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APPLICATION OF A QECN-QFD TO DESIGN AN ENVIRONMENTALLY-FRIENDLY ONE-HANDED LIPSTICK PACKAGING

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บทคัดย่อ

บทความนี้นำเสนอ 12 ขั้นตอนของเทคนิคการกระจายหน้าที่เชิงคุณภาพที่ใช้งานง่ายและรวดเร็ว (QECN-QFD) เพื่อวิเคราะห์ความต้องการของลูกค้า โดยใช้กับการออกแบบบรรจุภัณฑ์ลิปสติกแบบการใช้งานมือเดียวที่เป็นมิตรกับสิ่งแวดล้อม โดยอาศัยข้อมูลจากการสำรวจภาคสนามเพื่อระบุความต้องการของลูกค้า แล้วแปลงให้เป็นคุณลักษณะทางด้านวิศวกรรมเพื่อใช้กับเทคนิคการกระจายหน้าที่เชิงคุณภาพ (QFD) กระบวนการนี้เริ่มจากการออกแบบและแจกแจงแบบสอบถาม การเก็บรวบรวมและการวิเคราะห์ข้อมูลผ่านกลุ่มของผู้มีความรู้ ความชำนาญจำนวน 5 คน ในการอภิปรายและแสดงมิติคุณภาพของบรรจุภัณฑ์ลิปสติกแบบมือเดียว ข้อมูลที่ได้จำนวน 6 มิติ จะนำไปใช้เป็นพื้นฐานในการจัดทำแบบสอบถามการสำรวจ โดยมุ่งเน้นที่เหตุการณ์สำคัญเชิงบวกและลบ ผู้ตอบแบบสอบถามจำนวน 33 คน ตอบคำถามเกี่ยวกับคุณลักษณะของผลิตภัณฑ์จำนวน 12 ข้อ (ขั้นตอนที่ 1-4) คำตอบจากแบบสอบถามทำให้สามารถขจัดคำถามที่ไม่เกี่ยวข้องออกไปเหลือแต่เฉพาะคำถามที่เป็นพื้นฐานจำเป็นสำหรับการออกแบบ ในส่วนแบบสอบถามความพึงพอใจประมาณ 20 คำถาม จะได้รับจากผู้ตอบแบบสอบถามจำนวน 94 คน ในขั้นตอนนี้พบว่าสามารถระบุความต้องการและความพึงพอใจของลูกค้าที่แท้จริงได้ โดยจะถูกแปลงให้เป็นคุณลักษณะทางวิศวกรรม (ขั้นตอนที่ 5-11) เพื่อวิเคราะห์ต่อไปโดยประยุกต์ใช้เทคนิคการกระจายหน้าที่เชิงคุณภาพ (QFD) สำหรับออกแบบและเปรียบเทียบกับตัวเลือกต่างๆ เพื่อลดการสูญเสียของเนื้อแท่งลิปสติกที่ไม่ได้ใช้และหลงเหลืออยู่ให้มากที่สุด โดยการคำนวณคะแนนในแต่ละทางเลือกตามเกณฑ์ที่กำหนด ทางเลือกที่ดีที่สุดสำหรับบรรจุภัณฑ์ลิปสติกแบบมือเดียวกับที่เป็นมิตรกับสิ่งแวดล้อมจะได้รับการคัดเลือก (ขั้นตอนที่ 12) รายละเอียดของบรรจุภัณฑ์ลิปสติกนี้จะใช้เป็นข้อมูลสำหรับเขียนภาพด้วยโปรแกรม Solid Work และสร้างบรรจุภัณฑ์ต้นแบบลิปสติกแบบการใช้งานมือเดียวที่เป็นมิตรกับสิ่งแวดล้อมด้วยเครื่องพิมพ์ 3 มิติ ต้นแบบที่ได้มีรูปทรงกลมที่มีกลไกการเปิดฝาพับที่ฝาด้านบนทำให้ง่ายต่อการเปิดด้วยมือเดียว และปุ่มสไลด์ขึ้น-ลง สามารถล็อกได้ในหลายขั้นตอน ทำให้การใช้งานสะดวกเหมาะสมและสมบูรณ์แบบพร้อมใช้งานได้ตลอดทั้งวัน แหวนที่ปลายแท่งลิปสติกสามารถถอดออกได้ง่าย จึงช่วยลดการสูญเสียของเสียเนื้อลิปสติก อีกทั้งต้นแบบผลิตภัณฑ์ลิปสติกที่ออกแบบนี้ยังได้รับการออกแบบมาให้สามารถนำกลับมาใช้ซ้ำได้

