RECEIVING AND WAREHOUSING DEPARTMENT LAYOUT RE-DESIGN PROPOSAL USING BLOCPLAN ALGORITHM METHOD TO REDUCE MATERIAL HANDLING COST AND TRANSPORTATION WASTE ACTIVITIES (CASE STUDY: PT. LINTAS BINTANG MULIA NUSANTARA)

Submitted to International Program Department of Industrial Engineering
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the degree of Sarjana Teknik Industri

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Yogyakarta, June 20th, 2022

Kresna Adji Setya Wardhana

THESIS APPROVAL OF SUPERVISOR

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DEDICATION PAGE

Assalamu'alaikum Wr. Wb.

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Wassalamu'alaikum warahmatullahi wabarakatuh

Yogyakarta, December 22th, 2021

Kresna Adji Setya Wardhana

MOTTO

Grief Enough

- Hindia

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CHAPTER I
INTRODUCTION

1.1 Background

Every human activity appears to be inextricably linked to information technology. Such circumstances must be understood as facts that have an impact on transformations, lifestyles, and people's perspectives on things (Khairawati S., 2020). Many developing countries rely heavily on the textile and garment industries for economic growth (Pinheiro E., 2018). Then, multiple stakeholders have long formed collaborations to develop in the global textile and garment industry (Beyers F., 2020). Basically, the garment industry fulfills one of significant needs of the people in Indonesia, namely clothing. Based on *Badan Pusat Statistik* (2020), industrial business is a type of company that engages in economic operations with the aim of producing products or services., there are four industrial classifications with the parameters of the number of workers which are Large Industry (100 workers or more), Medium Industry (20-99 workers), Small Industry (5-19 people workers), Home Industry (1-4 people workers). Then, one of kind medium industries is retail clothing business.

Retail clothing business is affected by movement of people's activity in shopping, which previously shopping to many outlets and now shopping to the online shops. (Khairawati S., 2020). Due to people activity in shopping, company on the clothing sector have to ready to stock and aware with product trends, because the result from previous research work (Aditi, 2018) stated customer preference for choosing product based on brand, price, quality, and design. The customer reference makes clothing companies need concern about their products in production process phase. According to (Budiartami and Wijaya, 2019) the output of production process is products that in accordance with plan, price, quality, quantity, and time process. In the production process, there is waste activities problem that gives impact to the production processes that company need to identify and eliminate it (Kartika L., 2012).

Waste is an important by product of human activity; it is also the outcome of inefficient manufacturing processes, resulting in a waste of essential resources (Asamsuomo and Baird, 2016). Then, waste activities possible to give an impact to material handling and cost. Moving things from one production facility to another or

from one department to another is what material handling is all about. Material handling can account for up to half of a company's overall production costs (Supriyadi, 2019).

PT. Lintas Bintang Mulia Nusantara (Starcross) is a retail company that engaged in the field of clothing business in Yogyakarta, Indonesia. In early 2020, it already has 25 branch stores spread across Indonesia's archipelago. Due to product production and distribution, Starcross has a center placed called as Headquarter. To support production and distribution, the company are providing nine departments on the production shopfloor area such as customer service, showroom, canteen, research and development (R&D), online, distributing, receiving, and warehousing.

Referring to production planning, Starcross use seasonal in production which are High and Low Season. In 2020, according to the previous researcher (Abrar, 2020) found mental workload level of receiving and warehousing departments in "Very High" category in High Season and need some mitigation through problems. Then to identify and visualize root cause behind the problems, researcher use fishbone diagram as a tool while do direct observation at receiving and warehousing department in High Season. Based on the fishbone result researcher is focusing on one parameter in fishbone which is Material. Thus, researcher found the two main cause that gives impact to mental workload which are material handling cost is high and waste transportation. Researcher use that problem cause as fundamental in this research to re-layout receiving and warehousing department. In this case, researcher is using BLOCPLAN Algorithm method to get a new optimized layout. Then, researcher create a problem formulation in this research is how to reduce material handling cost and waste transportation activities through re-design layout using BLOCPLAN Algorithm during High Season on receiving and warehousing departments at PT. Lintas Bintang Mulia Nusantara?

1.2 Problem Formulation

Based in the background, the formulation of problem in this research as follows:

- How to reduce material handling cost and waste transportation activities through re-design layout using BLOCPLAN Algorithm during High Season on receiving and warehousing departments at PT. Lintas Bintang Mulia Nusantara?

1.3 Research Objective

According to the problem formulation the objective of this research is:

1. Analyze various company activities that go underneath the classification of waste activity at receiving and warehousing department.
2. Analyze material handling; workflow classification and cost, dimension of each department area, rectilinear distance between each facility, and initial layout design.
3. Re-design facility layout at receiving and warehousing department so it able to reduce waste activities and material handling cost.

1.4 Scope of Research

Research objectives can be achieved appropriately, the following research boundaries are needed as follows:

1. The research was conducted at the receiving and warehousing department at PT. Lintas Bintang Mulia Nusantara which focuses on facility layout re-design.
2. Data collection is carried out on December 30, 2020 until January 30, 2021.
3. The method that used is the BLOCPLAN
4. Data obtained through direct observation and documentation at the receiving department at PT. Lintas Bintang Mulia Nusantara.
5. The technology of the production process has not changed.
6. Physically the building has not changed from the shape and area of each department.
7. The discussion and analysis are seen from the size of the distance, initial material handling cost, initial distance, distances area, and the variables used in this study.

1.5 Research Benefits

This research is expected to provide the following benefits:

1. For the government, this research is expected to be a material for policy considerations to support the progress and increase the competitiveness of small and medium industries.
2. For the community, this research is expected to be a reference to improve the performance of a business or industry so that more people build businesses and have an impact on improving the community's economy.
3. For related companies, this research is expected to be a reference for reducing transportation waste and material handling cost at receiving and warehousing department and more concern about facility layout planning.

4. For further researchers, this research is expected to be a reference for research related to improving the optimum micro-layout or can be developed further.

1.6 Systematical of Research

To make this thesis more organized, the research systematics is divided into six chapters, as follows:

The context of this research, problem formulation, research aims, research scope, research advantages, and research systematics will all be discussed in Chapter 1. This explanation will be expanded upon in the literature review, which will be discussed in greater detail in the following chapter.

To solve research challenges, we require concepts and principles. Then, in Chapter 2, these topics will be discussed. It also includes a summary of the findings of past research by other researchers that is relevant to this study. After the review has been thoroughly explained, a strategy for resolving existing issues and determining the stages of completion is required.

Researchers must create a description of the research framework, framework and flowchart, methodologies employed, data collection strategies, materials, instruments, research procedures, data to be investigated, and analytical methods to be used to make this research more organized. Then go on to research and data processing, which will be covered in more detail in the following chapter. They will be placed in the appropriate chapter 3.

Following that, in Chapter 4, the data obtained throughout the research and processed using the chosen approach will be discussed. This chapter serves as a starting point for discussing the findings, which will be covered in Chapter 5.

The following chapter, Chapter 5, assesses theoretical explanations subjectively, quantitatively, and statistically based on research findings and research planned to accomplish research objectives. Then will also get the expected answer based on the problem formulation in the introductory chapter.

Then, while some conclusions are founded on research, suggestions or plans for achieving desired outcomes are nothing more than theoretical evidence, answers, and recommendations. Based on researchers' experiences and considerations, which might be used to enhance future study. As a result, one chapter, Chapter 6, will be dedicated to this topic.

CHAPTER II
LITERATURE REVIEW

2.1 Production System

The production system has several components that play an important role in supporting the operational processes of an industry (Eprida B., 2017). In essence, the production process in a company must have a waste, waste generally consists of seven types, namely overproduction, waiting, motion, transportation, unnecessary processes, inventory, and defects (Novitasari R., 2020).

Productivity is one of the most important factors affecting countries competitiveness, economic growth, nations' wealth and standards of living (Shahnazi R., 2021). According to Prasetyo (2017), the ratio of output to input is known as productivity. When there is only one output and one input, productivity is simple to calculate. Productivity improvement can be broken down into three important sections, in the productivity literature. The three parts of increasing productivity are known as the three main sources of productivity such as (Suyanto, 2012): Increasing technical efficiency, advancing technology, increasing scale efficiency.

Thus, according to Nurprihatin and Tannady (2017), industrial companies should ideally pay attention to and always regulate the level of work productivity to remain at a certain desired level. Inside the production there is lean manufacturing. Lean manufacturing is a concept that can design a production process to be better, faster, and cheaper with minimal space, less inventory, fewer working hours, and avoiding waste (Novitasari R., 2020). The main idea of lean manufacturing is that efficient production can be achieved through a comprehensive approach to minimizing waste in terms of minimizing excess production and inventory, excess material movement, lead times and delays, process redundancy, worker redundancy, and the need for re-production and improvement (Nurwulan N.R., 2021).

2.2 Fishbone Diagram

The cause-and-effect diagram, often known as a fishbone diagram is graphical technique for identifying and assessing variables that have a major impact on job quality criteria identification (Slameto, 2016). Also, according to Mario C. (2017) stated if fishbone diagram is a precise visual representation of a phenomenon that involves investigating the

various causal factors and how they relate to one another. Fishbone diagram or as knows as “Ishikawa Diagram” is created by Kaeru Ishikawa. Down below is the example of fishbone diagram (Bose T.K, 2012):

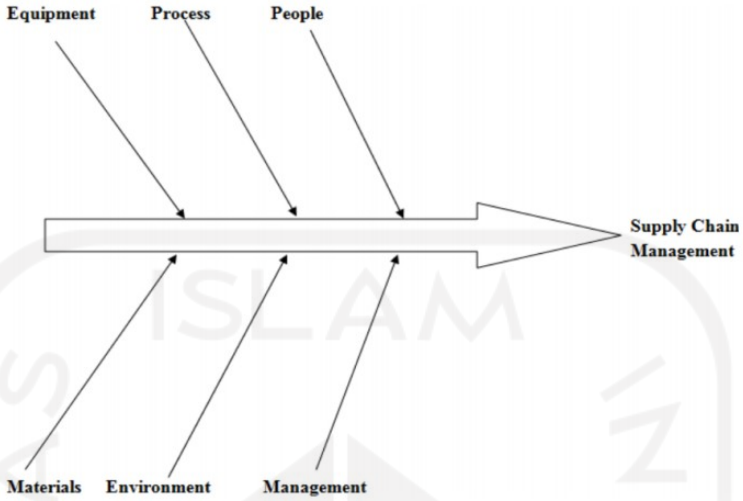

Figure 1. Fishbone Diagram

There are six classic categories of fishbone diagrams which are categorized as the main cause of every business process problem. Namely people, equipment, materials, environment, management and processes. The analysis of these six variables that stated on Figure 2 above reveals the reasons for a problem regardless of its type or severity (Ishikawa, 1986).

2.3 Nine Waste

One of the fundamental principles of lean manufacturing is to decrease or eliminate waste in the manufacturing process (Paramawardhani H., 2020). Manufacturing with Lean Principles There are nine different types of waste factors (waste), all of which are represented as E-Downtime. Here is a breakdown of each of these wastes: (Baharudin I., 2021):

1. Environmental Health and Safety (EHS), the type of waste that occurs due to negligence in paying attention to matters relating to the EHS principle.

2. Defect, the type of waste that occurs due to the emergence of defective products. Defects are always seen in the manufacturing industry because they are directly related to company costs.

3. Over Production, this type of waste is caused by overproduction. The category where the product produced exceeds what was originally planned.

4. Waiting, the type of waste that occurs because a process is hampered so that the next process must wait for the previous process to complete its work.

5. Non-Utilizing Employees, the type of waste of human resources that occurs because employees as resources are not able to do their work optimally due to lack of competence.

6. Transportation, excessive transportation activities will lead to wasted costs, time, and energy.

7. Inventory, this type of waste that occurs because of the need for raw materials for production in excessive inventory. The Just in Time concept is needed to eliminate the existing waste.

8. Motion, this type of waste that occurs due to unnecessary movements by the operator and can slow down the process so that lead times are longer.

9. Excess Processing, this type of waste occurs because of the need for redundant steps in the process. This category includes unnecessary processes such as rework

2.4 Material Handling

Material handling strives to deliver materials to the appropriate place, at the right time, in the correct quantity, and in the right sequence according to the expected conditions in order to reduce production costs (Judha O.C., 2015). According to Hari Purnomo "*Pengantar Teknik Industri*" (2003), Material Handling is unimportant activity in a factory, but in reality, this is not the case.

Then the objective of material handling as follows in a production level as follows: reduce material handling costs, increase use of facilities, improve safety and working conditions, simplify the manufacturing process, increase productivity. The following equation can be used to compute material handling transportation expenses per meter

(Muslim D., 2018):

MHM = ∑ MHC / ∑ r x hk

Description:

- MHM = material handling cost per meter
- r = displacement distance (m)
- hk = working days in a month

The total material handling cost (MHC) can be calculated by the following equation:

∑ Total MHC= MCM x ∑ r x f

Description:

- MHC = material handling cost
- MHM = material handling cost per meter
- r = total displacement distance (m)
- f = total displacement frequency

Monthly operating costs are calculated by add up depreciation expense with labour cost Material flow system is divided into four types of layouts (Yuliant R, 2014):

1. Product Layout, in product layout, machines or tools are arranged according to the process order of a product. Products move continuously on the assembly line.

2. Process Layout, factory/process/functional industry's structure and all processes of the same sort are grouped in the same department.

3. Group Layout, this sort of arrangement groups components that are not identical into one group based on the shape of the components, machineries, or equipment used.

4. Fixed Layout, the product moves to the machine in the sequence in which the process is completed, thanks to a system based on product and process arrangement.

In production processes that use machines, the transfer of goods between machines must be carried out efficiently and effectively (Haryono H.D., 2021). In general, the layout of a production facility can be divided into three categories based on material flow pattern:

1. Layout based on product flow or product layout. The types of product flow lines that may be applied through the facility layout are:

   a. Straight line

Figure 2.1 Straight Line

Once the production process is short, simple, and comprises of several components or types of production equipment, the flow pattern based on a straight line is commonly used.

   b. S-Shaped or Zig-zag

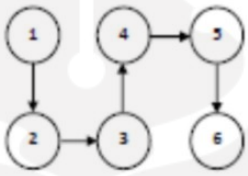

Figure 2.2 S-Shaped or Zig-Zag

When the flow of the production process is longer than the available area, the flow pattern based on the dotted line works effectively.

   c. U-Shaped

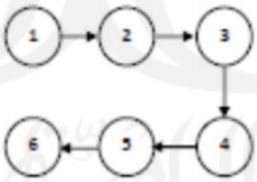

Figure 2.3 U-Shaped

If it is desirable that the end of the production process be in the same location as the beginning of the production process, the U-Shaped flow pattern will be used.

   d. Circular

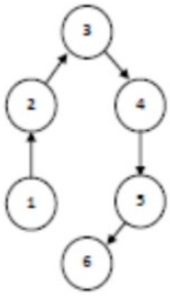

Figure 2.4 Circular

When it's necessary to return a material or product to the start of the production flow, circular flow patterns are quite handy.

e. Odd Angle

Figure 2.5 Odd Angle

This flow pattern, which is based on odd angles, is not as well recognized as other flow patterns.

2. The layout is based on the flow of the process (process layout). Functional layout refers to layout that is based on process flow (process layout).

3. The materials and components of the main product will remain in their position/location while manufacturing facilities such as tools, equipment, people, and other small components will move to the location of the major material or product components in a layout based on position or fixed position layout.

2.5 Distance Measurement Method

According to Heragu (1997) there are several ways that can be used for distance measurement, namely:

1. Euclidean,

Euclidean matrix measures the straight line between the center of the facility.

xi = x coordinate of facility centers i, yi = y coordinate of facility centers I, dij = distance between facility centers i and y. The following is the equation of the Euclidean matrix = $[(xi)^2 + (yi)^2]^{0.5}$

2. Squared Euclidean,

   Name implies (squared eucledian), squaring gives greater weight to the distance of a pair of facilities as well as to their proximity. The equations used are:

   $d_{ij} = [(x_i - x_j)^2 + (y_i - y_j)^2]$

3. Square,

   The rectangle is the sum of the differences between the horizontal and vertical distances from the center point of the two facilities. and has the following equation:

   $d_{ij}=|x_i - x_j| + |y_i - y_j|$

4. Tchebychev,

   The time to reach the center of facility j from the centre of facility i depends on the magnitude of the distance x and y. with the following equation:

   d_{ij} =max $(|x_i - x_j|, |y_i - y_j|)$

5. Aisle Distance,

   Aisle distance is different from all formulas because it is a calculation of the distance that moves along the aisle (aisle) by means of material handling transportation.

6. Adjacency,

   Another formula that indicates whether the facilities are adjacent. This is called the boundary or proximity matrix. The drawback of this formula does not distinguish facilities that are not next to each other or next to each other.

7. Shortest Path,

   In each arc there is a distance or time travelled between the two vertices connected by the arc. Since there is more than one path between a pair of nodes, the shortest path is

an important consideration. Location and distribution problems can be described in a network.

2.6 Facility Layout Planning

The distance, time, cost, and distance of material moving are all critical factors in manufacturing planning. The long-term efficiency of production is influenced by the form of the manufacturing facility (Pramesti M., 2019). Facility layout is the arrangement of available facilities on shop floor to get the maximum layout. The following are the parameters that were used (Amri, 2014):

1. The process room's transport distance is kept to a minimum, reducing labor and material moving costs.
2. The material flow is smooth and does not obstruct the continuing production process.
3. Effective space use entails maintaining a spacing between equipment that is neither too large nor too small.
4. Flexibility refers to the design of the plan in such a way that, if necessary, alterations can be made in accordance with current developments (type of product, quantity, quality, etc.).
5. Transported items are guaranteed to be safe. These facilities may me machines, workers, rooms, etc.

