ANALYSIS OF LOADING GOODS USING SOFTWARE CUBE IQ AT PT. XYZ

Muhamad Marsyeika Rifanro Ferdiansyah1, Ariel Bagdja Nugraha2, Arif Budiman3, Gani Kusuma Negara4, Muchammad Fauzi5

1, 2, 3, 4, 5 Industrial Engineering Department, Widyatama University, Bandung, Indonesia
muhamad.marsyeika@widyatama.ac.id

ABSTRACT

Cube IQ is Load Planning software that generates optimal loading plans and packing patterns (recipe) for containers, pallets and cartons. This solution can be customized for specific needs and can be integrated with ERP, WMS, and TMS systems for full automation. All algorithms are developed completely in-house, and under continuous R&D. The problem of arranging goods in containers that are not optimal makes a company's expenses increase. Problems with the arrangement of goods can be caused by not optimal use of space and the arrangement of goods in containers. Container loading is a three-dimensional problem that determines the arrangement and arrangement of goods in containers, the main purpose of container loading is optimizing the use of containers for loading activities. Therefore, to overcome the problem of arranging goods in containers so that they are optimally using one of the software. Cube IQ is software that can help plan loading activities properly and regularly, if applied to actual loading activities, it will approach the results of what has been processed in this system. Cube IQ has operating modes for container loading, truck loading, palletization, and cartonization. This study aims to optimize the preparation of goods in containers using Cube IQ software. The optimization results obtained are expected to be able to provide input in making decisions on the preparation of goods and determine the order and orientation of goods in the container. Based on the results of the comparison of container volume utilization with goods, the optimization results using Cube IQ software reached 30.56 m³ or about 56.44%, while in the current condition the container volume utilization used in loading activities only reached 27.12 m³ or about 50.08%.

Keywords: Loading Activity; Container Loading; Cube IQ; Container.

1. INTRODUCTION

The players in the industrial world today will always be required to be faster to meet market demand and prevent losing opportunities in business. Supporting these activities requires an effective and efficient system. Industrial activity can be assessed for its effective and efficient level from various aspects including warehouse management (Salam & Khan, 2016). Warehouses have major functions such as storage of receipts, and delivery of goods. Therefore, to produce an effective and efficient system, it is necessary to plan and design a warehouse that can reduce costs and provide the best service to its customers (Oktarina, 2010).

Warehouse productivity is influenced by the smoothness of its activities, one of which is loading activities. The description of the activities carried out in loading activities is to move an item from a temporary storage area, then deliver it to consumers. Storage and arrangement of goods in proper containers supports the smooth operation of loading activities to be effective and efficient which makes warehouse productivity increase (Pandapotan & Abadi, 2013). In addition to warehouse productivity, another important key to logistics activities after the company's service standards is transportation. Transportation has a great influence in meeting the level of customer satisfaction and smoothing the company's business interests.

Loading is a series of activities to move goods from one place of loading (unloading) to their destination (debarkation) as a place of unloading cargo. In general, it is stated that every transportation aims to arrive at the destination safely and increase the use-value for the goods transported. Transportation means lifting, loading, carrying, and sending. Transportation means the business of carrying, delivering or moving people or goods from one place to another. (Maulana R., 2020). This loading is one of many series of logistics activities in the warehouse.
A Container is a means of transporting goods that can be used in various modes of transportation to carry out goods delivery activities. Arrangement of goods in containers (container loading) is an important first step to distribute goods of various weights and sizes by maximizing the utilization of available space in containers. Container loading is the core of many problems that arise in logistics and distribution activities (Wardani, Mulyadi, & Anggraeni, 2020; Tang et al., 2020; Brookes, 2020; Weriss, 2020).

Container Loading is an obstacle related to the dimensions of the vehicle volume due to capacity limitations, in the arrangement and arrangement of goods in containers, so to overcome this, it is necessary to optimize the use of containers for these activities. Container loading is a three-dimensional problem that determines the arrangement and arrangement of goods in a container. The main purpose of container loading is to optimize the use of containers for loading activities. The factor of arranging goods in a container that is not optimal will require double the cost because another container is needed to transport the rest of the goods that should be included in one container (Moura & Oliviera, 2005).

PT. XYZ is a company engaged in manufacturing, more precisely a flavour company that has a main warehouse in Karawang, the resulting product is a powder that is packaged using a box, loading activities at PT XYZ can be said to be still less effective and efficient because there are still items that don't fit in one container in one loading activity so that the goods must be loaded in another container. This happens because the preparation of goods and the order of goods cargo is not right, conditions like this are very detrimental to the company and can cause huge costs if not handled properly. Powder products at PT XYZ received an average demand of 934 boxes in one day of delivery. Meanwhile, data from the company shows that PT XYZ can only fulfil 710 boxes for one delivery of goods. So if you calculate the cost for 1 loaded box, it has a higher cost.

