

Original Research Paper

## Optimization of Space in the Oyster Mushroom Industry with the Activity Relationship Chart Method

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**Abstract:** Layout is a technique of arranging facilities to be better than before which aims to minimize all costs and maximize profits. The purpose of this research is to optimize space in XYZ which produces oyster mushrooms. The optimization of space in this study uses the Activity Relationship Chart (ARC) method approach. ARC is a method that identifies the relationship of importance between one facility to another or one activity to another, whether it is important to bring it closer or it should be kept away. The results showed that the layout of the facilities in the XYZ home industry can still be optimized, including adding raw material warehouses, toilets, prayer rooms, ablution places, and the use of vacant land as oyster mushroom houses.

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**Keywords:** ARC, Layout, Mushroom.

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## 1. Introduction

According to BPS data in 2018, the mushroom harvested area in Indonesia was only 475 hectares, and mushroom production only reached 37,020 tons. This is an opportunity to increase mushroom production in Indonesia [1].

One of the production of oyster mushrooms in South Sumatra is the XYZ home industry. To find out how the production process in the XYZ home industry, the following can be seen the stages of oyster mushroom production in the XYZ home industry in Figure 1.

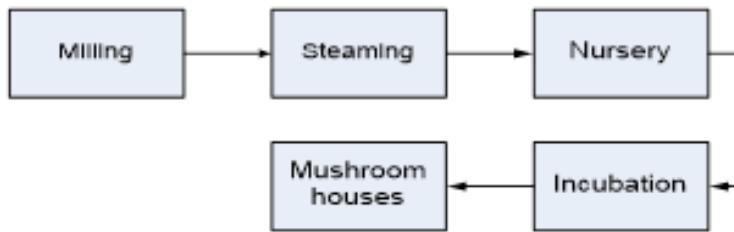


Figure 1. Production Flowchart

A more detailed explanation is as follows:

1. Milling  
In this process milling of powder, bran, lime, water to become one
2. Steaming  
In this process steaming at a temperature of 90°C - 95°C for 4 hours
3. Nursery  
In this process, the mushroom seeds are sown into the planting medium after being steamed
4. Incubation  
In this process, waiting for the mycelium to decrease for 2 months
5. Mushroom houses  
In this process, the oyster mushroom grows

Mushroom harvest time is approximately between 3 months to 4 months. However, if the treatment is not good, the harvest time can only last a maximum of 2 months. The fungal treatment can be done by maintaining the humidity of the air temperature in the mushroom house [2].

After observing the condition of the XYZ home industry, the researcher saw that there were still problems, one of which was in terms of the layout of the storage area for the raw material for the production of oyster mushrooms, which was still irregular from one department to another, resulting in a long production time. This resulted in not achieving the demand from consumers per month as much as 800 kg of oyster mushrooms. Meanwhile, with the current layout, the production output is only 250 kg of oyster mushrooms per month, so there is still a shortage of 550 kg of oyster mushrooms per month [3].

From the problems mentioned above, researchers are interested in reviewing the layout in order to optimize space at XYZ so that it can be maximized from the layout side so that later it is expected to increase production.

## 2. Literature Review

Oyster mushroom (*pleurotus sp.*) is a type of wood mushroom commonly consumed by the people of Indonesia, has a fruiting body that blooms to form a shallow funnel like a conch shell [4], oyster mushroom can be seen from its external morphology which has a variety of species that are quite tall such as fruit body color, hood size, stalk size, and shape [5]. White oyster mushroom (*pleurotus ostreatus*) has a balanced nutritional content such as carbohydrate and protein content so that it can be beneficial for the human body [6]. Places to plant oyster mushrooms can use oil palm husk (*elaeis guinensis*) as much as 75% and use durian skin (*durio zibethinus*) as much as 80% [7]. However, according to Sunandar et al, the use of corn seed media was able to facilitate the development of mycelium in approximately 15 days [8].

### 3. Methodology

#### 3.1. ARC Method

Research on the layout of previous facilities that has been carried out includes redesigning the layout of fashion retail displays using ARC with the result of saving space that can be used to add new shelves [9]. Then there is also a study with the theme of reviewing the newspaper printing area using ARC with the results obtained that there is a saving of 300 m<sup>2</sup> of space which is also proposed to be rented out so that there is other income [10] [11].

This research was conducted at Home Industry XYZ. The method used in this study is the Activity Relationship Chart (ARC) method. Where ARC is a method that identifies the relationship between the level of importance of one facility with another facility or activity with one another, whether it is important to bring it closer or it should be kept away. According to Pradana et. al [12] with ARC it can be seen whether the room is close or not. The ARC method was developed by Muther which is a simple technique in planning the layout of the facility. This method connects activities in pairs so that all activities will know the level of relationship [13] [14] An example of an ARC diagram can be seen in Figure 2.

