Planning of Production Facilities Layouts of Home Industry of Cabalu Smoked Salted Egg in Bone District

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Abstract. The home industry of Cabalu smoked salted egg is one of the home industries in Bone Regency that operates in the egg processing sector. This home had the potential to produce smoked salted eggs, which was quite promising and was supported by the main raw material for duck eggs, which was available in three cages in Cabalu village and had a group of ducks and raw materials for salt that are easy to obtain, as well as the public's interest in home products. Currently, the layout of production facilities and working environment conditions in the home industry of Cabalu smoked salted egg are experiencing problems. This research aims to redesign the Home Industry of Cabalu smoked salted egg facility's layout, which can utilize the area, minimize material path length, reduce process constraints, and maximize production results using the Activity Relationship Chart (ARC) method and the BLOCPLAN algorithm. The proposed layout was selected based on the adjective value and R-Score, which was close to 1, with a rel-dist score with the lowest value and adapting to the conditions of the home industry. The proposed layout number 20, the alternative layout was chosen as the proposed layout with the lowest material transfer distance.

1 Introduction

Layout planning is an important consideration in determining the efficiency and effectiveness of production results. Preparing a good layout according to factory conditions by optimizing the area so that small and large-scale factories no longer experience losses. Planning can determine efficiency in the form of production processes and material flows that lead to successful work in the industry. Utilization of large areas in making layouts which are used for placing machines or other facilities so that the production process runs smoothly. The layout is planned based on the objectives of the layout planning. Because of this, planning a factory requires knowing its purpose [1].

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Home Industry of Cabalu smoked salted egg is a home-based business that has been established since 2017 with a promising potential for smoked salted egg production, which is supported by the main raw material of duck eggs, which are available in three cages in Cabalu village and has a group of ducks as well as salting materials, which is easy to get, as well as the interest of local and foreign people of product from home industry of Cabalu smoked salted eggs which is one of the regional superior products in exhibition activities.

Seeing this potential and the various problems that are obstacles in developing this business, one of them is that the layout of the production room facilities is still not organized, so the production flow is still less effective and efficient in the production process. Facility layout design aims to support the smooth production process, prevent work accidents and eliminate unnecessary movements of labor and raw materials [2]. Utilization of the area has not been optimized and there are still empty areas.

Based on the existing problems, research was carried out on layout design, using the Blocplan algorithm. The design was carried out using The BLOCPLAN algorithm required a linkage map or activity relationships Activity Relationship Chart (ARC). The goal of blocplan was to minimize the distance between facilities or maximizing the close relationship between facilities so as to optimize area use and production results [3].

2 \textbf{Methods}

The first step that must be taken before conducting research is to conduct a preliminary study [4]. A preliminary study was carried out at the Home Industry of Cabalu smoked salted egg Home Industry which became the object of research by knowing the general description of the home industry, including the initial layout. The method used to plan the home industry layout using the blocplan method consists of three stages. The first stage was determining the area of each department or workstation. The second stage creates a map of activity or relationship or Activity Relationship Chart (ARC). The third stage was to create a layout based on the blockplan. The final stage was choosing an alternative layout that suits the conditions of the Home Industry of Cabalu smoked salted egg.

3 \textbf{Results and discussion}

3.1 \textbf{Layout}

Layout objectives are to minimize material handling costs, increase the efficiency of room utility, increase the efficiency of energy utility factory work, reduce process obstacles, and facilitate communication and interactions between workers, workers and their supervision, and/ or between workers with company customers [5]. The purpose of layout planning is to obtain The most optimal layout arrangement of the facilities available within the company is expected to increase efficiency and effectiveness within the company, increasing production results and reducing costs of company production so that production activities run smoothly and the workers can complete the task in accordance with what is targeted in company.

One technique for determining the layout of production facilities based on the need for tools/machines and equipment is an analysis of the interrelationships between activities, which aims to see the interrelationships between activities that occur in the industry/factory so that it can serve as a guideline in designing the layout of the home industry as a whole. This will determine the subsequent layout design per the conditions of the home industry, which will contribute to achieving the highest possible productivity, efficiency, and effectiveness [6].
3.2 BLOCPLAN

BLOCPLAN (Block Layout Overview with Layout Planning) is a heuristic algorithm that uses data quantitative and qualitative data [7]. The design is carried out using BLOCPLAN algorithm, which requires a linkage map or activity relationships Activity Relationship Chart (ARC). The layout design will be carried out to produce several alternative layouts for each department with a layout score, and then, a facility layout design with the most optimal total rectilinear value will be selected [8].

The BLOCPLAN method can use linkage maps as input data. Layout costs can be used, measured both by distance and by proximity. The number of rows in BLOCPLAN is determined by the program and is usually two or three lines. BLOCPLAN is a program developed for facility layout design using a hybrid algorithm that combines algorithms constructive and repair algorithms. The function of blocplan is to minimize the distance between facilities or maximize the proximity between facilities. The results of the facility layout design Using the Blocpan method, several alternatives can be selected based on three types The existing criteria are adjacency score, R-score, and product movement [8].

3.3 The Home Industry of Cabalu Smoked Salted Eggs

The home industry of Cabalu smoked salted egg is one of the home industries in Bone Regency, South Sulawesi. The condition of the Cabalu area with the majority of people having jobs as farmers/breeders and having several duck pens as a livestock group, makes the main source of raw materials for making smoked, salted eggs easy to obtain, and this is also the main reason for the establishment of this home industry. The location of the home industry on the outskirts of the city of Bone District makes access and mobility very easy, both in terms of sales and supply of materials, as well as bricks and rubbing ash, which are easy to obtain in the area.

