# PURESHARE METHOD IN DASHBOARD DEVELOPMENT TO MONITOR WAREHOUSE PERFORMANCE AT PT XYZ USING THE COST PER CASE (CPC) PERSPECTIVE

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*Abstract*

*Warehouse costs contribute about 22% of the company's total logistics costs. Thus, a warehouse manager must have comprehensive knowledge of costs and cost triggers in the warehouse to be able to minimize costs while keeping customer satisfaction. One effective way to minimize warehouse costs is by conducting the cost analysis. Although PT XYZ is one of the biggest Fast Moving Consumer Goods (FMCG) companies in Indonesia applying one of the most comprehensive Enterprise Resource Planning software, its existing warehouse management support system occupies only standard Microsoft Excel. One of its warehouses, located in West Java, is responsible for more than 147,000 pallets each day, and the warehouse manager still uses Microsoft Excel with limitations in displaying the required information, especially the information related to the Cost Per Case (CPC) in every activity. Therefore, a template or dashboard that can provide information related to CPC in the warehouse is urgently needed. Given the importance of cost monitoring in the warehouse of PT XYZ, this research aims to create a dashboard that can make it easier for companies to monitor warehouse performance from a CPC perspective. The methods used in data collection consist of several processes, namely interviews, observations, and literature studies. While analyzing the needs of dashboard creation, this research uses the PureShare method. Thus, the results are obtained in the form of a proposed warehouse dashboard that can be used by the company to conduct cost analysis by providing information related to CPC of every activity in the warehouse, where the information presented on the dashboard is in accordance with the company's needs.*

## 1. Introduction

Business competition in the current era of globalization is getting tougher. As a result of globalization, the development of the business world will continue to experience socio-economic changes that are increasingly broad, competitive, and complex, both in the company's internal and external environment. This results in obstacles and challenges that must be overcome by every company, thus requiring them to develop strategies in order to be able to compete with other companies. Of the various competitions conducted by the company, the goal is to create an effective and efficient process in producing goods or services for distribution to consumers. However, in reality, companies can't do all that to overcome them, so they choose shortcuts and conveniences to compete with their competitors through supply chain management [1]. Supply chain management is the integration of activities into three main streams, the first is sourcing, procurement, and supply management, the second is material management, and the last is logistics and distribution. Successful supply chain management requires many decisions related to the flow of information, products, and money. Every decision must be made to increase supply chain surplus or maximize value [2]. In this study, the authors focus on material management, especially warehouse management system that also includes the functions of forecasting, inventory management, store management, stock storage, and the production planning and control.

Warehousing plays a major role in the supply chain. The role of the supply chain is to deliver the right product, at the right condition, in the right quantity, to the right customer, at the right place, at the right time, and

at the right price. Providing the right amount of product to customers depends on the warehouse's accuracy in picking and dispatching a product. In order to be able to deliver to the right customer at the right place and time, products should be properly labeled or coded and loaded on the correct vehicle in sufficient time not to exceed the delivery time limit. In the right condition means that the product is ensured to leave the warehouse clean and free of damage [3]. The importance of the role of the warehouse in the supply chain urges companies to continuously improve their systems so that operational activities in the warehouse are more effective and efficient. Thus, it is necessary to find out what improvements will be made in order to increase productivity and accuracy in the warehouse and reduce costs and inventory along with improving service to customers. This was done because the warehouse cost contributed about 22% of the total logistics costs incurred by the company [3]. Thus, a warehouse manager requires comprehensive knowledge of all costs and cost drivers in the warehouse to be able to reduce costs but still produce optimal customer service.

Decision making for every manager in the warehouse certainly requires accurate data in a that can be obtained shortly while maintaining minimum business risk. Therefore, it is important for every manager to have all the information in a fast, intuitive, and fluent reading. One of the opportunities that companies can take advantage of to support managers in decision making is the development of technology. This technology is needed for the development of the company so that managers can see and analyze the handling costs in the warehouse for each box. For that we need a system that can integrate all supporting elements in order to be able to produce performance monitoring that allows management to be more effective and efficient [4].

Dashboard is a data visualization tool that provides information by displaying the latest conditions related to organizational performance in the form of key indicators or Key Performance Indicators, widely known as KPI [5]. The dashboard created will assist companies in cost analysis by providing accurate information related to Cost Per Case (CPC). CPC can be used to monitor the operational activities in the warehouse so that they are in accordance with what has been planned and when there are processes that are not according to plan, it is immediately known which areas and activities are seen from the cost side. In addition, the purpose of cost analysis is to be able to see opportunities to increase productivity and accuracy in the warehouse and reduce production and distribution costs along with improving service to customers through improvements in the warehouse such as changes of warehouse layout, improvement of order management, application of automation or systems, sophisticated software in operational activities in the warehouse as well as other improvements that can increase the company's gross margin. When the gross margin increases, the company will be able to invest more in advertisement and marketing or to improve warehouse performance to handle more product effectively to increase sales.

Traditionally, there are two techniques to maintain a company healthy: increasing sales and reducing costs. Cost reduction can be done after a comprehensive cost analysis is completed. The case study in this paper is the West Java warehouse of PT XYZ, one of the biggest Fast Moving Consumer Goods (FMCG) companies in Indonesia. Although it already implemented the comprehensive Enterprise Resource Planning software, for the supporting warehouse management system, PT XYZ uses only standard Microsoft Excel application. It is quite effective in recording and computing costs, but it cannot meet the needs of managers to perform cost analysis at the warehouse, especially the Cost per Case (CPC) in each activity. It happens due to the limitations the existing system has in displaying the required costs information. Considering the scale of PT XYZ West Java warehouse, which handles more than 147,000 pallets, not less than 650 truckloads and dispatch volume of more than 480,000 cases per day, a simple but effective Microsoft Excel template in a form of dashboard is urgently needed.