All the available resources must be properly laid out on shop floor for getting enhanced production. Activity relationship chart is base for designing any type of plant Layout design of industry is very important, and it directly affects the productivity (Sharma, 2015). Broadly speaking, the main purpose of factory layout according to Purnomo (2014), the basic goal of layout design is to maximize the value provided by the manufacturing industry by optimizing the arrangement of operating facilities (Triyono, 2014).

According to Industrial engineering introductory teaching materials by Amri on 2014. The general purpose of the layout is simplify the process, minimize material transfer, maintain flexibility, maintain the turnover of semi-finished goods, save the use of building space, provide convenience, safety and comfort for employees in doing their jobs.

2.7 Facility Layout Planning Method

In Facility Layout, there are several methods that can be used to perform facility layout planning, such as Systematic Layout Planning (SLP), Computerized Relationship Layout Planning (CORELAP), Computerized Relative Allocation of Facilities Technique (CRAFT), BLOCPLAN, and others (Jati, 2020). In addition, many supporting factors and considerations (safety, ergonomics, quality, and economy) are involved in the design and layout of the facility (Al-Zubaidi, 2020).

2.8 Activity Relationship Chart (ARC)

Activity Relationship Chart (ARC) is a simple technique in planning the layout of a facility or department based on activity relationships which is often expressed in a "qualitative" assessment and tends to be based on subjective considerations of each departmental facility (Pratiwi I., 2012). Then, ARC according to Ukurta Tarigan (2018) is created to determine the level of proximity and to find out why a product should be brought closer or farther away. Before the data is proceed on ARC, the researcher has to collect questionnaire data by related respondents to get the variables closeness. Down below is the example of variables questionnaire (Wahyukaton, 2019):

	AD	LR1	LR2	MDB	IB	SIB	DC	PM	OR	T
Administration Desk (AD)										
Lecturer Room 1 (LR1)										
Lecturer Room 2 (LR2)										
Mark Display Board (MDB)										
Information Board (IB)										
Seminar Information Board (SIB)										
Documents Cabinet (DC)										
Photocopy/Printer Machine (PM)										
Officer Room (OR)										
Toilet (T)										

Figure 2.6 Table of Closeness.

According to Tampubolon (2020,) he stated that ARC is used to convert quality into quantity. ARC consists of 15 work stations, and each section/station is assigned a grade of A, E, I, O, U, or X. Moreover, Prayogo (2020) stated if the reasons for proximity are divided into 3 criteria (Production Criteria, Employee Criteria and Information Criteria). Down below is table of Degree of Importance in Activity Relationship Chart:

Code	Colour	Degree of Importance
A	Red	Absolute
E	Orange	Especially
I	Green	Important
O	Blue	Ordinary
U	White	Unimportant
X	Brown	Undesirable

Figure 2.7 Degree of Importance.

The table above provides a code that may be used to describe the level of relationship in each facility in a consistent and standardized manner. Down below is the example of Activity Relationship Chart implementation (Wahyukaton, 2019):

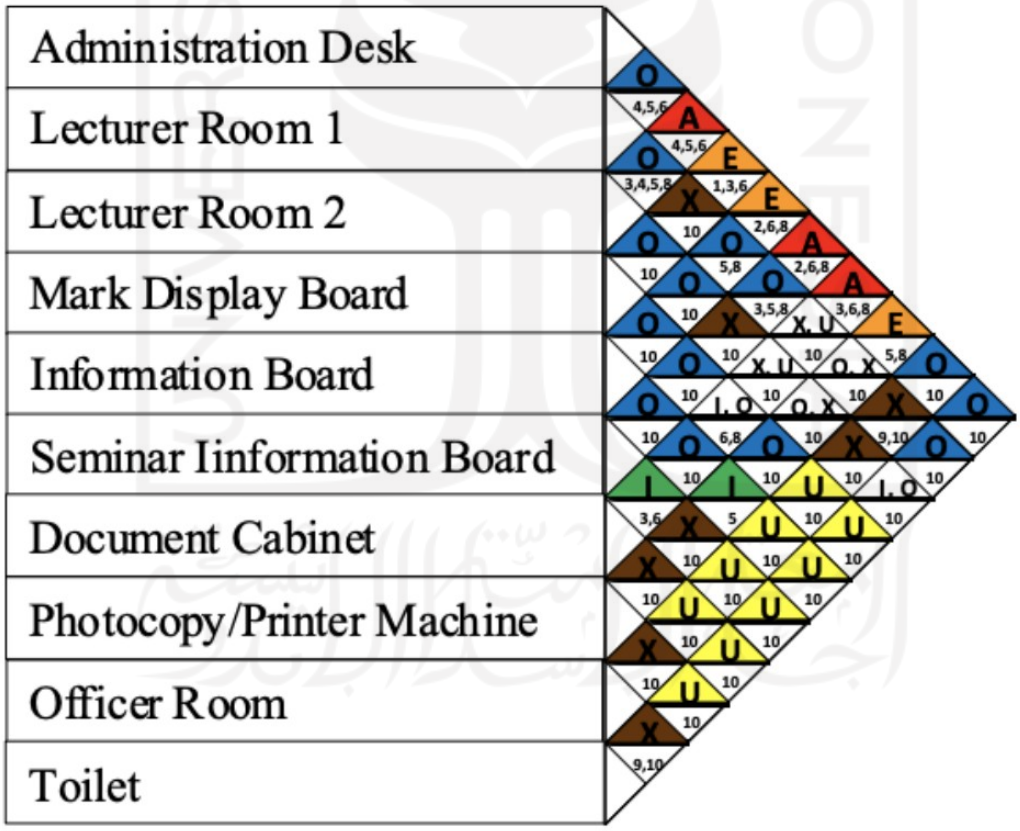

Figure 2.8 Activity Relationship Chart (ARC)

In the Activity Relationship Chart that has been designed by, values that show the degree of relationship are recorded together with the underlying explanations

(Wingnjosoebroto, Factory Layout and Material Transfer: Third Edition, 2003). The following steps can be used to create an activity relationship map:

1. Identify all work facilities or departments to be arranged in the layout and list them sequentially on the map.
2. Conducting interviews (interviews) or surveys with employees from each department listed on the map list and also the authorized management.
3. Determine the criteria for inter-departmental relations to be placed based on the degree of closeness of the relationship and the reasons for each on the map.
4. Discuss the results of the assessment of the relationship between the mapped activities and the basic reality of management. Feel free to provide evaluations or changes that are more suitable.

2.9 BLOCPLAN Algorithm

The Total Closeness Rating was calculated using data available at the ARC and the department with the highest TCR was chosen as first department in order (Binoy, 2018). TCR is based data on BLOCPLAN Algorithm.

BLOCPLAN Algorithm (Block Layout Overview with Layout Planning) is a heuristic technique that provides both quantitative and qualitative data to create the design, which necessitates the use of an activity relationship chart. This process utilizes the Activity Relationship Chart (ARC), the From to Chart, and the Process Flow as inputs to create and test block type layouts (Widodo, 2006). BPLAN90 software is used to implement the BLOCPLAN algorithm (Setyawan D.T., 2017). According to Andri Nasution and Budi Anugrah (2020), BLOCPLAN Algorithm is one of method in Facility Layout Planning to minimize distance between departments or facilities based on quantitative or qualitative data. Requirements to use BLOCPLAN Algorithm is author must have data of ARC.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Object

This study will analyze various company activities that go underneath the classification of waste activity at receiving and warehousing department, analyze material handling; workflow classification and cost, dimension of each department area, rectilinear distance between each facility, and initial layout design, and re-design facility layout at receiving and warehousing department so it able to reduce waste activities and material handling cost.

3.2 Data Collection Types

This research makes use of both primary and secondary data. For this study to be effective, both sorts of data are required to complement and support each other. The two data are analyzed and explained in the following way:

1. Primary Data

   Primary data is the result of data acquisition where the data is obtained directly from data sources in the field, in this study, to collect primary data it obtained through interviews and observations.

2. Secondary Data

   Secondary data is the result of data acquisition where the data is taken from available information such as papers, national or international journals, books, articles, and through intermediaries or studies on existing research. The use of this secondary data is to support and validate the classification qualitatively during the research process.

3.3 Data Collection Method

The receiving and warehousing departments are in charge of data collection. The information gathered in this study is divided into two categories: primary data and secondary data. The data collection methods for each data type are as follows:

1. Primary Data

   A. Discussion

      Discussion is activity that occurred with one or more people to get an information regarding to the facility layout issue that researcher take by ask several questions to

lead worker at receiving and warehousing department of PT. Lintas Bintang Mulia Nusantara.

B. Direct Observation.

Direct observation is an activity where researchers directly see the conditions, problem identification, waste activities identification, worker habits, business processes that occur, and measure total department area, questionnaire. Measurement of the area of the receiving and warehousing departments using a roll meter at receiving and warehousing department of PT. Lintas Bintang Mulia Nusantara.

2. Secondary Data

Secondary data was carried out from supporting documents, secondary data was gathered and analysed. Literature studies, as well as previous research sources or scientific publications, were consulted.

3.4 Data Processing

Data processing will explain how to analyze the layout of the facility to make a proposal for the design of the facility layout at the receiving and warehousing departments. Data processing is carried out after the collection stage is finished.

Facility layout planning is the arrangement of available facilities on shop floor to get the maximum output fromthem. Activity relationship chart is base for designing any type of plantlayout. Layout design of industry is very important, and it directly affects the productivity (Sharma, 2015). The first tool for using Activity Relationship Chart (ARC). Thus, there are several steps taken in using the Activity Relationship Chart (ARC) method (Suminar, 2020).

According to the steps, the basic elements in redesigning the layout of the production process are: the power of the owner of capital, product design, sales volume planning, production process selection, make or buy analysis, factory size, product selling price, factory location, factory layout, building type selection. factory, diversity or diversification of product types and organizational development.

3.5 Research Flow

To propose design of the facility layout in 3D as the final result, the researcher uses the flow chart below as a tool to facilitate the implementation of this research. Down below is the research flow chart:

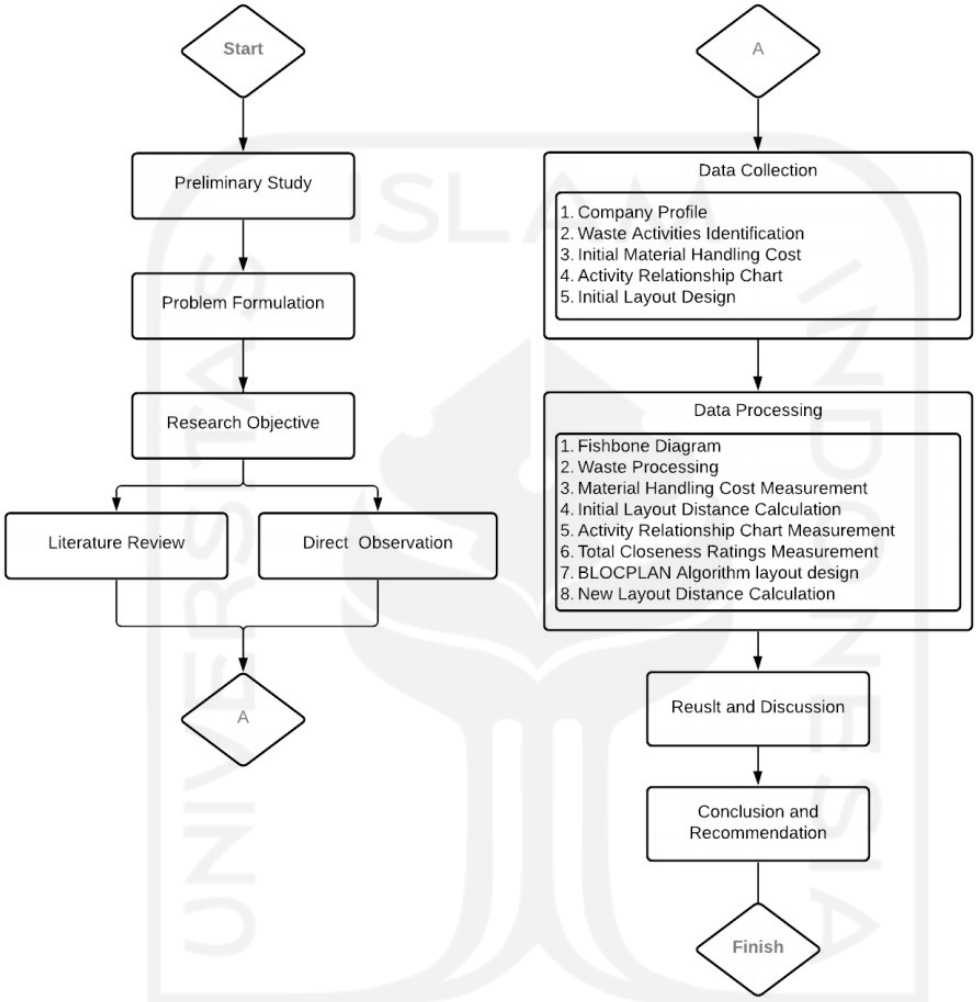

Figure 3. 1 Research Flow

According to research flow, there are eight steps to conduct the research. Down below are the explanation of each step:

1. Preliminary Study

   Preliminary is systematic review into issues relating to the proposed quality review or evaluation that can be used to identify key aspects of the quality process that need to be a critical examination. Preliminary study for this research is discussed about research background which become the reason behind the research. The background of the

research is there are several problems in receiving and warehousing department due to have optimum layout so when high season quartal is coming, new product does not swell and pile up randomly at receiving department. Warehousing department also have a trouble for managing the finished products because there is no product categorization for each rack.

2. Problem Formulation

   The step in identifying user attributes and needs is problem formulation. The performance criteria and target properties for the designed solvent will be used to determine the desired solvent performance criteria in this step. The problem formulation for this research is how to redesign a proposed layout at receiving and warehousing department to get a new optimum layout at receiving and warehousing department to increase worker productivity.

3. Research Objective

   The research objectives are a realistic depiction of what the study is attempting to accomplish. They summarize the goals that the researcher hopes to achieve through the project and give the research direction. The research objective for this research is receiving and warehousing department are getting an optimum layout.

4. Literature Review

   Literature review is a summary of previously published work on a particular subject, complete scientific work or a portion of a scientific work, such as a book or an article that referred to by this term. Literature review for this research as a guidance and support data.

5. Direct Observation

   Direct Observation is a one of the research parts to know the initial conditions on the field at receiving and warehousing departments at PT. Lintas Bintang Mulia Nusantara

6. Data Collection

   Direct Collection is the process of collecting and analyzing data about the desired variables in a pre-determined system, allowing one to answer pertinent questions and assess the results that happens on the field. The way researcher obtain data collection

is using interview, discussion, observation, and measure the area.

7. Data Processing

   Data processing is a process to increased productivity and profitability, better decisions, and higher accuracy and reliability are all benefits of data processing. Additional cost savings, ease of storage, distribution, and reporting generation, as well as improved analysis and presentation, are all benefits. The data processing for this research are using several tools such as Fishbone Diagram, Rectilinear Distance Measurement, Activity Relationship Chart (ARC), Total Closeness Rating (TCR), Block Layout Overview with Layout Planning (BLOCPLAN), Activity Allocation Diagram (AAD)

8. Result and Discussion

   Result and discussion are to interpret and explain the significance of your findings in relation to what is already known about the research problem under investigation, as well as to shed light on any new understanding or insight gained as a result of your research.

9. Conclusions and Recommendation

   The conclusion of this research is answering the problem formulation and researcher gives a recommendation for the company.

CHAPTER IV
DATA COLLECTING AND PROCESSING

4.1 Data Collection

Data collection is an activity carried out in research to collect information. The collected data will then be input to the data processing stage. Data collection methods used are observation and giving a questionnaire. The data needed is the general review data of PT. Lintas Bintang Mulia Nusantara, namely in the overall core business processes (related to the receiving and warehousing departments), office layout sizes, and data on close relationships between departments. Data collection at PT. Lintas Bintang Mulia Nusantara was carried out by direct observation to get an information that relate between company and measure the area, waste activities that happen, problem identification, material handling cost, and distance in the receiving department and warehousing. The data needed by this research for the receiving and warehousing departments are existing layout, business process, and area size.

4.2 Company Profile

4.2.1 Brief History

Starcross is a retail company brand that engaged in clothing or fashion sector that the product distribution center or the headquarter is located in Yogyakarta. Starcross is a local clothing retailer which first opened for business in August of 2004. Starcross focused on distribution at first, implementing a guerrilla strategy. On September 4th, 2004, Starcross was established as part of a limited liability business called CV. Multiline. While time grow older, at the beginning of 2020 already has 25 branch stores spread across the archipelago in Indonesia and make an independent company under the name of PT. Lintas Bintang Mulia Nusantara. Starcross does a lot in developing a real retail store. For example, starting from the visual / display system to the goods data management system. In addition, the news / catalogs that are provided directly in this store will also continue to be sent regularly to potential consumers. other than that, it will also hold outreach or promos by holding a showcase that will bring in media, observers, buyers, and consumers. For example, Starcross Store appreciates each of its customers by making the event very personal for its consumers. With the target that Starcross must be a priority label in the minds of

consumers, Starcross ensures that these products are indeed feasible. Where, when consumers want to look more casual, relaxed and still look mature and of course can look conventional or market, the products available at Starcross are the first choice.

