

# **Sterilizer Box Design for Online Store Courier Services**

**Dyah Santhi Dewi<sup>1</sup>, Pinkan Magarena Juanda<sup>2</sup>, Rahmat Hidayatullah<sup>3</sup>, Adhitya Galuh Damayanti<sup>4</sup>, and Reyhan Ar-Rizquanata<sup>5</sup>**

Industrial and Systems Engineering Department, Faculty of Industrial Technology and Systems Engineering, Sepuluh Nopember Institute of Technology, Surabaya, Indonesia.

Email: [dyah@ie.its.ac.id](mailto:dyah@ie.its.ac.id)

## **Abstract**

The problems related to COVID-19 have not been completely overcome in several countries and transmission is still happening. The COVID-19 virus, which can survive for several hours or even days on the surface of objects, can increase the risk of transmitting the virus if the virus is attached to various surfaces of goods. During the pandemic, many people turn to online purchases where packages will be delivered by online courier services. In a pandemic condition like this, logistics companies are no longer only required to be able to deliver packages on time but are also expected to ensure that the delivered packages do not become one of the transmission media for the COVID-19 virus or other viruses/bacteria. Based on these problems, this study aims to design a sterilizer box to sterilize goods, especially food packages that can be carried by couriers so that packages can be sterilized during the delivery process and are safe for health when received by the recipient of the package. The results of this study provide ideas and initial design concepts of a food delivery service sterilizer box which can later be developed further until it can be commercialized.

## **Keywords**

COVID-19, Food Package, Logistics, Online Courier, Sterilizer box

## **1. Introduction**

The COVID-19 pandemic has affected all countries in the world. Indonesia is one of the countries that has a high number of COVID-19 cases compared to other countries. Transmission of the COVID-19 virus can come from various media such as droplets (drops of saliva) when someone coughs, sneezes, talks, or breathes, and small particles that float in the air. One of the media that can transmit this virus is the surface of a contaminated object. A person can catch the COVID-19 virus when they touch his nose, mouth, or eyes after touching a surface that may have been contaminated with the virus from a person who coughs or sneezes without washing hands or using an antiseptic.

Due to the pandemic, people tend to make purchases online. According to Anteraja Suyanto Tjoeng, CEO of PT Tri Adi Bersama (Lokadata.id, 2021) said that the volume of goods shipments rose by 20 percent, with the average daily volume reaching 135 thousand since the COVID-19 pandemic entered Indonesia. This is due to a surge in buying and selling transactions in e-commerce which is triggered by the fear and concern of the public being infected with the virus when they have to shop outside the home. During the COVID-19 pandemic, people often shop for daily necessities through digital platforms, ordering food online is the most people's expenditure during a pandemic. This is in line with the results of research conducted by the Demographic Institute of the Faculty of Economics and Business, University of Indonesia (LD FEB UI) which conducted a survey of 4,199 active users of Grab or Gojek services. From the survey results, it was found that 97% of digital spending during the COVID-19 pandemic was for ordering food online followed by online at 76%.

Motorcycle couriers are one of the most effective alternatives for delivery of food and beverages door-to-door. Motorcycle couriers are considered efficient because they can more easily get through traffic jams on the highway. Regarding food delivery, online couriers often use delivery boxes. The use of boxes for food couriers is indeed considered better because it keeps food from being damaged and avoids the influence of environmental conditions such as heat and rain. However, couriers still have some problems related to boxes used, such as the size of the box that cannot be adjusted to the size of the item, easy to carry, safety etc. In terms of online store customers, in the midst of the current COVID-9 pandemic, the need for goods or food delivery facilities that can reduce the risk of virus transmission has increased. Currently, there is no delivery box for goods or food equipped with facilities for the prevention or reduction of viruses or bacteria (sterilizer). Therefore, we need a means of carrying goods or storage that can meet the needs of shipping couriers while meeting customer needs in terms of maintaining the quality and hygiene of the goods or food delivered.

