Journal Of Industrial Engineering Management
(JIEM Volume 5. No.2 2020)

Facility Layout Planning In Small Industry Big Boy Bakery To Increase Efficiency

(Case Study: Small Industry *Big Boy Bakery*, Batam, Kepulauan Riau, Indonesia)

Fuad Dwi Hanggara[1]
Industrial Engineering Department, Engineering Faculty, Universal University
Kompleks Maha Vihara Duta Maitreya, Jl. Bukit Beruntung, Sei Panas, Batam
29456, Kepulauan Riau, Indonesia
E-mail: samfu.31@gmail.com[1]

ABSTRACT

In the food industry competition in Indonesia, Big Boy Bakery which is a small-scale food industry competes with the food industry both small and large scale. This pressured Big Boy Bakery to continue to grow both in increasing the quality and quantity of production. One method that will be used is planning the layout of facilities at the production site so that it becomes the basis for consideration of the placement of important elements in the design of the construction of future production sites. Facility layout is carried out because there are differences in the distance between production operations and other production operations which cause inefficiencies in productivity. In this problem approach the method used in Big Boy Bakery layout planning is the Systematic Layout Planning (SLP) method. The function of SLP is to improve the layout of Big Boy Bakery, by finding alternatives that have been considered with important elements in production operations that have been taken into account at either the level of interaction, or other needs. Placement of important elements such as proper production operations, will reduce travel costs, and waste time, so that the planned layout can provide increased productivity efficiency. With the proposed spatial planning made, it is hoped that it can make a significant contribution to the development of Big Boy Bakery.

Article history:
Submit 20 Juli 2020
Received in from 11 Agustus 2020
Acceted 19 Oktober 2020
Avilable online 23 November 2020

Keyword : *Efficiency, Layout Planning, Systematic Layout Planning*

Published By:
Fakultas Teknologi Industri
Universitas Muslim Indonesia
Address :
Jl. UripSumoharjo Km. 5 (Kampus II UMI)
Makassar Sulawesi Selatan.
Email :
Jiem@umi.ac.id
Phone :
+6281341717729
+6281247526640

DOI :http://dx.doi.org/10.33536/jiem.v5i2.571

1. Background

Industrial development in Indonesia is currently proliferating every year. With the government encouraging the manufacturing industry, it is hoped that the manufacturing industry can become the primary source of state revenue. This is marked by the government's contribution to the non-oil and gas industry sector, which boosted revenue in 2019 to reach 17.58 - 17.70% with industrial production exports touching the figure of USD123.7 - 129.8 billion of total Gross Domestic Product (GDP) and it is estimated in 2020 it will increase again around 17.80 - 17.95%. One of the most significant sectors contributing to GDP is the food industry, which reached USD21.73. Billion (Kementrian Perindustrian Republik Indonesia, 2020).

The food industry plays a role in the development of the Indonesian economy, not only factory-scale industries but also small-scale industries. It is said to be a small industry because the production site is only on a private house scale. The number of employees does not exceed 19 people, and the production output is not comparable to the large-scale food industry or factory(Badan Pusat Statistik, 2020). One of the small-scale household industries that will be researched is *Big Boy Bakery*, a storehouse level 4, which has 330m^2, which is powered by 11 workers.

Big Boy Bakery is a small-scale food industry that is engaged in pastries and bread. Big Boy Bakery produces various kinds of bread in Batam City; various Big Boy Bakery sales can be found in several mini-markets in Batam City. With an output of around 150 loaves of bread a day, of course, the output produced is not comparable to the large-scale food industry. Seeing the possibility of development being carried out in Big Boy Bakery, several common problems are usually found in small-scale industries, one of which is the distance from the production shift, which has an unsystematic production line obstruction of ongoing production. The layout of the facilities that have not been adequately structured also impacts waste of

human resources and time(Arif, 2017). The facility layout in question is the arrangement of the layout of machines, equipment, material flow or production flow, and people directly related to production activities towards the optimal point of the existing layout (Suhardini, Septiani and Fauziah, 2017). If the facility layout is well arranged, production activities will be effective and efficient (Wignjosoebroto, 2009).

