1.3 RapidMiner

RapidMiner help client understands their customer more by using the data. The client has to input their customer information in the Repidminer software. The software can provide these following details Churn Prevention, Customer Life Time Value, Customer Segmentation, Demand Forecasting, Fraud Detection, Next Best Action, Price Optimization, Predictive Maintenance, Product Propensity, Quality Assurance, Risk Management, Text Mining, and Up- and Cross-Selling. There has experience working for many industries without the fashion industry. Not only software, but RapidMiner also provides production and hardware.

Price is depending on the service and quantity of the service used. The service annually charges.

7.10.1.1.4 Turi

Turi is a support learner who wants to learn machine learning. They are a partner with the University of Washington to create a course on coursera. The code is free for students and practitioners. It provides starter source code and server, within AWS free tier services to learn, shown in figure 43.

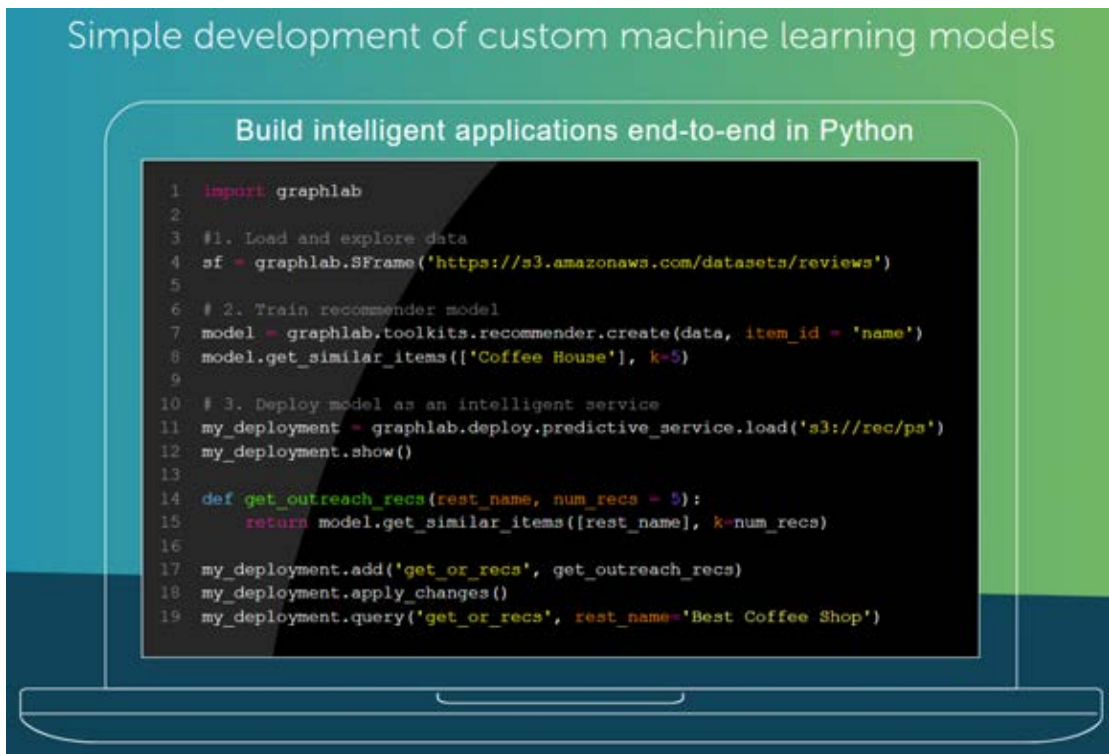


Figure 43 : Turi Code

Preference : ("Simple development of custom machine learning models," 2019)



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The summarize of each competitors service is in table 15.






					
Web site	This research	https://prevision.io/home/en	https://www.yuspify.com/	https://rapidminer.com/	https://turi.com/
Core business	Recommendation system	Data science	Recommendation system	Data science	Machine learning
Region expert	South East Asia	European	European	USA	USA
Type of services	SaaS with any type of platform	SaaS with any type of platform	CRM plugged-in	Customize recommendation software	For a start the recommendation research
The technique need to apply	Little	Little	Little	Medium	High
Cost	Commission base	Project base	Commission base	Project base	No for research, Project base for business
API	✓	✓	✓	✓	✓

Table 15 : Competitors analysis

7.10.1.2 Segmentation

There are 2 main segments of our fashion recommendation system.

The first segment is the e-commerce company. Within e-commerce, we are focused on the fashion industry. The fashion category in e-commerce is including beauty products. The fashion & beauty category in e-commerce was estimated to reach \$703.5M in 2018. This category is range in the 3rd in terms of sales volume and the 1st in terms of sales growth, shown in figure 44.

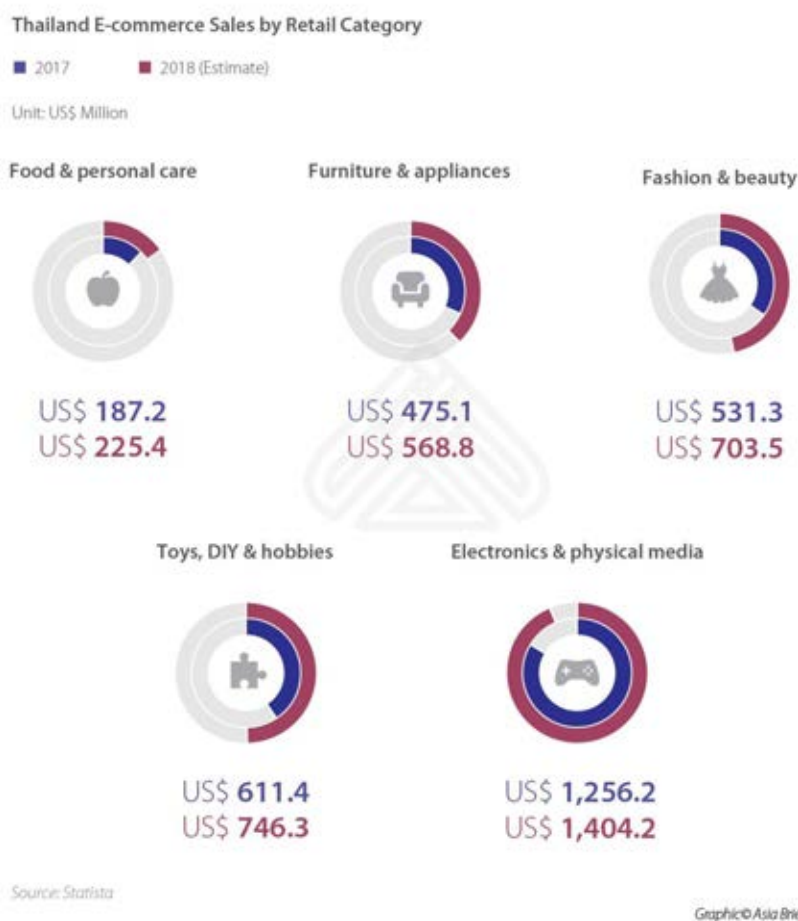


Figure 44 : Thailand E-commerce Sales by Retail Category

Reference : (Rastogi, 2019)

The second segment is an end-user. The advantage of applying this system to the end-user is the higher margin. However, to apply to the end-user, we have to build our e-commerce platform that has a cost both time and money.