Starcross Store is here as a store label by displaying brands / products that are branded but affordable. Then at this time Starcross has become an independent corporate corporation to become PT. Lintas Bintang Mulia Nusantara and has two subsidiaries, namely VAST which is a retail and clothing company with the theme of skateters and SUPOYO, which is a company in the field of gifts and merchandise souvenirs.

4.2.2 Ownership Status

Starcross is a local retail clothing company that was founded in August 2004. Starcross, which initially concentrated on distribution using the guerilla system. Starcross was inaugurated on September 4, 2004 which is part of a limited company of CV. Multiline. As time goes by, the Starcross brand has now become an independent company under the name PT. Lintas Bintang Mulia Nusantara, where the type of business is a Limited Liability Company (PT / Corporations / Corporates): a company that has an official legal entity owned by two or more persons with the responsibility only applies to the company without involving personal assets and members of the shareholders are limited to shares that are it has.

4.2.3 Location

PT. Lintas Bintang Mulia Nusantara, which is located on Jl. Javanese Eagle No.5A, Nglarang, Wedomartani, Kec. Ngemplak, Sleman Regency, Yogyakarta Special Region 55584. Following are the environmental conditions at PT. Lintas Bintang Mulia Nusantara:

Figure 4. 1 Starcross Headquarter (SH) on Google Maps

Figure 4. 2 Starcross Headquarter (SH) Building

The picture above is the Headquarter or the head office of PT. Lintas Bintang Mulia Nusantara where the processes of design, planning, marketing, R&D, Receiving, distribution, etc. are carried out at this head office. Apart from the head

office, specifically for the Starcross brand, it also has 25 branches throughout Indonesia, namely:

Table 4. 1 Starcross Store List

STORE	CITY
Demangan Store	Yogyakarta
Tamsis Store	
Boulevard Store	Makassar
Alauddin Store	
Bangka Store	Bangka
Kendari Store	Kendari
Palu Store	Palu
Samarinda Store	Samarinda
Malang Store	Malang
Online Store	Online
Semarang Store	Semarang
Mataram Store	Mataram
Lampung Store	Lamping
Salatiga Store	Salatiga
Purwokerto Store	Purwokerto
Pontianak Store	Pontianak
Belitung Store	Belitung
Solo Store	Solo
Kediri Store	Kediri
Bogor Store	Bogor
Kudus Store	Kudus
Palopo Store	Sulawesi
Jakarta Store	Jakarta
Tendencies 2 Store	
Highway Store	Bantul

4.2.4 Company Product

PT. Lintas Bintang Mulia Nusantara is a creative industry that is engaged in the lifestyle, where a variety of lifestyle items are based on pop, action sports, music and street themes. The goods produced by this company are very diverse with more than hundreds of types of items. Down below the example of the products:

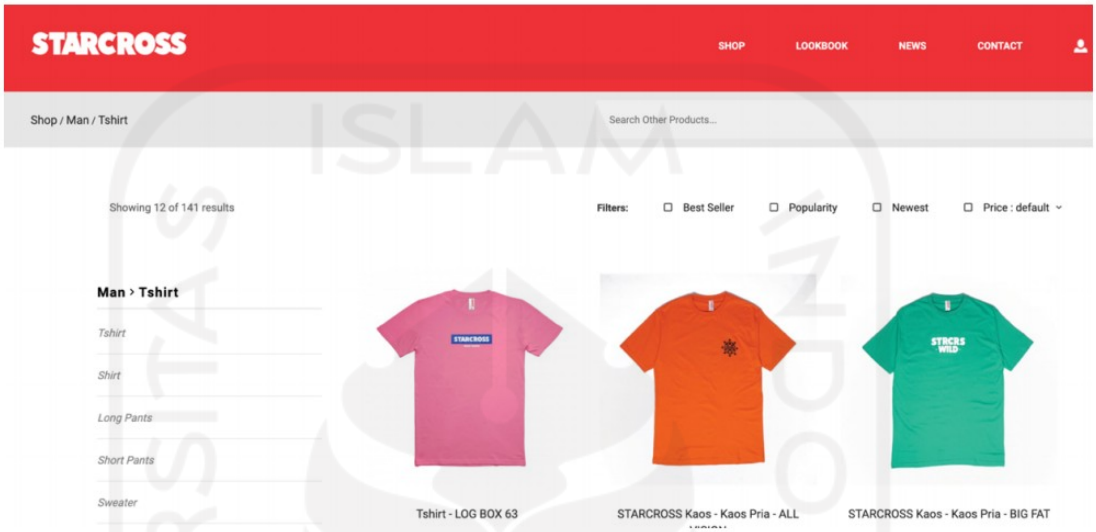

Figure 4. 3 Starcross Product (T-Shirt)

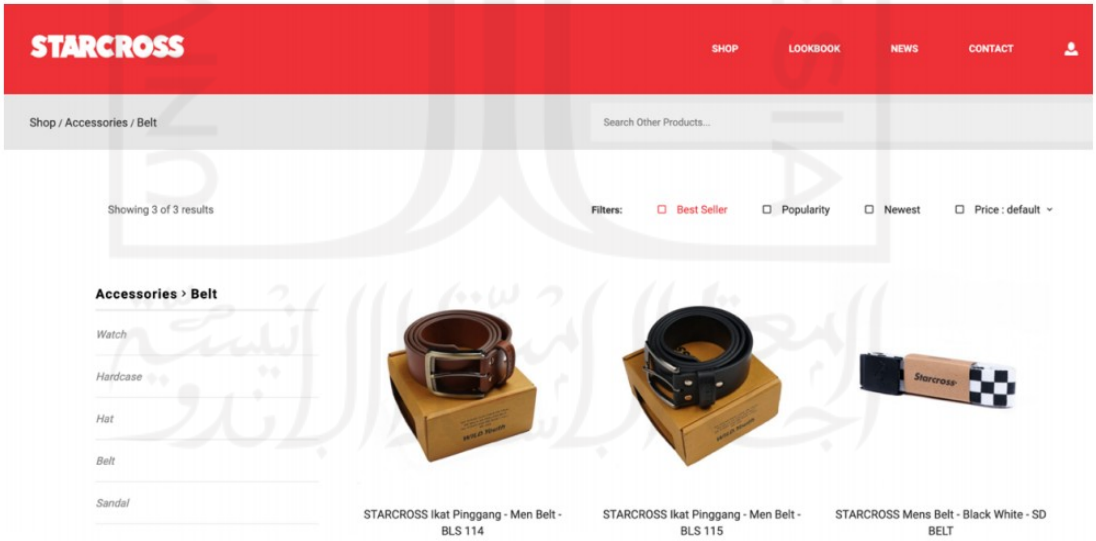

Figure 4. 4 Starcross Product (Belt)

Furthermore, PT. Lintas Bintang Mulia Nusantara produced clothing such as t-shirts, jackets, shirts, polo shirts, pants, skirts, jeans. To expand its market share, Starcross continues to expand its product lines such as bags and other fashion

accessories, such as beanies, mesh hats, wallets, phone cases, pins, sandals, shoes, denims and boxers as well as clothing products for small children aged 3 up to 6 years old. But the bestseller items from PT. Lintas Bintang Mulia Nusantara, especially the Starcross brand, include:

A. T shirts, T-shirts are the best-selling products from Starcross. The T-shirts produced by Starcross use the best materials, namely Chinese bamboo fabrics, imported from China. This bamboo fabric is above the standard fabric used by clothing in general (30s combed cotton). Bamboo China is smoother and is used more coolly. The screen printing used by Starcross also varies, from the type of screen printing, plastisol, colors and so on. With good quality, the t-shirts produced by Starcross are not easily damaged.

B. Shirts & Polo Shirts, the shirts and polo shirts are also produced in-house by Starcross. The shirts that are produced also have good quality and neat stitches. For shirts, polo shirts and t-shirts, Starcross products are very exclusive because 1 design is only produced 5 times (sizes S, M, L, XL, XXL).

C. Jacket, Jamper, Hoodie, Starcross also has jackets, jampers, hoodies, coach jackets, etc. which have various designs and collaborate with other brands as well.

D. Pants, Starcross produces pants, ranging from short to long pants. The material also varies, there are jeans, fabrics, cadets.

E. Bag, When the Starcross brand was founded in 2004, Starcross started by selling bags, until now the bag has become one of the bestselling items and has various types and designs.

F. Accessories and more, accessories produced by Starcross are quite a lot like hats, vets, wallets, belts, wallets, bracelets, watches. For watch products, Starcross imports from China but for other products they produce themselves and are partially subcontracted.

4.2.5 Marketing Strategy

In marketing PT. Lintas Bintang Mulia Nusantara does this in various ways, from

print media, social media, collaboration with other brands, involving influencers, exhibitions and words of mouth. The following are details of some of the marketing activities carried out by PT. Lintas Bintang Mulia Nusantara:

A. Print Media

Various ways have become feasible for the business world in looking for something interesting. In delivering a message that will be conveyed, it should not be separated from other basic things in advertising, namely informative and persuasive. Starcross also uses print media as their promotional media, one of which is advertisements in newspapers and magazines. Newspapers and magazines are considered more effective and efficient because newspapers are read more frequently by the public and are easier to obtain and the price of advertisements is relatively cheap compared to television media.

B. Banner and flayer

Various ways have become feasible for the business world in looking for something interesting. In delivering a message that will be conveyed, it should not be separated from other basic things in advertising, namely informative and persuasive.

Figure 4. 5 Banner Promotion

Flayers or brochures are one of the most effective promotional media because they usually contain information about Starcross products. In addition, the flayer is also used as a medium if Starcross has new products or promotions or discounts.

These players are usually placed at Starcross stores or distributed during exhibition events. With a composition in the form of images or writing without reducing its value, the banner is one of the outdoor advertising media that is used as a medium of information about the products it offers.

C. Website and social media

Starcross also uses social media such as Facebook, Twitter and Instagram as their promotional media and is an effective way to market their products because using social media is inexpensive and has a very effective impact. This social media is used to share the latest products as well as event information and discounts to followers.

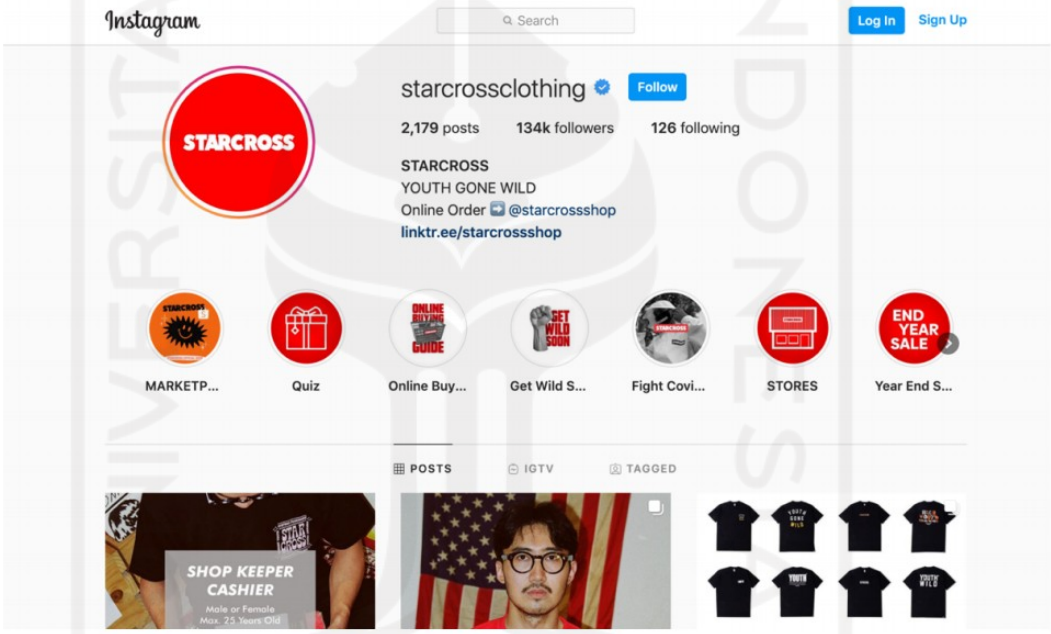

Figure 4. 6 Starcorss Official Instagram

Apart from social media, Starcross also has a website, namely https://Starcross.shop/. This website contains a catalog of products from Starcross. This website is also e-commerce for Starcross because you can purchase Starcross products online. This website is also an image for Starcross, which is the biggest clothing brand or clothing in Yogyakarta. The Starcross website contains more about the latest products and reviews of the latest brands as well as promotion of exhibitions and events.

D. Events

In developing a business, the implementation of marketing communications must run and never stop looking for opportunities. Not only selling in stores and through online media, Starcross also uses the media of clothing exhibitions that are often held. This exhibition also includes marketing or direct selling to consumers. This is done in an effort to reach consumers and increase sales of Starcross products. There are several clothing distribution exhibition events every year that are held in Yogyakarta and in Indonesia.

Figure 4. 7 Starcross Event

Starcross always participates in exhibition activities. Starcross regularly participates in clothing exhibitions in Yogyakarta, Jakarta, Bandung, Surabaya. The broadcast events that Starcross have participated in are Indie Clothing Carnival (Yogyakarta, 7-9 June 2016, Purwokerto, 19-21 June 2016, Surabaya, 23-26 December 2016), The Parade (Yogyakarta, 9-11 January 2016 and 14-17 December 2016), Jackcloth (Jakarta, 1-3 January and 17-20 December 2016), Kickfest (Yogyakarta, 15-17 August 2016, Bandung, 12-14 February and 24-27 November 2016), Showcase (Makassar, 3- 6 May 2016 and Solo, 4-6 August 2016) and Clothing Distro Festival (Palembang, 27-30 June 2016). Most of the exhibitions that Starcross participated in were on a national scale, but the priority was in Java Island. Through this clothing exhibition, Starcross can get 3 times more profit than normal days. In addition, the exhibition is also a means of promotion for Starcross to better introduce its products to the public.

E. Collaboration

Starcross pays close attention to trending in the world and its development, so one of the strategies that inspired Starcross to expand the market is to collaborate with the Starcross brand with other well-known brands in Indonesia.

Figure 4. 8 Starcross Collaboration with local brands

By collaborating with the brand, Starcross will get many benefits not only from the market but also the personal branding of Starcross itself so that the character of the brand will become stronger. Brands that collaborate with Starcross such as indomie, didi kempot, local brands, etc. The following are examples of products that collaborate with Starcross. Down below the example of third-party collaboration:

F. Words of Mouth (Influencer)

There are various kinds of ways for people to promote goods in cyberspace, one of which is the endorsement system. Endorsement means support or support; this system is widely used by stores built on several social networks such as Twitter or Instagram and has mushroomed starting mid-2012. Endorsement is a way to promote products by asking someone who is widely known to use the goods sold on the shop. People who help this promotion process are called endorsers. They will be asked to consume, or use the item and then document it so that it is hoped that more followers will be interested in the item This method is not done for free because there is feedback that will be obtained by endorsers, namely in the form of several products from online stores that request endorsements. There are also contacts that will be made in the next few years to use Starcross products with salary payments that have been agreed upon by both parties between the endorsement and the endorser.

When compared to advertising, this system has an advantage because these endorsers have a strong enough influence on their followers or fans. These fans tend to imitate what their idols do. Sales will increase if more and more people want to follow the endorser's style. Some people who can be used as endorsers of a product are artists, musicians, public figures, athletes and so on. In this case, Starcross also carries out an Endorsement strategy to promote their products. One of them is by endorsing a top band from Yogyakarta, namely Endank Soekamti. This band is currently on the rise because it often appears on television shows, major music events and so on. Apart from that, Endak Soekamti also has Iqbal Coboy Junior, Yoshiolo, etc.

4.2.6 Human Capital Management

PT. Lintas Bintang Mulia Nusantara is led by the founder of the company called owner. At PT. Lintas Bintang Mulia Nusantara employees are divided into three categories, namely creative category, shopfloor category, and shop category. Down below is the organizational structure of Starcross:

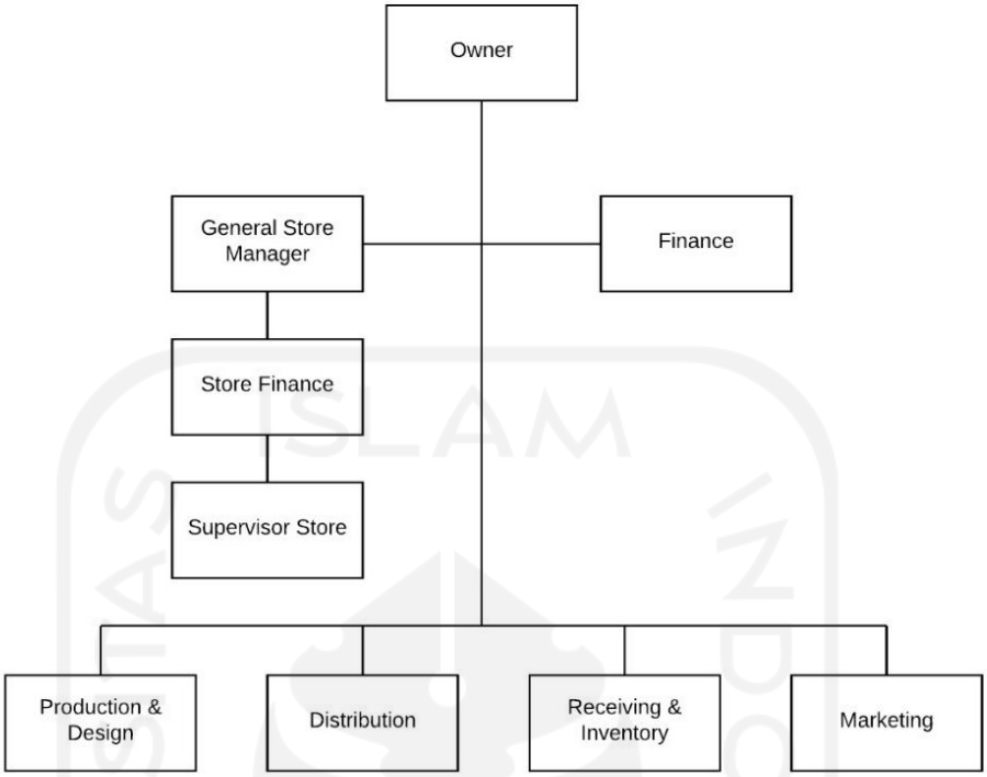

Figure 4. 9 Organizational Structure

Each category has its own division, the creative category consists of production & design and marketing divisions, the shopfloor category consists of distribution and receiving divisions, for the store category consists of general store manager, store finance, and store supervisor. The following is the organizational structure of PT. Lintas Bintang Mulia Nusantara.