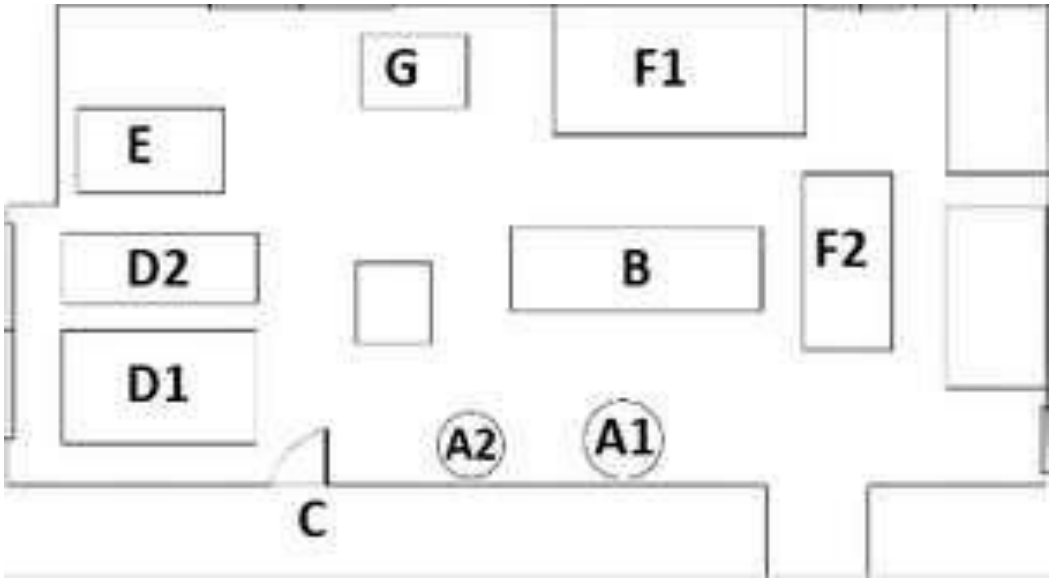

Figure 1. Sketch 2nd Floor *Big Boy Bakery* Production.

Nama	Keterangan
A1	Dough Making Machine
A2	Dough Making Machine
B	Dough Fermentation Table
C	Dough Forming Room
D1	Bread Filling Table
D2	Bread Filling Table
E	Bread Enlargement Box
F1	Bake Machine
F2	Bake Machine
G	Bread Cooler Box

Table 1. Sketch Information 2nd Floor *Big Boy Bakery* Production.

One of the developments carried out in planning the facilities' layout to achieve a certain level of efficiency. Facility layout planning is the main foundation that aims to increase the efficiency of the relationship between each operator working so that the production process can reach an optimal point(Nurhasanah and Simawang, 2013)(Purnomo, 2004). A good facility layout can be found, and the level of efficiency studied by using the Systematic Layout Planning (SLP) method to obtain an alternative layout planning that suits your needs (Arif, 2017), and also Systematic Layout Planning (SLP) can solve problems regarding the production process, as well as the journey in the production process (Wignjosoebroto, 2009). By looking at the Big Boy Bakery layout's condition, a solution is needed that can solve the layout problem, namely by using the layout systematic planning method to get an optimal alternative layout in the development of the production site

2. Literature Review

2.1. Food Industry

The industry is a series of economic activities that process raw materials, raw materials, semi-finished goods, and finished goods into higher-value goods, including industrial design and engineering activities(Nurdiyanto and Meilia, 2016). The food industry is part of the industry which operates in the food sector. With the increasing public demand in the food industry, especially in dynamic urban areas, the availability of fast food is increasingly needed by the public, the need for fast food results in increasingly competitive conditions in the food industry(Pondaag, Kawet and Talumewo, 2014).