Based on the description of the background, the problems that become the focus of this research are as follows:

1. There is no box that can be used by couriers who deliver food/drinks or goods that can maintain the hygiene of

the delivered goods.

2. The box used today is not flexible enough to be adjusted in size to the needs of the goods or food/drinks that are delivered.

Based on these problems, this study would like to propose a sterilizer box to sterilize goods carried by couriers so that the goods are not contaminated and do not endanger the health of the buyer. In addition, the sterilizer box has an expandable so that it can adjust to the package received or delivered. In this study, the focus of the design is on the food delivery box. This research is an initial research, which aims to capture the need and provide an initial idea related to the concept of a sterilizer box bag design. With this research, it is hoped that it will be further developed, so that it can be produced and marketed to the public, especially couriers who deliver goods. The target of the output of this research is food expedition services that use two-wheeled or motorbike transportation such as Grabfood, Gofood, Shopeefood, Traveloka eats.

## **2. Methodology**

Research starts with determination of market segment and targets. Segmentation and determination of target markets are needed to identify and understand user needs in related market segments. In this study, the target segment is a motorcycle courier, an online food delivery service company. The products that are designed can later be used to carry, deliver food packages as well as to disinfect food packages in order to reduce exposure to the Corona Virus so that consumers no longer have to worry about being exposed to bacteria or viruses through the food packages they ordered. After that the process continue with the identification of customer needs. Data on consumer needs is collected by conducting an initial survey by targeting couriers as consumers who will directly experience the benefits of this package sterilization box product. Then, the product benchmarking process is conducted. Benchmarking process is done by comparing the attributes of innovation products that will be obtained from data on consumer needs. The product attributes are then compared with similar competitor products, in order to determine the value of the innovation product attributes with competitor products. The competitor's products used are products that are superior and inferior to innovation products. Next step is to create Quality Function Development matrix. QFD is briefly carried out to translate customer needs into product characteristics to be made. The pre-defined technical responses are then converted into metric units. For example, consumers want a product to accommodate more goods, so the product needs a large capacity with detailed specifications in metric units. TRIZ method and Morphological Chart will be used in this research to help develop the product concept. After the product specifications have been obtained, then the product begins to be designed according to the specifications obtained from the volume of the product to the materials and components attached to the product. The product prototype is then created using software. In this study the prototype design will be made in 3D. The process also involves an economic analysis to determine the feasibility of the product to be mass produced from an economic point of view. Feasibility in question is the cost that producers need to pay to produce on a large scale. With the economic analysis, producers will be able to find out the costs incurred in 1 batch of production and the profits they will get.

## **3. Results and Discussion**

The proposed design box sterilizer product name is OXEN. OXEN is a box that is design to have a function to automatically sterilize food or drinks delivered by couriers or motorcycle taxis. This is expected to make consumers feel safer to order food or drinks using online courier services or motorcycle taxis because they are protected from exposure to viruses or bacteria. Also can provide convenience to the courier in delivering food.

In this study, VOCs were obtained from direct interviews with food and beverage delivery service couriers from Grab, Gojek, and Shopee as many as 32 people that shown in table 1.

Table 1. Results of Food and Beverage Courier's VOC

No	Customer Need
1	There is a partition so that the food does not slide
2	Sizes are made in several types
3	Design applicable, matched with standard motorbike
4	Size of box is small to medium
5	There is a drink box
7	Materials that are durable from heat and water resistant
8	Can maintain the temperature of food or drink
9	Use alternative locks other than padlocks because the keys are prone to loss
10	Box stable
11	Comfort driver
12	Storage box that easy and does not take up space
13	The capacity of the goods can be adjusted or flexible, the corners must be strong

No	Customer Need
14	Able to sterilize incoming food and drinks
15	Easy to carry, can be designed like a retractable suitcase
16	Easy to hold
17	UV light can turn on automatically when closed

In the QFD stage, several stages are carried out starting from identifying customer needs to becoming a House of Quality.