This research focuses on the preparation of the dashboard which aims to determine the Cost Per Case (CPC) of each activity in the warehouse. This dashboard is also expected to make it easier for companies to monitor warehouse performance from a Cost Per Case (CPC) perspective. This research also explains the flow of using the dashboard to display the required information for the activities of West Java Warehouse that supplies the demand of greater areas in Jakarta.

## 2. Methodology

This research was conducted using the following method:

A. *Data Collection.*
   *This method was carried out through several processes, namely [6]:*

- Interview: A Question-and-Answer session with warehouse supervisor was done to obtain crucial information related to the data needed to create a dashboard.
- Observation: Observations were carried out by analyzing data provided by the company, such as product inbound and outbound volume data, fixed and variable costs data for each area and activity, direct and indirect cost data, productivity data, and overtime data.

- Literature study: This activity was done by exploring various research to obtain information related to the dashboard and PureShare method as described in Table 1.

Table 1. Previous Research

| Characteristics | Previous Research | | | | | This Research (2022) |
|---|---|---|---|---|---|---|
| | Ilyas and Setiaji (2021) | Lavrador and Laureano (2019) | Utomo and Sungkar (2014) | Saputra, Hendrawan and Priand (2013) | Sungkar, Mustafid and Widyanto (2011) | |
| **Research Purpose** | | | | | | |
| Productivity and Performance Measurements | √ | | | √ | | |
| Customers data visualization | | | √ | | | |
| Management Control System | | | | | √ | |
| Cost Monitoring | | √ | | | | √ |
| **Research Object** | | | | | | |
| Students and faculty members at a university | √ | | | | | |
| Hospitality service at a hotel | | √ | | | | |
| Medical record and healthcare service at a hospital | | | √ | | √ | |
| Government institution | | | | √ | | |
| Private, profit-oriented organization | | | | | | √ |
| **Method** | | | | | | |
| PureShare | √ | | √ | √ | | √ |
| Noetix | | | | | √ | |
| Qualitative, Explorative Interviews | | √ | | | | √ |

From Table 1, it can be concluded that PureShare is a method commonly used to build a dashboard for various purposes. It was applied to design the attendance monitoring system of students and faculty members at a university, to keep the in-patient record as well as to measure the healthcare service at a hospital, to evaluate employees' performance at a government institution, and to compute the cost per case at a warehouse. PureShare method uses top-down approach in the planning stage and bottom-up approach during implementation, but a combination between PureShare and Qualitative, Explorative Interviews for cost monitoring at a private, profit-oriented organization dashboard was applied in this research. The focus of this research is to prepare the dashboard to determine the Cost Per Case (CPC) of each activity at the warehouse. This dashboard is also expected to make it easier for PT XYZ to monitor the performance of a warehouse in West Java that supplied the demand of greater areas in Jakarta from a CPC perspective.

B. *The analysis method is carried out using the PureShare method, where this method consists of several stages which can be seen in Table 2 [7]:*

Table 2. Stages of Research Work Based on PureShare Method

| PureShare Method | Research Work Stages |
|---|---|
| Planning and Design | 1. Data Collection<br>2. Needs Analysis<br>   a. Identify the Purpose of Making the Dashboard<br>   b. Dashboard User Identification<br>   c. Identify Dashboard Type<br>   d. Determination of KPIs in the Dashboard<br>   e. Identify Dashboard Design Needs<br>   f. Making Dashboard Layout Design |
| System and Data Review | 3. Identification of Data Needs and Sources |

| PureShare Method | Research Work Stages |
|---|---|
| Dashboard Prototype | 4. Dashboard Prototype Making |
| Prototype Improvement | 5. *Testing or Trial Using Dashboard* |
| Release | 6. Company Use of Dashboard |
| Continuous Improvement | 7. Dashboard Updates and Modifications |

## 3. Theoretical Foundation

This research raises several theoretical foundations as a theoretical framework, namely:

*A. Supply Chain Management*

The supply chain includes all parties involved directly or indirectly in meeting customer needs, not only manufacturers and suppliers, but also transportation companies, warehouses, retailers, and even consumers. In each of these organizations, for example in manufacturing, the supply chain includes all the functions involved in receiving and meeting the needs of consumers. These functions include, among others, the production process, new product development, marketing, distribution, finance, and customer service. While supply chain management is integration and coordination across departments and across companies related to the flow of material, information, and money to transform and use supply chain resources in a rational way along the value chain where there are activities on three main streams, including as follows [2]:

1. Sourcing, procurement, and supply management

These functions are part of the purchasing sector which has a fairly dominant role because of its impact on cash flow and its contribution to company profitability. The company realized that efforts to increase profits through increased sales were far greater than generating equivalent revenue through reducing procurement costs. Purchasing responsibilities relate to procurement and material management functions. Usually better known as a series of activities, functions, and processes related to the procurement or flow of inputs into the company as well as efficient control over the flow of funds out of the company. In the context of supply chain management, this process includes sourcing, supply side management, inbound logistics, and supplier relationship management related to material, information, and money flows that are interconnected with each other.