2.2. Small Industry

A small industry is one of the industries fostered by the industry and trade service. A small industry is an industry with a small scale. Following Law Number 20 of 2008 concerning Micro, Small, and Medium Enterprises, small industries carry out business activities in the industrial sector with an investment value of not more than IDR 200,000,000 (two hundred million rupiahs), excluding land and buildings for business premises (Heryanto and Jumiatiningrum, 2017).

Small industries can be defined as individuals or households' economic activity and a small-scale entity that aims to produce goods or services. Here are the characteristics of a small industry (Mariana, 2012):

a. Management is independent; that is, there is no clear separation between owners and company managers. In other words, the owner also acts as a manager in a small industry.
b. Capital comes from the owner or owner of capital.
c. In general, small industrial operation areas are local.
d. The company's size, both in terms of total assets, number of employees, and infrastructure, are small.

Here are the strengths and weaknesses of small industry (Mariana, 2012):

a. The strengths of the small industries are:
    1) Freedom of manager or owner to act and make decisions.
    2) Adjusting to local needs.
    3) Participation in taking action/effort.
b. The weakness of small industries are:
    1) Relatively weak in the specialization.
    2) Capital under development is limited.
    3) It is not easy to find capable employees.

2.3. Facility Layout Planning

A good layout can provide consistent flexibility to work activities, use the place efficiently and effectively to generate optimal benefits (Muther and Halles, 2015). The advantages referred to are time savings, the distance from each place of operation to the next operation site, utilization of the place used economically, and not forgetting the operator or user's safety and comfort.

A fair system's layout requires a special plan that can use each place optimally, namely, layout planning. Layout planning is an arrangement of each component of a system that has a relationship with each other, which is placed according to each component's needs.

2.4. Systematic Layout Planning Methods

In Systematic Layout Planning, several sections explain planning, delineation, and ranking so that there are several alternatives involved to achieve optimal layout planning (Muther and Halles, 2015). Some considerations, such as interactions and delivery costs, are included in the planning part.

Planning can be done by analyzing layout problems with state simulations using layout sketches as a consideration in changing the layout (Suhardini, Septiani and Fauziah, 2017). Planning and drawing are needed as concepts, while essential components are closely related, connected through the description of elements that correspond to the object's realization.

Planning and depiction are needed as concepts, while essential components are closely related, connected through the appropriate elements' description. From the planned drawing, reviewing the drawing's suitability with the realization in the place where the layout planning will be carried out is given a functional rating to assist in selecting optimal alternatives. Of course, the optimal alternative provides productivity efficiency, which is much better than the previous layout problems.

3. Methodology

3.1. Research Results

Based on the problems in the Big Boy Bakery production process, it takes a method used to solve layout problems, namely the Systematic Layout Planning method. There are several steps to carry out the Systematic Layout Planning method, namely(Muther and Halles, 2015).

1. Location

   Determination of the place to be planned, based on data from the actual location to solve problems related to the layout to achieve optimal use.

2. Overall Layout

   Data on the location area, which is the root of the problem, is combined into a size, relationship, and configuration to produce a rough picture.

3. Layout Details

   The actual placement of the premises' specific physical components, which are usually drawings or sheets with related replicas.

4. Installation

   The stage of making installation planning is based on the details of the drawings that have been made.

There are several possible reasons, and support the importance of a relationship ranking for each operation (Muther and Halles, 2015), that is:

1. Material Flow
2. Use the same equipment
3. Share the same personnel
4. Cost of utility distribution

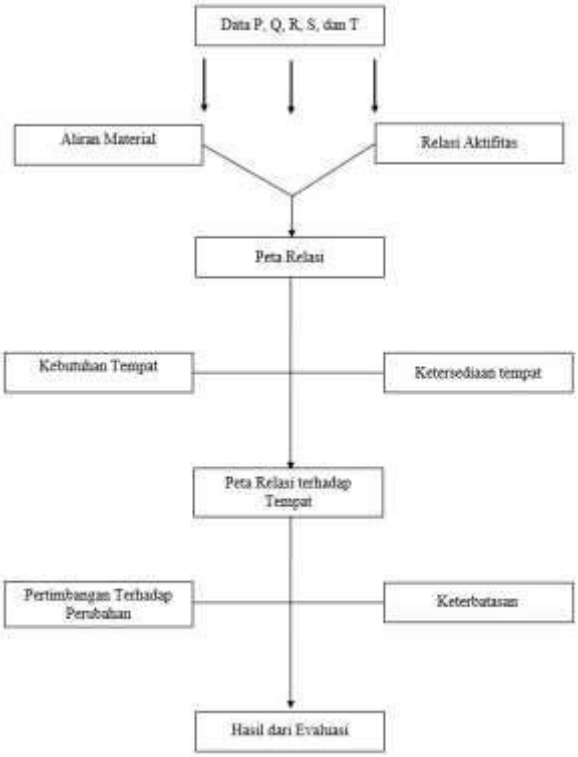

Figure 2. Systematic Layout Planning Method

4. Discussion

One of the factors causing the productivity inefficiency of Big Boy Bakery is the difference in the two floors distance between the production site and the bread wrapping place, and after the wrapping process is complete, the production results must be immediately entered into the 1st-floor warehouse. This is the root of the problem, which will serve as the basis for making the production site's layout design.

The design area of the production area used by Big Boy Bakery in designing the production site uses the size of the current Big Boy Bakery, which is 330m2. This site is used as a reference because the previous elements' placement can fill the space in the previous layout but a non-optimal condition.

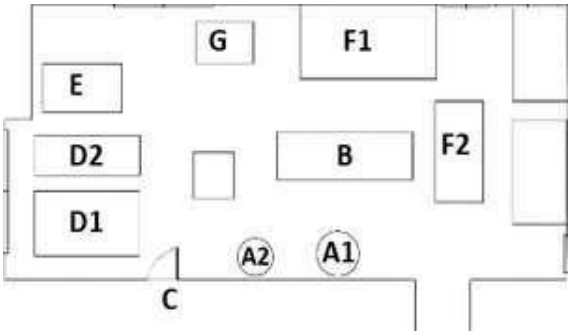

Figure 3. Sketch 2nd Floor

Table 2. Information Sketch 2nd Floor

Nama	Keterangan
A1	Dough Making Machine
A2	Dough Making Machine
B	Dough Fermentation Table
C	Dough Forming Room
D1	Bread Filling Table
D2	Bread Filling Table
E	Bread Enlargement Box
F1	Bake Machine
F2	Bake Machine
G	Bread Cooler Box

Analysis of the time of each process of making one of Big Boy Bakery's bread products at the current production site is shown by the flow of the operating process in figure 4.

