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Evaluating the Performance of Kanban Method in Managig Industrial Food Product Development Projects at Pt.XYZ: A Literature Jurnal

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Abstract:- This study evaluates the performance of the Kanban method in managing product development projects in the food industry at PT. XYZ. The dynamic and competitive nature of the food industry requires companies to continually innovate. PT. XYZ uses the Kanban method to enhance efficiency in managing its product development projects. This study analyzes Kanban implementation, compares product development project performance before and after Kanban implementation, and assesses the benefits and challenges encountered during the process. The results of this study are expected to significantly contribute to the understanding and development of the Kanban method in the context of the food industry in Indonesia. Data is obtained from annual and monthly reports, including information on production processes, production plans, raw material processing times, raw material needs, and raw material capacity per pallet. This research focuses on quantitative and evaluative aspects, aiming to improve the efficiency and smoothness of production flow with a structured Kanban system.

Keywords:- *Production, Effectiveness, Design, Kanban, Food Industry.*

I. INTRODUCTION

The food industry is one of the most dynamic and competitive sectors in the global market. It plays a central role in the global economy and daily life. The importance of this industry is not only limited to providing food for the growing world population but also as a major driver of economic growth in many countries (Nusratovic, 2019). Managing product development projects in the food industry often faces various complex challenges, such as complicated supply chain management related to coordinating multiple suppliers and distributors to ensure the timely and quality availability of raw materials (Seo & Kaleka, 2024).

To stay competitive and meet increasing consumer demands, companies must continuously innovate in their product development. PT. XYZ, as an experienced player in the food industry, is an example of a company that continuously strives to improve the quality and efficiency of its product development. Their products are designed to meet the growing demand for healthier lifestyle choices, and they have established themselves as a trusted brand in this industry (IndoTrading, 2024).

One method that can be used to enhance efficiency in managing product development projects is the Kanban method. This method has proven effective in the manufacturing industry to reduce waste and improve workflow (Vidianto & Haji, 2020). However, there has been limited research focusing on evaluating the performance of the Kanban method, particularly in the context of food product development in Indonesia. Therefore, this study aims to evaluate the performance of the Kanban method in managing product development projects in the food industry at PT. XYZ. By conducting this evaluation, it is hoped that potential improvements and more effective applications of the Kanban method in the food industry context can be identified.

This study will include an analysis of Kanban implementation, measurement of product development project performance before and after Kanban implementation, and an analysis of the benefits and challenges encountered during the implementation process. The results of this study are expected to provide significant contributions to the understanding and development of the Kanban method in the context of the food industry in Indonesia.

II. LITERTURE REVIEW

The Kanban method, first introduced by Toyota in the automotive industry, has become one of the widely accepted approaches in project and production management. Kanban aims to control workflow, reduce waste, increase efficiency, and improve product quality. In the context of food product development, evaluating the performance of the Kanban method is important to understand the extent to which this method can provide significant benefits in project management (Witania, 2002).

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The Kanban method is a management approach originating from Just-In-Time (JIT) practices in manufacturing, which has been applied in various project and production management contexts (Ihsan et al., 2023). The basic concept of Kanban involves the use of Kanban boards or visual boards that serve as control tools to manage workflow. The main principle of the Kanban method is to regulate workflow by limiting the amount of work-in-progress at each stage, thereby minimizing cycle time and increasing efficiency (Damij & Damij, 2021).

Research by Lemadi (2023) suggests that the Kanban system is an information management approach used to regulate the flow of raw materials through various production stages. This system addresses issues of discrepancies in the delivery of raw materials from inventory to production, which often causes material build-up during the production process. The study aims to reduce these discrepancies by implementing a customized Kanban system for biscuit production and evaluating its effectiveness.

Research by Tiawan et al. (2023) explains that the planning for the creation of a website for the Primakara business incubator using the Design Thinking, Branding, and Kanban Board approaches aims to create an attractive, user-friendly website that can strengthen the Primakara brand image. This process involves structured and iterative planning to ensure that the website can meet user needs and expectations.