2. Material management

Classical material management includes functions of forecasting, inventory management, storage management, warehousing, stock keeping, scheduling to production planning and control, then expanded and developed into material management. Furthermore, it is better known as integrated material management because of the ordering process. Efficient material management is being implemented by companies as a way to reduce expenses and increase profits, this is because 60% of the production cost of a product is material costs. Merging purchases provides an opportunity to reduce material input costs. Several techniques in materials management focus on reducing the total cost of inventory at the lowest possible level but not neglecting the service level. In relation to supply chain management, it is considered the management of the flow of materials out, throughout, and for the company.

3. Logistics and distribution

Logistics is part of the supply chain management process from planning, implementing, and controlling the effective and efficient storage and flow of goods or services, money, and information from the point of origin to the point of destination to meet customer needs. The distribution function that Peter Drucker identified as "today's frontier" is synonymous with logistics. Meanwhile, transportation is the backbone of logistics because it contributes up to 50% of the total logistics costs. This makes the company pay special attention to creating efficient transportation management by developing practices related to transportation that involve all modes (multimodal). This can be evidenced by the development and growth of the handling and movement of containerized cargo around the world. The existence of a tradeoff between the choice of transportation mode and inventory policy causes integration and logistics to appear as cross-functional. An approach that integrates all materials, purchasing functions, purchasing management, production control, inbound movement, warehousing, and quality control with the aim of ensuring efficient operations. In this case, logistics is considered as an early avatar of supply chain management.

In the context of supply chain management, logistics is the end of a network of flow of goods or processes from raw materials to finished products to the hands of consumers, which is commonly referred to as inbound and outbound logistics. In manufacturing logistics, the flow of materials between companies gives this discipline a wide range of material movement from end (producer) to end (consumer) at every stage of industry and business in the distribution of value to customers. Thus, supply chain management has emerged as a strategic integration and business practice covering the flow of goods/services, money, and information across networks that provide value to customers.

Based on the description of the three main activities, it can be concluded that supply chain is the physical network, while supply chain management is a tool, method, or approach to manage it. [8]

*B. Warehouse*

The role of the supply chain is to deliver the right product, in the right quantity, to the right customer, at the right place, time, condition and price. Warehouse has an important role in the supply chain. Delivering the right product with the right quantity highly depends on the accuracy of the picking and dispatching processes in the warehouse. Delivering the product to the right customer at the right place and time means that the product must be properly labeled and loaded on to the right vehicle in sufficient time span to meet delivery deadlines. While in the right condition means that the warehouse must ensure the product is delivered in good condition or without damage. Finally, at the right cost means that operational activities must be efficient so that they are able to provide value to the product at the appropriate cost.

According to Meyers and Stephens (2002), the warehouse is a place to store products, both raw materials and finished goods. Meanwhile, according to the Warehousing Management Institute (2008), a warehouse is a storage place that has a function to store inventory before further processing is carried out. [9]. In the book Warehouse Management by Gwyne Richards (2011) it is explained that the warehouse is a place for storing stock by adjusting between supply and demand or acting as a buffer between producers and consumers. So, it can be concluded that the warehouse is a temporary place to store raw materials for use in the manufacturing process as well as finished goods that are ready to be distributed.

There are several activities carried out in the warehouse, ranging from inbound to outbound processes, where the processes in the warehouse can be seen in Fig. 1 and the following are some of the main activities in it. [3]

1. Receiving. This is the most important activity in the warehouse. This activity consists of receiving goods, checking the suitability and condition of goods (checking), to determining the quality of goods (accepted or rejected).
2. Putaway. This activity covers distributing goods from the receiving area to storage or racking locations.
3. Storage. This is an area at a warehouse that is divided into storage for raw materials and finished goods.
4. Picking. This activity involves taking goods according to consumer demand from the storage area to be collected in the dispatch area.
5. Dispatch. It is an activity of consolidating goods according to customer requests and then carrying out the loading process on the transport vehicle complete with the preparation of documents for delivery of goods.
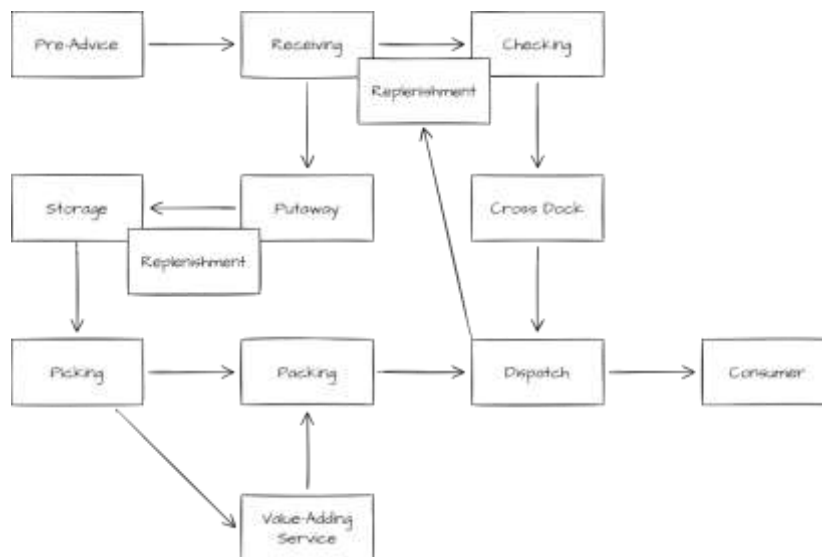