4.2.7 Work Unit Responsibility

The following is a work unit at PT. Lintas Bintang Mulia Nusantara:

A. General Store Manager

He is the head of the unit who controls and manages all the branch stores of the Starcross brand, and is fully responsible for what happens from all of the 25 Starcross store branches.

B. Supervisor

He Is a unit head who oversees only one shop and is fully responsible for what

happens in that store? If something happens, the supervisor will report it to the general store manager.

C. Finance

The department that is responsible for the entire financial management of the company. Relating to all cash flows in and out of company finances.

D. Store Finance

The department responsible for all financial management at one Starcross store branch. Make daily financial reports and report them to the finance center.

E. Production and Design

This department is the brain of Starcross, this department does creative thinking to design every article that will be produced by the company as well as doing production planning, simple forecasting, and selecting vendors.

F. Distribution

The department is fully responsible for the entire distribution process of goods, be it distribution to resellers (wholesale), B2B, direct customers, and all Starcross brand store branches spread throughout Indonesia. This department also designs goods distribution plans, and subcontracts freight forwarders to distribute goods from companies.

G. Warehousing and Receiving

This department is fully responsible for the process of receiving incoming goods, where the process includes creating a new item code, carrying out a good receipt process, quality control, labeling goods, store to warehousing, warehouse management.

H. Marketing

This department does market for the Starcross brand in general and new goods in particular. Marketing is done by utilizing various platforms such as social media, websites, word of mouth and others. This department also formulates sales and marketing strategies, marketing strategies that are often carried out, among others;

do exhibitions, create events, big discounts, collaborations with other brands, and collaborate with influencers.

4.2.8 Labor

PT. Lintas Bintang Mulia Nusantara has a workforce that can be divided into 2, namely permanent workers and contract workers (not permanent). The available labor force is divided into 2 different types, namely workers in the creative field (production, design, marketing, RnD) and workers in the shop floor (Receiving and Distribution). Permanent workforce of PT. Lintas Bintang Start Nusantara is generally a worker who used to be a contract worker who has worked for a certain period of time. Contract labor or commonly known as freelancers is usually enforced when entering the high season where the company will be very busy pursuing targets to meet customer demands.

4.2.9 Work Hour

Down below is the information work hour of worker at Receiving and Warehousing Department of PT. Lintas Bintang Mulia Nusantara:

Table 4. 2 Employee Work Hour

Receiving and WarehousingDepartment Working Time			
No.	**Description**	**Quantity**	**Unit**
1	Work Productive Day per Week	6	Day
2	Work Hours per Day	8	Hour
3	Work's Break Time per Day	1	Hour

The worker starts working at 09:00 am to filling the attendance, then at 12:00 – 01:00 pm worker take a break for lunch or sleep. After that, workers work again until 05:00. But before leaving the Headquarter (HQ) usually worker clean up the area.

4.2.10 Creative Process

The creative process distribution center is also carried out starting from design, production planning, and distribution planning. However, the main activities carried out are on the shop floor or production floor, namely the activities of receiving,

warehousing and distributing goods. Activities on the production floor often have trouble with various factors, this trouble will occur more often when the high season is on the day before Eid, this happens because the demand from customers will increase up to 6x during high season. Of course, when this time the work on the production floor will be very hectic, and trigger a lot of risks that occur. In addition, the workload at that moment will certainly increase because workers are pressured by various variables such as deadlines, targets, leaders, etc.

4.2.11 Aggregate and Material Planning (Raw Material)

PT. Lintas Bintang Mulia Nusantara conducts an aggregate planning of goods to be sold with the latest model every quarter, meaning that the aggregate planning will take place four times a year. Aggregate planning that has been carried out has gone well where this company is able to plan in the long term. With this planning the company can and is able to manage its production activities properly. So that production targets can be achieved and meet consumer desires. The same thing applies to material planning, material planning is also carried out every quarter, meaning four times a year. This is because every quarter the company will update their catalog into a new design, therefore the material needed is also new and it is necessary to plan the material according to the number of items that will be planned for production.

4.2.12 Scheduling

The planning process at PT. Lintas Bintang Mulia Nusantara is carried out not only on the manufacturing quantity, but also until the target product is delivered to each store. As a result, good planning is required to meet the intended goal. Scheduling is done for each vendor's manufacturing and product distribution operations; these two processes are extremely important for scheduling because if they are not completed on time, the total production planning would fall apart. Both have been well-scheduled by PT. Lintas Bintang Mulia Nusantara.

4.2.13 Production and Subcontracting System

PT. Lintas Bintang Mulia Nusantara produces goods in three ways: first, by making their own products, then by subcontracting or outsourcing the production of products to other vendors, and finally, by purchasing finished items directly from the manufacturer. In comparison, 20% of the items produced in-house and 80% of the

products manufactured by other suppliers are produced. Purchasing a finished product is quite uncommon. According to the comparison, PT. Lintas Bintang Mulia Nusantara frequently uses vendors to manufacture its products. This is because the number of goods produced is so large and diverse that PT. Lintas Bintang Mulia Nusantara's production house can only produce about 20% of the total product produced.

4.2.14 Asset and Information Management

PT. Lintas Bintang Mulia Nusantara is using a Revota application due to help managing the asset and information. Revota is utilized to guarantee that all departments are aware of what is going on within the company, such as warehousing input and output monitoring, as well as product flow for each branch store. Revota will keep track of all products that come in and go out, as well as any automated sales transactions. Using the various data records, the company may easily generate financial reports, sales reports, incoming and outgoing goods reports, and other information.

4.2.15 Capacity and Forecast Planning

Production planning and forecasting are carried out by the owner and the production & design division in particular and conduct a general meeting of all workers from PT. Lintas Bintang Mulia Nusantara every quarter to discuss this production planning. Planning is done simply with reference to historical sales data, waste goods, and the intuition of the owner and the production & design division. In addition to production planning, distribution planning is also carried out by the distribution department, distribution planning is the division of the number of articles of goods that will be sent in quantity to all Starcross brand store branches in Indonesia. The number of articles of goods for each store will vary depending on the number of sales from each store.

4.2.16 Quality Management

PT. Lintas Bintang Mulia Nusantara has a special sub-division under the production & design division, namely the Research and Development (RnD) division. One of the jobs of the Rn D division is evaluating post-sales products and evaluating sample products that are ready for mass production. The evaluation process of this

sample item is carried out to maintain the quality of Starcross products. The main aspects that are considered when evaluating samples are the size of the goods, the quality of raw materials, the quality of the screen printing, and the suitability of the color.

After the sample evaluation process has been carried out and has been revised from the vendor or production house, the mass production process is carried out. The quality evaluation process is also carried out by the Receiving division when carrying out the good receipt process, one of the good receipt processes is to check items one by one to ensure the quantity and also pay attention to the condition of the goods, if there are defective items, they will be rejected.

4.2.17 Warehousing

PT. Lintas Bintang Mulia Nusantara has two main warehouses for its two big brands, namely Starcross and VAST, there are no special provisions for storing goods in the warehouse, storage of goods is only grouped by type of goods such as t-shirts, pants, bags, etc., then for the arrangement it is placed according to the type of article the same for each type of item. Judging from the layout arrangement, there is no specific method in its preparation, but the 3 front racks that are close to the picking place are usually goods that have been planned for distribution, this is done to minimize the distribution division looking for goods to every corner of the warehouse.

4.3 Waste Activity Identification

Identification of waste is determining the category of waste that occurs in the receiving and warehousing department when the author is making observations at PT. Lintas Bintang Mulia Nusantara. There are 9 categories of this waste, namely: Environmental Health and Safety (EHS), Defect, Over Production, Waiting, Non-Utilizing Employee, Transportation, Inventory, Motion, and Excess Processing.

Table 4. 3 Waste Activities

No.	Waste Categorization	Waste Description
1	Environmental Health and Safety	Receiving employee using sandals not shoes

No.	Waste Categorization	Waste Description
2	Defect	Misaligned or incorrect stitching of clothes and improper placement of brand logos.
3	Over Production	Lack of space when in High Season position and an overload incoming goods from third-party
4	Waiting	-
5	Non-Utilizing Employees	Freelancer not compatible
6	Transportation	Material handling distance have a long distance
7	Inventory	Full storage and uncategorized
8	Motion	The sitting position in labelling employee is not good because of the bent body posture and repetitive motions
9	Excess Processing	-

4.4 Initial Material Handling Flow

Down below is the flow of material handling on receiving and warehousing department at PT. Lintas Bintang Mulia Nusantara:

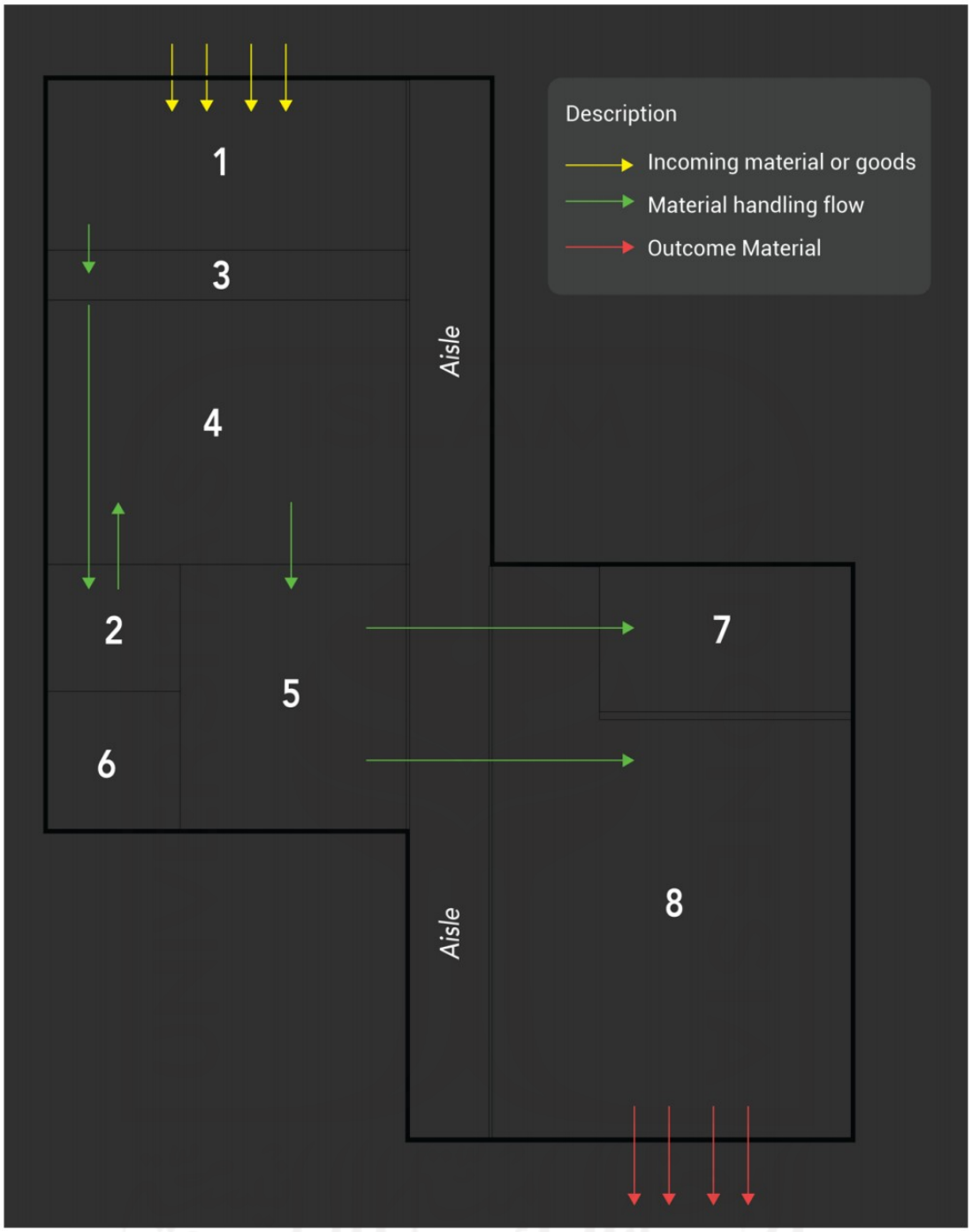

Figure 4. 10 Initial Material Handling Flow

4.5 Initial Layout Design

4.5.1 Facility Layout Categorization

According to Purnomo (2003) "*Pengantar Teknik Industri*", Broadly speaking there are four types of factory layout such as product layout, process layout, fixed product layout, and group layout. Down below are the explanation:

A. Product Layout

Product layout is a method of arranging the required production facilities into a particular department. A product can be made to completion within the department. The product manufacturing process follows a flow in the form of a line where raw materials are processed sequentially from the set of machines that have been installed. In general, product layout is used to produce products in large quantities and standardized or continuous production processes. A good sequence of production processes will reduce the costs of handling and storing materials. Down below are the advantages and disadvantages of product layout:

- Product Layout Advantages: Layout according to the order of operation, work from one process is directly carried out in the next process so that the inventory of semi-finished goods becomes small, total production time to be small, the machine can be placed at a minimum distance so that material transfer is short, simplify policies especially for untrained workers so they can learn them quickly.

- Product Layout Disadvantages: Dependence between or facilities on the production line is very large in case of damage to a machine will result in the cessation of the production process, changes in product design result in changes to the engine layout or require modification of existing facilities, production speed is determined by the slowest operating machine, requires a large investment due to the use of special purpose equipment and duplication of existing machines, the work pattern is monotonous, resulting in boredom for employees.

B. Process Layout

The layout process is carried out when the production volume is small, and especially for non-standard types of products, usually on an order basis. This condition is called a 'job shop'. The characteristic of process layout is that similar machines are grouped into one department. Down below are the advantages and disadvantages of process layout:

- Process Layout Advantages: Reduce investment invested in production facilities, flexibility in employee equipment settings, supervisors in each section will have more control over the functions of machines and facilities within the scope of their supervision, the workforce is able to operate equipment that produces various types and models of products and provides satisfaction for employees

who like work that is not monotonous (varied).

- Process Layout Disadvantages: Long process flow results in more expensive or inefficient material handling, the total production time is longer because each job has to wait for orders, inventory of semi-finished goods is quite large, highly skilled workforce is required to handle various kinds of production with large variations, employee productivity is low because the type of work has different characteristics.

C. Fixed Layout

The fixed position layout is very different from the two layouts above. A fixed position layout is indicated that labor, equipment or machinery and materials go to a fixed location and are then worked at that location until they become the final product. This layout is usually used for the assembly process, producing relatively heavy items and producing large items so that it is impossible to move from one place to another in a short time. Down below are the advantages and disadvantages of fixed product layout:

- Fixed Layout Advantages: Because those who move production facilities so that the movement of materials can be reduced, and fixed locations minimize material damage and do not require new planning and instructions as is the case for other types of layouts.

- Fixed Layout Disadvantages: There is an increase in the frequency of movement of production facilities and labor during operations, thus requiring high costs due to the displacement, requires strict supervision and work coordination, especially in production scheduling, it takes a combination of skilled and trained workers to work in a team which results in labor costs, the utility of the equipment is low because the equipment may be left at a location and will be used again at a later time so that the interval becomes unproductive.

D. Group Layout

This type of layout is known as a group technology layout, where products are grouped into product families and then processed according to these families. Grouping products into families usually on the same sequence of processes, based

on the equipment used. Product families that match the similarity of attributes are then processed into groups of machines. The grouping of machines is known as a manufacturing cell. Down below are the advantages and disadvantages of group layout:

- Group Layout Advantages: Higher machine utilization, due to product grouping, smoother flow and shorter transfer distance, can reduce set-up time, reduce material handling costs and reduce production floor area, and able to eliminate duplication and the availability of product information if needed at any time.

- Group Layout Disadvantages: Requires high labor skills for team members required skills that can handle all operations, reducing the opportunity to use more specialized equipment, and allows machine duplication

Based on the direct observation at PT. Lintas Bintang Mulia Nusantara, the company implement the product layout type because the flow production on receiving and warehousing department is sequentially.

4.5.2 Business Process Flow

The business processes of the receiving and warehousing departments at PT. Lintas Bintang Mulia Nusantara, as follows:

Figure 4. 11 Business Process Flow

When the goods from the vendor come to the Headquarter (HQ) at PT. Lintas Bintang Mulia Nusantara, a letter checking will be carried out in advance so that travel documents and goods brought is in accordance with the appropriate quantity. Then, if it is appropriate, the incoming goods will be moved or transported to the Goods Collection Area (GCA). The goods data comes and then entered into the Revota

software to be adjusted to the type of goods and the price of the goods. Then, the result from Revota is in the form of a barcode which will be pasted when labelling.