ABSTRACT

The 12-step QECN-QFD (Quick-easy-customer's needs quality function deployment) was proposed to design an environmentally-friendly one-hand lipstick packaging. By using the information from the survey to identify the actual customer needs and the resulted requirements were transformed into engineering characteristics for further QFD application. It firstly starts with a questionnaire design and distribution, collection and data analysis via a focus group of 5-knowledgeable people to help discussing and listing the quality dimensions of one-handed lipstick packaging. Six dimensions was then achieved and used as basis for laying out the survey questionnaire, focusing on positive/negative critical incidents. Twelve questions were distributed with 33 respondents and analyzed (Step 1-4). The resulted analysis were calculated and used for eliminating the non-relevant questions. The remaining questions were further used as a basis for designing the satisfaction survey questionnaire of about 20 questions. The results of the survey and analysis with 94 respondents were used to identify the actual customer needs and the resulted requirements were further transformed into engineering characteristics (Step 5-11). The resulted engineering characteristics were finally analyzed by QFD method and the possible ways of packaging were designed to minimize the non-used content of the lipstick compartment left over. The new lipstick compartments design were proposed and compared with several available options by calculating the scores according to the required criteria. The best solution for one-handed lipstick packaging with environmental-friendly one was therefore selected (Step 12). The detailed drawing was then visualized through the sketches using Solid Work Program and the prototype of the designed one-handed environmental-friendly lipstick packaging was finally created using 3-D Printer. The round-shape body prototype with a flipping opening mechanism at the top-cap made it easy to be opened by one-hand. The slide- up button was convenient to push up with several steps of locking, making it suitable and perfect usage at all ongoing day; especially, for traveler, teenager, elder, and women-on- going. The detached ring at the sleeve could be twisted and pulled off easily, help minimizing the waste of lipstick content. This packaging was also designed to be reused.

KEYWORDS: 12-step QECN-QFD, One-handed lipstick packaging, Environmental-friendly, Solid-work program, Prototype, 3-D Printer

1. Introduction

Lipstick is one of the most commonly used cosmetic products and the most popular item which all women have in their bag (15.5%), while, the second one is the press powder (13.9%) [1, 2]. Apparently, almost all working women need to apply lipstick before going to work. It is normally to reapply the lipstick several times during the day to moisturize and compensate loosing lipstick on the lip. Lipstick is loosed after 3 hours, especially after lunch time or eating something greasy and oily. So, the users want to reapply quickly to make their lip refresh again. Therefore, it is necessary to carry lipstick in their purse all the day. However, there are still very limited products available in the market that can accommodate and best fit to their needs. It is worthy to note that the appearance of lipstick is very important for women since they will use it in public areas. Today women who touch their lipstick in public are a breach of etiquette. Thinking more innovatively as customers demand, convenience, and

performance in their purchases must be included. The packaging of lipstick is challenging for the engineer to serve the convenience of women in public with a quick apply. There will be some changes or modification to the case of lipstick with a new design package of lipstick specially for working women, teenager and the elderly. The uses with one-hand open and apply are the answer. In addition, minimizing the left-over content will save the cost and the world ecology.

Lipstick has revealed some interesting trivia through its evolution. For several decades, the conventional lipsticks have been used in the same shape or packaging with the cover cap and twisting roller. They have not been changed for a long time while the other cosmetics have had a big change. Some design was applied to the exterior of the case to make them more attractive, for example; attaching a mirror or brush. Putting more function together is the idea of marketers to encourage potential customers to buy and keep them for collection after the ultimate using. The only change that was observed was just an outlook of the packaging not the function. Nowadays, new product development (NPD) is one of the most crucial factors for business success. In 2008, Avon cosmetic fashioned a unique lipstick package, called Pro-To-Go. This package allowed the user to extend and retract the lipstick pomade for one-handed application [3]. In 2014, Stiks cosmetiks was specifically designed for one-hand lipstick by flipping the cap open, apply lipstick and flip the cap closed with the same hand. While the mechanism and the gesture are somewhat unusual, the lipstick incorporates a traditional element-the base retaining the native functionality of a regular lipstick [4]. This one handed manipulation reflected a general trend in behavior: On the telephone, in the car, while walking, women check the way they look, put on make-up. Re-doing lipstick is the task repeated most often. Made in Polypropylene (PP), the lipstick could be finished with a chapel metal trimming in aluminum to satisfy the needs of more selective markets [5]. Eco-friendly packaging has lots of present and future implications. For the plastic based packaging, principles of “Reduce, Reuse, and Recycle” would have to be seriously followed in all business. The notable growth of the market in recent years indicated apparel consumers' interest in organic fiber products [6,7].