Figure 1. Warehouse Processes

Operational activities in the warehouse cost an average of 1% - 5% of the total cost of sales depending on the type of company and the value of the goods. Meanwhile, costs for warehousing activities account for up to 22% of the company's total logistics costs. [3]. The costs included in warehouse operations can be seen in Fig. 2. The existence of various types of costs ranging from storage, handling, to overhead costs exposes a warehouse manager to comprehensive knowledge regarding all costs that trigger expenses in the warehouse in order to perform cost analysis and minimize cost without reducing the quality of services.
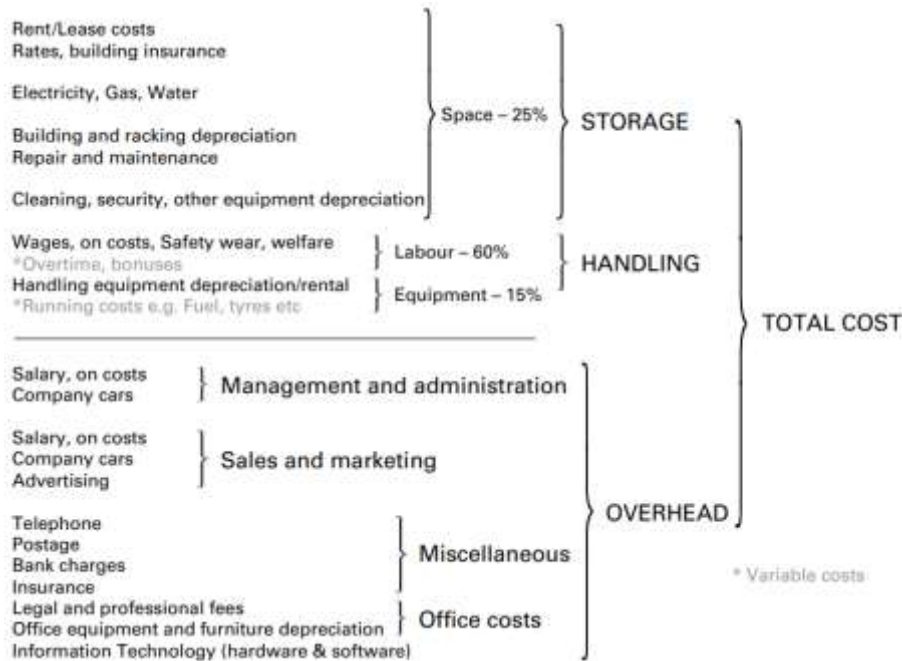
Figure 2. Simple Warehouse Cost Tree

### C. Cost Analysis

Cost analysis according to Stock and Lambert is the basis of integrated logistics management to minimize the costs of transportation, warehousing, storage, ordering processes, and information systems by achieving the appropriate level of customer service. The purpose of cost analysis is to examine the effect of each alternative improvement on the company's total logistics costs [10]. By knowing the effect of alternative improvements based on cost analysis, the results of the analysis can be used for decision making by managers through cost comparisons or other cost components.

### D. Activity Based Costing (ABC)

Activity Based Costing (ABC) is an approach to allocate additional costs or other costs that often appear outside of the previous plan to several sets of activity costs and then assign these costs to products and services through cost drivers or factors that have an impact on changes in the total cost level. For example, companies can track the costs of setting up or setting up machines for each batch of a production process. Then the company can allocate a portion of the total set-up cost to a particular product based on the number of set up required by the product. [11]

### E. Dashboard

Dashboard is basically a new name for an executive information system which was first developed around 1980. After going through a series of studies and having experienced a hibernation phase due to the support method for providing data, namely data has not evolved to provide a data handling methodology, Few (2006) defines dashboards as a visual display of important information the company needs to achieve a goal. These displays are consolidated and arranged into one screen so that the information to be conveyed can be monitored in one view [12]. There are four main criteria that must be owned by a dashboard, including the following [13]:
1. Combine relevant business information and present it in a unified view.
2. Information submitted must be accurate and timely.
3. Provide secure access to sensitive information. The dashboard must have a security mechanism so that data or information cannot be accessed by unauthorized parties.
4. Dashboard is able to provide comprehensive solutions to the main problems that need to be addressed.

According to Few (2006), there are 6 categories of presentation forms in the dashboard, including:
1. Graphics
   In general, the type of data on the dashboard is quantitative data, so most dashboard presentation media use graphical form. Several types of graphs that can be used in the dashboard are bullet graph, stacked graph, bar

chart, line graph, combination bar and line graph, sparklines, box plots, scatter plots, treemaps. All types of graphs, except treemaps, are two-dimensional with the x and y axes.

2. Figures

Images on the dashboard can be used to display things that need to be displayed in the form of images, such as faces, room conditions, and others. The use of images such as illustrations, photos, and diagrams are sometimes useful in the dashboard, but in practice this type of image is still very rarely used.

3. Icon

An icon is a simple image that can be used to describe a simple function.

4. Drawing objects

Drawing objects is a combination of several types of dashboard presentation to present information in a structured manner so that it can provide information properly. One example of drawing objects is a combination of graphic and text types.

5. Text

Each type of dashboard must have information that can only be displayed in text form. Text can be placed somewhere as a caption or information or used to provide a label that identifies the item in the image.

6. Organizer

There are three types of organizers on the dashboard, namely spatial data, tables, and small multiples. Where the information presented by the table is information arranged in rows or columns, either in the form of images, icons, or text. Spatial maps are used to provide information in the form of geographic maps. While small multiples present information consisting of one row or column with a graph, or several rows and columns arranged in a matrix.

According to Eckerson (2006), based on the level of management it supports, dashboards can be grouped into three parts, namely, operational dashboards, tactical dashboards, and strategic dashboards. The explanation of each dashboard can be seen in Table 3.