When the barcode and data have been entered, the incoming goods will be moved to the Labelling Area where later the goods will be rechecked for quality and put on a brand label using a string pin, brand card, and barcode. Finished goods (which have been labelled with the brand) and defective goods will be separated before being entered into the warehouse area. Then, the finished goods will be moved to the warehouse area and the defect goods will be moved to the Reject Goods Area.

4.5.3 Production Area and Process

The production area is where the facility's initial layout, as well as the layout of proposals at reception and warehousing, are created. The entire accessible area is 202 m^2, which includes 112 m^2 for the reception department and 90 m^2 for the warehousing department. The reception department area measures 16.47 meters by 6.8 meters in length and width. The length and width of the departmental warehouse area are 18 meters long and 5 meters wide. Because the suggested area is in agreement with the actual conditions, this size is used as a reference for refining the layout of the proposal so that the changes made can be implemented.

4.5.4 Facility Area of Function and Capacity

PT. Lintas Bintang Mulia Nusantara is a company engaged in the clothing sector with an area of 2 departments is 202m^2, which is then divided into several sub-departments. The area of the sub-departments and the number of workers in each department were obtained based on direct observations and interviews as follows:

Table 4. 4 Detail of Function and Capacity

No.	Facility Name	Area Function	Worker
1	Goods Arrival Area I	To carry out checking of travel documents and letters of conformity with the number of shipments ordered from vendors.	7
2	Asset Management Area	Entering incoming goods data in the receiving department into the Revota application to update	

No.	Facility Name	Area Function	Worker
		data and create barcodes. Then, do barcode printing	
3	Goods Arrival Area II	As a place for goods to be unloaded from transportation and still random and untidy after checking the letter has been verified	
4	Goods Collection Area	Sorting incoming goods from Good Arrival II into 4 categories including clothing, pants, accessories, and footwear. and prepare equipment for labeling workers into baskets.	
5	Labelling and Quality Control Area	Checking the quality of the product, labelling Starcross brand, put on selected barcode. Thus, separate the finished goods and defect goods.	
6	Locker Room and Smoking Area	A place to store workers' personal belongings and as a place to chat while resting.	
7	Reject Goods Area	As a storage place for reject goods.	0
8	Warehouse Area	As a place to store finished goods and have been labelled and categorized	

4.5.5 Facility Dimensions

Down below are the dimensions of each facility on receiving and warehousing departments at PT. Lintas Bintang Mulia Nusantara:

Table 4. 5 Facillity Dimensions

No.	Facility Name	Code	Size (m)		Total Area
			Length	Width	
1	Goods Arrival Area I	A	4,1	2,65	10,865
2	Asset Management Area	B	1,7	2,65	4,505

No.	Facility Name	Code	Size (m)		Total Area
			Length	Width	
3	Goods Arrival Area II	C	6,8	2,65	18,02
4	Goods Collection Area	D	6,8	5,3	36,04
5	Labelling and Quality Control Area	E	6,8	3,975	27,03
6	Locker Room and Smoking Area	F	6,8	1,325	9,01
7	Reject Goods Area	G	5	3	15
8	Warehouse Area	H	5	15	75

The dimensions of the facilities obtained are used to carry out the preparation of the existing layout facilities as well as the proposed layout so that the dimensions of each facility can be known and arranged according to the actual dimensions. Dimensions of existing facilities can be seen in Table 1. According to Pailin (2013), The shape of the area and its appropriateness with the dimensions and facilities contained therein can be considered as evidence of the feasibility of this layout upgrade, which can then be used to recalculate the moment of displacement and material handling costs.

4.5.6 Initial Layout of Receiving and Warehousing Departments

Based on the observations that have been made at PT. Lintas Bintang Mulia Nusantara. Receiving and warehousing department is obtained the layout of the room that is currently used by PT. Lintas Bintang Mulia Nusantara in the following picture:

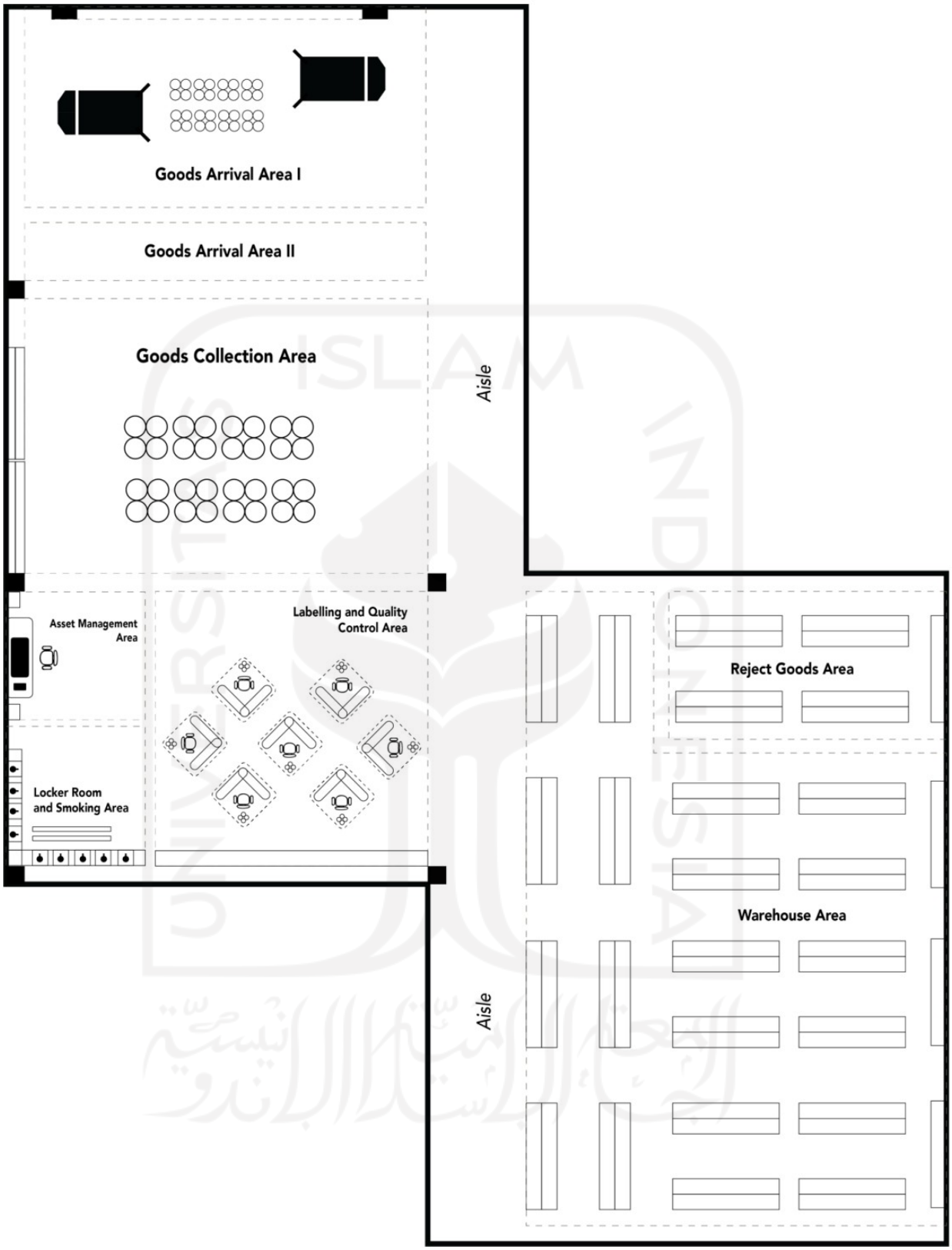

Figure 4. 12 Initial Layout

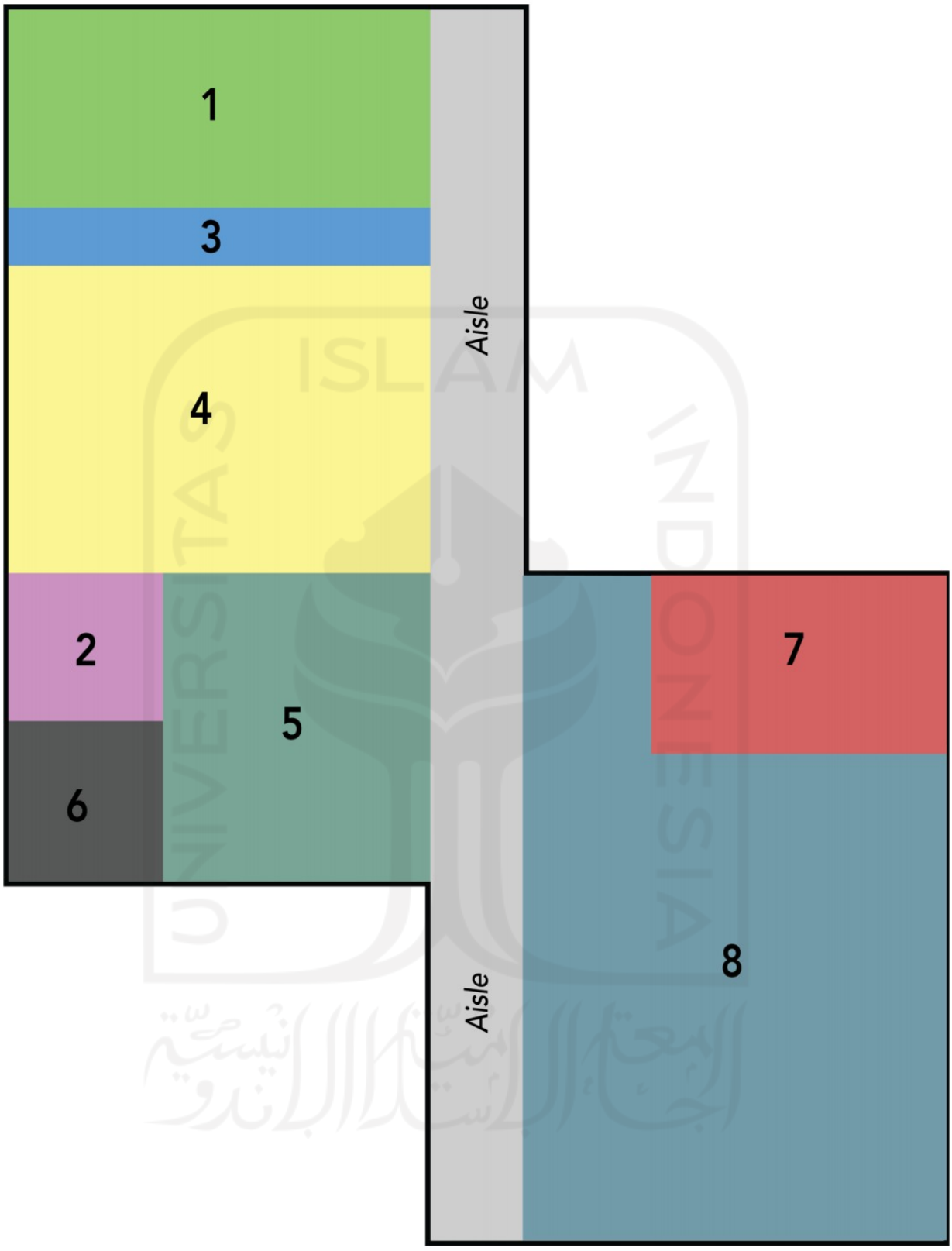

Figure 4. 13 Initial Layout (Block Form)

4.5.7 Activity Relationship Chart

The interaction between activities on the shop floor of any industry is referred to as an activity relationship. Machines, departments, offices, storage, and other

industry activities are examples of activities. To develop an activity connection map, relationships between activities and resources must be identified. You can get this information via conducting surveys or conducting interviews. Down below is the form to chart of Activity Relationship Chart (Sharma P., 2018):

Table 4. 6 From to Chart ARC

No.	Facility	Code	A	B	C	D	E	F	G	H
1	Goods Arrival Area I	A		A	A	E	U	O	U	U
2	Asset Management Area	B	A		A	A	U	O	U	A
3	Goods Arrival Area II	C	A	A		A	U	O	I	U
4	Goods Collection Area	D	E	A	A		A	O	A	A
5	Labelling and Quality Control Area	E	U	U	U	A		O	A	A
6	Locker Room and Smoking Area	F	O	O	O	O	O		U	U
7	Reject Goods Area	G	U	U	U	U	A	U		U
8	Warehouse Area	H	U	A	U	I	A	U	A	

4.5.8 Initial Layout Distance

The distance between departments is visible from the existing layout. To use the cube of the distance, the distance between departments is computed. (Tompkins, White, & Tanchoco, 1996). The following are the results of the departmental rectilinear distance calculation that can be placed in a layout based on the coordinates of the reference point.

Table 4. 7 Facility Coordinates

No.	Facility Name	Code	Coordinates	
			X	Y
1	Goods Arrival Area I	A	23,38	14,38
2	Asset Management Area	B	21,8	4,09
3	Goods Arrival Area II	C	23,6	11,76
4	Goods Collection Area	D	23,6	8,24
5	Labelling and Quality Control Area	E	25,08	2,89
6	Locker Room and Smoking Area	F	21,82	1,56
7	Reject Goods Area	G	32,32	4,09
8	Warehouse Area	H	31,37	-3,46

4.6 Data Processing

The results of direct observations and interviews at PT. Lintas Bintang Mulia Nusantara became the basic material for data processing. Data processing requires information such as weighting on Activity Relationship Chart (ARC), distance between sub-departments, waste identification, material handling cost, area of sub-departments, initial layout, and total area. Then, the data will be processed using the BLOCPLAN algorithms to get optimal layout results.

4.7 Fishbone Diagram

According to Kriswanto (2021), there are 6 fundamental or principle of Fishbone Diagram to dig some problem identification. Down blow is the principle of Fishbone Diagram:

A. Manpower (Labor), manpower associated to a lack of information, fundamental mental and physical skills, tiredness, tension, indifference, and so on.

B. Machines (Machinery or Equipment), due to the lack of a preventative maintenance system for manufacturing machines, as well as other facilities and equipment, not adhering to task specifications, not being calibrated, being too complicated, being too hot, etc.

C. Methods (Work Methods), work procedures and methods that are incorrect, confusing, unknown, unstandardized, improper, and so on.

D. Materials (Raw Materials and Auxiliary Materials), quality criteria and supporting raw materials are already in place in the sector, ensuring that there are no roadblocks during the manufacturing process and the processing of raw materials and auxiliary materials, for example.

E. Environment, cleanliness, health, work safety, a pleasant work environment, lack of lighting, insufficient ventilation, excessive noise, and other factors are ignored while discussing the location and time of work.

F. Measurement, the action of systematically determining numbers for an object is referred to as measurement.

To conduct the Fishbone Diagram, only a related principle that use according to the main problem. For the case study, author only use 4 principle such as Manpower, Machines, Materials, and Environment. Down below is the Fishbone diagram on departments of receiving and warehousing at PT. Lintas Bintang Mulia Nusantara:

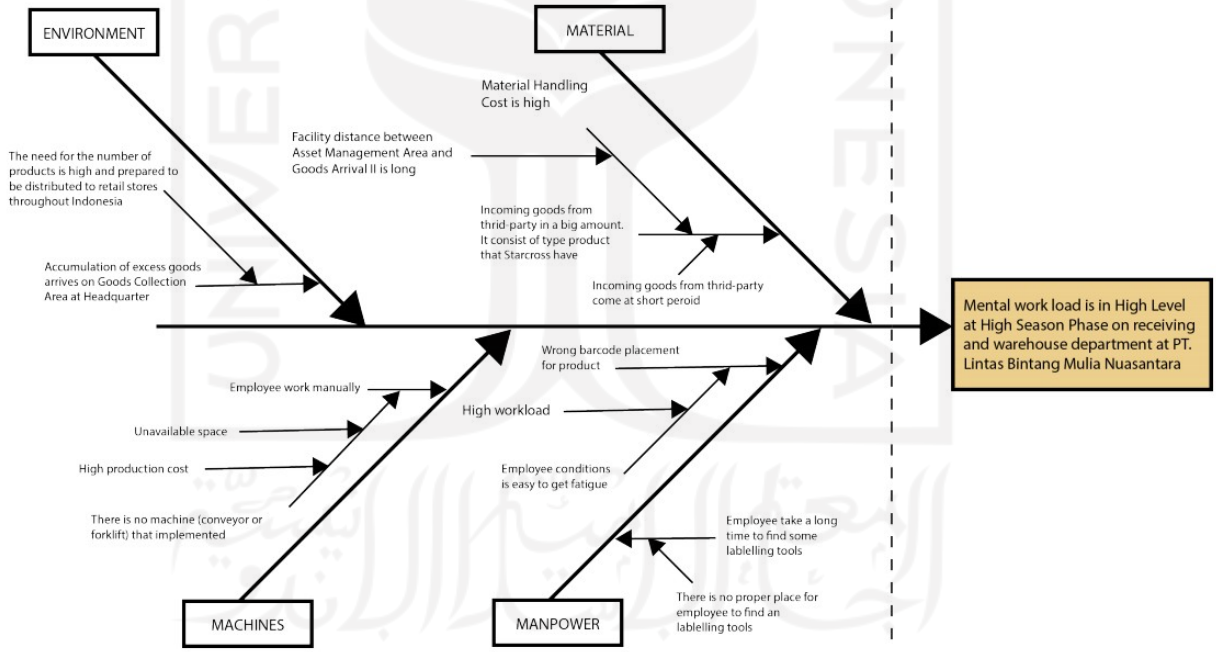

Figure 4. 14 Fishbone Diagram

4.8 Waste Activity

The company struggles significant losses as a result of the waste problem, enhancing production line efficiency is the key to generating earnings (Purnomo D.H., 2020). According to data collection process of waste activity identification on receiving and

warehousing departments at PT. Lintas Bintang Mulia Nusantara, the waste activity that related with case study and give a significance impact for the company is waste transportation. Meanwhile, waste transportation is the process of transporting waste from the collection point to the integrated waste processing site or final processing site, minimize the distance between departments is one of the ways to reduce the transportation waste (Priambodo B., 2020).