The Quality Function deployment (QFD) was an effective tool to help the decision makers to determine appropriate product specifications in the product planning stage. Traditionally, in the QFD, the product specifications were determined by a rather subjective evaluation, which was based on the knowledge and experience of the decision makers [8,9,10,11]. As customer requirements are the input of QFD, it is very important to classify the customer requirements in a systematic way. However, there is a lack of systematic methods for companies. The heart of QFD is to involve the customer’s needs and satisfactions in which the traditional QFD still have shortcomings the input of ambiguous voice of customers as used QFD. To help tackle these shortcomings, it was then important to have the customer’s needs involvement as much as possible by using the methodologies of Hybrid QFD proposed by Tsai Y C. [12] and Telrad’s questionnaire methodology: the elimination and addition procedure proposed by Glushkovsky [13]. A combination of the strength of these two methods with some modification was then initiated and developed as a novel supporting tool, named “A Quick, Effective, Customer’s Need, Quality Function Deployment (QECN-QFD” by Fongsatitkul, T [14].

2. Objective

This research aimed to initiate a new design of one-handed environmental-friendly lipstick packaging, using a proposed 12-step approach of the quick, effective, customer's need, quality function deployment (QECN-QFD).

3. Methodology

The heart of QFD is to involve the customer's needs and satisfactions in which the traditional QFD still have shortcomings of using the input of ambiguous voice of customers into the QFD. To help tackle these shortcomings, it is then important to have the customer's needs involvement as much as possible. A 12-step approach of the QECN-QFD was then proposed and used in this study as shown in Figure 1, It firstly started with Step 1: A focus group of 5 knowledgeable people to list the quality dimensions: issue required by customer's need on one-handed lipstick, small group discussion, and followed by Step 2: Let the customers to list the positive examples of 12 open-ended questions under each quality dimension which would be the inputted for the survey questionnaire design: close-ended questions. Then, the questions and engineering characteristics were properly set up (Step 3) and the relationships between questions and engineering objective were identified by putting symbols (Step 4). Step 5: Eliminating the questions according to the procedure was carried out and the remaining questions were further used as a basis for designing the satisfaction survey questionnaire. After that, the survey questionnaires were distributed, collected, and analyzed, respectively (Step 6 and 7). Step 8: Respondents gave satisfaction's level and count the number of respondents per level. The results from the satisfaction survey and analysis (Step 9 and 10) could finally identify the actual customer needs. After eliminating the unrelated questions of the final QFD construction according to the procedure criteria, the remaining questions and engineering objectives, could be further used as the important inputs for the QFD process for the best possible solution for one-hand lipstick (Step 11). Step 12: Using QFD process for the best possible solution for one-hand lipstick could be finally initiated, involving a construction of several matrices, containing information relating to each other as called "House of Quality" as shown in Figure 2.

Quality Function Deployment is an important method to find the relation between customers' needs and specifications. After conducting the voice of customers (VOCs), it was then to interpret them as the customers' needs and gave the priority. The produced specifications were identified according to each customer's need. The relationship matrix representing the relation between each customer's need and each specification were established and followed by a comparison between a conventional product and that of the competitor was made. A technical assessment comparing the existing specifications in the market and aiming to identify the target of our product were then initiated. The highest rank specifications should be strongly related to the customer's needs and represent the important features of the product. The correlation matrix presenting the relation among each specification was finally established. After that, the new lipstick compartment design was compared with several available options by calculating the scores according to the required criteria. Then, the best solution for one-handed lipstick packaging with environmental-friendly one was selected. The details could be visualized through the sketches using Solid Work Program and the prototype of the designed one-handed environmental-friendly lipstick packaging was then created using 3-D Printer.