7.10.1.3 Target

We are going to launch our fashion recommendation system as the 3rd party API software as a service. Our target is a fashion e-commerce platform that wants to have a recommendation system to help to style their customers and do not want to develop this system in-house.

7.10.1.4 Positioning

There is a few 3rd party recommendation system that provides software as a service, available. To use the service, some service providers only the framework and require developers to setup, namely <https://turi.com>, <https://rapidminer.com>. Those 2 recommendation system providers are not included in our direct competitor as our target does not want to have an in-house developer.

Other recommendation systems are a broad recommendation in retail, finance, and etc., So, our system has the unique in terms of industry focus using pay per usage revenue model, shown in figure 45.

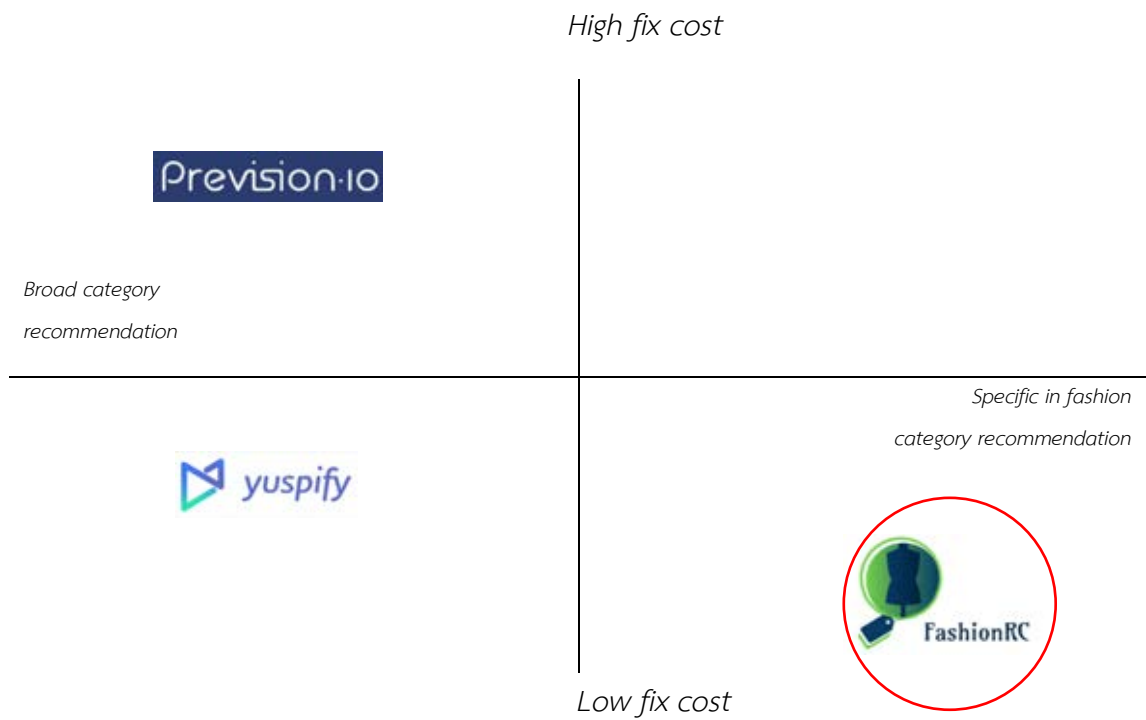


Figure 45 : Positioning

7.10.1.5 7P's

Our system is service, to do the marketing mix the 7p's is needed.

7.10.1.5.1 Product

The service is the 3rd party API of the fashion recommendation system for fashion e-commerce, which has Thai females, age 16-39 as a target customer. It is a website platform that opens 24/7 for contact with our customer support. A system is a software as a service that every e-commerce can plugged-in to their back-end.

7.10.1.5.2 Price

Price is separate into set up cost, software customization cost, and cost per purchase.

The setup cost and software customizing cost depends on the scope of work each client wants to apply to their system. This cost also includes the maintenance cost and further insight research about their customers to use as a new factor(s) to their recommendation system.

The price is the cost per purchasing of products recommended. We will charge 3% of the value that their customer(s) purchases the product that is recommended by our system.

7.10.1.5.3 Place

The main contact for our system is a website platform. So the potential customer who interested in our service can connect to us 24/7.

7.10.1.5.4 Promotion

As our channel is on online, the promotion will also focus on the online channel. We have to make sure that our website will be on the first page in most of the popular search engine websites using SEO and SEM techniques.

SEO is ideally marketing tools for promoting our services. There are some keywords that have the potential to promote our system such as recommendation system, fashion recommendation system, increase conversion. However, SEO takes time to see the result. We have to use SEM in order to build the website traffic volume.

We have to use the SEM technique during the launching period. SEM makes our website hold in the top position. There is a high potential to gain awareness from a potential customer who searches for the recommendation system service-related keywords. After getting the volume from SEM, our SEO technique is gradually working. When SEO work, we can pause the SEM.

We have to build the traffic volume from the website article and in the meta tracks. There are in need of a coordinate between developer, copywriter, and SEO specialist to plan keywords, set the keywords in the tracking system, and schedule the content.

We also have to PR our system in the tech and retails-related website. The PR type can be in the advertorial style, review style, or recommendation style. There

are 2 benefits in doing the PR campaign. First, we will gain trustworthiness from the reader. Second, it will help enhance our website rating.

7.10.1.5.5 People

Our staff has to be well trained. They can provide the best solution for our clients, especially for the groups of employees who have direct contact with clients. We will train our staff to help the client virtually via chat, call, and conference. For the current customer, there will be a monthly meeting to see the result and suggest new factors that might help to improve our client conversion.