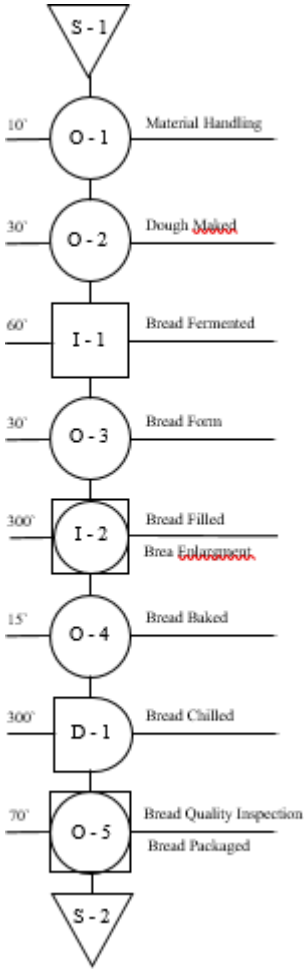

Figure 4. ***Operational Chart Big Boy Bakery.***

The Big Boy Bakery bread dough area is divided into three production floors, the 1st floor serves as a warehouse for raw materials and a warehouse for finished materials, a 2nd floor is a place for bread and pastries production, and the last floor is on the 4th floor as a place for packaging. . One of the main factors in the causes of differences in production floors is the limited availability of space, so that several production components are moved, and become a new production floor. As a result, the distance between the dough-making machine and the warehouse is separated by a different production floor, namely between the 2nd floor as a production site and the 1st floor as a warehouse. Given the distance between the machine and the raw material warehouse, the waste of time and energy will be affected by the considerable distance (Barnwal and Dharmadhikari, 2016). The distance that becomes a problem in the production process is that the difference in floors from several production operations places a waste of time and energy caused by the difference in the distance between the production floors which causes workers to carry the finished product to the wrapping area on the 4th floor(Suhardini, Septiani and Fauziah, 2017). After that, the product that is ready to be packaged will be taken to the product warehouse on the 1st floor; this causes the production process to be inefficient due to low material transfer (Wignjosoebroto, 2009).

Based on some predetermined reasons, an Activity Relationship Chart was created that connects each plce of operation, to measure the level of importance of the Big Boy Bakery layout planning.

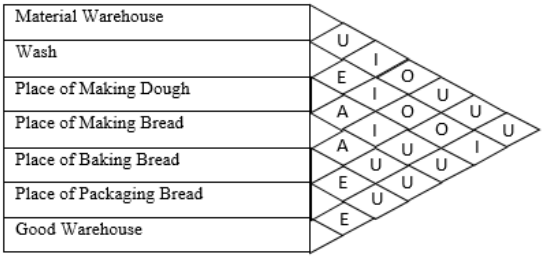

Figure 5. ***Activity Relationship Chart Big Boy Bakery*.**

Table 3. Information *Activity Relationship Chart Big Boy Bakery*.

Nilai	Keterangan
A	Absolute
E	Very Important
I	Important
O	Usual
U	Not Important
X	Undesirable

Based on the Activity Relationship Chart of Big Boy Bakery that has been made, an alternative improvement is obtained from the old layout, which was made using two production floors.

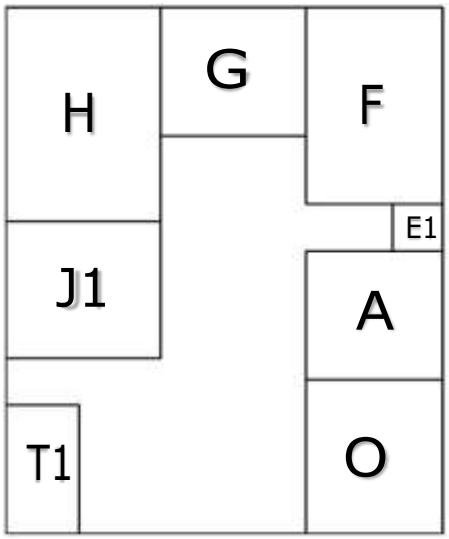

Figure 6. New Sketch 1st Floor

Table 4. Information New Sketch 1st Floor.

Label	Keterangan
A1	Wash & Toilet
E1	Cargo Lift Elevator
F	Fermentation Room
G	Baking Room
H	Packaging Room
J1	Warehouse
T1	Stairs

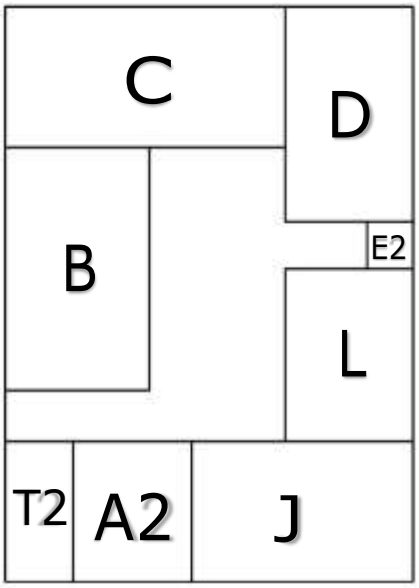

Figure 7. New Sketch 2nd Floor

Table 5. Information New Sketch 2nd Floor.

