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Designing Public Kitchen in a Disaster Evacuation Site using the Pahl and Beitz Method

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Abstract

The purpose of this study is to address the urgent needs at disaster evacuation sites, such as death, loss, injury, and displacement, by creating an emergency public kitchen. The methodology for designing this emergency kitchen involves an ergonomic approach that considers air circulation, necessary equipment, and supporting items like trash cans. The author follows the methods and design steps of Pahl and Beitz, which include four stages: planning and task explanation, product concept design, product shape design, and detail design. The results of this approach yield a new layout for an emergency kitchen that can support the logistical needs of disaster victims. This kitchen design can serve as a guide for universities and Muhammadiyah organizations to address the challenge of establishing public kitchens in disaster evacuation sites.

Introduction

Indonesia is one of the disaster-prone countries (Azzahra et.al., 2023). Meanwhile, data from the Head of the National Disaster Management Agency (BNPB) Suharyanto (2022) shows that until November 2022 Indonesia was hit by around 3,207 natural disasters. Of these, 95 percent were hydrometeorological disasters such as floods and landslides. According to BNPB data, the impact of natural disasters is death, missing, injured, and displaced victims. The impact of damage to public facilities is damage to houses, health facilities, educational facilities, worship facilities and others. One of the disasters, namely earthquakes, generally occurs quickly and without prior warning. This triggers changes in psychological conditions in disaster victims (Pangaribuan et.al., 2023). To deal with potential disasters, countermeasures are needed that involve various parties, from the government, private sector, non-governmental organizations, and the community (Badri, 2018). There are 3 stages in the disaster management cycle, namely pre-disaster, disaster, and post-disaster. Actions taken include prevention, early warning, water rescue, logistical assistance and restoration of environmental conditions (Ferdiansyah, 2018).

In handling post-disaster management, such as in fulfilling logistical needs, especially food for victims and officers, a public kitchen is needed. Public kitchens for natural disaster management that exist today are usually from platoon tents, houses / posts that are used as kitchens or field cars. The establishment of public kitchens at this time is still considered makeshift, such as tents tied to trees, houses used as posts, or open cars. Existing public kitchens are also not able to accommodate supporting facilities, such as rest rooms, equipment, logistics containers, and activity rooms. Public kitchens not only play a role in natural disaster refugee camps, but also fulfill logistical needs during warfare (Hidayat & Siswanta, 2022). The dimensions and space of public kitchens are also limited so that the movement of activities is not free (Sulistyanto, 2009). Disaster emergency assistance is assistance in meeting basic needs in a disaster emergency response. Basic assistance provided, such as food assistance is provided in the form of food or public kitchens, by paying attention to special victims such as the elderly, pregnant women and babies. Indonesia is one of the earthquake-prone countries in the world. Proper building structures need to be prepared to function properly (Prasetyo, 2018). The success in designing and developing products is the selection of the design method used (Nasution et.al, 2022).

Existing public kitchens are emergency, makeshift and cannot be located near the scene. From these problems, it is necessary to design a public kitchen for natural disaster management, which can meet the needs, officers and victims. The resulting public kitchen design is able to accommodate sufficient logistics, provide space for officers, is protected from external environmental conditions, and can be placed in a location near the incident. (Hidayanto, 2014)

The function of the home kitchen can be optimized, apart from being a place to prepare family meals, it is also a means of interaction (Polniwati, 2014). Components in the work system in the realm of safe and secure performance are work climate, noise, lighting, vibration, dust, ventilation (Corlett and Clark, in Kuswana 2014).

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According to SNI, the floor space for the kitchen is at least 2 square meters, minimum net width of 140 cm and minimum net height of 240 cm. According to SNI 03-2396-2001, daytime natural lighting can be said to be good if a) during the day between 08.00 to 16.00 seternpat time there is enough light entering the room. b) the distribution of light in the room is quite even and or does not cause disturbing contrasts. c) the light distribution in the room is quite evenly distributed and does not cause disturbing contrasts. d) the light distribution in the room is quite evenly distributed.

Working in the kitchen is a combination of sitting and standing. Although sitting is usually more beneficial than standing, sitting for a relatively long time should be avoided because it can affect the health of the body (Kuswana, 2014). In the placement of the stove, and cooking utensils should be placed in front of or near the body, important work should be done within a radius of approximately 50 cm, this applies to both sitting and standing work. According to the classification of activities in the workplace, cooking activities in the kitchen are standing work, namely work activities that are served in a standing position and in a relatively routine time. The position of the body in carrying out activities with a standing position is a totality of alertness behavior in maintaining physical and mental balance. The standing position requires more energy than the sitting position, considering the legs as the foundation of the body (Kuswana, 2014).