7.10.1.5.6 Physical Evidence

The well-structured website with a professional theme.

7.10.1.5.7 Process

We have the guild line for each department that has to contact potential customers and customers.

When potential customer contact or require to contact, there is a checklist that customer support will have to check to know the customer. Then, the customer support makes their profile before sending the information to another department that can provide more information.

To continue to contact the same potential customer, the staff have to read and understand their needs before calling out. There will be no asking the same question, except to confirm the information. The same process will also be applied to our current customer.

Our current customer will have an account manager who the client can ask for help. And each account manager has to build a strong relationship with the client to provide the best services to them.



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7.10.1.6 Customer analysis

7.10.1.6.1 Who

Our target customer is the fashion e-commerce platform. The e-commerce platform includes both the official website and e-marketplace platform. As, most of the e-marketplace platform service, have their in-house developers. We are going to focus on the official fashion e-commerce website that has the mixing in style and variety of cloth items such as Zara, H&M, Mango, and Uniqlo.

7.10.1.6.2 What

The fashion recommendation system provides a 3rd party API plugged-in for the fashion e-commerce platform. The client can plug our service to their back-end with some modification. After plugged, the product list in front-end will change according to each customer preference and brand setting trend.

7.10.1.6.3 When

The service can require to use at any time via the website.

7.10.1.6.4 Where

The potential customer can connect us 24/7 via the website.

7.10.1.6.5 Why

The cost of online acquiring continues to increase. The conversion rate of an e-commerce platform has to increase in order to cover the acquisition cost. The recommendation system is an onsite optimization that helps suggest the product related to customer preference the most. However, it takes time and needs a specialist to build and implement their own recommendation system. There are in need of a budget to start. Instead of building their own, they find the 3rd party that has the knowledge to help create their recommendation system.

7.10.1.6.6 How

They can contact us online to see how our system can help them to increase the conversion rate. After confirming brief and negotiation to apply this system, our development team will customize recommendations best suited for them.

7.10.2 Production strategy

We have to aware and prepare for the rapid change in technology. We also have to continue research for the input factors that will match with many client's customer's style and taste.

We have to keep our product stand out for the client in terms of speed and flexibility. The Agile Methodology is applying to plan the development process. This method focuses on the result of each process. The development process will be separated into a minimum viable product (MVP). After finish develops each MVP, it will be validated by the client. If there is any change, we will discuss and negotiate for the best fit.

7.10.3 Operation strategy

All the departments have to coordinate with each other to have the overall information that can help improve both individual department and company performance.

We have to manage the operation department to keep our system always online. The system will be monitoring and maintenance 24 hours every day by experience computer system engineering. They will coordinate with the other department in concern when there is any problem that occurs in the system. They also the main person who received the system's problem.

We have to manage a long-term relationship with clients. The customer relationship staff response to keep contact with current clients together with the potential clients. They have to understand the client's target customer. So, they can

suggest and gathering the insight information back to computer system engineering to improve the system.

Even though our system is open 24/7, our client support still works in a working hour. The chat and email system will provide for the client(s) who want to content us. There will be an automatic response to each inquiry to notify the client that our client support will be response within 24 hours. To improve the response rate, the chatbot will be developed to answer the high-frequency question.

We will conduct the Plan Do Check Act (PDCA) process together with the Lean Methodology to operate our software. The software will develop only the core to test with the real market. We have to do it fast to get real feedback from the client. After getting the feedback, we will adjust the development process according to it.

There is a training session provide for each department to improve their skill both soft skill and technical skill.

7.10.4 Human resource strategy

7.10.4.1 Workplace planning

The company has to start small and gradually increase employees. We will hire full-time employees to fill the requirements to operate the core business. The other position will hire part-time employees. The core business position of employee need is by following.

Full-time

- Software developer (Machine learning specialist)
- Data science
- Sales
- Marketing
- Business developer

- Stylist
- Customer service
- Admin
- Accountant
- Financial

Part-time

- Graphic
- Copy writer
- Tester
- Marketing research

7.10.4.2 Recruitment

To get the best employees, we have to have a recruitment plan and employee criteria for each position.

Criteria for full-time employment

- Strong passion as what you are doing
- Open-minded
- Adapt to a new thing
- Live long learning
- Be professional in your working area

Criteria for part-time employment

- Professional in the working area
- On-time
- Polite and well communicate
- Accept the request to change

7.10.4.2.1 Recruitment plan

We will employ 9 full-time employees for the first year. We will hire more employees according to company growth. We are plan to recruit the full-time employees as table 16.

Month	Position	Main responsibility	Amount	Salary
1	Software engineer	Develop back-end system	2	25K
	UXUI designer	Develop front-end, web platform	1	25K
4	Marketing	Market the system online	1	20K
	Graphic	Create graphic for marketing purpose	1	20K
5	Partnership	Build the relationship with potential customer	1	25K
7	Customer relationship	Content and response with potential client inquiry	1	20K
9	Software engineer	Custom input factor for each client	1	25K
16	Software engineer	Custom input factor for each client	1	25K
	Marketing	PR and Event	2	20K
	Graphic	Create graphic for marketing purpose	2	20K
	Partnership	Build the relationship with potential customer	1	25K
	Customer relationship	Content and response with potential client inquiry	1	20K
24	Partnership	Build the relationship with potential customer	1	25K

Table 16 : Recruitment plan

We will continue to growth company year over year. There is at least 1 additional employee for each department every 6 months to ensure we have enough people to run the operation.

However, the recruitment plan can be changed depending on the company's situation.

7.10.4.3 Welfare & Employee Relation

We provide all the basic welfare as social security, health insurance, traveling expenses (for sales position), annual holiday leave with paid, company outing, and annual bonus (if any).

As the new startup company, the basic salary and benefit might not attractive enough to get and keep a high-quality candidate. So, there is the other benefit that can offer to catch the attention. The one tool that we will use is an employee stock option pool (ESOP).

We will offer the employee stock option pool to the best match employee who can help drive the company to the next step. That employee who received the option has to work with us within some period of time. Then they will have an option to buy company stock in a specific condition.

7.10.5 Financial strategy

In the financial part, there is a need to know how the company will be received the fund and how to spend those funds efficiently.

7.10.5.1 Source of funds

The first source of funds will come from the owner, their friends, and family. As a tech-startup company, there is some government's grant fund available. This model can be classified in the digital industry. This industry is one of the new s-curve industries. So, there are many further supporting funds from the government.