Table 3. Types of Dashboards Based on Management Level

| Criteria | *Operational Dashboard* | *Tactical Dashboard* | *Strategic Dashboard* |
|---|---|---|---|
| Function | Provides direct information related to several matters that need to be responded to quickly | Provide information needed to find out the reasons for an event | Provide information to make business decisions, predict opportunities, and provide direction for achieving strategic goals |
| Focus | Monitoring activities and events that change constantly | Determine the cause of a certain condition or event from an analysis | Measurement of high-level performance and achievement of the organization's strategic goals |
| Presentation of Information | The information presented is very specific and detailed through simple, easy-to-understand media, and there are alert facilities | Designed to interact with data such as drilldowns that allow users to analyze data | The information presented is not too detailed, so the mechanism is simple, easy to understand, and graphical display |
| Data Requirements | Dynamic and real time | Does not require real time data | Does not require real time data |

*F. Key Performance Indicator (KPI)*

Monitoring activities can be carried out properly if the information displayed on the dashboard is in accordance with the solution to the problems faced by the company. Therefore, Key Performance Indicators are used to formulate key indicators for the problems encountered, so that the information displayed is effective and can overcome company problems. [14]. By definition, KPIs are financial and non-financial metrics that can help an organization, or a company determine and measure progress towards the organization's or company's targets [15]. In simple terms, KPIs are quantitative indicators that can be used to analyze and evaluate the effectiveness and efficiency of the current and future performance of an organization or company. Performance evaluation is carried out to measure and determine the performance of various levels (organization, process, and people) so that it can be seen the comparison of expected and observed performance to align tasks with the strategy and

goals of the organization or company. The monitoring process also aims to maximize the chances of success in achieving the commitments set out in the strategic plan of activities and the company's annual budget. The selection of indicators that will be used as performance measurements must consider several requirements, including selectivity, representation, simplicity, cost reduction, stability, experimental approach, external comparison, accessibility, and continuous improvement. There are several indicators that can be used in management, generally divided into main types, namely financial and non-financial, which are used to define each objective, calculation formula, result, goal, deviation, performance, evaluation. [4]

*G. PureShare*

The PureShare method was developed by the PureShare vendor to facilitate projects related to the management and measurement of organizational performance, including the construction of dashboards. [16]. The following Fig. 3 describes the stages of the PureShare method [17]:



Figure 3. Stages of PureShare method

During the planning and design step, the dashboard developer must gather information regarding users' needs to determine the key features that will be displayed on the dashboard. After key features are firm, the system and data review stage are carried out with a bottom-up implementation approach, ensuring the indicators of data quality, data source and how to access the data.

Creating a prototype design involves both top-down and bottom-up approaches simultaneously. This stage is done to prove an overview of the final appearance and interface of the dashboard. The prototype is then reviewed by the developer and users. Feedbacks are treated as references to dashboard further development.

When the dashboard is complete, a release is mandatory to ensure that every user of the dashboard get enough exposure regarding the new dashboard and eventually uses it effectively.

A continuous improvement of the dashboard is mandatory since it needs to be adjusted as what the users need.

## 4. Results and Analysis

This dashboard development research was completed during three-month internship and the company found it useful to compute and monitor CPC at the West Java Warehouse. This chapter describes the stages of creating a dashboard using PureShare method that also involves in-depth interviews with the users. After the dashboard was completed, it was released to the users, and it got various suggestions for improvement, especially in terms of integrating the executed data to the existing ERP module.

Following PureShare method, the dashboard development was as follows.

*A. Planning and Design*

At the planning and design stage, the developer must understand the user's needs and be able to determine the key features that will be displayed on the dashboard. Therefore, data collection was carried out using several methods to determine user needs. In conducting a needs analysis, it is necessary to identify the purpose of manufacture, users, types, and needs of the dashboard design, as well as determine the KPIs in the dashboard.

1. Data Collection

   Data was collected using interviews, observations, and literature studies as a source for the authors in identifying relevant indicators to be displayed on the dashboard as a source of information for users. In addition, data collection is needed to find out the data needed in making the dashboard.

2. Needs Analysis

   At the planning and design stage, there are several activities to analyze dashboard needs, including:

   a. Identify the Creation Purpose, User and Dashboard Type

      The purpose of making this dashboard is to assist companies in obtaining important information related to handling costs per box for each activity in the warehouse in an attractive and easy-to-understand visual form. This dashboard is used by warehouse managers to conduct cost analysis on warehouse operations to find out the cost of handling each box for each month. So that the dashboard used is included in the type of operational dashboard.

   b. Identification of Business Processes and Calculation of Cost Per Case (CPC)

The company's business processes start from production carried out at the factory, then the products are stored in the warehouse for further distribution to customers. The business process of the company can be seen in a simpler way in Fig. 2. In carrying out its business processes, there are costs incurred by the company. One of the cost components incurred by the company is the handling cost per box or CPC obtained from the quotient between the costs incurred by the company for activities in the warehouse and the volume handled on the activity. The following is an example of calculating CPC for putaway activity in April in WH 1.

$$\text{CPC} = \text{Cost/Volume}$$
$$= \text{IDR } 400{,}000{,}000.00 / 16{,}000{,}000 \text{ cardboards}$$
$$= \text{IDR } 25.00 \text{ per box}$$

3. Identify Relevant KPIs for Users (Warehouse Manager)

Based on the results of interviews, observations, and literature studies that have been carried out by the author, the KPIs can be grouped into two dimensions to make it easier for users to understand the information displayed on the dashboard. The following are KPIs used to display information related to Cost Per Case (CPC).

    a. Warehouse Volume

        It is an indicator obtained from the volume of inbound and outbound products in the warehouse.

    b. Cost Per Case

        It is an indicator that is obtained from the calculation of cost per activity data divided by inbound or outbound volume.