4.9 Material Handling Cost Measurement

Transfer of material handling distance at PT. Lintas Bintang Mulia Nusantara, especially in the receiving and warehousing departments, was based on the initial layout. The frequency of movement of workers and the cost of material handling per meter are the quantities for calculating the total material handling costs. Labor work hour/days is 5,5 because at Saturdays only a half day. The amount of frequency is multiplied by 3 because every day there is 3 cars from supplier or third party come to the Headquarter (HQ), down below is the table of initial layout of Material Handling Cost (MHC) at receiving and warehousing departments:

Table 4. 8 MHC Initial Layout

Code	Facility	From	To	Frequency	Distance (m)	MHC/m (Rp)	Total MHC (Rp)
A	Goods Arrival Area I	A	C	6	31,4	Rp175	Rp144.317
B	Asset Management Area	B	D	3	16,44	Rp335	Rp137.821
C	Goods Arrival Area II	C	B	6	31,84	Rp173	Rp142.323
D	Goods Collection Area	D	E	18	29,31	Rp188	Rp463.824
E	Labelling and Quality Control Area	E	G	18	14,94	Rp368	Rp909.952
		E	H	12	13,39	Rp411	Rp676.857
F	Locker Room and Smoking Area						
G	Reject Goods Area						
H	Warehouse Area						
Total					**137,32**		**Rp2.475.094**

4.10 Initial Layout Distance Calculation

Distance calculations based on business processes that occur in the receiving and warehouse departments are used for comparison and to find out the total distance gap before being converted into a finished layout at PT. Lintas Bintang Mulia Nusantara. In this case the author uses rectilinear distance as tools measurement, down below is the initial layout distance calculation:

Table 4. 9 Initial Rectilinear Distance

No.	From	To	Coordinates From		Coordinates From		Rectilinear Distance (Dij= |xi-xj| + |yi-yj|)	Total
			X1	Y1	X2	Y2		
1	A	B	23,38	14,38	0,22	2,62	34,92	170,69
		C	23,38	14,38	0,22	6,14	31,4	
		D	23,38	14,38	1,56	10,29	25,91	
		E	23,38	14,38	1,56	12,82	23,38	
		F	23,38	14,38	1,64	11,49	24,63	
		G	23,38	14,38	8,94	10,29	18,53	
		H	23,38	14,38	7,99	17,85	11,92	
2	B	A	21,8	4,09	0,22	2,62	23,05	103,75
		C	21,8	4,09	0	3,52	22,37	
		D	21,8	4,09	1,78	7,67	16,44	
		E	21,8	4,09	1,78	10,2	13,91	
		F	21,8	4,09	1,43	8,87	15,59	
		G	21,8	4,09	8,72	7,67	9,5	
		H	21,8	4,09	7,77	15,23	2,89	
3	C	A	23,6	11,76	0,22	6,14	29	184,13
		B	23,6	11,76	0	3,52	31,84	

No.	From	To	Coordinates From		Coordinates From		Rectilinear Distance (Dij= |xi-xj| + |yi-yj|)	Total
			X1	Y1	X2	Y2		
		D	23,6	11,76	1,78	4,15	29,43	
		E	23,6	11,76	1,78	6,67	26,91	
		F	23,6	11,76	1,43	5,35	28,58	
		G	23,6	11,76	8,72	4,15	22,49	
		H	23,6	11,76	7,77	11,71	15,88	
4	D	A	23,6	8,24	1,56	10,29	19,99	161,11
		B	23,6	8,24	1,78	7,67	22,39	
		C	23,6	8,24	1,78	4,15	25,91	
		E	23,6	8,24	0	2,53	29,31	
		F	23,6	8,24	3,2	1,2	27,44	
		G	23,6	8,24	10,5	0	21,34	
		H	23,6	8,24	9,55	7,56	14,73	
5	E	A	25,08	2,89	1,56	12,82	13,59	126,32
		B	25,08	2,89	1,78	10,2	15,99	
		C	25,08	2,89	1,78	6,67	20	
		D	25,08	2,89	0	2,53	25,44	
		F	25,08	2,89	3,2	1,32	23,45	
		G	25,08	2,89	10,5	2,53	14,94	
		H	25,08	2,89	9,55	5,03	13,39	
6	F	A	21,82	1,56	1,64	11,49	10,25	103,34
		B	21,82	1,56	1,43	8,87	13,08	
		C	21,82	1,56	1,43	5,35	16,6	
		D	21,82	1,56	3,2	1,2	18,98	

No.	From	To	Coordinates From		Coordinates From		Rectilinear Distance (Dij= |xi-xj| + |yi-yj|)	Total
			X1	Y1	X2	Y2		
		E	21,82	1,56	3,2	1,32	18,86	
		G	21,82	1,56	7,29	1,2	14,89	
		H	21,82	1,56	6,34	6,36	10,68	
7	G	A	32,32	4,09	8,94	10,29	17,18	165,85
		B	32,32	4,09	8,72	7,67	20,02	
		C	32,32	4,09	8,72	4,15	23,54	
		D	32,32	4,09	10,5	0	25,91	
		E	32,32	4,09	10,5	2,53	23,38	
		F	32,32	4,09	7,29	1,2	27,92	
		H	32,32	4,09	0,95	7,56	27,9	
8	H	A	31,37	-3,46	7,99	17,85	2,07	74,15
		B	31,37	-3,46	7,77	15,23	4,91	
		C	31,37	-3,46	7,77	11,71	8,43	
		D	31,37	-3,46	9,55	7,56	10,8	
		E	31,37	-3,46	9,55	5,03	13,33	
		F	31,37	-3,46	6,34	6,36	15,21	
		G	31,37	-3,46	0,95	7,56	19,4	

4.11 Activity Relationship Chart Measurement

The Activity Relationship Chart (ARC) was created based on considerations of the object of study, process flow, and the number of reasons for proximity based on observations of current work areas and interviews conducted in accordance with the business process flow. owned. The following is an ARC from PT. Lintas Bintang Mulia Nusantara's working area:

Code	Explanation
1	Follow the work flow
2	Using the same work equipment
3	Using the same room
4	Ease of Supervisor in conducting inspections
5	Using the same notes
6	Using the same employee
7	Easy to move goods
8	Doing a similar job
9	Employee transfer
10	The importance of connecting/communicating between employees
11	Not following the work flow

No.	Level of Importance	Code	Color
1	Absolutely Necessary	A	
2	Especially Important	E	
3	Important	I	
4	Ok	O	
5	Unimportant	U	
6	Not Desired	X	

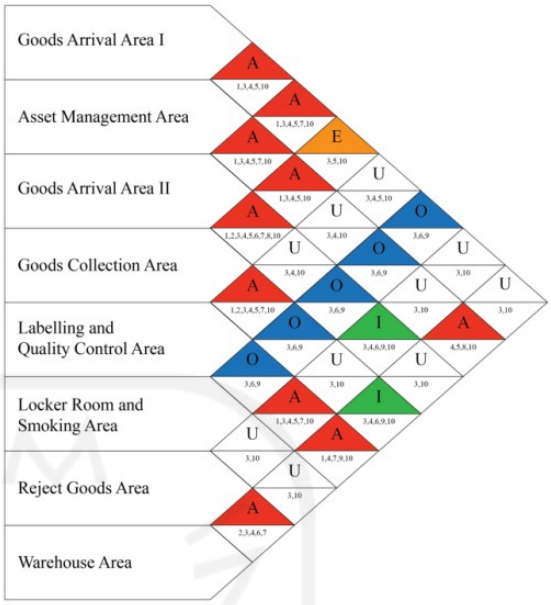

Figure 4. 15 Activity Relationship Chart

4.12Total Closeness Ratings Measurement

The Total Closeness Rating (TCR) is calculated utilizing the results of filling in the ARC:

Table 4. 10 Total Closeness Ratings (TCR)

No.	Sub-Department	Code	A	B	C	D	E	F	G	H	A	E	I	O	U	X	Total	TCR
											5	4	3	2	1	0		
1	Goods Arrival Area I	A		A	A	E	U	O	U	U	2	1	0	1	3	0	7	19
2	Asset Management Area	B	A		A	A	U	O	U	A	4	0	0	1	2	0	7	24
3	Goods Arrival Area II	C	A	A		A	U	O	I	U	3	0	1	1	2	0	7	22
4	Goods Collection Area	D	E	A	A		A	O	A	A	1	0	1	1	4	0	7	14
5	Labelling and Quality Control Area	E	U	U	U	A		O	A	A	3	0	0	1	3	0	7	20
6	Locker Room and Smoking Area	F	O	O	O	O	O		U	U	0	0	0	5	2	0	7	12
7	Reject Goods Area	G	U	U	U	U	A	U		U	2	0	1	0	4	0	7	17
8	Warehouse Area	H	U	A	U	I	A	U	A		3	0	1	0	3	0	7	21
		A	2	4	3	1	3	0	2	3								
		E	1	0	0	0	0	0	0	0								

I	0	0	1	1	0	0	1	1
O	1	1	1	1	1	5	0	0
U	3	2	2	4	3	2	4	3
X	0	0	0	0	0	0	0	0

4.13BLOCPLAN Algorithm Layout Design

The following are the steps involved in performing calculations using the BLOCPLAN algorithm:

1. Fill the amount of department, sub-department, or facility. In this case, there are 8 sub department for the input.

Figure 4. 16 BLOCPLAN data Input

2. Fill the Activity Relationship Chart (ARC) value data from Figure 3:

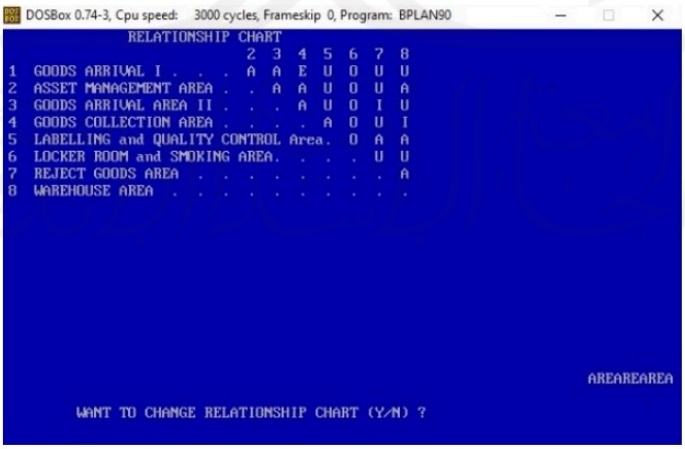

Figure 4. 17 BLOCPLAN ARC input

3. Adjust the layout and select the best proposed layout iteration from 10 iteration:

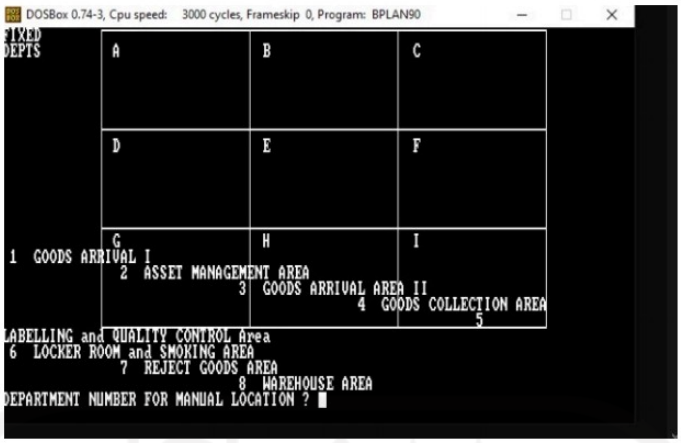

Figure 4. 18 BLOCPLAN Layout Adjustment

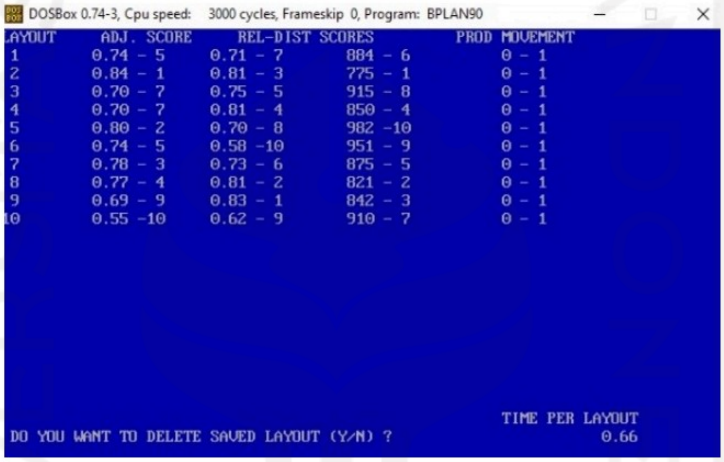

Figure 4. 19 BLOCPLAN Layout Proposal Iteration Scoring

4. The final result using BLOCPLAN Algorithm as follows:

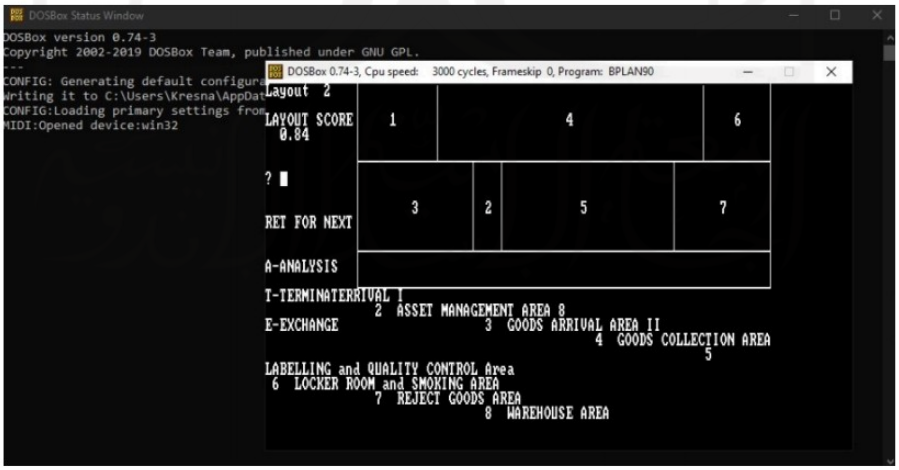

Figure 4. 20 BLOCPLAN Final Result

4.14Proposed Layout Design

Down below is the proposed layout according to BLOCPLAN Algorithm result and adjusted according to the available space:

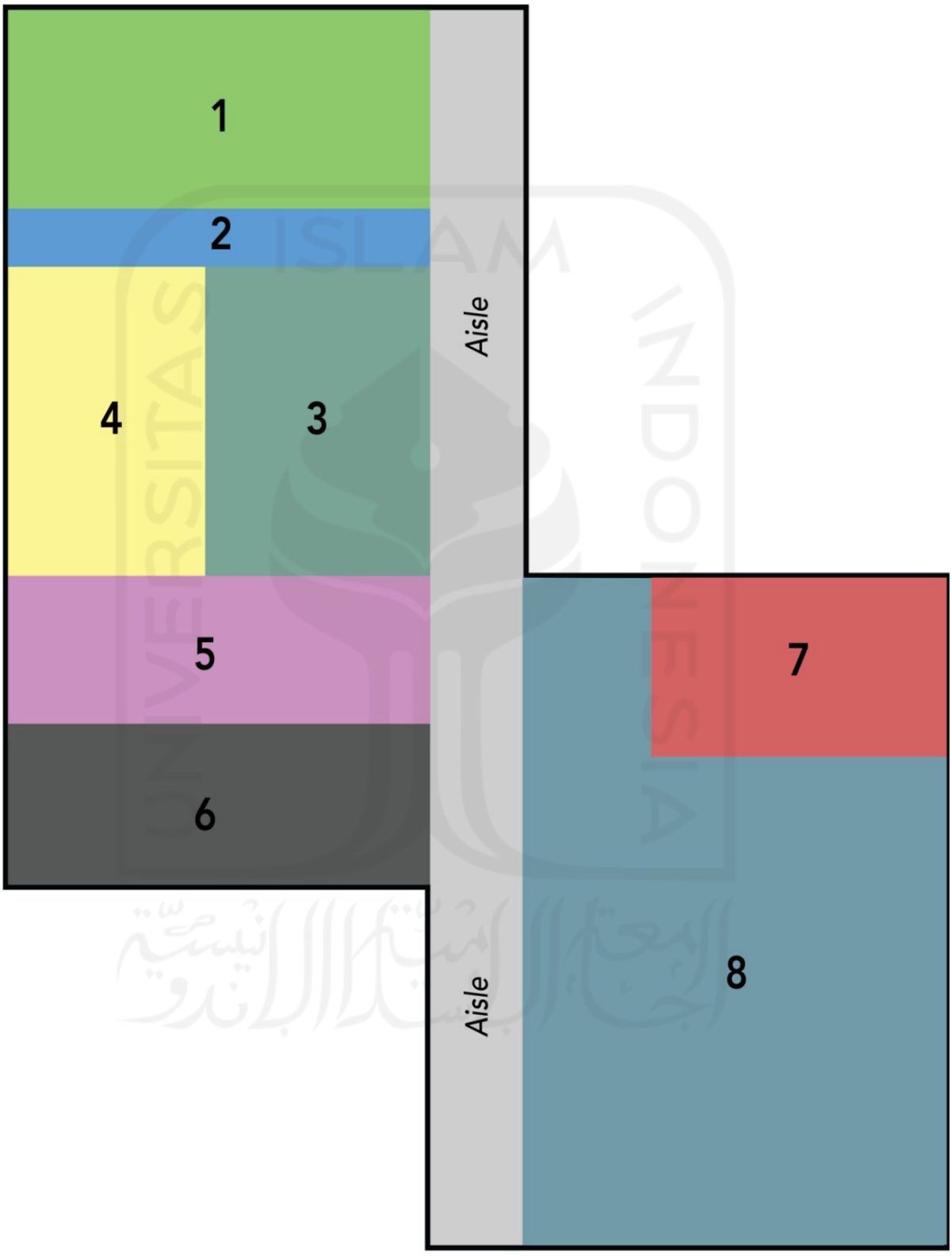

Figure 4. 21 Proposed Layout (Block Form)