Another way to get funding is from debt or equity. Even though there are amazing products or services, to get the debt fund for the launching period is very hard. So, we have to expand the connection to find the matching VC in order to get the fund in the exchange of the company equity.

We have to plan the fundraising period to match the use of the fund period need as each source of the fund has its own length of approved time. To smoothly operate the company, we have to match short term funds with short term expense, as well as the long term one.

7.10.5.2 Use of funds

The main use of funds in the early stage is the employee's salary, especially the technical team. After minimal valuation product complete, the marketing spend is continuing to grow to gain customer and expand the market.

7.10.5.3 Financial plan

There is a 5 years growth projection for this software. The average estimated month on month growth of the 1st, 2nd, 3rd, 4th, and 5th year is 45%, 15%, 15%, 10%, and 10%.

To reach this projected growth, we have to have 5.15M THB as our starting cash flow. There is only a development cost for the first 6 months. We will start to do marketing our service 1 month before the soft launch.

This software has an estimated breakeven period in 2 years and 4 months and a playback period in 2 years and 10 months. In the 5th years, there will be a 62.4M THB profit for this software. The details show as below.

The financial assumptions show as below.

- 1 partnership can bring 1 new client per month for the first year. The partnership will bring new clients per month for an additional year.
- There is a 6 months contract.

- Retention rate is 90% for company.
- The average revenue per month generated from the recommendation system is 100K for the 1st year, with the growth rate of 33% for the 2nd year, and 5% for each additional year.
- %commission for the first year is 3%, then 5%, 7% and 10% for the following year.

The income statement shown as table 17.

Income statement					
	2019	2020	2021	2022	2023
Revenue					
Revenue from partnership commission	-	171,000	4,095,000	21,504,000	71,450,000
Revenue	-	171,000	4,095,000	21,504,000	71,450,000
Expense					
Full time salary	250,000	1,765,000	3,130,000	4,555,000	5,270,000
Outsource cost	-	535,000	900,000	1,160,000	1,160,000
COGS	250,000	2,300,000	4,030,000	5,715,000	6,430,000
SGA	-	450,000	730,000	1,100,000	1,955,000
Depre	-	-	-	-	-
Water&Electricity	-	-	-	-	-
Office Rental	0	210,000	420,000	540,000	660,000
EBIT	- 250,000	- 2,789,000	- 1,085,000	14,149,000	62,405,000

Table 17 : Income statement

The revenue shift year on year is the result of the high retention rate and the average revenue growth from each client. In the middle of 2022, there is a plan to promote our system globally. So, the revenue continues to growth onward.

7.10.6 Innovation strategy

Since the objective of this research aims to develop an automatic recommending system for fashion industry without human intervention, the most suitable strategy is to deploy the capability of machine learning to extract recommending rules from a set of collected data. However, there are various types of machine learning techniques having been already proposed. The selected technique must be able to cope with the defined data format as well as the values. From Section 3, the values of data are in forms of integers, either 0 or 1. Thus, the best type of machine learning suitable for this data should be just a simple decision

tree. This tree structure will represent a set of extracted rules obtained from the opinions of experts in the area based on the analyzed data set.

7.10.6.1 Technology and innovation management (TIM)

Technology

The advice automatically generated by the proposed system is based on the searching method of the decision tree technology. This approach is simple and rather efficient in terms of accuracy and computational speed. Furthermore, more additional rules can be easily derived from new data sets collected in the future. The additional rules are extracted by re-training the decision tree with the new data set and previous data set.

Innovation

The innovative contributions of this research are an automatic fashion recommending system and a set of recommending rules. The system is versatile and adaptable to regeneration of a new set of recommending rules according to a new piece of fashion trend information. We apply the personal styling processes and knowledge as the input factors in the machine learning. This system will help both customers and e-commerce owners. Customers will get the in-shop personalized experience during searching for fashion items in the online store. The e-commerce owners will have more income as the system is increasing the conversion rate.

Management

Fashion recommendation system as a 3rd party API service is a marketing's tools to help increase the conversion rate for the fashion e-commerce business.

7.10.6.2 Technology acceptance model (TAM)

We have to analyze the potential that our fashion recommendation system will have a client. The technology acceptance model, shown in figure 46, is used as a framework to analyze.

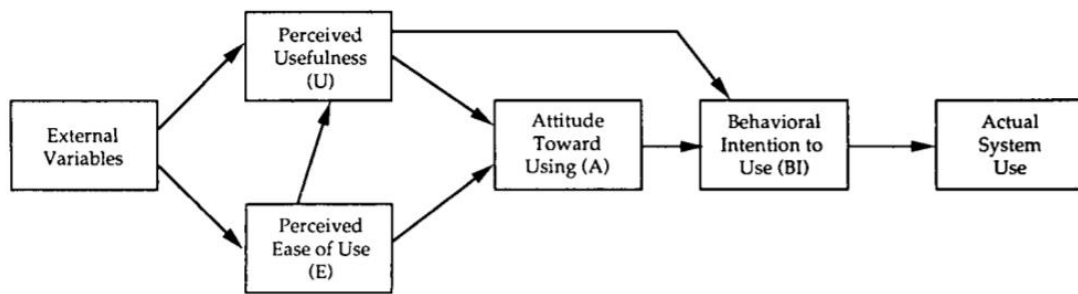


Figure 46 : Technology acceptance model (Fred et al., 1989).

We develop the fashion recommendation system as increasing demand from the platform's owner, demand-pull service. This system will help increase the possibility that website or app visitors going to purchase the items. The system is a 3rd party API software service. The platform owner who wants to get our service can contact our customer support anytime online. So, our system is useful and ease of use for users.

The end customers also use our system easily. Our interview questionnaire was designed to have a similar process as once the system will be applied in e-commerce. Every action in the questionnaire was recorded. There is 97% of online interviewees reach to the end of the submission process, submitted the questionnaire. With 3% drop off rate, it can prove that our system easily use

Our software engineer and stylist will work together to customize the input factor in the system for each client's target customer. Clients will get a better conversion rate right after implement our system in their back-end system. The accuracy rate will continue to increase as the data flow in the system. So, once the client uses our system, they tend to continue to using our system.

To compete in the current rapid change situation, the company has to have an innovation strategy to maintain its strength.

First, create an innovative organizational culture. Allow employees to think out of the box and try the idea in the real world. The leader has to understand and learn from both success and failure.

Second, partner with related business. As there is a continuous improvement process to increase accuracy, it is still a long way to develop the model. To develop all the factors ourselves, might take a lot of time. To be partnering with the other developer who already studies or tries, help reduce the development time together with to reduce the A/B test cost to develop and proof each concept.