Research by Lubis et al. (2023) outlines that immigration offices provide various services such as the issuance, retrieval, revocation, and replacement of regular passports, as well as passport issuance for prospective pilgrims. They also offer assistance in issuing travel documents replacing passports and provide visa recommendations for work and holiday purposes. However, the public often complains about inadequate handling of these processes, especially in terms of complaint management and record-keeping, which still require improvement. This makes it difficult to retrieve complaint data when needed. Based on this research, the authors plan to create a web-based information system that can manage complaints at immigration offices.

III. RESEARCH METHODOLOGY

The research method used is a quantitative method with an evaluative type of research. This study will focus on comparing or conducting an evaluation study on the production effectiveness at PT. XYZ under pre- and post-implementation conditions of the Kanban method. This research will use data in the form of information from the company related to various production plans, data on production processes, data related to raw material processing times, data on raw material requirements, and data on raw material capacity per pallet. These data sources will be taken from annual and monthly reports and then processed for research purposes. The number of Kanbans analyzed will be based on calculations in equations regarding the number of Kanban inputs for raw material requests.

The determination of the number of Kanbans follows the previously explained formula, where the number of Kanbans issued for a specific raw material request is calculated using the following formulas:

$$\text{KT (Kanban tarik)} = \frac{D}{Q} \quad (1)$$

$$\text{KT (Kanban produksi)} = \frac{D}{Q} \quad (2)$$

Explanation:
KT = Pull Kanban
KP = Production Kanban
D = Demand / Day (Batch)
Q = Capacity Per Palet.

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➢ *The Research Framework can be Explained in the Diagram Below:*