4. Identify Design Needs and Create Dashboard Layout Designs

After carrying out the previous stages, identification of design needs and the creation of a dashboard layout design are carried out by identifying the form of visualization that you want to display from each information. The form of dashboard visualization can be seen in Table 4 below.

Table 4. Dashboard Visualization Forms

| No. | Information | Form Visualization |
|-----|-------------|--------------------|
| 1 | Warehouse Volume | Bar Chart |
| 2 | CPC per Activity | Bar Chart |
| 3 | CPC Comparison | Bar Chart |
| 4 | Quartal | Table |

*B. System and Data Review*

The next stage is a system and data review to identify the data sources used. The data must be in accordance with the needs in making the dashboard.

After identifying the relevant KPI requirements for users at an early stage, the next step is to determine the needs and data sources as input on the dashboard. Identification of data sources for each KPI can be seen in Table 5.

Table 5. Identification of Data Sources

| No. | Key Performance Indicator (KPI) | Data Source |
|-----|--------------------------------|-------------|
| 1. | Warehouse Volume | Inbound/Outbound Volume Data |
| 2. | Cost Per Case | Data Resume CPC Warehouse |

*C. Prototype Design*

In the third stage, prototype design was carried out using Microsoft Excel software.

    1. Data Cleaning

        This step is mandatory since not all the data obtained from the company is needed and not all data is in the right format of table, so it should be organized and sorted following the arrangement that has already planned for the dashboard.

    2. Data Processing (Dashboard Creation)

        This process was carried out to process data so that the information presented on the dashboard is in accordance with the company's needs. There were several stages in creating a dashboard, including:

        a. Creating Sheets in Microsoft Excel and Data Input

            The first step in creating a dashboard in Microsoft Excel is to create a sheet according to what the user needs. In this warehouse dashboard, 20 sheets were made, ranging from dashboard display

sheets, instruction sheets, to sheets for data that need to be inputted. The display of the instruction sheet and several sheet names on the warehouse dashboard can be seen in Fig. 4.



**Steps to Complete Template**

| Sheet | Action | Status |
|---|---|---|
| Volume | Update volume data every month by Site. | |
| ABC | Check the data, whether it is in accordance with the summary on ABC Costing, especially for despatch activity on variable costs. | |
| Monthly billing ABC | Update monthly billing ABC based on ABC costing for all Sites. | |
| GR | Update fixed and variable costs based on actual data. | |
| OT Warehouse & Factory | Update Total OT data every month by Site and category based on actual data. | |
| Input Data | Update Direct & Indirect Cost and productivity based on ABC costing. | |
| CPC | - | |
| Java | Update data based on data from Java. | |
| Non-ABC | - | |

Figure 4. Instruction Sheet Display

The required input data were incoming and outgoing goods volume data, fixed and variable costs in each area of the warehouse, ABC monthly invoices, actual costs for fixed and variable costs, total costs and overtime hours, direct and indirect costs, productivity of handling equipment. materials, and monthly bills for non-ABC expense groups.

b. Calculation Process

After all the required data were met, the next step was to carry out the calculation process to present the required information. The first calculation was to determine the percentage of fixed and variable costs in each area of the warehouse. The second was to determine the volume of inbound and outbound that could be handled during overtime for each month. The third was to determine the percentage of direct and indirect costs incurred by the company for handling cardboard and pallets in each area. Fourth was to determine the percentage of costs incurred by the company for the use of material handling equipment based on its productivity. The last was to calculate the handling cost per box for each activity, both fixed costs and variable costs for the ABC group, such as direct costs which were divided based on expenses in each area of the warehouse and indirect costs such as administration, management, and others. Meanwhile, for the non-ABC group, the handling fee per box was calculated for each group of expenses such as rental fees, minimizing the risk of Covid-19 transmission, electricity, water, employees' meals, and others. The following is an example of a calculation to determine the percentage of fixed and variable costs in each area of the warehouse with the percentage of other areas can be seen in Fig. 5.

% Picking (fixed cost) = Picking (fixed cost)/Total fixed cost × 100%
= Rp 25,968,872.164/Rp 195,517,891,074 × 100%
= 13,282 %



| Area | Core Activity | Activity | Warehouse | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | % | Fixed | % | Variable | % |
| 1 | Receiving | Unloading | 9.625.744.034 | 6,328% | 6.763.980.369 | 7,991% | 2.861.763.666 | 4,241% |
| 1 | Receiving | Checking | 1.738.895.700 | 1,143% | - | 0,000% | 1.738.895.700 | 2,577% |
| 2 | Put In / Out & Storage | Putaway | 17.171.299.223 | 11,288% | 6.296.597.294 | 7,438% | 10.874.701.930 | 16,117% |
| 3 | Picking | Picking | 41.809.442.566 | 27,484% | 10.186.359.128 | 12,034% | 31.623.083.438 | 46,866% |
| 4 | Despatch | Loading | 21.612.894.713 | 14,207% | 18.137.830.599 | 21,427% | 3.475.064.114 | 5,150% |
| 4 | Despatch | Checking | 4.958.821.635 | 3,260% | - | 0,000% | 4.958.821.635 | 7,349% |
| 5 | Returns | Returns & Other | 6.987.939.951 | 4,594% | 2.893.809.846 | 3,419% | 4.094.130.104 | 6,068% |
| 6 | Administration & General | Administration & General | 12.835.350.393 | 8,437% | 12.835.350.393 | 15,163% | - | 0,000% |
| 7 | Site Costs | Site Costs | 12.126.116.189 | 7,971% | 12.126.116.189 | 14,325% | - | 0,000% |
| 8 | Management | Management | 14.657.046.294 | 9,635% | 14.657.046.294 | 17,315% | - | 0,000% |
| 9 | Miscellaneous Other | Miscellaneous Other | 8.601.756.266 | 5,654% | 752.749.213 | 0,889% | 7.849.007.053 | 11,632% |
| | Total | | 152.125.306.965 | 100% | 84.649.839.324 | 100,000% | 67.475.467.641 | 100,000% |