Third, design the innovation roadmap for the company. The innovation roadmap is the map for an overview of the thing that we have to develop in nearly future. Clarify each developed innovation step and their prerequisite need for development. Then select the partner that has specialized in that particular area.

Finally, the leader has to lead the team toward innovation culture. The innovation organization culture cannot be happening, If a leader does not take it as a priority.



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CHAPTER 8 RESEARCH SUMMARY, AND FURTHER STUDY

8.1 Research Summary

There are 2 research conduct within this research. First, the qualitative research use to find the factors that affect fashion styling for fashion recommendation system via an e-commerce platform. Second, the quantitative research use to test the fashion recommendation system.

8.1.1 Qualitative research

After conduct the qualitative research, we found that the factor effect fashion styling is similar to the fashion recommendation system factor of the other researchers. The fashion recommendation system of the other researcher uses big data to analyze. The input data can come from the historical data action and purchase (Y. Liu & Shen, 2018) or the mix and match recommendation (Zhou et al., 2019). However, fashion is changing every season. We can not depend on the historical data of each customer. Fashion has a lot of details. So, using the 1 – 2 factors to create the fashion recommendation system might not enough.

The culture different is another interesting factor to consider. The meaning of the color is different from culture to culture. Some colors might have a similar meaning. But, there is some color that is totally different in meaning. So, we have to aware of this culture different when applying this research for further study.

There are still have the other interesting factor(s) for further study which recommended by the fashion specialist.

8.1.2 Quantitative research

After getting the answer from responders, we found that our recommendation system enhances customer decision-making to buy up to 67%. If we consider only buy or not buy options, the customer decision-making rate is raising up to 81%.



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We also found that there is some apparels image detail that contains the few relevances with the other. We remove the answers that select the recommendation apparel according to those few relevances. The decision-making to buy is increased by 5%. The new decision-making rate from the recommended apparel is 72%. If we consider only buy or not buy options, the customer decision-making rate is raising up to 85%.

8.2 Further study

This research is focused on the most effective fashion factor. There are still many fashion-related factors to consider. The combination of the other deep-tech technique is also interesting for further study.

The other deep-tech technique can be plugged-in with our model both for the input and output. There are 2 technologies that can help extract the input details. First, the image processing technology can help extract the information from the input image and automatically label it as a text in the system. Second, the text processing technology is another input gathering technique from fashion detail. For the output side, there are many interactive technologies that can apply to our model. It can help to present the fashion image with a more extractive style.

The input should have enough relevance factor in output. The fewer factors relevance between input and output lead to less precision rate in the fashion recommendation system.

We are now focusing on sales through B2B. However, if this study has more input factors from combining techniques, it will help us to change the business model for sales through B2C.

CHAPTER 9 APPENDIX

9.1 Qualitative research

Question

1. What is the relevancy of the following **factor** aspect that effect the customer decision making?
(1 = relevance, 0 = not sure, -1 not relevance)

Cloth items	Cloth Color	Cloth Style	Cloth Occasion	Skin Color	Body shape

2. What is the relevancy of the following **cloth items** for A/W 2019 fashion trend?

- 2.1. Top
(1 = relevance, 0 = not sure, -1 not relevance)

								
Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

- 2.2. Bottom
(1 = relevance, 0 = not sure, -1 not relevance)

					
Jean	Pants	Legging	Shorts	Skirt	Mini skirt

- 2.3. One piece
(1 = relevance, 0 = not sure, -1 not relevance)

		
Mini dress	Maxi dress	Jumpsuit

3. What is the relevancy of the following **cloth color** aspect for A/W 2019 fashion trend?
(1 = relevance, 0 = not sure, -1 not relevance)

															
Yellow	Orange	Red	Pink	Violet	Purple	Blue	Light blue	Turquoise	Green	Light green	Light brown	Brown	Black	Gray	White

4. What is the relevancy of the following **style** for A/W 2019 fashion trend?
 (1 = relevance, 0 = not sure, -1 not relevance)



5. What is the relevancy of the following **occasion** aspect that effect to customer decision making?
 (1 = relevance, 0 = not sure, -1 not relevance)

Casual	Job Interview	Formal	Company Party	Cocktail Party	Dinner Party	Festival	Wedding	Religious Ceremony

6. What is the relevancy of the following **occasion** style for A/W 2019 fashion trend?
 (1 = relevance, 0 = not sure, -1 not relevance)

6.1. Casual

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.2. Job Interview

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.3. Formal

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.4. Company Party

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.5. Cocktail Party

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.6. Dinner Party

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.7. Festival

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.8. Wedding

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

6.9. Religious Ceremony

Dandy	Hiphop	Skater	Grunge	Punk	Fetish	Goth	Steampunk	Japanese style tribe	Minimalist	Classic	Romantic	Sporty	Urban	Postmodern	Deconstructivist	Antifashion

7. Do you think **body shape** has effect for cloth items selection?








Yes	No

If yes, continue to do next questions

If no, stop questionnaire

8. What is the relevancy of the following **Body shape** aspect that effect to styling customer?

(1 = relevance, 0 = not sure, -1 not relevance)

						
Inverted Triangle	Lean column	Rectangle	Apple	Pear	Neat hour glass	Full hour glass

9. Which is the relevancy of the following **cloth items** for each following body shape that effect to styling customer?

9.1. Inverted Triangle

9.1.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

9.1.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.1.3.One piece

Mini dress	Maxi dress	Jumpsuit

9.2. Lean column

9.2.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

9.2.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.2.3.One piece

Mini dress	Maxi dress	Jumpsuit

9.3. Rectangle

9.3.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

9.3.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.3.3.One piece

Mini dress	Maxi dress	Jumpsuit

9.4. Apple

9.4.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

9.4.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.4.3.One piece

Mini dress	Maxi dress	Jumpsuit



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9.5. Pear

9.5.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

9.5.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.5.3.One piece

Mini dress	Maxi dress	Jumpsuit

9.6. Neat hour glass

9.6.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

9.6.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.6.3.One piece

Mini dress	Maxi dress	Jumpsuit

9.7. Full hour glass

9.7.1.Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

9.7.2.Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

9.7.3.One piece

Mini dress	Maxi dress	Jumpsuit


10. Do you think **skin color** has effect for cloth color selection?















Yes	No


If yes, continue to do next questions












If no, stop questionnaire


11. Which is the relevancy of the following **A/W 2019 color trend** for each following skin color?















11.1. Skin color  #fce999
(1 = relevance, 0 = not sure, -1 not relevance)


															