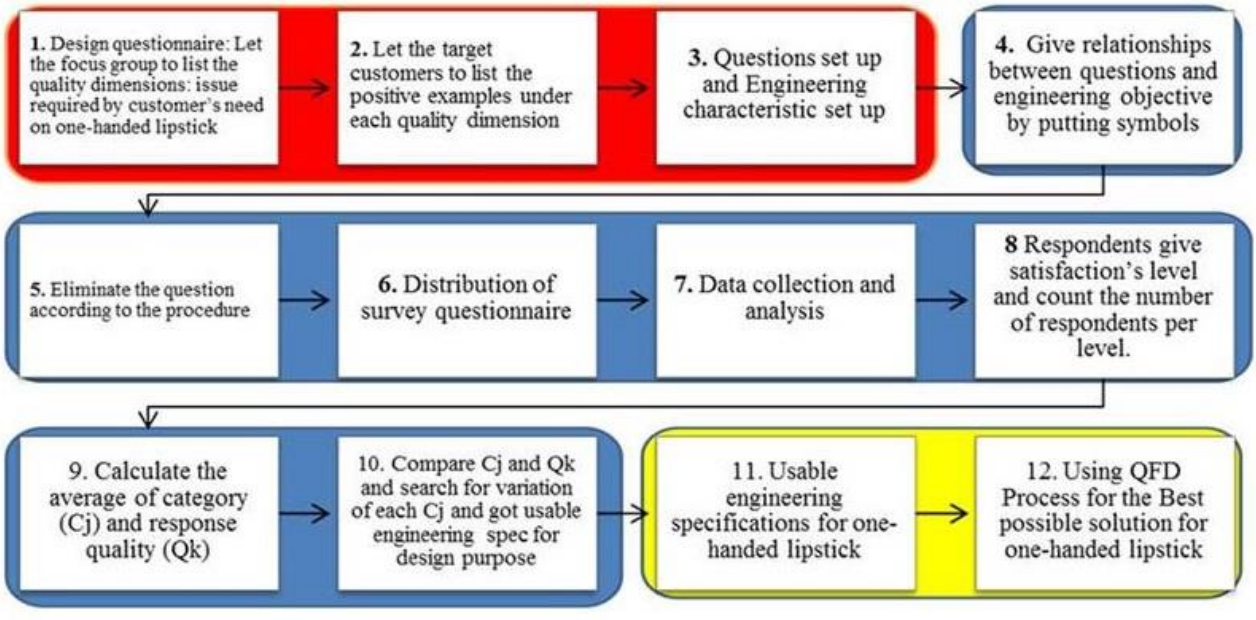

Figure 1 12-step packaging approach design for one-handed environmental-friendly lipstick

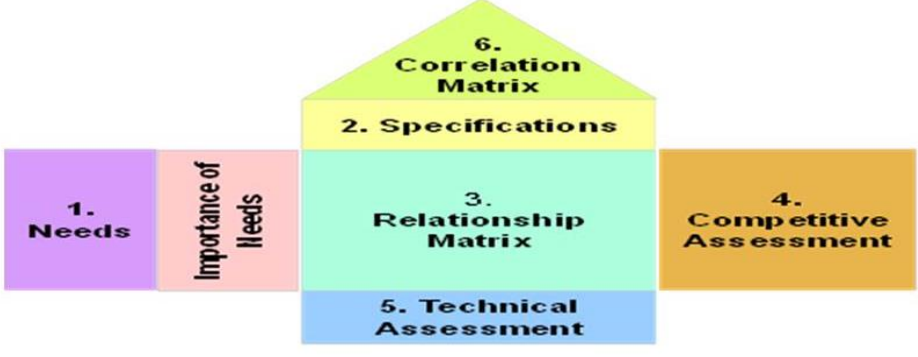

Figure 2 Six-dimensions of House of Quality

4. Results

The research has followed the 12-step QECN-QFD approach step-by-step. It firstly starts with a questionnaire design and distribution, collection and data analysis via a focus group of 5-knowledgeable people to help discussing and listing the quality dimensions of one-handed lipstick packaging. Six dimensions was then achieved and used as basis for laying out the survey questionnaire, focusing on positive/negative critical incidents. A pre-test of 12-question, both Thai and English versions for Thai woman aging from 16 to over 60, was distributed using an on-line Words through 33 respondents with non-probability sampling (Step 1-4). The remaining questions were further used as a basis for designing the satisfaction survey questionnaire of about 27 questions, divided into 3 parts: (1) Demographic data (2) Woman consumption habits and (3) Idea, attitudes and suggestions. The