Label	Keterangan
A2	Wash & Toilet
B	Dough Making Room
C	Dough Development Room
D	Bread Forming Room
E2	Cargo Lift Elevator
L	Living Room
J2	Material Warehouse
T2	Stairs

The alternative layout design chosen has several advantages that are focused on the process flow distance, with the level of interaction being the top priority, so that there are several developments for new site designs such as freight lifts, which aim to reduce slack in the flow of materials so that production efficiency can be increased(Muther and Halles, 2015).

When viewed from figures 6 and 7, the warehouse on each floor is functioned based on the needs on the production floor, where the 2nd floor is the warehouse for raw materials, so that when the manufacturing process begins, workers can take the materials on the 2nd floor, and go straight to the dough forming room. The 1st floor is a warehouse for finished materials, which shortens the distance of material flow based on a priority of interest.

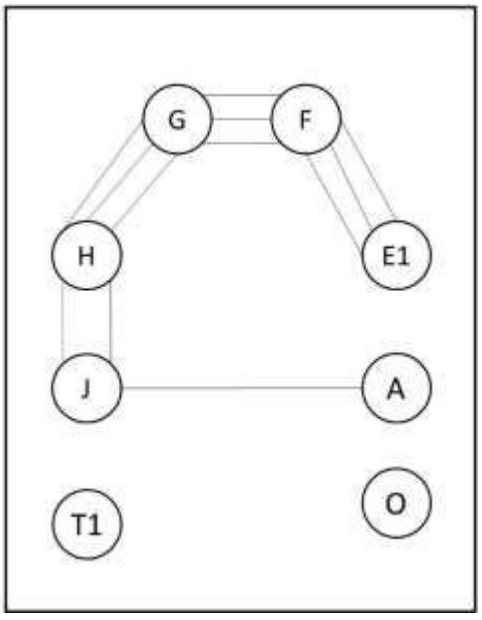

Figure 8. Activity Relationship Diagram 1st Floor.

In the 1st floor sketch, the bread formation space is divided into two parts, namely the fermentation and forming space; due to limited space, the formation space is moved to the 2nd floor. To reduce the distance between the process flow and slack in the material flow, the use of an elevator is an alternative option in the layout design.

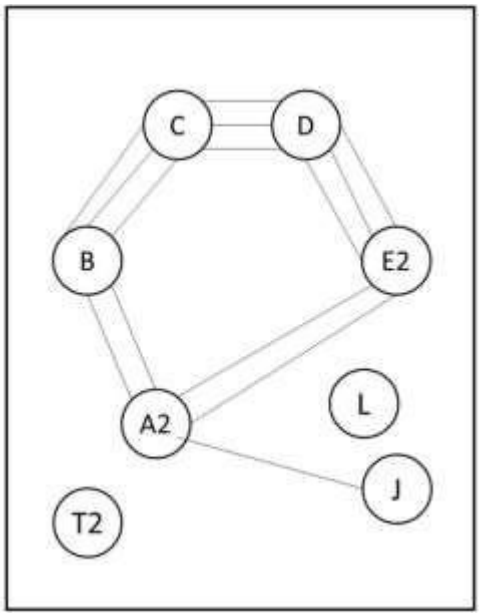

Figure 9. Activity Relationship Diagram 2nd Floor.

Whereas in the 2nd-floor sketch, the dough-making room is also divided into two parts, namely, the place for making the dough and the place for developing the dough; this is done because the time for making the dough is much shorter than the time for developing the dough so that additional development space can be an alternative in development—the layout of the production site.

The main key in solving this problem based on the alternative layout obtained to complete the layout design of the future production site is the systematic arrangement of each production component, taking into account the placement based on the level of importance that has been given (Muther and Halles, 2015).

5 Conclusion and Suggestion

5.1 Conclusion

Based on the problems that occur in the Big Boy Bakery production process to increase efficiency in the

next production site design, a layout design is needed to increase production results using the Systematic Layout Planning method.