11.2. Skin color  #fce666
(1 = relevance, 0 = not sure, -1 not relevance)


															








11.3. Skin color  #f99333
(1 = relevance, 0 = not sure, -1 not relevance)


															

11.4. Skin color  #f99666
(1 = relevance, 0 = not sure, -1 not relevance)


															












11.5. Skin color  #cc6666
(1 = relevance, 0 = not sure, -1 not relevance)


															

11.6. Skin color  #cc6633
(1 = relevance, 0 = not sure, -1 not relevance)

11.7. Skin color  #996633
(1 = relevance, 0 = not sure, -1 not relevance)

11.8. Skin color  #993333
(1 = relevance, 0 = not sure, -1 not relevance)

12. What is the relevancy of the following **factors and details** that effect to customer decision making, A/W 2019 fashion trend?
 (1 = relevance, 0 = not sure, -1 not relevance)

12.1. Occasion

12.1.1. Casual

12.1.1.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.1.1.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.1.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.2. Job Interview

12.1.2.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.1.2.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.2.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.3. Formal

12.1.3.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.1.3.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.3.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.4. Company Party

12.1.4.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.1.4.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.4.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.5. Cocktail Party

12.1.5.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.1.5.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.5.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.6. Dinner Party

12.1.6.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.1.6.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.6.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.7. Festival

12.1.7.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.1.7.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.7.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.8. Wedding

12.1.8.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.1.8.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.8.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.1.9. Religious Ceremony

12.1.9.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.1.9.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.1.9.3. One piece

Mini dress	Maxi dress	Jumpsuit



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12.2. Style

12.2.1. Dandy

12.2.1.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.1.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.1.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.2. Hiphop

12.2.2.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.2.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.2.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.3. Skater

12.2.3.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.3.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.3.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.4. Grunge

12.2.4.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.4.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.4.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.5. Punk

12.2.5.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest



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12.2.5.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.5.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.6. Fetish

12.2.6.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.6.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.6.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.7. Goth

12.2.7.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.7.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.7.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.8. Steampunk

12.2.8.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.8.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.8.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.9. Japanese style tribe

12.2.9.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.9.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.9.3. One piece

Mini dress	Maxi dress	Jumpsuit



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12.2.10. Minimalist

12.2.10.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.10.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.10.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.11. Classic

12.2.11.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.11.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.11.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.12. Romantic

12.2.12.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.12.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.12.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.13. Sporty

12.2.13.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.13.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.13.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.14. Urban

12.2.14.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoodie	Shirt	Suit, Blazer & Jackets	Vest

12.2.14.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.14.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.15. Postmodern

12.2.15.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.15.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.15.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.16. Deconstructivist

12.2.16.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.16.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.16.3. One piece

Mini dress	Maxi dress	Jumpsuit

12.2.17. Antifashion

12.2.17.1. Top

Tank	T-shirt	Sweater & Knitting	Blouse	Roll-neck	Hoddie	Shirt	Suit, Blazer & Jackets	Vest

12.2.17.2. Bottom

Jean	Pants	Legging	Shorts	Skirt	Mini skirt

12.2.17.3. One piece

Mini dress	Maxi dress	Jumpsuit

9.2 Quantitative research questionnaire

9.2.1 Profile

แบบสอบถามนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ซึ่งจัดทำโดยบัณฑิตปริญญาโท สาขาธุรกิจเทคโนโลยีและการจัดการนวัตกรรม จุฬาลงกรณ์มหาวิทยาลัย โดยจัดทำขึ้นเพื่อสอบถามการตัดสินใจของผู้มีความสนใจซื้อเครื่องแต่งกายผ่านทางออนไลน์ต่อระบบการออกแบบเครื่องแต่งกาย สำหรับนำผลการประเมินไปพัฒนาโมเดลในการออกแบบการแต่งกายผ่านช่องทางอีคอมเมิร์ซ โดยเฉพาะกับโอกาสการสามเือนส่วนเทคโนโลยีการวิจัยเครื่อง

แบบสอบถามมี 5 ส่วน ดังนี้

- ส่วนที่ 1 Profile : ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม
- ส่วนที่ 2 Style : ข้อมูลลักษณะเครื่องแต่งกายที่ผู้ตอบแบบสอบถามชอบ
- ส่วนที่ 3 Shape : ข้อมูลลักษณะรูปร่างของผู้ตอบแบบสอบถาม
- ส่วนที่ 4 Color : ข้อมูลสีที่ผู้ตอบแบบสอบถามชื่นชอบ
- เมื่อเลือกทั้ง 4 ส่วนแล้ว กรุณาคลิก ส่ง ที่ปรากฏขึ้นที่มุมขวาบนของหน้า Color เพื่อให้ระบบแนะนำเครื่องแต่งกาย
- ส่วนที่ 5 Recommended : การประเมินการตัดสินใจซื้อเครื่องแต่งกายที่แนะนำโดยระบบการออกแบบเครื่องแต่งกาย

แบบสอบถามฉบับนี้ใช้เวลาในการตอบประมาณ 8 นาที หากผู้วิจัยใคร่ขอความร่วมมือนำในการตอบแบบสอบถามด้วยข้อมูลที่เป็นจริง เพื่อความสมบูรณ์ในการวิจัย ทั้งนี้ข้อมูลจากแบบสอบถามนี้จะถูกเก็บเป็นความลับ และจะไม่เปิดเผยต่อสาธารณะงานวิจัยนี้เท่านั้น ผู้จัดทำขอขอบคุณที่ท่านกรุณาเสียสละเวลาและให้ความร่วมมือตอบแบบสอบถามมา ณ โอกาสนี้