3.4 Layout Analysis of Cabalu Smoked Salted Egg Home Industry

The initial layout consists of 4 parts: the production room, smoking egg room, raw materials room, and packaging room. The current condition of the business premises still has many problems that need to be corrected. One of the problems that can be seen is that the area utilization is not optimal and parts or flows are combined with other parts so that the production space facilities are still not organized, the production flow is still less effective and efficient in the production process. Irregular movement of labor and raw materials.

The results of re-planning the layout of the home industry of Cabalu smoked salted egg production facilities began with determining each department or work facility. The home industry of Cabalu smoked salted egg work facilities can be seen as follows:
Table 1. The home industry of Cabalu smoked salted egg work facilities

<table>
<thead>
<tr>
<th>Work Facilities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Materials Room</td>
<td>1</td>
</tr>
<tr>
<td>Washing Room</td>
<td>1</td>
</tr>
<tr>
<td>Production Process Room</td>
<td>1</td>
</tr>
<tr>
<td>Salting Room</td>
<td>1</td>
</tr>
<tr>
<td>Smoking egg Room</td>
<td>1</td>
</tr>
<tr>
<td>Packaging Room</td>
<td>1</td>
</tr>
<tr>
<td>Display case</td>
<td>1</td>
</tr>
<tr>
<td>Toilet</td>
<td>1</td>
</tr>
</tbody>
</table>

Activity relationship linkage map or Activity Relationship Chart (ARC), which can be seen in the image below:

Figure 1. Activity Relationship Chart (ARC) of the home industry Cabalu smoked salted eggs

I proposed the layout with the addition of 4 production flows using the Activity Relationship Chart. The next step is to input values based on linkage symbols whose values are obtained from ARC. The results of inputting the linkage symbol can be seen in Figure 2 below:
Figure 2. Linkage map

The score value for each department can be determined by the BLOCPLAN user or followed by the value determined by the system. The values of the linkage symbols can be seen in Figure 3 below:

Figure 3. Relationship symbol value

BLOCPLAN would display a choice of ratios of the desired layout form, selected according to the conditions of the Home Industri of Cabalu smoked salted egg. The layout can be seen in Figure 4 below:
There were five ratio options for the layout form above, including the first 1.35: 1, the second 2:1, the third 1:1, the fourth 1:2, and the fifth option where you can determine the ratio of the layout form yourself. In accordance with the conditions of Home Industry of Cabalu smoked salted egg, based on the length and width of the Home Industry production facility, it had a length of 7.6 m x 7.6 m, so the ratio that suits the layout chosen was the third option with a ratio of 1:1.

Next, it would produce a TCR value, and then the BLOCPLAN algorithm would automatically generate as many iterations as needed to get a good proposed layout. Each department would be randomly placed in a certain layout area, and BLOCPLAN would display the layout alternatives one by one and their values. The best layout can be seen from the highest R-Score value. If the value is close to 1, then it can be proposed as the best alternative. The scores and each alternative layout can be seen in Figure 5 below:

**Figure 4. Layout form**

**Figure 5. Score each layout alternative**
Based on the layout alternatives that had the highest score and the same value, there were two, namely Layout number 5 and 20, but the alternative layout was chosen based on the condition of the home industry and the relationship between departments, so the proposed alternative layout was number 20. Layout images can be seen in Figure 6 as follows:

![Figure 6. BLOCPLAN proposed layout](image)

Based on the results of data processing that had been carried out at Home Industry of Cabalu smoked salted egg production facility, redesigning the layout of the production facility using the BLOCPLAN method, there were 20 proposed layout improvements where the layout that had the highest R-Score or close to 1 was in the layout 5 and 20 was chosen because it had the highest R-Score value, namely 0.91, but because a smaller Distance score value was the best, layout 20 was the alternative proposal chosen with a value of 85.

This new proposed layout utilizes empty areas so that they can be used as work facilities or new departments, so the layout would be more orderly and each production process would be more focused. Based on the total area available and the results of the calculation of the required production area for the home industry of Cabalu smoked salted egg by using a tolerance of 0.5 meters for the machine and an allowance of 40% for the operator, it was found that the total area required for the production area is 57.76 m², so the production area requirement for Home Industry of Cabalu smoked salted egg had sufficient from the total area available, namely 70.5 m².

The proposed layout for the home industry of Cabalu smoked salted egg had several additional facilities: a washing room, salting room, display case, and toilet. With the display space, the home industry of Cabalu smoked salted egg had a special place as a mini market for selling products apart from distributing them to shops.

4 Conclusion

Based on the results of research conducted at the home industry of Cabalu smoked salted egg, the overall area requirement for the home industry of Cabalu smoked salted egg is 57.76 m², where the area requirement is sufficient for the available area requirement, which is 70.5 m². The proposed layout for the home industry of Cabalu smoked salted egg had several additional facilities: a washing room, salting room, display case, and toilet. With the display
space, the home industry of Cabalu smoked salted egg had a special place as a mini market for product sales.

The area required sufficient for eight work facilities or departments. There were 20 alternative layout proposals available in the BLOCPLAN method. The proposed layout was selected based on the highest adjective and R-Score value or a value close to 1, the rail-dist score with the lowest value and taking into account adjustments to the conditions of the home industry was the proposed alternative layout to 20 were selected as the proposed layout with the lowest material movement distance.

References

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4. S. Arikunto. Research procedures a practical approach, (Rineka Cipta, Jakarta, 2006)