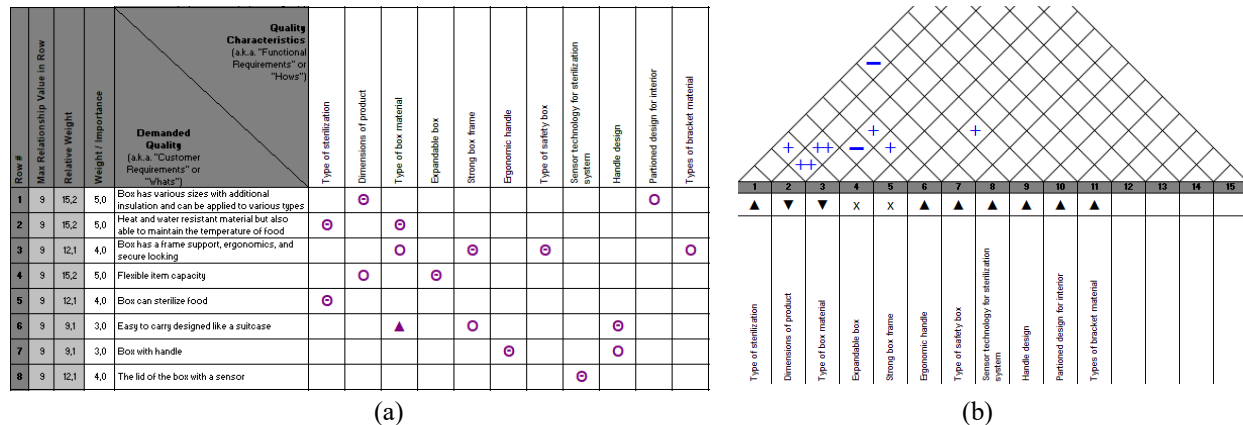


Figure 1. (a) Planning Matrix between demanded quality and technical response in HOQ; (b) Technical Correlation between technical responses

### 3.1 TRIZ Analysis

TRIZ comes from Russia, namely "Theoria Resheneyva Isobretatelskehuh Zadach" or in Turkish "Creative Problem-Solving Method". TRIZ is a systematic approach to understanding and solving problems that allows implementation based on logic/not intuition and generating innovative ideas. TRIZ is used when there is a contradiction where TRIZ will provide a choice of solutions based on the existing problem. One of the benefits of using TRIZ is an understanding that contradictions can be resolved methodically by implementing innovative solutions.

#### Step 1: Describe the problem

In the HOQ correlation, there is a contradiction or negative correlation between one technical response and another technical response, namely between UV sterilization and sensor technology for sterilization systems where when the sensor is on, UVC rays will sterilize food or drinks as long as the sensor is on. This is felt to be wasteful of the battery as a resource, thereby reducing productivity.

#### Step 2: Matching and comparing common problems with TRIZ

From these problems, improvements without losing a value. In case, what we want to improve is to minimize sterilization time in order to save battery without losing value of UVC sterilization effectiveness. There are 39 technical parameters to identify parameters to improve and undesired result. The following is a table of problems.

Table 2. Parameter to Improve dan Undesired Result

	Parameter to Improve	Undesired Result
Specific Problem	Sensor technology for sterilization systems	UV sterilization
General Problem	Loss of energy	Reliability
Explanation	The less energy that comes out will save the battery used	More battery saving that does not hinder the reliability of sterilization

#### Step 3: Finding a TRIZ solution

From parameters to improve and undesired result, 40 inventive principles will appear, where for parameter to improve form of loss of energy and undesired result form of reliability will produce three principles namely: beforehand cushioning, preliminary action, and parameter changes.

#### Step 4: Developing an ideal solution for the problem

From the three principles, the most likely to be applied is parameter changes where the consistency of the emission is not considered to be more concerned by placing UV-C rays at corner points so that it is more evenly distributed to all points with a stronger emission than being placed at one point. side.