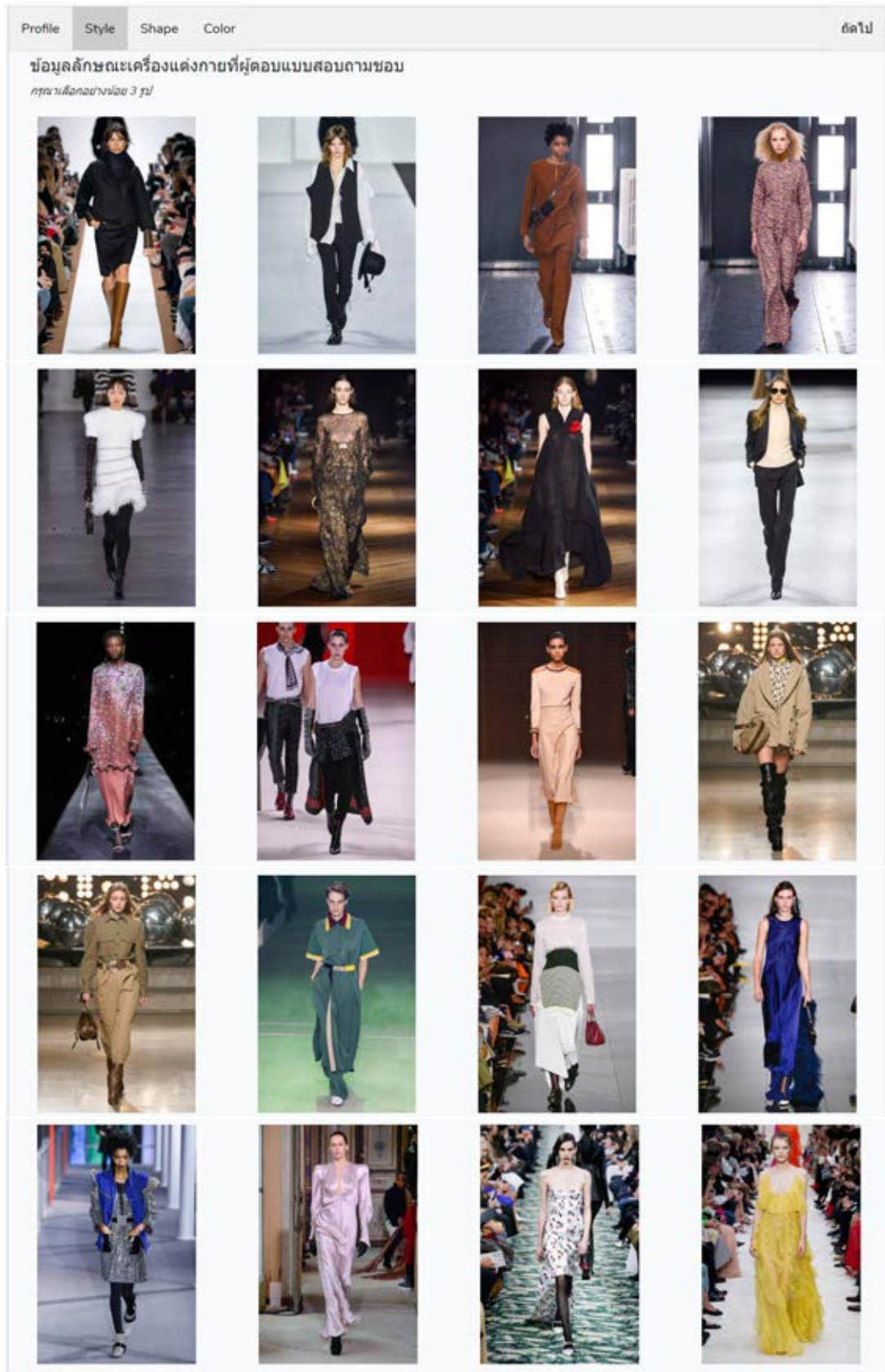
Profile	Style	Shape	Color	ถัดไป
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เพศ				
<input type="text" value="ชาย"/>				
อายุ				
<input type="text"/>				
จังหวัดที่ทำงานอยู่ในปัจจุบัน				
<input type="text" value="----- เลือกจังหวัด -----"/>				
จังหวัดที่อาศัยอยู่ในปัจจุบัน				
<input type="text" value="----- เลือกจังหวัด -----"/>				
ความถี่ในการซื้อเครื่องสำอางผ่านช่องทางออนไลน์				
<input type="text" value="ไม่เคยซื้อเครื่องสำอางผ่านช่องทางออนไลน์"/>				
บทความเพื่อนที่ติดตาม				
<input type="checkbox"/> นิตยสาร				
<input type="checkbox"/> นิตยสารออนไลน์				
<input type="checkbox"/> แฟนเพจ (Facebook Fan Page) ที่เกี่ยวข้องกับเพื่อน				
<input type="checkbox"/> อินสตาแกรมที่เกี่ยวข้องกับเพื่อน				
<input type="checkbox"/> เว็บไซต์ที่เกี่ยวข้องกับเพื่อน				
<input type="checkbox"/> ผู้ทรงอิทธิพล (Influencer)				
<input type="checkbox"/> อื่น ๆ โปรดระบุ...				
<input type="text"/>				
ความถี่ในการอ่านหรือดูบทความเกี่ยวกับเพื่อน				
<input type="text" value="ไม่ได้อ่านบทความเกี่ยวกับเพื่อนมานานกว่า 3 เดือน"/>				



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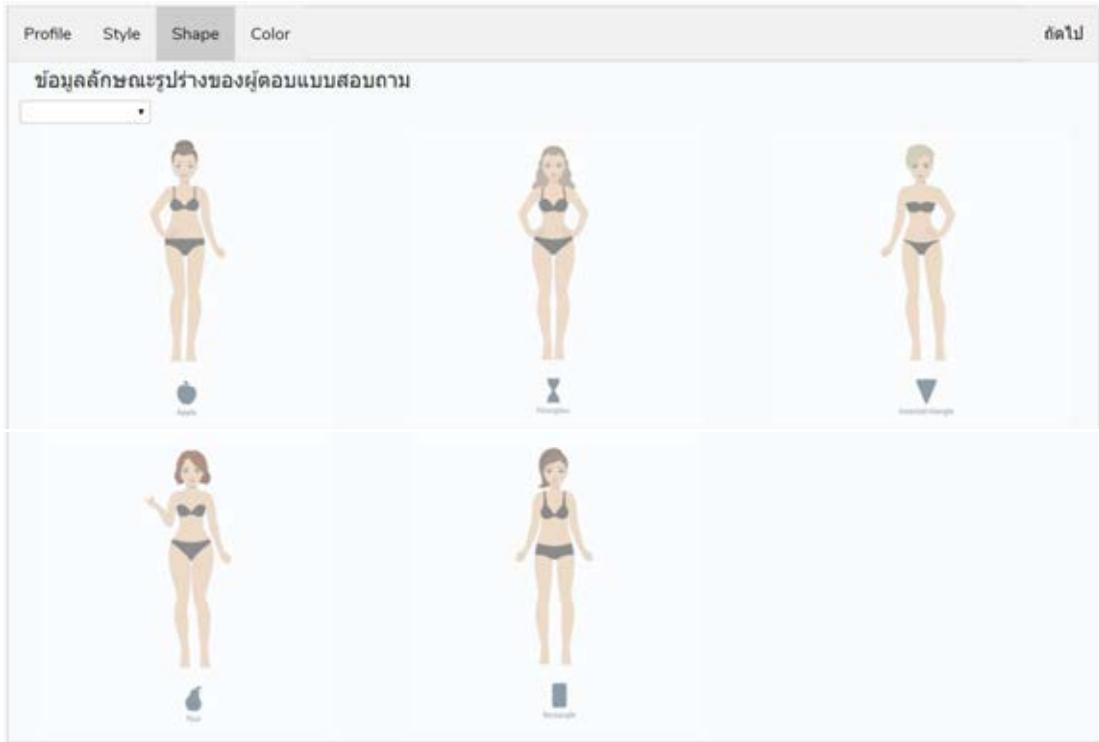
9.2.2 Style