intention was to record the user experiences and opinions as accurately as possible to assist the packaging development efforts. The questionnaire was designed to measure attitudes, motivation and actual needs of users. The results from the general part were used to build up a profile of an average user. Thus, provide a better understanding of their background and motivations, while the second and third part focused on commuting behavior and suggestions. That measuring user's preferences and product perception were to identify actual user needs and respective importance. The questions that ask for getting the information from user relate to the product and package. Some questions relate to the product asking about "How often do you apply to top up your lipstick during a day?" or "Will you use the remaining content at the bottom and why?"

Sample size was calculated by using single proportion estimation formula [15] $n = \mathbf{Z}^2 P(1-P) / d^2$ (95 % CI, P=0.9, d=0.1); estimated n was $\geq$ 62. The results from the satisfaction survey and analysis using on-line Words with 94 respondents can identify the actual customer needs and the resulted requirements were transformed into engineering characteristics (Step 5-11). The resulted engineering characteristics were finally analyzed by QFD method and the possible ways of packaging were designed to minimize the non-used content of the lipstick compartment left over. The new lipstick compartments design were proposed and compared with several available options by calculating the scores according to the required criteria. The best solution for one-handed lipstick packaging with environmental-friendly one was therefore selected (Step 12). The use of QECN-QFD with 12-step approach can be summarized and concluded in accordance with the dimensions of "House of Quality".

4.1. Needs and importance

After conducting the voice of customers (VOCs) and interpreting them as the customers' needs and giving the importance (Step 1-2) by using the score ranging from 1 to 10, where 1 represented the least important of customers' needs and 10 represented the most important, to each customers' needs as shown in Table 1.

4.2. Specifications and relationship matrixes

The produced specifications were identified according to each customer's need and given the units as well as attribute to each specification by using setting criteria, resulting in the final specifications and relationship matrix which represented the relation between each customer's need and each specification (Step 3-4). The relationship matrix and criteria score were initiated as shown in Table 2

Table 1 Importance of customers' needs

No.	Customers' needs	Importance score
1	Reusable lipstick case	5
2	Easy to hold (does not roll)	5
3	Refillable lipstick case	5
4	Safety to use (Good protection/doesn't smear)	5
5	Easy opening methods	9
6	Reduce lipstick waste	7
7	Light weight	7
8	Follow material industry standards and specifications: Have a certification (Certified by FDA, ISO9001:2008 or etc.)	9
9	Environmental-friendly	9
10	Durable	5
11	Modern and beautiful lipstick case	9
12	Easy to use	9
13	Portable	5
14	Compact size	5
15	Compact shape	5

4.3. Competitive and Technical Assessments

A conventional product and that of the competitor were compared and estimated the expected values of the product. A survey of the conventional product in the market and evaluation of the strength and weakness were needed. The assessment used the score ranging from 0 to 9 representing the lowest and the highest level of serving, respectively. After the evaluation, calculating the improvement ratio could be done by using today's value divided by future's value and then assigning the sale impact and finally calculating the overall weight score by using the importance multiply with improvement value and the sale impact. These scores were finally normalized and used to prioritize/rank the needs of customers as shown in Table 3. The technical assessment aimed to compare the existing specifications in the market and identify the target of our product (Step 5-11).

Table 2 Relationship matrix score between each customer's need and each specification.

Specifications / Customers' needs	Importance	↓ Dimension of lipstick	○ Weight of lipstick	↓ Time to complete applying	↓ Minimum time to open lid or twist up	↑ Life time	○ Resistance to the environment	↓ The resistance to scratches
1. Reusable lipstick case	5	3	1	0	0	9	0	1
2. Easy to hold (does not roll)	5	9	3	0	1	0	0	0
3. Refillable lipstick case	5	9	1	0	0	9	0	1
4. Safety to use (Good protection/does not smear)	5	0	0	0	3	0	0	0
5. Easy opening methods	9	9	0	9	9	9	0	0
6. Reduce lipstick waste	7	3	0	9	9	0	0	0
7. Light weight	7	1	9	0	0	0	0	0
8. Follow material industry standards and specifications: Have a certification (Certified by FDA, ISO9001:2008 or etc.)	9	0	0	0	0	9	1	0
9. Environmental-friendly	9	0	3	0	0	9	3	0
10.Durable	5	3	0	0	0	9	3	9
11. Modern and beautiful lipstick case	9	0	0	0	0	0	9	9
12. Easy to use	9	0	0	9	9	0	0	0
13. Portable	5	9	9	0	0	0	0	0
14. Compact size	5	9	9	0	0	0	9	0
15. Compact shape	5	9	9	0	0	0	9	0