### 3.2 Product Concept Development

Concept is a picture of technology, working principles, and product form. Meanwhile, concept selection is the process of evaluating the concept with respect to consumer needs and other criteria, comparing the strengths and weaknesses of a concept, and selecting one or more concepts for further development. (Ulrich, 2011). In the development and selection of concepts, several stages were carried out, namely morphology chart, alternative concept, concept screening, and concept scoring.

Step 1: Morphology Chart: A morphology chart is a list or summary of a systematic analysis of changes in shape to assist product designers in identifying new combinations of product elements or components.

Step 2: Concept Alternative: Concept screening is compiled based on a matrix of alternative concept results and is assessed using selection criteria determined based on Demanded Quality. There are three codes where + for "better than," 0 for "same as," - for "worse than" compared to existing products on the market. In the alternative concept, there are 5 alternative concepts that can be used for further product development. From 5 alternatives, three concepts chosen for scoring are concepts 2, 3, and 4 because they have a net score and are not negative.

Step 3: Concept Scoring: Concept Scoring is conducted based on selection criteria based on Demanded Quality. weight used is derived from the calculation of demanded quality on the HOQ.

### **3.3 Product Design Prototype (3D)**

Based on several stages of prototype design, the results obtained 3D sketch are as follows:

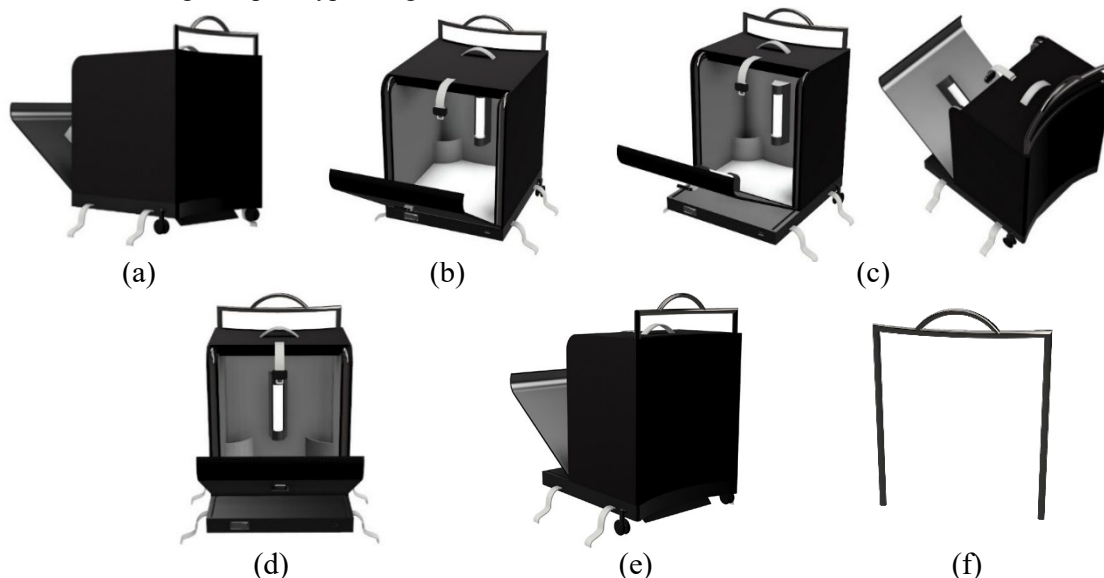


Figure 2. (a) Front Side View (Extended version); (b) Isometric View (Extended version); (c) Isometric View (Unextended version); (d) Back View (Unextended Version); (e) Side View (Unextended version); (f) Back frame