Figure 5. Percentage Display of Fixed and Variable Costs for Each Area in the Warehouse

c. Creating Graphics

After the required data was collected and data processing had been carried out, the last step in making the dashboard was to create a graph. The graphing was adjusted to the results of the analysis of the company's needs. The results of the dashboard design that have been made can be seen in Fig. 6.

Figure 6. Warehouse Dashboard

d.  Prototype Repair

At this stage, improvements were made to the dashboard obtained from the results of testing or trials by users. The trial phase was carried out to ensure whether the dashboard made was in accordance with the company's needs or there were things that need to be improved. The initial display on the dashboard only presents information on handling costs per box or CPC for each activity in the form of simple tables and graphs for the ABC group as shown in Fig. 7, while for the non-ABC group only information on handling costs per box for each expenditure group such as covid19, depreciation, fixed costs, maintenance, and others as shown in Fig. 8. Therefore, a prototype improvement for the ABC group was made to make it more user friendly and make it easier for users to analyze the results of data processing presented. Improvements for non-ABC groups were not possible if done at this time because the existing data was not able to accommodate for dashboard creation.



Figure 7. CPC Display Before Repair

Figure 8. Display of CPC in the Non-ABC Group

e.  Release
    When the dashboard had passed the testing phase and improvements have been made, the users could start using the finished dashboard after several simple training following the manual (process flow) as shown in Table 6.

Table 6. Steps to Complete the Dashboard

| Sheet | Action | Status |
|---|---|---|
| Volume | Update volume data every month by Site. | |
| ABC | Check the data, whether it is in accordance with the summary on ABC costing, especially for dispatch activity on variable costs, the cost is split into loading and checking. | |
| Monthly billing ABC | Update monthly billing ABC based on ABC costing for all Sites. | |
| Good Receipt | Update fixed and variable costs based on actual data from finance team. | |
| Overtime Warehouse | Update Total overtime (Hour and Value) data every month by Site and category based on actual data from 3rd party logistics. | |
| Input Data | Update direct & indirect cost and productivity based on ABC costing to find out the percentage of cost usage by area. | |
| CPC | - | |
| Java | Update data based on data from Java YTD (Year to Date). | |
| Non-ABC | - | |

Users must complete all sheets in Microsoft Excel so that they can see the required information on the dashboard. The 'Status' column is a description of filling out the sheet required by the user.

f.  Continuous Improvement
    Several updates and modifications were carried out to adjust the dashboard as needed by the users, such as the expense identification for the non-ABC section. It was added to enable the identification and calculation of expenses that were not included in the non-Activity Based Costing group.

g.  Results and Analysis
    Based on the results, after several adjustment, the dashboard can be effectively used by PT XYZ to compute the Cost per Case (CPC), so the company can do a cost analysis and monitor the operational activities in the warehouse. This CPC is crucial, since it checks whether the activities are

done in accordance with what has been planned and to see opportunities in an effort to increase productivity and accuracy in the warehouse along with improving service to customers through improvements in the warehouse, such as layout changes, order management repair, application of automation or sophisticated software systems in operational activities in the warehouse as well as other improvements that can increase the company's gross margin. The increase in gross margin can be used by the company to invest in product development or to improve the warehouse so that more products are handled and in parallel can increase sales.

In order to perform a cost analysis, the company must know the description of each chart on the warehouse dashboard. The following is a chart description based on the warehouse dashboard to monitor CPC:
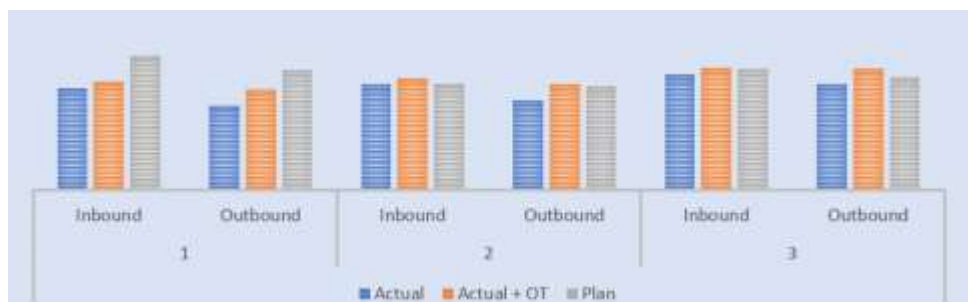

Figure 9. Warehouse Volume

The diagram in Fig. 9 is a comparison of inbound and outbound volumes in the warehouse for planning volume, actual volume, and actual volume in the presence of overtime. The display on the dashboard can be set for each month or every quarter.