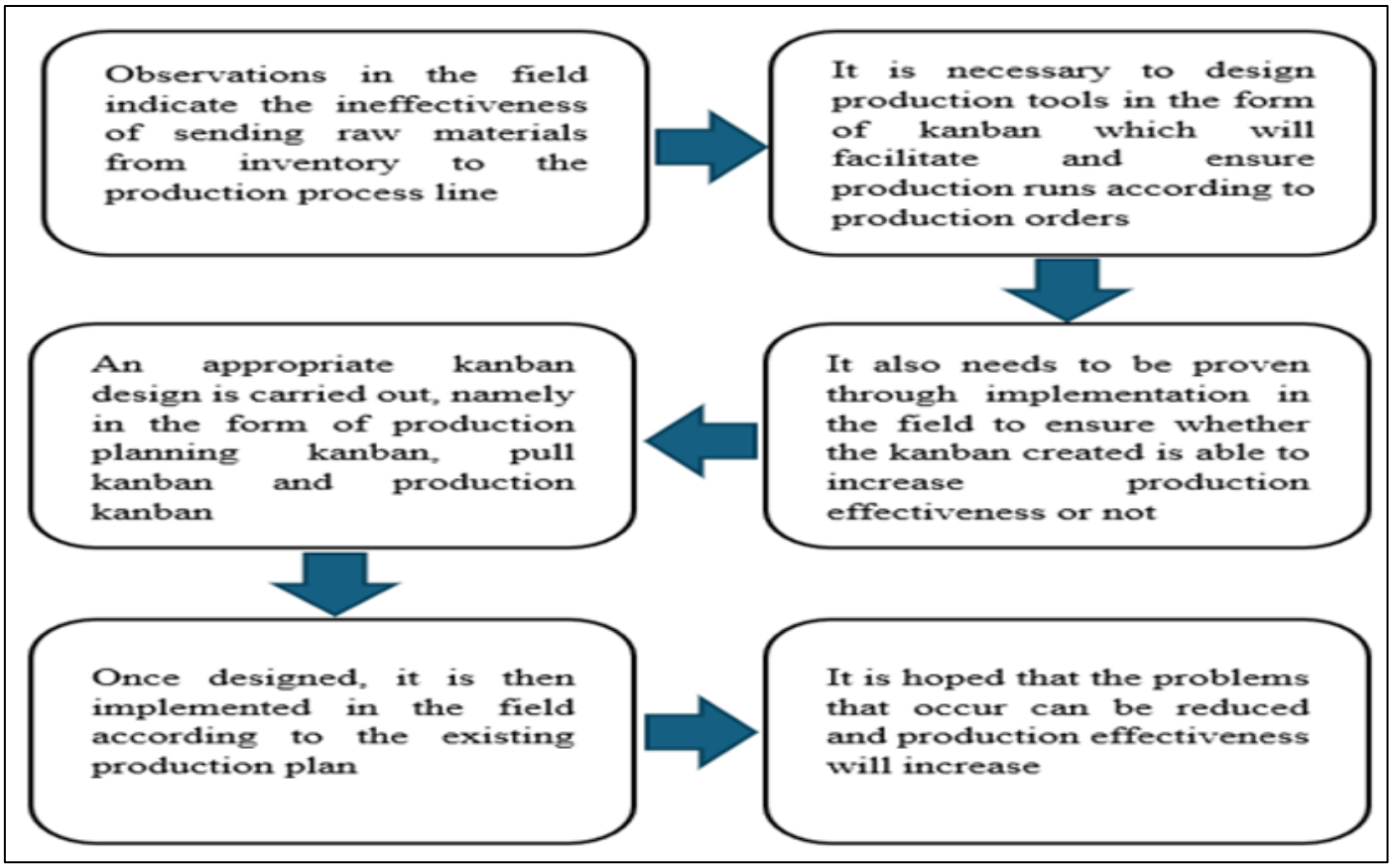

Fig 1: Research Framework Diagram

IV. RESULT AND DISCUSSION

A. Production Process of Chips

The production process of chips at PT. XYZ involves several stages, starting from the selection of raw materials to the packaging of the finished product. Here is an explanation:

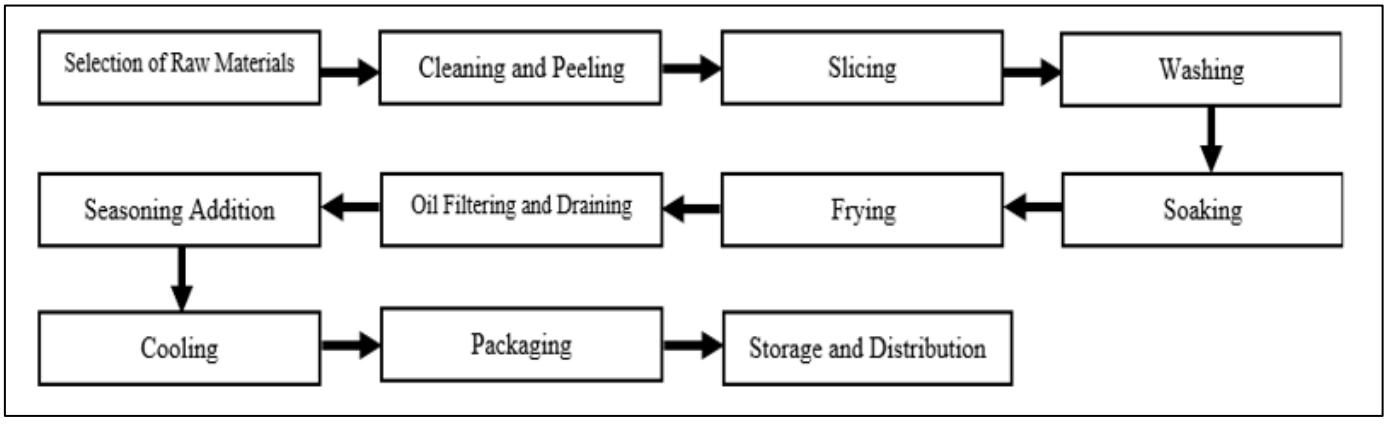

Fig 2: Folowchart of the Chip Production Process at PT.XYZ

➢ *Selection of Raw Materials*

The process begins with selecting high-quality raw materials to produce crispy and delicious chips.