Based on these problems, this study aims to optimize the arrangement and order of goods in containers using Cube IQ software at PT. XYZ, so those loading activities and container volume and weight utilities at PT. XYZ can be known. The results of research with the Cube IQ software can approach the results that are following the existing ones. So the results of this study can be input for companies to determine the utility of goods and the number of containers.

II. LITERATURE REVIEW

Cube IQ is software that can help plan loading activities properly and regularly. If it is applied to the actual loading activity properly and regularly, it will approach the results like what has been processed in this system. Cube IQ has operating modes for container loading, truck loading palletization, and cartonization so that the placement of goods in containers can be optimized (Oktarina, 2010).

The application of Cube IQ software can help plan loading activities properly and regularly. If applied to the actual loading activity, it will be close to what results are processed in this system. Cube IQ has operating modes for container loading, truck loading, palletization, and cartonization. There are various advantages of Cube IQ in loading activities, that is (Wardani, Mulyadi, & Anggraeni, 2020):

1. Cube IQ allows editing materials in real-time, in real 3D using load editing. These include adding and removing products, rotating loads, picking up boxes, and dragging them to new locations. Cube IQ updates the item stacking plan so items can be loaded properly.

2. Cube IQ is very flexible in product loading and stacking rules, which can be set for each product size orientation, able to optimize the load under the stack as a whole, according to the rules.

3. Cube IQ can be used in several units depending on the data used. Can be used for data in inches/cubic and pounds but want to organize into meter containers with dimensions in centimetres, cubic meters, and kilograms. Conversions are easy to maintain between loads and are 100% accurate.

Loading activity is one of the factors that factor into the smoothness of loading activities, namely the movement of an item from the storage area and the preparation of the right container goods to support the smoothness of loading activities to be effective and efficient which makes warehouse productivity increase (Pandapotan & Abadi, 2013). The process of moving goods/materials from the area of receiving goods/materials to the delivery vehicle is called loading. This process is a form of warehouse service to users and consumers. The loading process is largely
determined by the type, clarification, and characteristics of the product (Mulcahy, 1994). One concept that can be used in the loading process is the Container Loading Problem (CLP). Usually, the main goal of CLP is emphasized by maximizing the utility efficiency of the use of container space for loading activities. Several limitations are considered in the CLP namely limited orientation for boxes, limited load stability, and limited container volume (Moura & Oliviera, 2005).

A Container is a rectangular crate, weatherproof, used for lifting and storing many packaged cargoes and bulk goods that protect the contents from loss and damage, can be separated from the means of transportation, is needed as a unit of loading, and if moving ships without having to unload the contents (Maulana R., 2020). A container is a package that is specially designed with a certain size, can be used several times, used to store, and at the same time transport the cargo in it (Suyono, 2005).

Methods

The research was conducted at PT. XYZ which is located in Karawang Regency, West Java by following the research flow. This study observes loading and unloading activities on exported food flavouring products. The loading activity is moving the finished product from the warehouse to the container truck. The data collection stage in this study was carried out by conducting direct observations (surveys) in the form of types of export products, average daily demand for each product, dimensions and weight specifications of packaged products, product storage characteristics, the average number of currently loaded products, and specifications of the mode of transportation used (Tan, Hilmola, & Binh, 2015). Then the data is processed using Cube IQ software. The product packaging used is a master box with a rectangular area measuring L: 39.2cm, W: 23.2cm, H: 42cm. The rotation of the product to be loaded in the container has only two positions as shown in Figure 1.

![Figure 1. Possible goods position](image)

Preparation of the position of goods at PT. XYZ must follow the rules where the top of the packaging must remain above or side up and every item to be stacked a maximum of only six stacks.

This study focuses on analyzing the utility of the volume and weight of the product loaded into the container and how the optimal position and order of storage in the container is carried out with the following research flow:

![Figure 2. Research flow](image)
The following is a description of the research flow in Figure 2:

1. **Preparation**

The preparation stage is the initial stage of research to find problems in supply chain process activities (in this journal is the activity of loading goods), the background of the problem, and its formulation.

2. **Survey**

This stage is the stage of data collection in this study carried out by direct observation.

3. **Literature Study**

Literature studies are carried out by collecting reference materials, namely from books, journals, articles, and websites from the internet. Literature studies were conducted related to logistics activities, product loading, and Cube IQ software.

4. **Data Collection and Processing**

At this stage, data collection and information that will be needed in research are carried out. In this journal, there are three categories of data collected, namely, Product Dimensions, Fleet Dimensions, and Product Demand.

5. **Data Processing with Cube IQ Software**

At this stage, an analysis of the literature study is carried out to determine the solution to the problem of optimizing the arrangement of goods in the container fleet. After that, the system design is based on the analysis that has been made previously using the Cube IQ software.

6. **Implementation**

At this stage, the results of the analysis and design are applied as well as an evaluation of the real case.