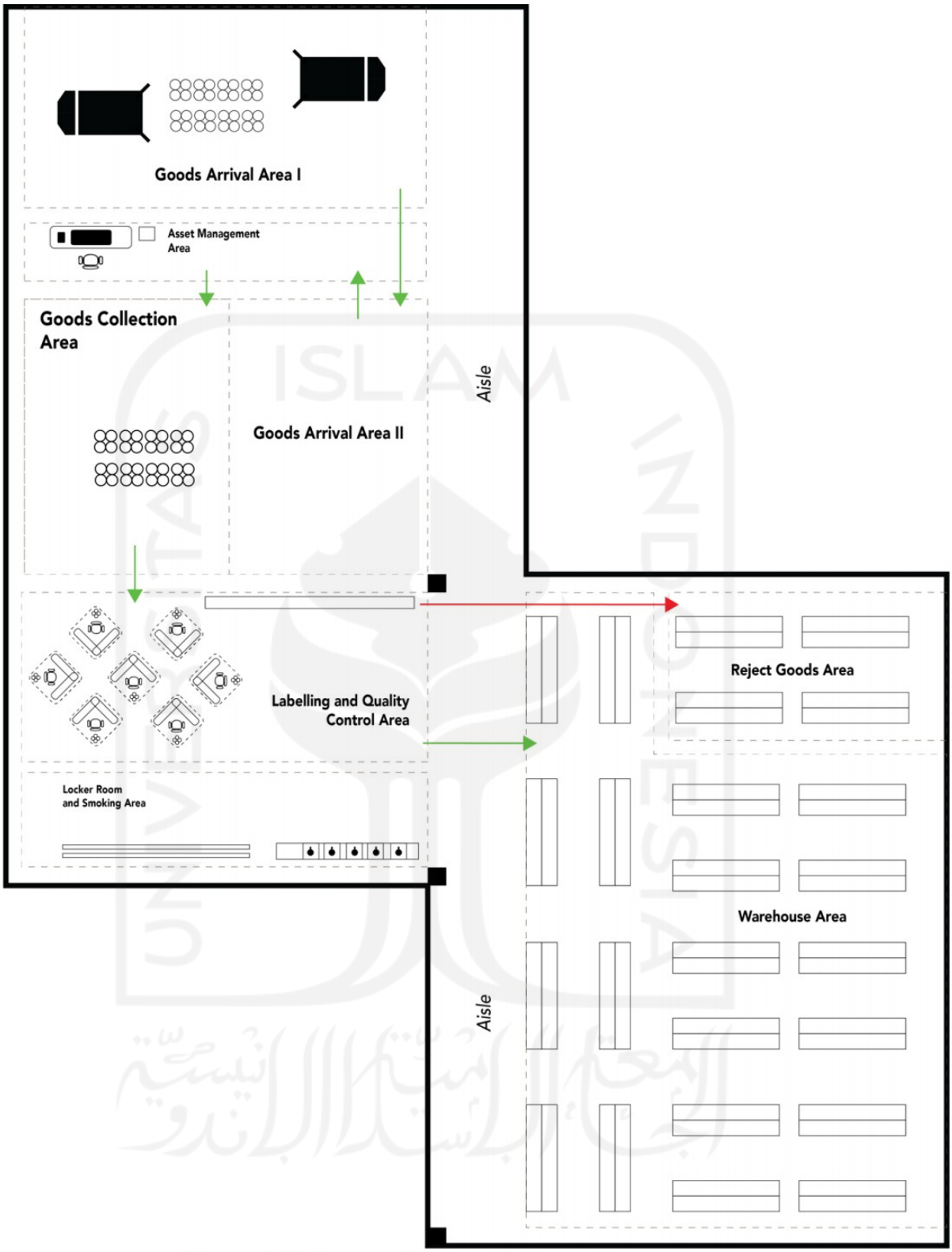

Figure 4. 22 Proposed Layout (Adjusted Form)

4.15New Layout Distance Calculation

After the proposed layout is adjusted, then author have to re-calculate the coordinate and rectilinear distance of proposed layout that changed that shown on the table as follows:

Table 4. 11 Proposed Layout (Coordinate)

New Coordinate				
No.	**Facility Name**	**Code**	**Coordinate**	
			X	**Y**
1	Goods Arrival Area I	A	23,38	14,38
2	Asset Management Area	B	23,6	11,76
3	Goods Arrival Area II	C	25,15	8,24
4	Goods Collection Area	D	22,05	8,24
5	Labelling and Quality Control Area	E	23,6	4,15
6	Locker Room and Smoking Area	F	23,6	1,62
7	Reject Goods Area	G	32,32	4,09
8	Warehouse Area	H	31,37	-3,46

Table 4. 12 Proposed Layout (Rectilinear Distance)

No.	**From**	**To**	**Coordinates From**		**Coordinates From**		**Rectilinear Distance**	**Total**
			X1	**Y1**	**X2**	**Y2**		
1	A	B	23,38	14,38	0,22	2,62	34,92	177,61
		C	23,38	14,38	1,77	6,14	29,85	
		D	23,38	14,38	1,33	6,14	30,29	
		E	23,38	14,38	0,22	10,23	27,31	
		F	23,38	14,38	0,22	12,75	24,79	
		G	23,38	14,38	8,94	10,29	18,53	
		H	23,38	14,38	7,99	17,85	11,92	
2	B	A	23,6	11,76	0,22	2,62	32,52	177,4
		C	23,6	11,76	1,55	3,52	30,29	
		D	23,6	11,76	1,55	3,52	30,29	
		E	23,6	11,76	0	7,61	27,75	
		F	23,6	11,76	0	10,14	25,22	

No.	From	To	Coordinates From		Coordinates From		Rectilinear Distance	Total
			X1	Y1	X2	Y2		
		G	23,6	11,76	8,72	7,67	18,97	
		H	23,6	11,76	7,77	15,23	12,36	
3	C	A	25,15	8,24	1,77	6,14	25,48	174,6
		B	25,15	8,24	1,55	3,52	28,32	
		D	25,15	8,24	3,1	0	30,29	
		E	25,15	8,24	1,55	4,09	27,75	
		F	25,15	8,24	1,55	6,61	25,23	
		G	25,15	8,24	7,17	4,15	22,07	
		H	25,15	8,24	6,22	11,71	15,46	
4	D	A	22,05	8,24	1,33	6,14	22,82	147,14
		B	22,05	8,24	1,55	3,52	25,22	
		C	22,05	8,24	3,1	0	27,19	
		E	22,05	8,24	1,55	4,09	24,65	
		F	22,05	8,24	1,55	6,61	22,13	
		G	22,05	8,24	10,27	4,15	15,87	
		H	22,05	8,24	9,32	11,71	9,26	
5	E	A	23,6	4,15	0,22	10,23	17,3	138,21
		B	23,6	4,15	0	7,61	20,14	
		C	23,6	4,15	1,55	4,09	22	
		D	23,6	4,15	1,55	4,09	22,11	
		F	23,6	4,15	0	2,53	25,22	
		G	23,6	4,15	8,72	0,06	18,97	
		H	23,6	4,15	7,77	7,62	12,36	
6	F	A	23,6	1,62	0,22	12,75	12,25	119,34

No.	From	To	Coordinates From		Coordinates From		Rectilinear Distance	Total
			X1	Y1	X2	Y2		
		B	23,6	1,62	0	10,14	15,08	
		C	23,6	1,62	1,15	6,61	17,46	
		D	23,6	1,62	1,15	6,61	17,46	
		E	23,6	1,62	0	2,53	22,69	
		G	23,6	1,62	0,72	2,46	22,04	
		H	23,6	1,62	7,77	5,09	12,36	
7	G	A	32,32	4,09	8,94	10,29	17,18	159,04
		B	32,32	4,09	8,72	7,67	20,02	
		C	32,32	4,09	7,17	4,15	25,09	
		D	32,32	4,09	10,27	4,15	21,99	
		E	32,32	4,09	8,72	0,06	27,63	
		F	32,32	4,09	8,72	2,46	25,23	
		H	32,32	4,09	6,95	7,56	21,9	
8	H	A	31,37	-3,46	7,99	17,85	2,07	70,81
		B	31,37	-3,46	7,77	15,23	4,91	
		C	31,37	-3,46	6,22	11,71	9,98	
		D	31,37	-3,46	9,32	11,71	6,88	
		E	31,37	-3,46	7,77	7,62	12,52	
		F	31,37	-3,46	7,77	5,09	15,05	
		G	31,37	-3,46	0,95	7,56	19,4	

4.16New Material Handling Cost Calculation

After the proposed layout is adjusted, then author have to re-calculate the Material Handling Cost (MHC) of proposed layout that changed that shown on the table as follows:

Table 4. 13 Proposed Layout MHC

Code	Facilility	From	To	Frequency	Distance (m)	MHC/m (Rp)	Total MHC (Rp)
A	Goods Arrival Area I	A	C	3	29,85	Rp184	Rp79.841
B	Asset Management Area	B	D	3	30,29	Rp182	Rp78.681
C	Goods Arrival Area II	C	B	6	28,32	Rp194	Rp168.309
D	Goods Collection Area	D	E	18	24,65	Rp223	Rp580.104
E	Labelling and Quality Control Area	E	G	12	18,97	Rp290	Rp502.532
		E	H	12	12,36	Rp445	Rp771.282
F	Locker Room and Smoking Area						
G	Reject Goods Area						
H	Warehouse Area						
Total					**144,44**		**Rp2.140.829**

CHAPTER V
DISCUSSION

5.1 Fishbone Diagram and Waste Analysis

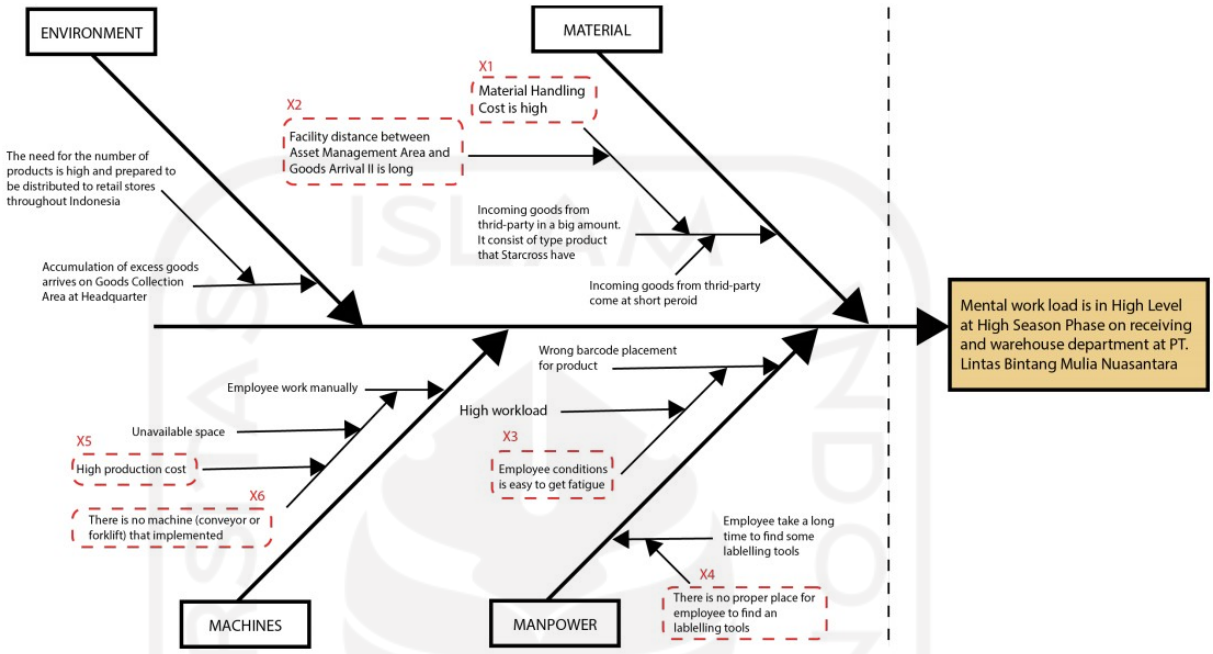

Figure 5.1 Fishbone Diagram

Basically, the essential of fishbone diagram is a tool in first stage to identify cause and effect regarding to the problem, six parameters of fishbone diagrams are manpower, machines, methods, materials, environment, and measurement. Problem of PT. Lintas Bintang Mulia Nusantara is when the company at High Season phase then it effects to the worker of receiving and warehousing department. The implementation of fishbone diagram regarding or related to is used 4 parameters, then fishbone diagram roots are Material, Manpower, Machines, and Environment. Down below are the main causes:

Table 5. 1 Fishbone Table

Code	Root Cause
X1	Material Handling Cost is high
X2	Facility distance between Asset Management Area and Goods Arrival II is long
X3	Employee conditions is easy to get fatigue
X4	There is no proper place for employee to find a labelling tool

Code	Root Cause
X5	High production cost
X6	There is no machine (conveyor, or forklift that implemented)

From the table 5.1, it stated if there are 6 main causes regarding the effect which is "Mental workload is in high level at high season phase on receiving and warehousing department at PT. Lintas Bintang Mulia Nusantara". In this case, according to the cause on fishbone diagram the author is focusing on martial root cause such as X1 and X2 that related with waste activities. When distance is influenced material handling cost means it categorized as transportation waste. The process of moving materials or work in progress (WIP) from one work station to another is known as transportation (Jakfar, 2014). Although transportation is necessary, it does not add value to a product.

5.2 BLOCPLAN Algorithm Analysis

The total amount of workstation and Activity Relationship Chart (ARC) proximity are the main data input before use BLOCPLAN Algorithm as a tool for choosing the most optimum layout proposal. Base on the tools, in this case author choose 15 iterations from 20 iteration as maximum capacity. Thus, after the software run calculation for proposed layout, the most optimum iteration is iteration number 2 because it has the highest score of R-Score, Adjacency Score, and Rel-Dist Score. The display visualization of iteration 2 stated down below:

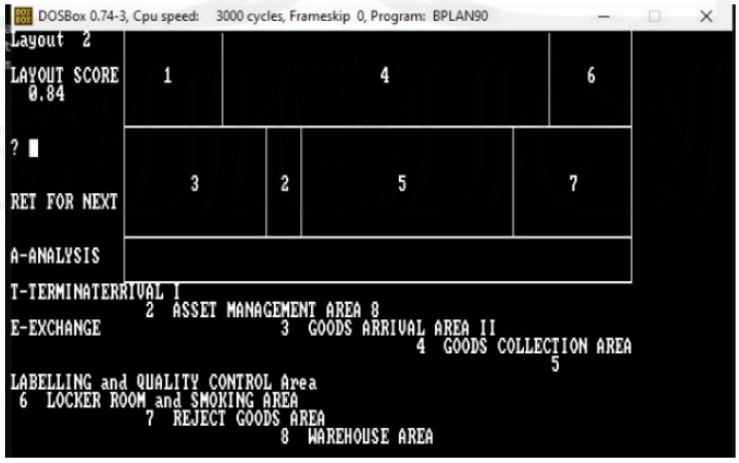

Figure 5. 2 Most Optimum Layout Proposal

The iteration is used by the author as parameters to re-design the proposal layout for PT. Lintas Bintang Mulia Nusantara.

5.3 Proposed Layout Analysis

Based on the BLOCPLAN Algorithm analysis, final iteration that can be seen in iterations 2 (Figure 5.2). Then, author use Adobe Illustration as a tool for display visualization and Solidworks for calculate adjustment on proposed layout distance conditions of PT. Lintas Bintang Mulia Nusantara. Proposal layout is calculated based on rectilinear distance, material handling milage, and material handling cost. The result of proposal rectilinear distance is 1164.15 meters, proposal material handling milage is 144.44 meters, and proposal material handling cost is Rp 2.180.750

5.4 Proposed Layout Distance Analysis and Material Handling cost

After doing a comparison between the initial and proposed layouts, you can perform calculations to find out how much efficiency you get in the receiving and warehousing departments after the facility displacement. The basic formula for calculating the percentage comparison can be presented as follows:

$$\frac{\text{Total Initial Rectilinear Distance} - \text{Total Proposed Rectilinear distance}}{\text{Total Initial Rectilinear Distance}} x\ 100\%$$

The final step of analyzation is comparison between initial layout with proposed layout. Down below is table comparison between both layout:

Table 5. 3 Analysis Comparison

No	Variable Comparison	Total Rectilinear Distance (m)	Total Material Handling Milage (m)	Total Material Handling Cost (Rp)
1	Initial layout	1089,34	137,32	Rp2.475.094
2	Proposed Layout	1164,15	144,44	Rp2.180.750
3	Percentage (%)	-7%	-5%	12%

According to the Table 5.3, as we can see comparison analysis of Total; Rectilinear

Distance, Material Handling Milage, and Material Handling Cost make a differentiation. Differentiation rectilinear distance between initial and proposed layout is -7%. Then, for the differentiation on material handling milage between initial and proposed layout is -5%. Moreover, the differentiation on material handling cost between initial and proposed layout is 12%.