## **4. Conclusions**

From the results of a series of design stages, this study proposes a sterilizer box design that has several innovations that distinguish it from boxes currently on the market, including: The proposed box offers sterilizer mechanism which use UVC light which is proven to be effective in killing viruses and bacteria. Sterilization also takes place automatically using a magnetic switch sensor. Second, it is expandable box. Third, it is easy to assembly. The proposed material of the box made from canvas that is not too rigid will be easier to adjust. In addition, with the addition of a frame and box, it will make the box easier to install on the motorbike stably. Therefore, the combination of canvas, base box and frame will make the box easy to disassemble and install. It is also proposed to be an Ergonomic design. Boxes generally use canvas without a frame so it is comfortable to use even though it is not strong enough. On OXEN, there are attachments such as frames on the sides of the box to keep it strong when placed on the vehicle. In addition, attachment that is adjusted to the shape of the back will make the rider more comfortable or if when the courier takes the service between passengers, the passenger will feel comfortable even though the box is still installed on the vehicle. Next, is portable (using wheels and carrying luggage). At OXEN, the added features of wheels and luggage carriers that can be adjusted in length to make it easier for couriers to pick up food at a shop that is quite far from the motorbike parking lot, food delivered in large quantities, or the customer's house is far from the motorbike parking lot like in an apartment.

## **References**

Elisanti, A., Ardianto, E., Ida, N., & Hendriatno, E. (2020). Efektifitas Paparan Sinar Uv Dan Alkohol 70% Terhadap Total Bakteri Pada Uang Kertas Yang Beredar Dimasa Pandemi Covid-19. *Jurnal Riset Kefarmasian Indonesia*, 2(2),

120. Retrieved 12 March 2021, From. <https://jurnalfarmasi.or.id/index.php/jrki/article/view/88/72> .
- Rahmawan, A., & Kholis, M. (2017). Implementation Of Quality Function Deployment (Qfd) In Agro-Industrial Technology Curriculum. *Agroindustrial Technology Journal*, 1(1), 11-17. Retrieved 12 March 2021, From <https://ejournal.unida.gontor.ac.id/index.php/atj/article/view/1836/1275>.
- Sellera, F. P., Sabino, C.P., Cabral F.V. & Ribeiro, M.S. (2021). A systematic scoping review of ultraviolet C (UVC) light systems for SARS-CoV-2 inactivation, *Journal of Photochemistry and Photobiology*
- Sutawidjaya, A., & Asmarani, P. (2018). Evaluasi Pelayanan Publik Produk Hukumonline.Com Untuk Mengetahui Kebutuhan Pelanggan Kasus PT Justika Siar Publika. *Jurnal Jdm*, 1(2), 34-42. Retrieved 12 March 2021, From <https://media.neliti.com/media/publications/279592-evaluasi-pelayanan-publik-produk-hukumon-fcc5ca64.pdf>.
- Ulrich, K., & Eppinger, S. (2016). *Product Design and Development* (6th Ed.) Mcgraw Hill Education.
- Virus Bertahan Di Udara Dan Permukaan Benda, Disinfektan Yang Efektif Solusinya. *Klikdokter.Com*. (2020). Retrieved 12 March 2021, From <https://www.klikdokter.com/info-sehat/read/3645577/virus-bertahan-di-udara-dan-permukaan-benda-disinfektan-yang-efektif-solusinya>

## **Biographies**

**Dyah S Dewi** is a senior lecturer in the Department of Industrial and Systems Engineering ITS Surabaya. Currently she works as the Secretary of Department of Industrial and Systems Engineering. She is an active member and a treasury of Indonesian Ergonomics Association earned Phd from Department of Mechanical and Manufacturing University of New South Wales (UNSW) Sydney Australia. Master of Engineering from Mechanical and Manufacturing University of New South Wales (UNSW) Sydney Australia. Bachelor's in industrial engineering from Department of Industrial Engineering, Faculty of Industrial Technology Sepuluh Nopember Institute of Technology (ITS) Surabaya Indonesia. Her research interest is on Human Factors/Ergonomics, Product and Service Development, Risk management in Concurrent Product Design, and Work Design and Measurement.

**Pinkan Magarena Juanda** is a bachelor's in Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember, Surabaya. During her study period, she was active as student association organization. She also becomes an assistance of Ergonomics and Work System Design Laboratory who responsible to conduct practicum for relevant courses and assist students to study some of Ergonomic and Work System related courses.