7. **Conclusion**

This stage explains the conclusions of the research that has been done and suggestions that can be made by PT. XYZ to further optimize the product loading process.

### III. RESULTS AND DISCUSSIONS

Data processing on the problem of loading goods at PT. XYZ uses Cube IQ software. It required an average daily demand for each product, dimensions and weight specifications that are already packaged products, product storage characteristics as shown in Table 1.

**Table 1. Demand Data and Product Specification**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Size (cm)</th>
<th>Weight (kg)</th>
<th>Carton/day</th>
<th>Max Stacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRM010567</td>
<td>39.2</td>
<td>23.2</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td>DRM0105657</td>
<td>39.2</td>
<td>23.2</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td>DRM010544</td>
<td>39.2</td>
<td>23.2</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td>DRM010553</td>
<td>39.2</td>
<td>23.2</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The mode of transportation recently used is the Wing Box with the dimensions of the Wing Box container in Table 2.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Container Dimension (cm)</th>
<th>Container Volume ($m^3$)</th>
<th>Truck Capacity (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L: 940 cm</td>
<td>54.14 $m^3$</td>
<td>20.000 kg</td>
</tr>
<tr>
<td></td>
<td>W: 240 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>H: 240 cm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The optimization process is carried out using Cube IQ software, where the results of the optimization process for the optimal arrangement and order of goods indicate the need for transportation modes as much as two units as shown in Figures 3 and 4.

Following the average daily demand of 934 cartons, Figure 3 shows the utility of container 1 for the used loaded volume of 30.56 $m^3$ or approximately 56.44% with a loaded weight of 100%, while Figure 4 shows the utility of container 2 for the used loaded volume. 5.12 $m^3$ or approximately 9.45% with a loaded weight of 16.75%. Container 1 shows the number of products that can load a maximum of 800 cartons and container 2 shows the number of products that can load a maximum of 134 cartons.
The utility of the container's current state can be determined by calculating it as follows:

Utility loaded volume container wing box (existing) carries 710 cartons

\[
Utility\ Loaded\ Volume\ Existing = \frac{A - (A - B)}{A} \times 100\%
\]

\[
Utility\ Loaded\ Volume\ Existing = \frac{54.144 - (54.144 - 27.12)}{54.144} \times 100\%
\]

\[
Utility\ Loaded\ Volume\ Existing = \frac{54.144 - 27.024}{54.144} \times 100\%
\]

\[
Utility\ Loaded\ Volume\ Existing = 50.08\%
\]

Information:

A = Total Container Volume (cm)

B = Total Box Volume (cm)
Utility loaded weight container *wing box* (existing) carries 710 cartons

\[ Utility\ Loaded\ Weight\ Existing = \frac{A - (A - B)}{A} * 100\% \]

\[ Utility\ Loaded\ Weight\ Existing = \frac{20,000 - (20,000 - (710 * 25))}{20,000} * 100\% \]

\[ Utility\ Loaded\ Weight\ Existing = \frac{20,000 - 2,250}{20,000} * 100\% \]

\[ Utility\ Loaded\ Weight\ Existing = 88.75\% \]

Information:

A = Maximum Container Weight (kg)

B = Total Weight of Box (kg) = amount x weight per box

A comparison of the results of the container utility for the existing conditions using Cube IQ software, the comparison is shown in Table 3.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total Product (Box)</th>
<th>Utilities Loaded Volume</th>
<th>Utilities Loaded Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>710</td>
<td>50.08 %</td>
<td>88.75 %</td>
</tr>
<tr>
<td><em>Cube IQ</em></td>
<td>800</td>
<td>56.44 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

From these results, it can be seen that by using the Cube IQ software, the resulting utility is more optimal with an increase in the loaded volume utility to 56.44% compared to existing which only uses the loaded volume utility of 50.08%. Also, an increase in the utility of the loaded weight of the container by 20,000 kg or 100% compared to existing which only uses its loaded weight utility of 88.75%. If you look at Figure 3, there is an empty container space. This is due to the maximum transport weight has reached 100% so that no more products can be added.

**IV. CONCLUSION**

From the results of the tests carried out on the preparation of goods in the Cube IQ software process, it can be concluded that there is an increase in the results of the utility loaded container volume used between the current conditions and the calculation of the Cube IQ software by 6.36% with the container volume utilization being 30.56 m³ or 56.44 %. Also, an increase in the utilization of the loaded weight of the container by 11.25% with the utility of the loaded weight being 20,000 Kg or 100%. Therefore, the activity of loading the product becomes more optimal. To meet the product demand of 934 cartons, we recommend choosing a fleet where the first fleet uses a Wing Box which can accommodate a maximum weight of 20,000 kg, equivalent to 800 cartons and the remaining 134 cartons or the equivalent of 3.350 kg which does not enter the first fleet using a Colt Diesel Double vehicle which can accommodate a maximum weight of 5,000 kg to reduce rental rates.

**REFERENCES**