Systematic Layout Planning functions to improve the layout of Big Boy Bakery by planning the placement of important elements in a production operation taken into accounts, such as the level of interaction and other needs. The correct placement of production operations will reduce travel costs and time wastage so that the planned new layout can provide better efficiency and productivity improvements going forward(Buchari, Tarigan and Ambarita, 2018).

5.2 Suggestion

Suggestions from the authors, it is hoped that this research can be considered for the company as the best solution in solving problems in the layout of the new facilities so that efficient conditions in the production process can be achieved. Furthermore, the facility layout of each area is considered carefully so that each transfer of materials does not take time and costs in moving.

Reference

Arif, M. (2017) *Perancangan Tata Letak Pabrik*. 1st edn. Yogyakarta: Deepublish.

Badan Pusat Statistik (2020) *Industri Mikro dan Kecil*. Available at: https://www.bps.go.id/subject/170/industri-mikro-dan-kecil.html (Accessed: 8 April 2020).

Barnwal, S. and Dharmadhikari, P. (2016) 'Optimization of Plant Layout Using SLP Method', *International Journal of Innovative Research in Science, Engineering and Technology*, 5(3), pp. 3008–3015. doi: 10.15680/IJIRSET.2016.0503046.

Buchari, Tarigan, U. and Ambarita, M. B. (2018) 'Production layout improvement by using line balancing and Systematic Layout Planning (SLP) at PT. XYZ', *IOP Conference Series: Materials Science and Engineering*, 309(1). doi: 10.1088/1757-899X/309/1/012116.

Heryanto, Y. and Jumiatiningrum, S. N. (2017) 'Koordinasi Bidang Industri Dinas Perindustrian Dan Perdagangan Kabupaten Cirebon Dalam Pembinaan Industri Kecil Menengah (IKM) Makanan Olahan Di Kabupaten Cirebon', *Jurnal Ilmiah Indonesia*, 2, pp. 166–175.

Kementrian Perindustrian Republik Indonesia (2020) *Kemenperin Bidik Industri Tumbuh 5,3 Persen Tahun 2020*. Available at: https://kemenperin.go.id/artikel/21346/Kemenperin-Bidik-Industri-Tumbuh-5,3-Persen-Tahun-2020 (Accessed: 6 March 2020).

Mariana, K. (2012) 'Peran Strategis Usaha Kecil Menengah (UKM) dalam Pembangunan Nasional', *Informatika*, 3(I Jarnuari), p. 15.

Muther, R. and Halles, L. (2015) *Systematic Layout Planning - A total system of layout planning*.

Nurdiyanto, H. and Meilia, H. (2016) 'Sistem Pendukung Keputusan Penentuan Prioritas Pengembangan Industri Kecil Dan Menengah Di Lampung Tengah Menggunakan Analitical Hierarchy Process (AHP)', in *Seminar Nasional Teknologi Informasi dan Multimedia 2016*, pp. 37–42.

Nurhasanah, N. and Simawang, B. P. (2013) 'Perbaikan Rancangan Tata Letak Lantai Produksi di CV. XYZ', *Jurnal Al-Azhar Indonesia Seri Sains Dan Teknologi*, 2, pp. 81–90.

Pondaag, J., Kawet, L. and Talumewo, P. (2014) 'Analisis Rantai Pasok Ketersediaan Bahan Baku Di Industri Jasa Makanan Cepat Saji Pada Kfc Multimart Ranotana', *Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, 2(3), pp. 1584–1591.

Purnomo, H. (2004) *Perencanaan dan Perancangan Fasilitas*. Yogyakarta: Graha Ilmu.

Suhardini, D., Septiani, W. and Fauziah, S. (2017) 'Design and Simulation Plant Layout Using Systematic Layout Planning', *IOP Conference Series: Materials Science and Engineering*, 277(1). doi: 10.1088/1757-899X/277/1/012051.

Wignjosoebroto, S. (2009) *Tata Letak Pabrik Dan Pemindahan Bahan*. 3rd edn.