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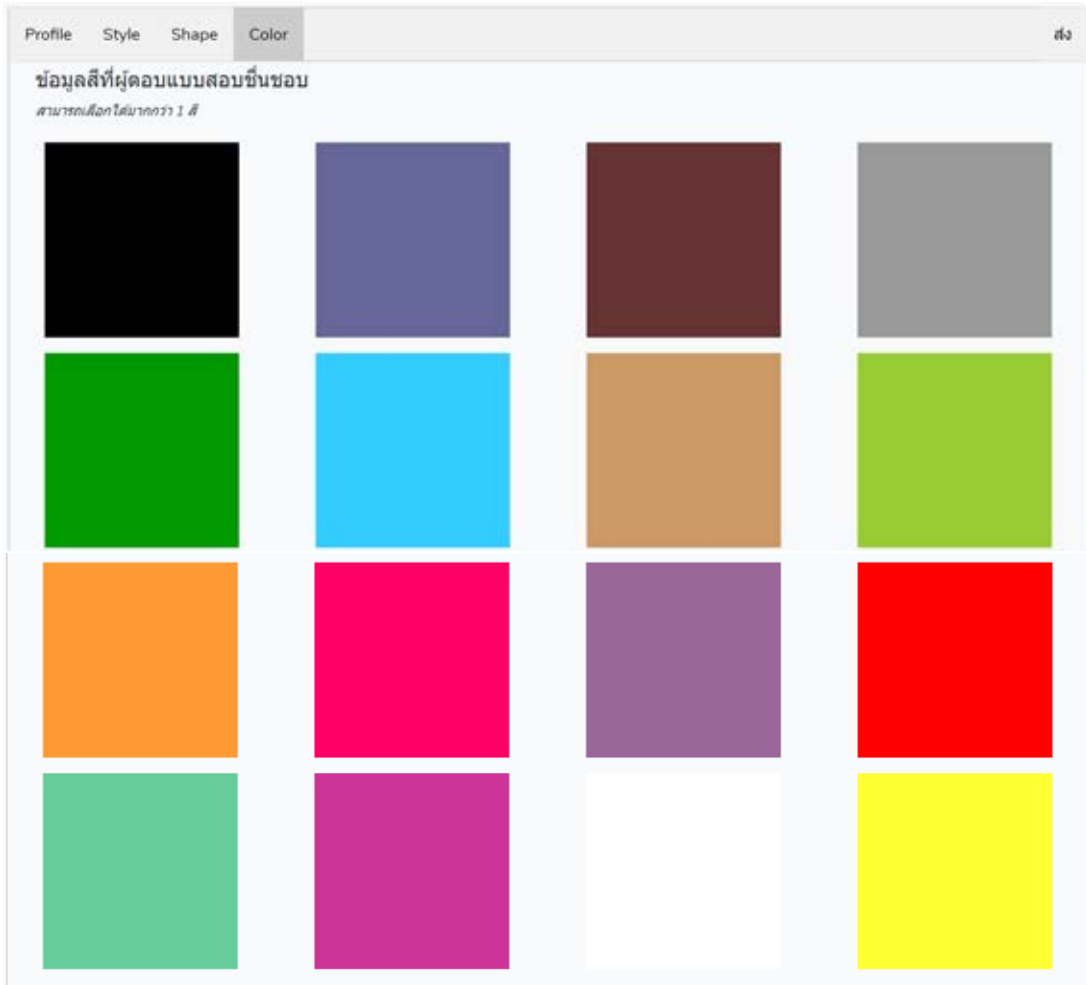
9.2.3 Shape



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9.2.4 Color








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9.2.5 Recommended

Recommended
การประเมินการตัดสินใจซื้อเครื่องแต่งกายที่แนะนำโดยระบบการออกแบบเครื่องแต่งกาย

หากท่านมีกำลังซื้อไม่จำกัด ท่านมีความต้องการซื้อเครื่องแต่งกายที่แนะนำอย่างไรพร้อมคำอธิบาย

	<ul style="list-style-type: none"><input checked="" type="radio"/> ซื้อ<input type="radio"/> ไม่สนใจ<input type="radio"/> ไม่ซื้อ <input type="text" value="ระบุเหตุผล"/>
	<ul style="list-style-type: none"><input checked="" type="radio"/> ซื้อ<input type="radio"/> ไม่สนใจ<input type="radio"/> ไม่ซื้อ <input type="text" value="ระบุเหตุผล"/>
	<ul style="list-style-type: none"><input checked="" type="radio"/> ซื้อ<input type="radio"/> ไม่สนใจ<input type="radio"/> ไม่ซื้อ <input type="text" value="ระบุเหตุผล"/>
	<ul style="list-style-type: none"><input checked="" type="radio"/> ซื้อ<input type="radio"/> ไม่สนใจ<input type="radio"/> ไม่ซื้อ <input type="text" value="ระบุเหตุผล"/>
	<ul style="list-style-type: none"><input checked="" type="radio"/> ซื้อ<input type="radio"/> ไม่สนใจ<input type="radio"/> ไม่ซื้อ <input type="text" value="ระบุเหตุผล"/>



- ชัด
- ไม่สนใจ
- ไม่ชัด

ระบุเหตุผล



- ชัด
- ไม่สนใจ
- ไม่ชัด

ระบุเหตุผล



- ชัด
- ไม่สนใจ
- ไม่ชัด

ระบุเหตุผล



- ชัด
- ไม่สนใจ
- ไม่ชัด

ระบุเหตุผล



- ชัด
- ไม่สนใจ
- ไม่ชัด

ระบุเหตุผล

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