In an effort to keep work activities within the normal working area, it is not enough to optimize the workplace layout, but the layout must produce a good anatomical position (Nurmianto, 2015). Three important kitchen functions are cleaning, mixing and cooking. These three functions are the guidelines in creating a general kitchen standard. Starting from the storing and cleaning area which is the beginning of cooking. Activities in this area are preparing food ingredients, cleaning equipment and supplies, and cleaning food ingredients. The mixing area is an area for mixing food ingredients that will be cooked. The cooking area is a food processing area, and is equipped with a stove (Jassmine et.al, 2022). Sensing is the first process humans do in work. Through the five senses, humans are able to receive information from their surroundings, whether from coworkers, machines, work tools, information boards or the environment. Poor lighting in a work system can reduce the ability of the eyes to see clearly. Excessive light can cause glare. Identify equipment that causes toxic noise, and place it in a separate room (Iridiastadi, 2014).

Muhammadiyah A.R. Fachruddin University in collaboration with the Muhammadiyah Disaster Management Center (MDMC) collaborated in Community Service activities for natural disaster management of the Cianjur 2022 earthquake. In this activity, observations were made about the public kitchen area at the evacuation site. The public kitchen used is a house left by its residents to anticipate aftershocks. The house is safe to be used as a public kitchen and at the same time to feed local residents in need. The house was reorganized by volunteers and functioned as a public kitchen. According to Governor Regulation No. 8 of 2023, MDMC is one of the organizations mandated to service the needs of disaster victims in Banten province. MDMC has also established a field public kitchen (DUL) in a natural disaster that occurred in Bima Regency (Syarifudin et.al, 2021).

The rearrangement carried out by the Unimar and MDMC teams has not been carried out based on the spatial guidelines for public kitchens in refugee camps. Therefore, researchers focus on the theme of Public Kitchen Design at Natural Disaster Evacuation Sites so that the design results can be used as a guide in making public kitchens at natural disaster evacuation sites.

Method

The method used in the kitchen design activities in the post-disaster evacuation area through the lay out method of public kitchen space facilities, and the provision of human resources for cooking, cooking utensils, cooking facilities and space facilities for eating that are ergonomic both for personnel who process food and residents who want to eat on the spot. Designing is the initial activity of realizing the kitchen layouts that are needed by the community. After the design is complete, the next activity is to organize the space according to the design. Both activities are carried out by two groups of people with their respective expertise, namely the design is carried out by a team of designers and arranging the space is carried out by a team of spatial groups. In designing this public kitchen for natural disasters, the author uses the methods and design steps of Pahl and Beitz. The G Pahl and W Beitz method was chosen because it tries to make a simple design. The implementation of the Pahl and Beitz method includes designing a rice husk grinding machine (Hendri & Kamarullah, 2021).

This model is based on the following stages of calculation: 1. Clarification of the problem, collecting information about the needs to be realized in the final product and also collecting information about the limitations of the problem. 2. Conceptualizing the design, establishing the function of the structure, research for suitable problem solving, incorporation into several concepts. 3. Design realization, starting from the concept, the designers create the form and make the product or system with technical and economic considerations. 4. Detailed design, setting out the shape, dimensions and general properties of each final component containing material specifications, engineering and economic feasibility. Review of all drawings and production documents that have been produced.

Pahl and Beitz propose a way of designing products as described in their book; Engineering Design: A Systematic Approach. The Pahl and Beitz way of designing consists of 4 activities or phases, each of which consists of several steps. The four phases are:

1. Planning and task description
2. Product concept design

3. Product shape design (embodiment design)
4. Detail design

Result And Discussion

1. Planning and Task Description

In designing the lay out space for this public kitchen, the design criteria were first determined. This is used as a reference for the design that will be produced. The criteria are:

a. Space. The dimensions are sufficient to fulfill the activities of the officers in it. Able to accommodate logistics and cooking equipment. There are open spaces and closed spaces for things that are not accessed by the public.

b. Circulation flow. The kitchen considers ergonomic factors, as well as circulation space in and out, the flow of activities in it. Has a free viewing area, and provides comfort. Air circulation is available, so that the temperature inside is comfortable for activities.