Figure 10. CPC per Activity Each Month

The diagram in Fig. 10 shows the cost per case for each activity in the warehouse, from inbound to outbound activities. The display on the dashboard can be set for each month or every quarter.
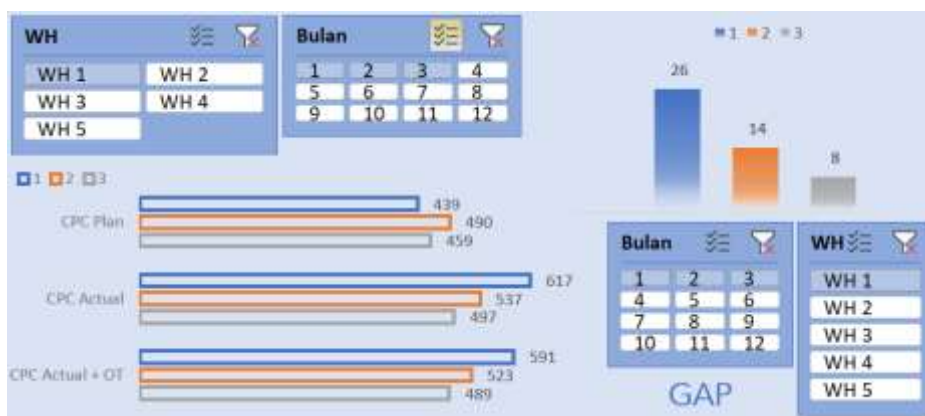

Figure 11. Comparison of CPC

The diagram in Fig. 11 is a comparison of Cost Per Case (CPC) in the warehouse for several categories including, CPC plan, actual CPC, and actual CPC with overtime. The display on the dashboard can be set for each month or every quarter as described in the following Table 7. In

addition, there is also a display of the difference in CPC for each category each month which can be adjusted by setting the month panel and warehouse information.

Table 7. Quarter

| The information is displayed Quarterly (Q) | |
| --- | --- |
| Quarter | Remarks |
| Q1 | January to March |
| Q2 | April to June |
| Q3 | July to September |
| Q4 | October to December |

Figure 12 is a panel for tracking what data users want to display. There are descriptions of volume, month, cost, and warehouse.
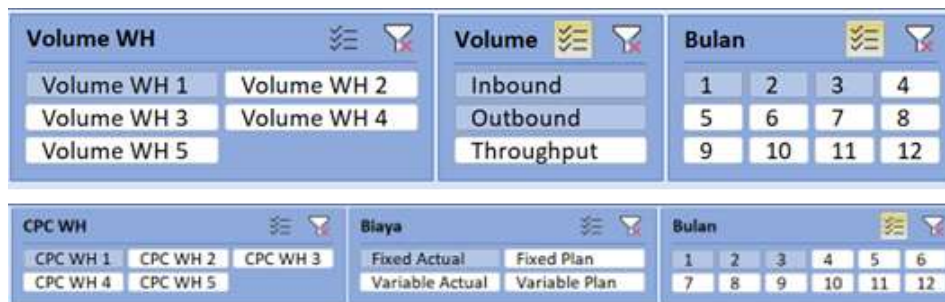


Figure 12. Tracking

When the dashboard was presented to all users, they found it very useful and came up with several improvement ideas. This dashboard is effectively used by PT XYZ to compute CPC as the basis for cost optimization as well as to provide the input data for the existing ERP module.

## 5. Conclusions and Suggestions

In this chapter, conclusions are drawn on the research that has been carried out and suggestions for the development of further research related to dashboard design are carried out.

*A. Conclusion*

Since warehouse is really important in the whole supply chain, continuous improvements in warehouse operational activities should be done more effectively and efficiently. Given the importance of monitoring costs in the warehouse of PT XYZ, this study aims to create a dashboard that can make it easier for companies to monitor warehouse performance from a Cost Per Case (CPC) perspective. Based on the results and analysis that has been done, conclusions can be drawn from this practical work research, namely:

1. The business process at PT XYZ starts from production to distribution with the CPC calculation obtained from the quotient between the costs incurred by the company for activities in the warehouse and the volume handled for these activities.
2. The process of creating a dashboard to find out the Cost Per Case (CPC) of each activity in the warehouse so that the information presented on the dashboard is in accordance with the company's needs is through three stages, namely making Microsoft worksheet creating and data input, performing the calculation process, and lastly is creating graphs.
3. Before using, the dashboard must pass the testing phase and be repaired. After passing this stage, the dashboard can be used by following the process flow of using the dashboard so that it can display information according to company needs. The process flow or steps can be carried out by completing the required input data as shown in Table 6.
4. Based on the results of data collection and processing, the results obtained in the form of a proposed warehouse dashboard that can be used by companies to perform cost analysis by providing information related to Cost Per Case (CPC). The purpose of conducting a cost analysis from CPC is to monitor the operational activities in the warehouse so that they are in accordance with what has been planned and to see opportunities in an effort to increase productivity and accuracy in the warehouse along with improving service to customers through improvements in the warehouse.

*B.    Suggestion*

Suggestions for further research on similar topics in the future are as follows:

1. Developers can consider other dashboard design methods such as the Noetix method, Brightpoint, or other new methods such as the Dashboard Development Methodology.
2. There is a need for development in terms of graphics and appearance on the dashboard to make it more user friendly and easy to understand.
3. Dashboard not only displays information related to CPC for ABC group but also for non-ABC group.
4. Adding filter data such as time and location on the dashboard so that the presentation of information can be more dynamic and tailored to user needs.
5. A module can be designed that contains a guide for users to follow up on every possible output generated by the dashboard. For example, when an error occurs in the output or when producing a number on a certain indicator, it can be explained what the purpose of the output is and what follow-up should be done.

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