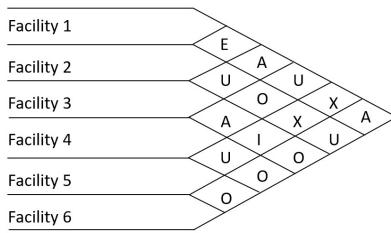


Figure 2. ARC Method [11]

As for how to fill in the columns on the ARC diagram, it can be seen in Figure 3 as follows:

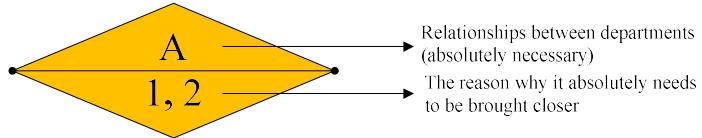


Figure 3. Example of How to fill in the ARC column

Table 1. ARC Method Symbols [9]

Symbol	Descriptions
A	Absolutely necessary
E	Especially important
I	Important
O	Ordinary Important
U	Unimportant
X	Undesirable

The symbols used to determine the degree of closeness in the Activity Relationship Chart method are [15]:

- A: absolutely necessary  
This symbol states that the two departments are closely related to each other and it is absolutely necessary to bring them closer so that the company's operating processes run well
- E: especially important  
This symbol states that the two departments are closely related, but the relationship between the two departments is not as important as the degree of relationship.
- I: important  
This symbol states that two important departments are also brought closer if the existing area conditions allow
- O: ordinary important  
This symbol indicates that the two departments are not closely related.
- U: unimportant  
This symbol states that the two departments do not need to be brought closer together, only under certain circumstances they can still be placed side by side.
- X: undesirable  
This symbol states that the two departments must be separated from one another, because it might disrupt the smooth operation of the process

### 3.2. Primary Data

The primary data taken in this study is the documentation of the oyster mushroom industry and the existing facility data at Home Industry XYZ in the form of:

- 1) Planting media production room  
This room facility is used for the production of mushroom growing media (baglog)
- 2) Steam room  
This room facility is used for steaming mushroom growing media (baglog)
- 3) Nursery room (inoculation)  
This room facility is used to lower the seeds into the mushroom growing media
- 4) Incubation room  
This room facility is used for the course of the micellium
- 5) Mushroom house  
This room facility is used for mushroom growth
- 6) Dining room  
This facility is used for dining

### 3.3. Secondary Data

The secondary data in this study were profiles of Home Industry XYZ, reference books, journals and other literature related to this research.

## 4. Finding and Discussion

From the preliminary observations that the researcher made, the original plan of Home Industry XYZ can be described in Figure 4.

Based on Figure 4; the location of the existing facilities, researchers saw that there were no raw material warehouses, prayer rooms, and ablution places. Where the existing raw material warehouse does not have a definite place so that it can hamper production. Then prayer rooms and ablution places that are not yet available require researchers to provide suggestions for procuring prayer rooms and ablution places.

Therefore, in the ARC analysis (as shown in Figure 5), researchers enter raw material warehouses, prayer rooms, and ablution places to find the right location. ARC (Activity Relationship Chart) analysis can be seen in Figure 5.

For more details, it can be seen in Figure 6, the proposal based on the ARC approach.