2. Product Concept Design

Kitchen is a space used for cooking and supporting activities. In the design of a public kitchen, it is necessary to record the activities that occur in it. From these activities will be obtained the necessary needs. Some of these activities are shown in Table.1:

Table 1. Activity and Kitchen's Reqiurement

Number	Activity	Requirement
1	In/Out	Door
2	Walking, Squitting	Circulation Area
3	Sitting, standing	Area Sirkulasi
4	Retrieving, putting item	cupboard, self, table
5	Picking up and disposing of trash	Trash bin
6	Protection from land	Padestal, floor
7	Cooking	Home Appliances
8	User	Dining room

3. Product Shape Design

From these activities, data will be obtained on the needs in the kitchen that require facilities. These needs. These facilities include: tables, chairs, trash cans, cooking utensils, space for eating. This research is the initial stage of disaster recovery steps. The public kitchen design can be used as a guide in making emergency kitchens at natural disaster sites.

4. Detailed Product Design

Detailed design results can be seen in Figures 1 and 2 below. There are 2 (two) alternatives for designing a public kitchen, namely by using a dishwasher and without a dishwasher.

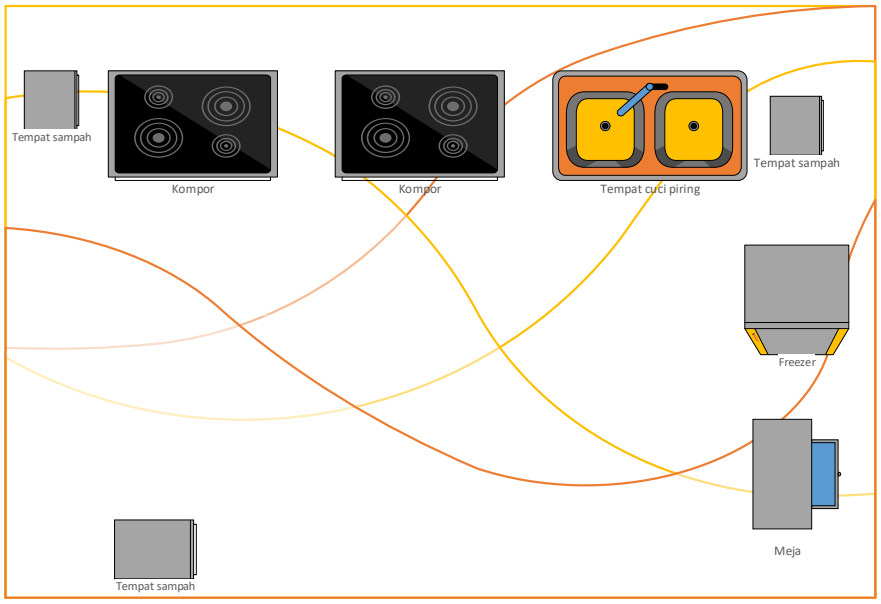

Figure 1. Public kitchen design (with sink)

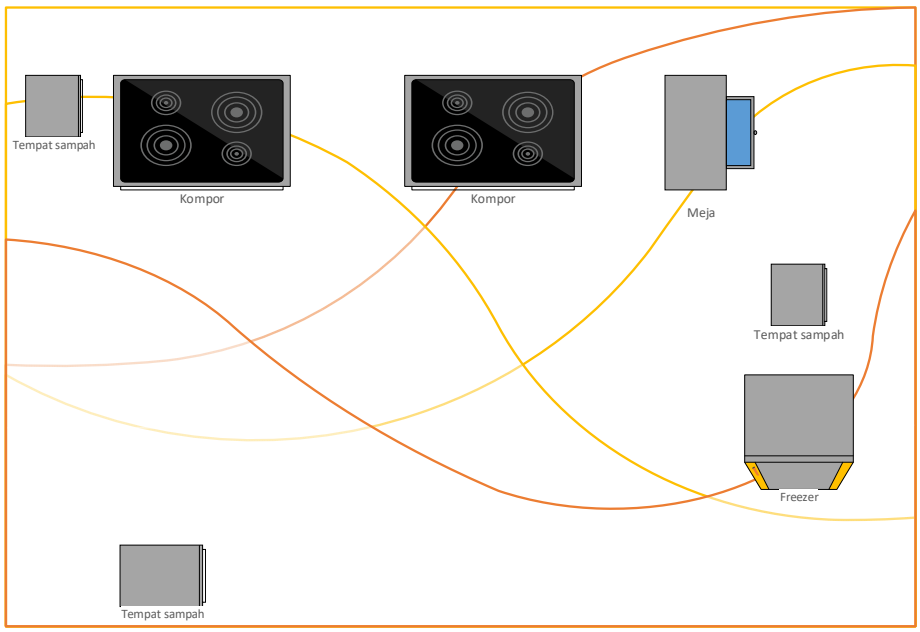

Figure 2. Public kitchen design (without sink)

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