Note: Criteria-score relationship matrix: Strong = 9, moderate = 3, possible = 1, no relation = 0

Symbols: ↑ Higher the better, ↓ Lower the better, ○ Target the best

Table 3 Normalization score of customers' needs used for ranking

Customers' needs	Overall Weight	Normalized score	Rank
1. Reusable lipstick case	6.25	4.18%	10
2. Easy to hold (does not roll)	6.00	4.01%	9
3. Refillable lipstick case	6.25	4.18%	10
4. Safety to use (Good protection/does not smear)	6.00	4.01%	9
5. Easy opening methods	20.48	13.68%	1
6. Reduce lipstick waste	13.48	9.01%	3
7. Light weight	12.32	8.23%	5
8. Follow material industry standards and specifications: Have a certification (Certified by FDA, ISO9001:2008 or etc.)	11.70	7.82%	6
9. Environmental-friendly	13.34	8.91%	4
10. Durable	5.00	3.34%	11
11. Modern and beautiful lipstick case	11.70	7.82%	6
12. Easy to use	16.38	10.94%	2
13. Portable	8.75	5.85%	7
14. Compact size	5.00	3.34%	11
15. Compact shape	7.00	4.68%	8
Total	149.65	100%	

4.4. Correlation matrix

A product concept was an approximate description of the technology principle and forms of the product. It would express as a sketch or as a rough three dimensional model and was often accompanied by a brief textual description. Concept generation process began with the customer needs and target specification: Identify problem from QFD; Find the solution of each sub-problem; and Select the solutions and create designs (Step 12). Through the concept selection, based on each solution on customer needs, was initiated as combination table and the possible solution design. For concept screening, the criteria were divided into 15 customer's needs, including the 12 possible designs were put into a concept screening matrix and one of the designs was selected as a reference. Then each design was scored as +1, 0 or -1 for each criterion. As shown in Table 4, four possible designs (design no.3, 4, 9 and 10) as compared to that of the reference, were chosen. These designs had the total score of 5, 7, 7 and 9, respectively.

Table 4 Concept screening matrix between customer–need criteria and possible designs

Customer needs	**Possible designs (No.)**											
	Ref.	2	**3**	**4**	5	6	7	8	**9**	**10**	11	12
1.Easy opening method	0	0	0	0	0	0	0	0	0	0	1	1
2.Convenient to use	0	0	1	1	0	0	-1	-1	1	1	0	0
3.Reduce lipstick waste	0	1	0	1	0	1	0	1	0	1	0	1
4.Environmental - friendly	0	0	0	0	0	0	0	0	0	0	0	0
5.Modern and beautiful lipstick case	0	0	1	1	0	0	-1	-1	1	1	-1	-1
6.Follow material industry standards and specifications	0	0	0	0	0	0	0	0	0	0	0	0
7.Light weight	0	0	1	1	0	0	1	1	1	1	1	1
8.Portable	0	0	1	1	0	0	-1	-1	1	1	-1	-1
9.Safety to use	0	0	-1	-1	0	0	0	0	-1	0	0	0
10.Compact shape	0	0	1	1	0	0	-1	-1	1	1	-1	-1
11.Reusable lipstick case	0	0	0	0	1	1	1	1	1	1	0	0
12.Refillable lipstick case	0	0	0	0	1	1	1	1	1	1	0	0
13.Easy to hold	0	0	1	1	0	0	-1	-1	1	1	-1	-1
14.Durable	0	0	0	0	0	0	0	0	0	0	0	0
15.Compact size	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	2	**5**	**7**	2	3	-2	-1	**7**	**9**	-2	-1

Note: Criteria: 0 = Equal importance, 1 = More importance, -1 = Less importance

A quantitative comparison among the concepts was further made, basing on the choice of weights and ranking. Firstly, the important rates were given for each criterion. After that they were converted to the percentage by dividing the sum of important rates and multiplied by one hundred. The weight scores were calculated by multiplying the raw scores with the criteria weights. The total score for each design was the sum of the weight scores as shown in the equation (1) and Table 5. The selected solution (Design no.10) for one-handed environmentally-friendly lipstick packaging was then chosen as shown in Figure 3.