- Cleaning and Peeling: Peeling can be done manually or using specialized machines depending on the production scale.
- Slicing: The raw materials are thinly sliced with uniform thickness using slicing tools. This is crucial to ensure even cooking of the chips.

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- Washing: Washing is typically done with cold water or a salt solution to help remove sap and make the chips crispier.
- Soaking: For some types of chips, sliced raw materials are soaked in special solutions such as saltwater or specific seasonings to add flavor and enhance crispiness.
- Frying: The frying process is usually done in several stages to ensure evenly cooked chips without excessive oiliness.
- Oil Filtering and Draining: This process can be done using filtering tools or by placing the chips on oil-absorbing paper to remove excess oil.
- Seasoning Addition: After draining the oil, chips are seasoned according to desired flavor variants.
- Cooling: Seasoned chips are then cooled to room temperature to maintain their crispiness.
- Packaging: Packaging is carefully done to ensure no chips are damaged during this process.
- Storage and Distribution: Packaged chips are stored in warehouses under appropriate conditions before distribution to the market.

➢ *Design of Kanban Stages in the Chip Production Process*

B. Kanban Design

Kanban design is a visual management method that can be used to enhance efficiency in the production process. Below is the Kanban design based on the chip production process at PT. XYZ. Kanban Stages for the Chip Production Process are explained in the following table:

Table 1: Kanban Stages in the Chip Production Process

Process	**Process**	**Process**	**Process**
Selection of Raw Materials	Tubres (potatoes, cassava, bananas)	Selected and ready-to-process tubers	100 kg per batch
Cleaning and Peeling	Selected tubers	Cleaned and peeled tubers	80 kg per batch
Slicing	Cleaned and peeled tubers	Sliced tubers	70 kg per batch
Washing	Sliced tubers	Cleaned sliced tubers	60 kg per batch
Soaking	Cleaned sliced tubers	Soaked sliced tubers	50 kg per batch
Frying	Soaked sliced tubers	Fried chips	40 kg per batch
Oil Filtering and Draining	Fried chips	Oil-drained chips	35 kg per batch
Seasoning Addition	Oil-drained chips	Seasoned chips	30 kg per batch
Cooling	Seasoned chips	Cooled chips	25 kg per batch
Packaging	Cooled chips	Packaged chips	20 kg per batch
Storage and Distribution	Packaged chips	Finished products ready for shipment	Warehouse capacity

➢ *The Kanban System to be Designed for all Forms of Chip Production Processes will Include the Following Aspects:*

- Analysis of the company's production plan design process (Production Kanban)
- Analysis of the distribution process or logistics management of production raw materials (Logistics Kanban)
- Analysis of the actual production process design in the company's raw material delivery design process using (Production Kanban)