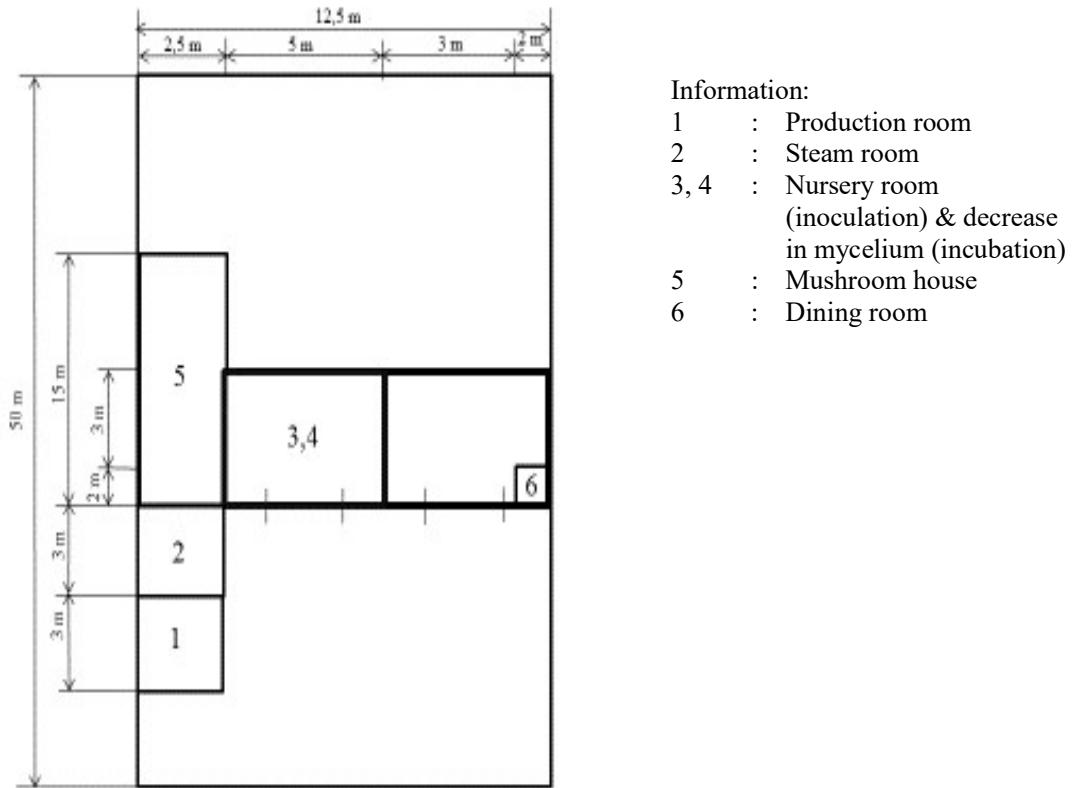


Figure 4. Plan of the Start of the Mushroom Production Home Industry

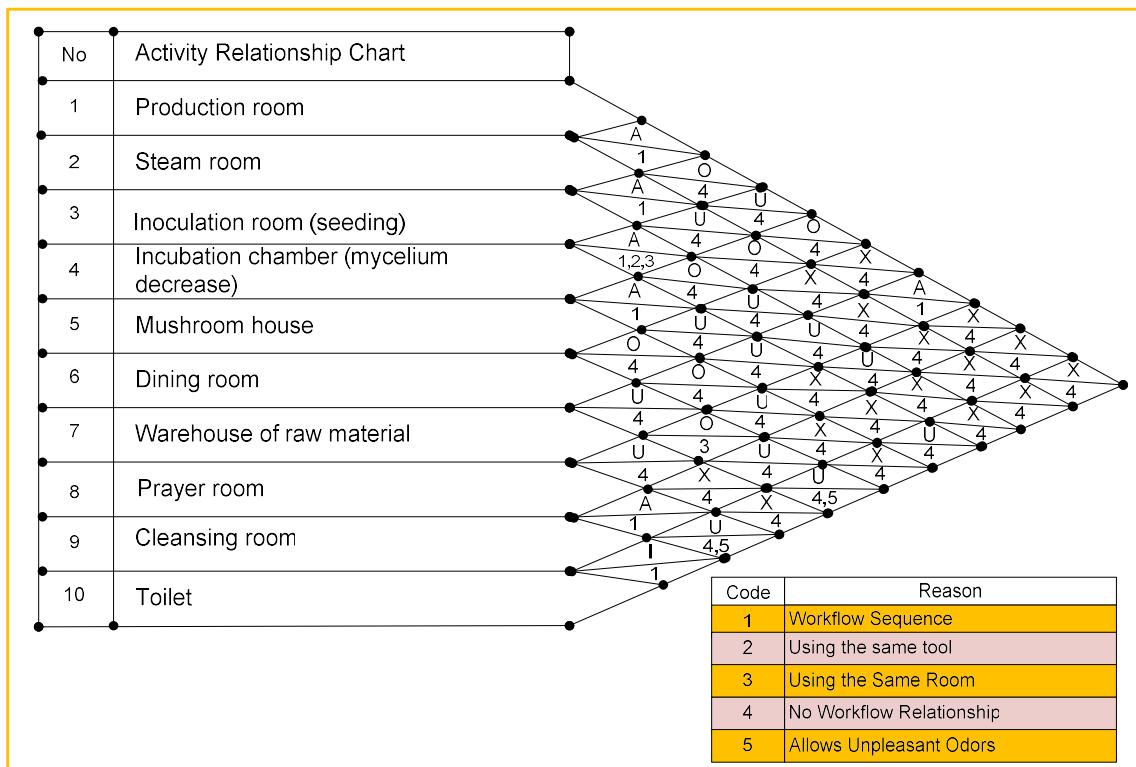


Figure 5. Activity Relationship Chart

Based on the ARC analysis in Figure 5, what needs to be the main concern is as follows:

- 1) The production room absolutely necessary to (A) be brought closer to the steam room and raw material warehouse space because it is a sequence of workflows. And conversely, the production room is undesirable (X) with the dining room, prayer room, ablution area, and toilet because there is no workflow relationship.
- 2) The steaming room absolutely necessary to be (A) closer to the production room and the inoculation room (nursery) because it is a sequence of workflows. On the other hand, the steam room is undesirable (X) with the dining room, raw material warehouse, prayer room, ablution area, and toilet because there is no workflow relationship.
- 3) The inoculation room (nursery) absolutely necessary (A) to be closer to the steam room, incubation room (micellium reduction) because it is a working flow sequence, using the same tools, and using the same room. On the other hand, the inoculation room (nursery) is undesirable (X) with ablution areas and toilets because there is no workflow relationship.
- 4) The incubation room (micellium reduction) absolutely necessary (A) to closer to the inoculation room (nursery) and mushroom house because it is a working flow sequence and uses the same tools.
- 5) Mushroom house) is undesirable (X) with ablution and toilet places because there is no workflow relationship.
- 6) Warehouse of raw materials is undesirable (X) with a place for ablution and toilets because there is no workflow relationship.
- 7) The prayer room absolutely necessary (A) to be brought closer to the place of ablution because it is a sequence of work or process flows.

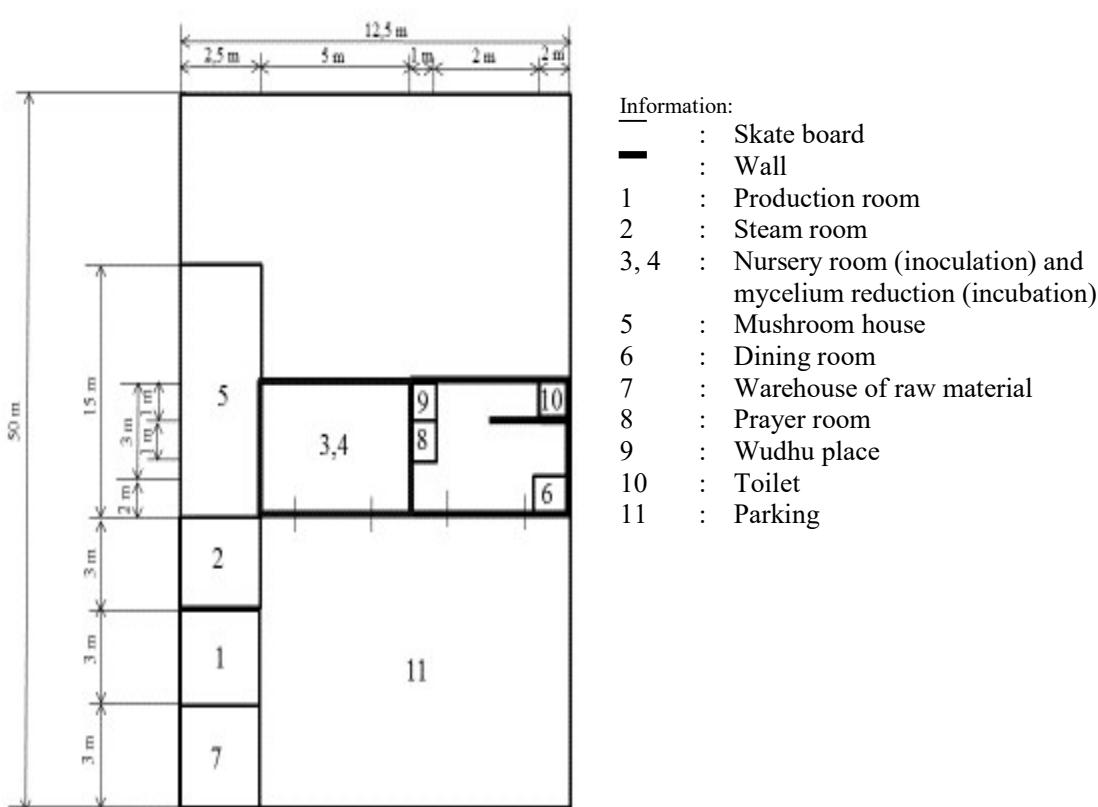


Figure 6. Proposed Home Industries

From Figure 6, the area can be broken down in detail as follows Table 3.