$$s_j = \sum_{i=1}^{n} \left(w_i r_{ij}\right) \quad (1)$$

Where; S_j = Total score for concept j, n = Number of criteria, r_{ij} = Raw raing of concept j for the i criterion

w_i = Weight for criterion

Table 5 Concept scoring and weighted-ranking of measurement criteria

Customer needs	**Possible Designs (possible designs 3, 4, 9, 10)**					
	Important rating	Weight (%)	No.3	No.4	No.9	No.10
1.Easy opening method	5	5.050	4	4	4	4
2.Convenient to use	5	5.050	4	4	5	5
3.Reduce lipstick waste	5	5.050	4	5	4	5
4.Environmental -friendly	5	5.050	5	5	5	5
5.Modern and beautiful lipstick case	9	9.092	3	3	2	2
6.Follow material industry standards and specifications	7	7.070	3	3	3	3
7.Light weight	7	7.070	3	3	5	5
8.Portable	9	9.092	4	4	4	4
9.Safety to use	9	9.092	3	3	5	5
10.Compact shape	5	5.050	3	3	3	3
11.Reusable lipstick case	9	9.092	3	3	5	5
12.Refillable lipstick case	9	9.092	3	3	4	5
13.Easy to hold	5	5.050	3	3	4	4
14.Durable	5	5.050	3	3	2	2
15.Compact size	5	5.050	3	3	3	3
Total	99	100	3.34	3.39	3.89	4.04

Note: Criteria for importance rating of customer needs = 5, 7, 9 and each design = 1 to 5

The details could be given visually through sketches using Solid Work Program as shown in figure 4. The round-shape body is smooth for holding in the palm of the hand. The opening mechanism using flipping at the top-cap made it easy to be opened by one-hand. The slide- up button was convenient to push up with several steps of locking making it suitable and perfect usage at all ongoing day; especially, for travelers, women on the go, teenagers, and elderly. This one hand lipstick design come with the assembled of various parameters derived from QFD to match the customer's needs. The one-hand lipstick prototype was generated using the 3D Printer process as shown in Figure 5 and Figure 6

Figure 3 Selected solution designs (No.10)

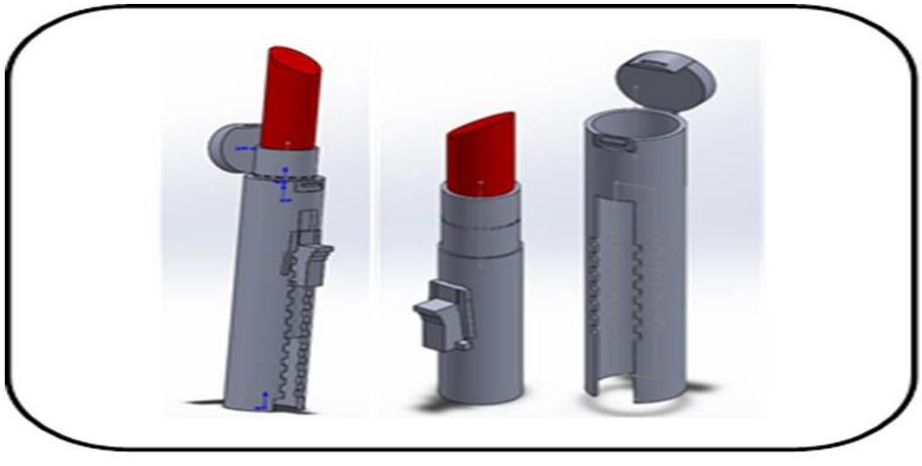

Figure 4 Drawing of the selected design (No.10) using Solid Work Program (Assembly: sleeve/case)