CHAPTER VI
CONCLUSIONS AND SUGGESTIONS

In this research, researcher find a problem in this research based on fishbone diagram's root cause which is have to reduce material handling cost and waste transportation activities through re-design layout using BLOCPLAN Algorithm during High Season on receiving and warehousing departments at Starcross which means the output of this research is a new layout proposal for the company. Researcher use BLP99 Software as a support tool to figure out automatically which one is most optimum layout, then on the software researcher select 15 iterations to measured automatically. On BLP99 Software, there are three scoring parameters such as R-Score, Adjacency Score, and Rail Dist. Score. Based on those three scoring parameters, the most optimum data that shown is Iteration 2.

Researcher use Iteration 2 for fundamental new layout. On the new layout, researcher also measure the new rectilinear distance, material handling millage, and material handling cost to differentiate with the initial data. The measurement result from proposal layout data is total rectilinear distance is -7%, total material handling milage is –5%, and total material handling cost is 12%. From the analysis comparison data above, researcher is failed to reduce the rectilinear distance and material handling milage from initial data then there still exist the transportation waste. But on the other side, researcher succeed to reduce the material handling cost in new layout proposal. It is concluded that this new layout still able to implemented for receiving and warehousing department at Starcross.

Suggestions for company regarding to the problem that discussed through this report is explained as follows:

1. Proposal layout on receiving and warehousing is implemented, because one of the layout parameters which is material handling cost is reduced. Thus, it will give impact to production cost on High Season phase.
2. Although, this research still needs further research to find another variable that influenced layout facilities to give more advantage for the company. For instance, based on fishbone diagram result there are aspects such as Material, Machine, and Manpower that still need further research.

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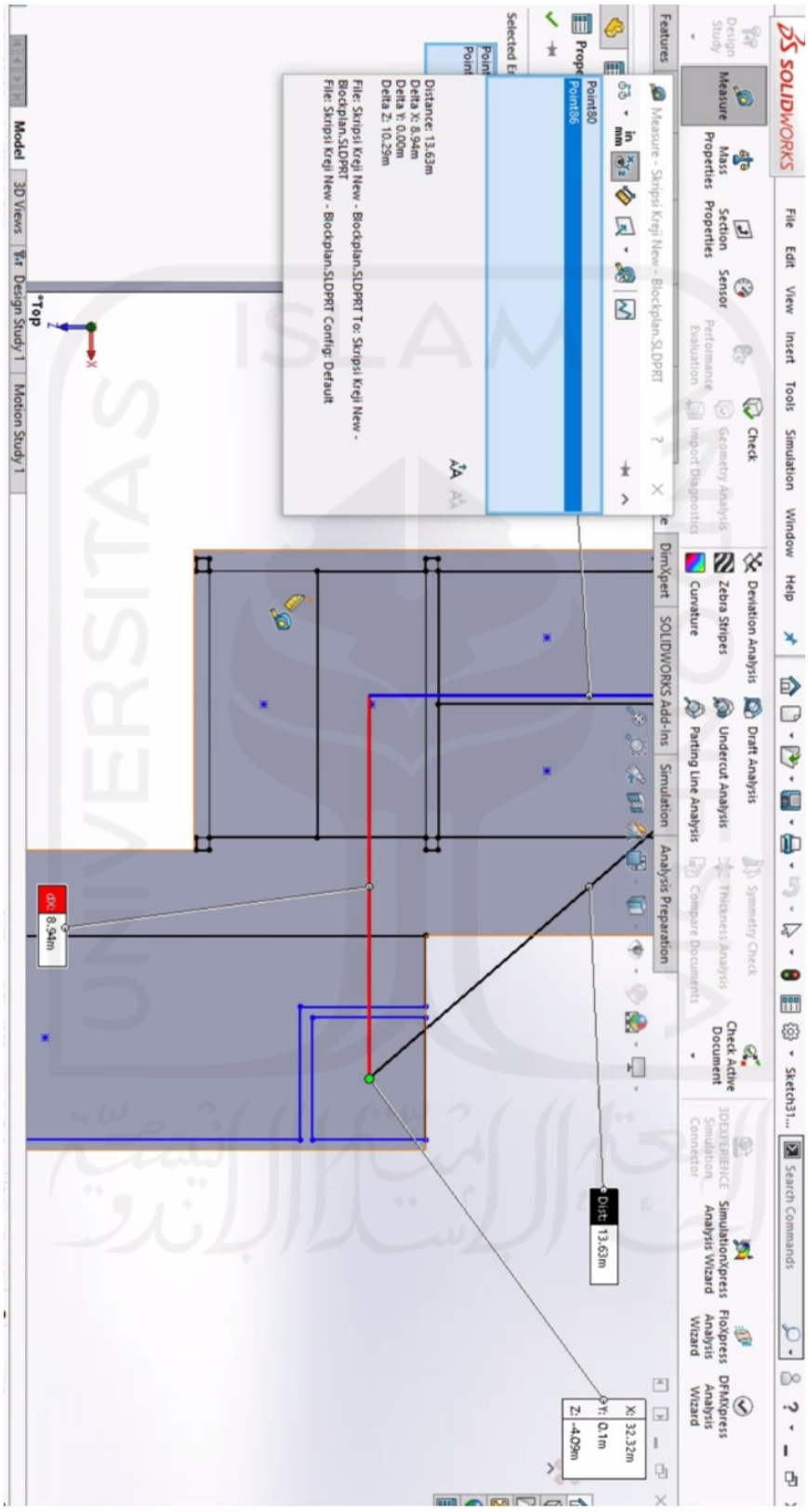
ATTACHMENT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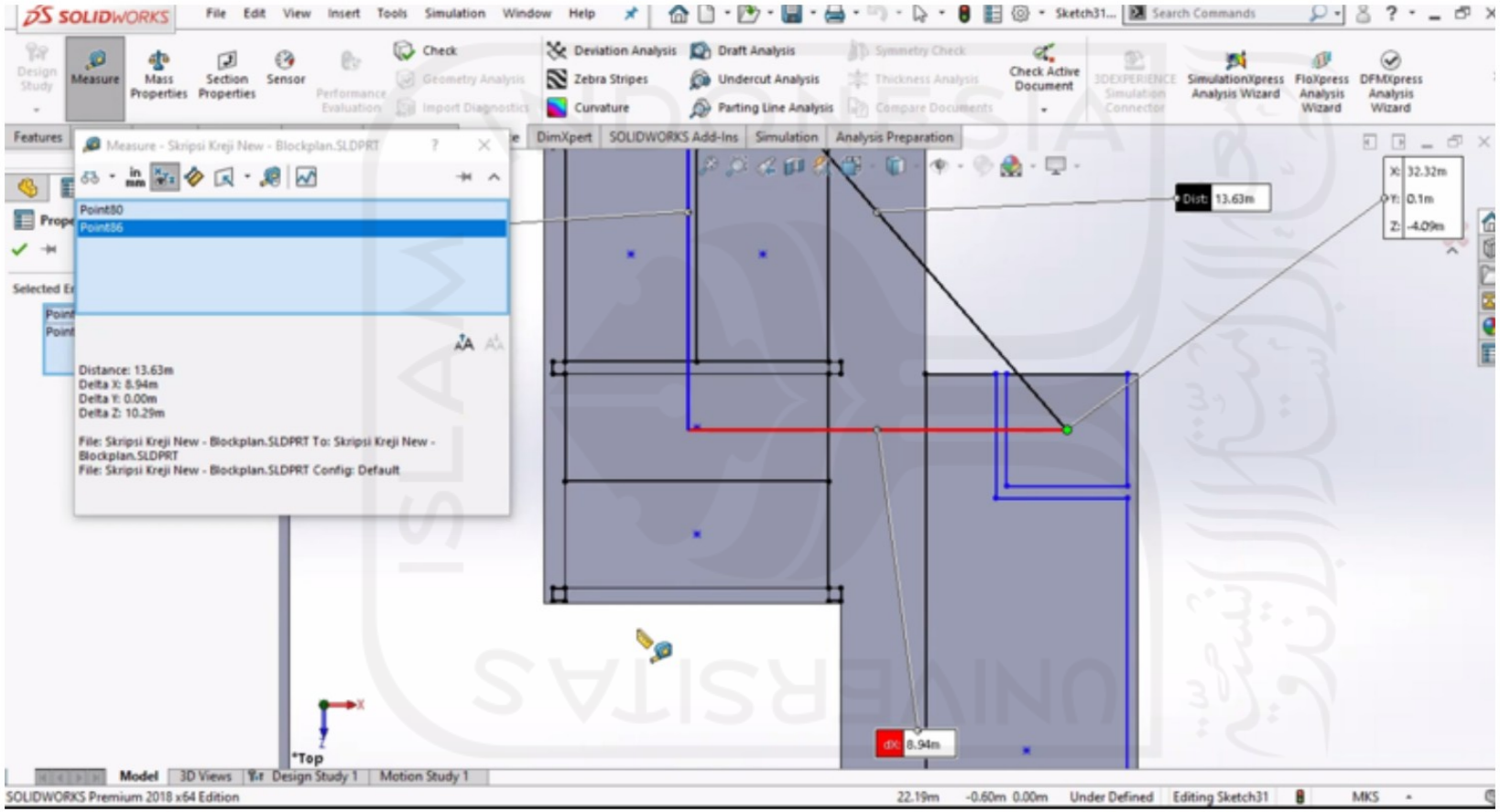
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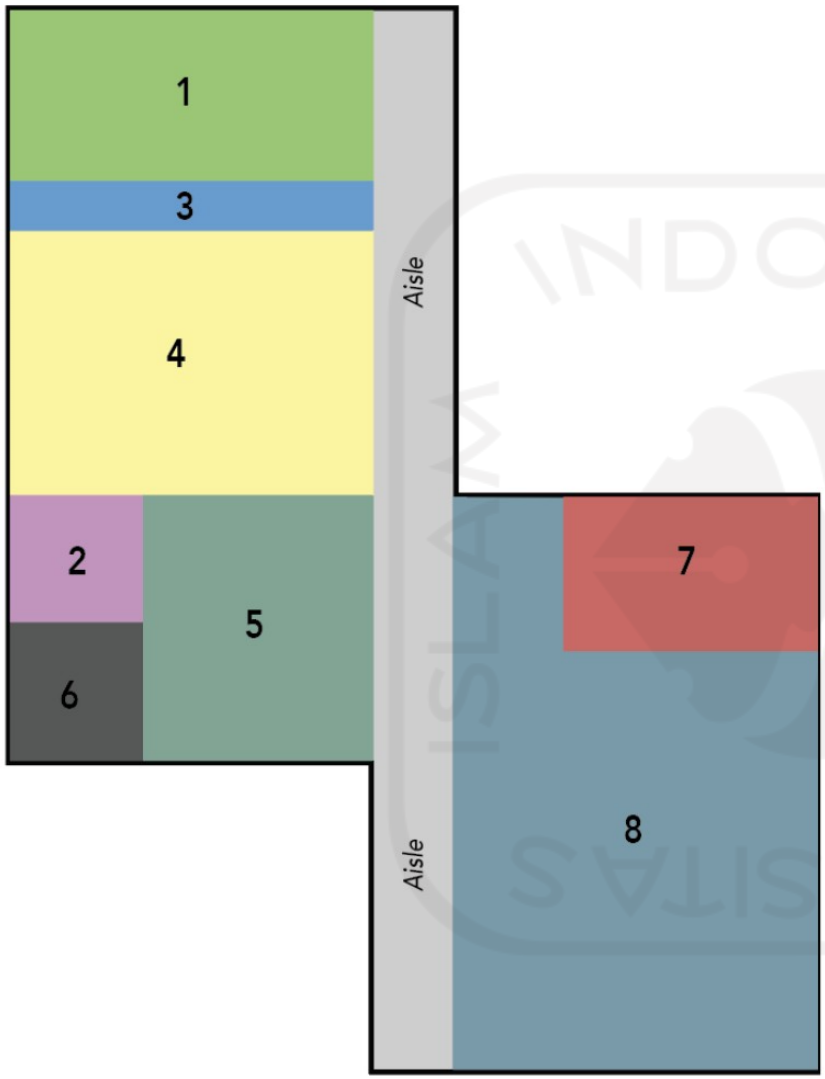
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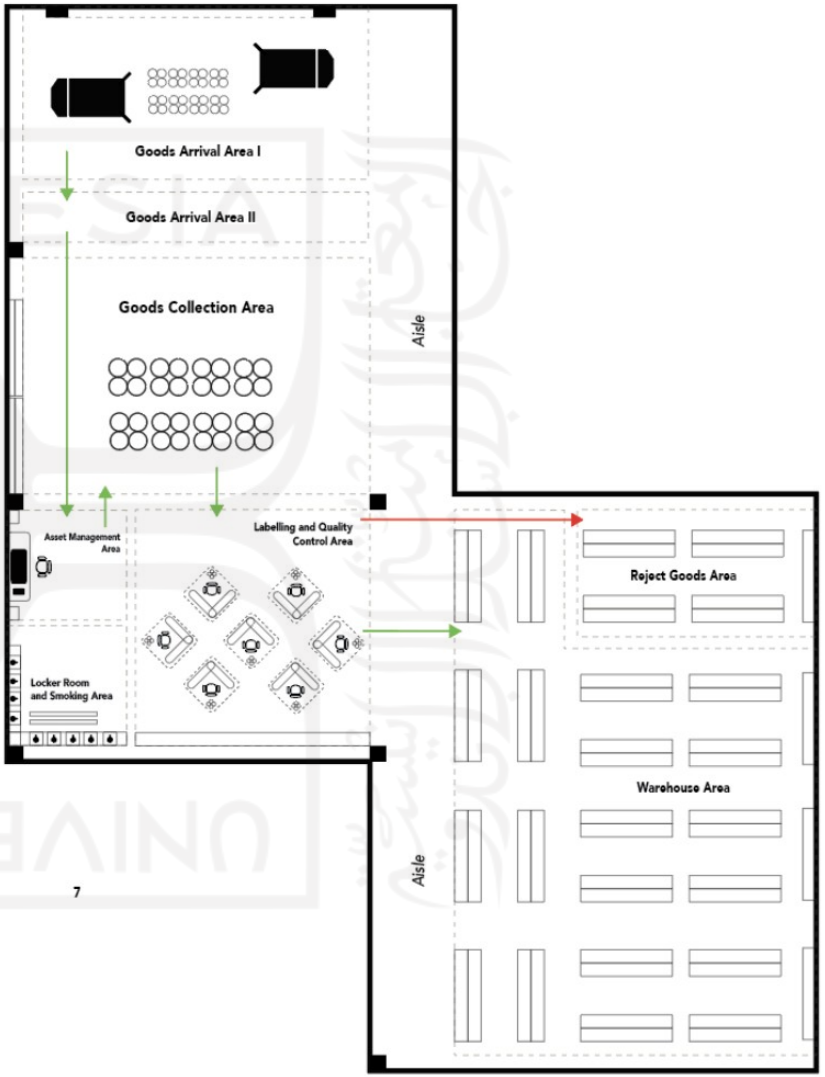
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Goods Arrival Area II
Goods Collection Area
Aisle
Asset Management Area
Labelling and Quality Control Area
Reject Goods Area
Locker Room and Smoking Area
Warehouse Area
Aisle
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STARCROSS
STARCROSS


NUSANTARA


5A
PT. LINTAS BINTANG MULIA NUSANTARA
PT. BALI MULIA NUSANTARA

Code	Facilility	From	To	Frequency	Distance (m)	MHC/m (Rp)	Total MHC (Rp)
A	Goods Arrival Area I	A	C	6	31,4	Rp175	Rp144.317
B	Asset Management Area	B	D	3	16,44	Rp335	Rp137.821
C	Goods Arrival Area II	C	B	6	31,84	Rp173	Rp142.323
D	Goods Collection Area	D	E	18	29,31	Rp188	Rp463.824
E	Labelling and Quality Control Area	E	G	18	14,94	Rp368	Rp909.952
		E	H	12	13,39	Rp411	Rp676.857
F	Locker Room and Smoking Area						
G	Reject Goods Area						
H	Warehouse Area						
Total					**137,32**		**Rp2.475.094**

Code	Facilility	From	To	Frequency	Distance (m)	MHC/m (Rp)	Total MHC (Rp)
A	Goods Arrival Area I	A	C	3	29,85	Rp184	Rp79.841
B	Asset Management Area	B	D	3	30,29	Rp182	Rp78.681
C	Goods Arrival Area II	C	B	6	28,32	Rp194	Rp168.309
D	Goods Collection Area	D	E	18	24,65	Rp223	Rp580.104
E	Labelling and Quality Control Area	E	G	12	18,97	Rp290	Rp502.532
		E	H	12	12,36	Rp445	Rp771.282
F	Locker Room and Smoking Area						
G	Reject Goods Area						
H	Warehouse Area						
Total					**144,44**		**Rp2.180.750**