Table 3. The area of Mushroom Production Used

Code	Areas	Area (m)	Total (m <sup>2</sup> )
7	Warehouse of raw material	3x2,5	7,5
1	Production room	3x2,5	7,5
2	Steam room	3x2,5	7,5
5	Mushroom house	15x2,5	37,5
3, 4	Nursery room (inoculation) and mycelium reduction (incubation)	5x5	25
6, 8, 9, 10	Dining room, prayer room, ablution area, toilets	5x5	25
		<b>Used Land (a)</b>	110
		<b>Total land (b)</b>	625
		<b>Unused land (b-a)</b>	515

Table 3 explains that the land used in mushroom production is 110 m<sup>2</sup>. The total existing land is 625 m<sup>2</sup>, so the unused land is 515 m<sup>2</sup>. Therefore, it is necessary to propose additional facilities in utilizing unused land.

The oyster mushroom home industry has vacant land, where the vacant land can still be utilized. Researchers provide suggestions for the use of the vacant land in Figure 7.

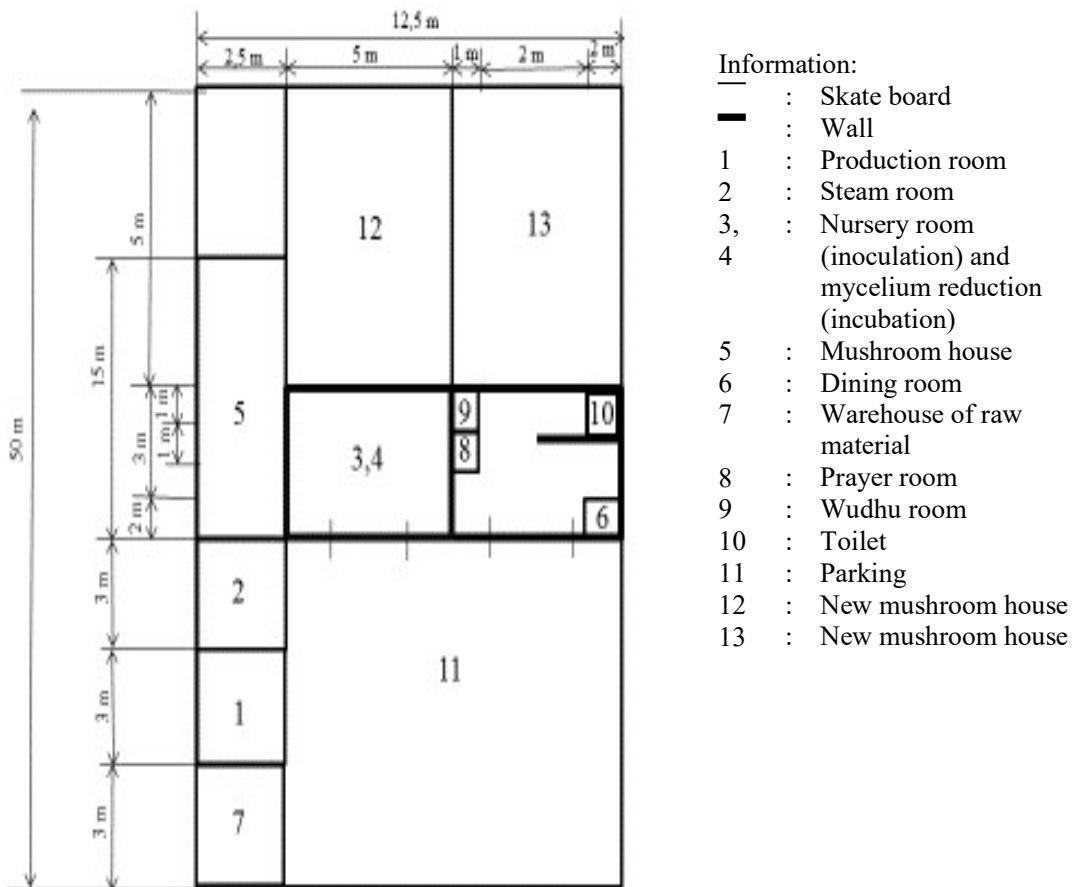


Figure 7. Proposed Use of Vacant Land

In Figure 7, two locals have described the use of vacant land as new mushroom houses. With this ban, it is expected to increase mushroom production, so that it can meet market demand.

## 5. Conclusion

From the results of the analysis that has been carried out, therefore redesigning the layout of the oyster mushroom production facility using the Activity Relationship Chart Method needs to be added to raw material warehouses, toilets, prayer rooms, ablution areas, and dining rooms. Then with the existing vacant land, the results of the discussion concluded that it could be used as a new mushroom house for two local oyster mushrooms. It is hoped that with this proposal, it can increase mushroom production, so that market demand can be fulfilled.

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