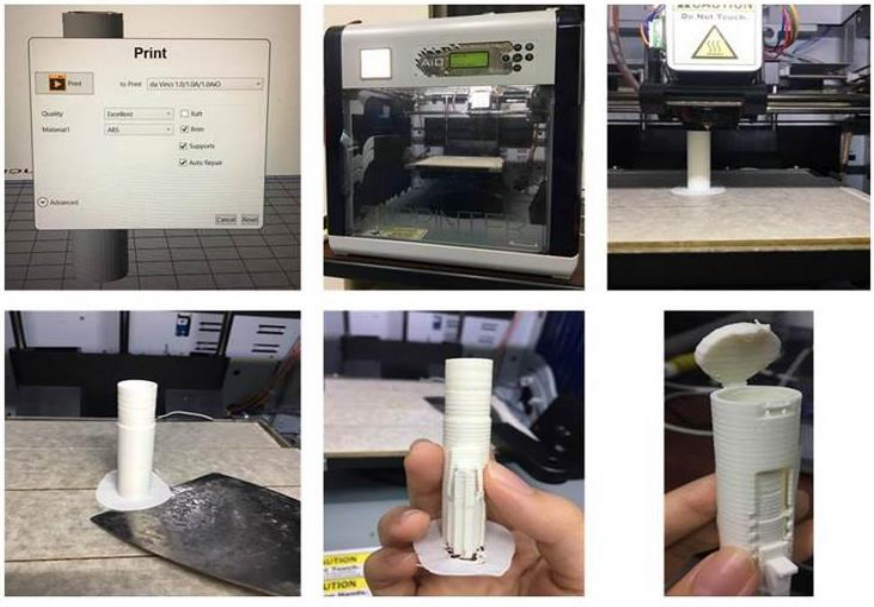

Figure 5 New design prototype generated using 3-D printing process

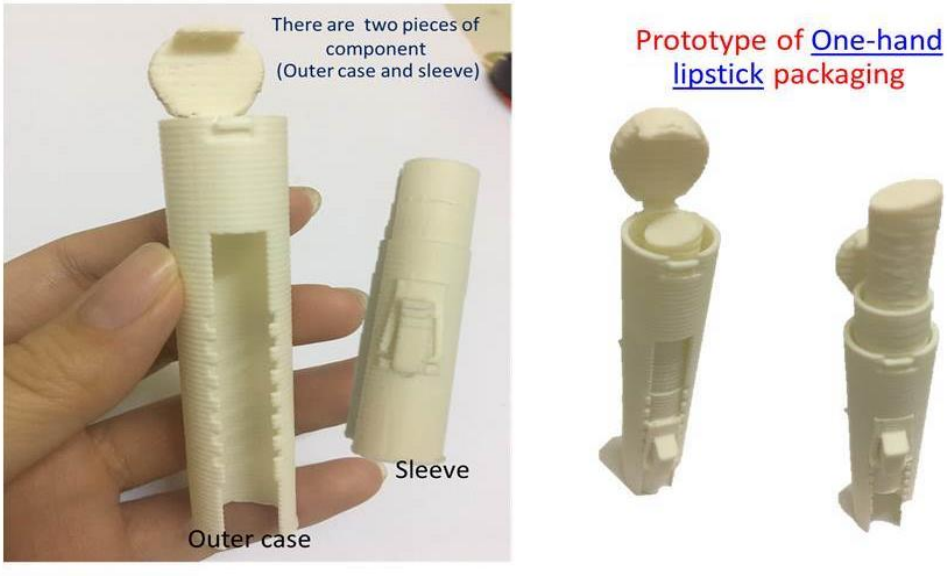

Figure 6 Prototype of One-hand lipstick packaging generated by 3-D printer (outer case and sleeve)

5. Discussions and Conclusions

A proposed QFD supporting tool and methodology, known as "A Quick-Effective-Customer's Needs Quality Function Deployment (QECN-QFD) for A New Product Development: one-hand environmentally-friendly lipstick packaging" was one of

the most effective innovation tools. It provided some advantages of easy-to-use (not sophisticated), convenience, time limitation, and full-scale of customer's needs participation via on-line word survey questionnaire. Results from the survey can identify the actual customer needs and the resulted requirements can be transformed into engineering characteristics. All possible options of packaging are designed, compared, and selected to minimize the non-used content of the lipstick compartment according to the required criteria. The best solution for one-handed lipstick packaging with environmental-friendly one was chosen. The details can be given visually through sketches using Solid Work Program and create a prototype of the designed one-handed lipstick packaging using 3-D Printer. In addition, for those people who were seeking for environmental friendly lipsticks, it would be satisfied with this attractive design case. The detached ring at the sleeve that could be easily twisted and pulled off would minimize the waste of lipstick content of about 30%. This packaging was also designed to reuse by freezing the lipstick content before replacing.

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