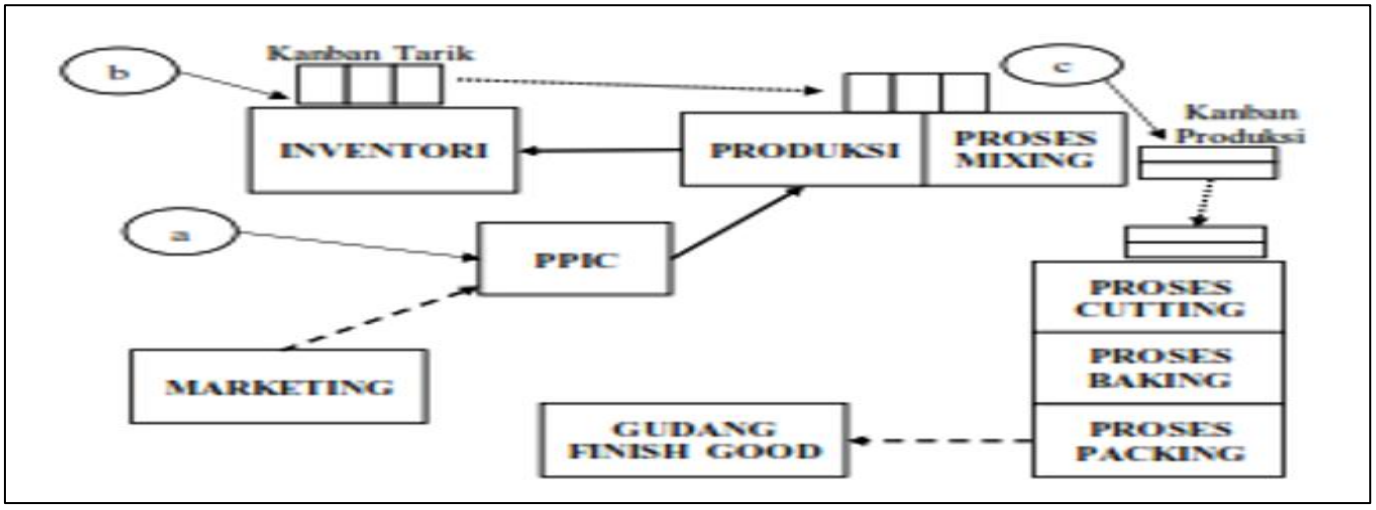

Fig 3: Diagram of the Company's Actual Prodction Process Design with Procuction Kanban and Pull Kanban

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Pull Kanban, or Pull System Kanban, is a method that can be implemented to manage the delivery of raw materials from inventory to the production line, ensuring efficient and problem-free processes. Pull Kanban cards should include the following details for optimal effectiveness: the sender's address data for raw materials, the destination address data for the production line receiving the raw materials, the name of the raw material being sent, LOT number indicating the arrival date of the raw materials, the product name to be manufactured, the raw material delivery date Kanban number, which tracks the number of Kanbans sent, total weight of Kanbans, and the unit of measurement used in Kanbans, which is kilograms (kg).

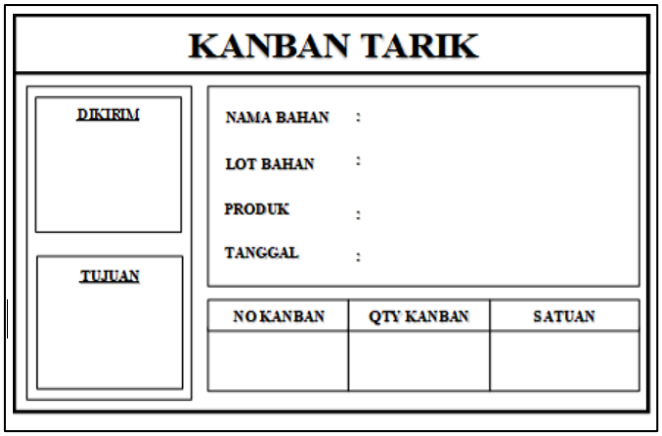

Fig 4: Pull Kanban Card

After designing the Kanban cards, the next step is to add color designs to the Pull Kanban and Production Kanban cards. Below is the table of the color design scheme for Kanbans per day.

Table 2: Kanban Color Scheme per Day

Kanban Color / Day		
No	**Day**	**Color**
1	Monday	Blue
2	Tuesday	Yellow
3	Wednesday	Pink
4	Thrusday	Green
5	Friday	Purple
6	Saturday	Orange
7	Sunday	White

The following is a calcuation and table of Kanban Pull calcuations for one of the production stages of frying chips,

$$K = \frac{(D \times LT) + SS}{WS}$$

$$K = \frac{\left(\frac{100kg}{day} \times 1day\right) + 20\ kg}{2\ hours} = \frac{(100kg + 20kg)}{2\ hours} = \frac{120kg}{2hours} = \ 60kg/hours$$

Table 3: Pull Kanban Calculation Table for Chip Frying Production

Prodcution Stage	**Chip Frying**
Cycle Time (CT)	2 hours
Demand (D)	100 kilograms/day
Safety Stock (SS)	20 kilograms
Lead Time (LT)	1 day
Number of Kanbans (K)	60 kilograms/hour

This, in the chip frying process, 60 kg/hour of Kanbans are required to maintain an efficient production flow and responsiveness to market demand. This calculation can be applied to each stage of chip production to optimize the overall production system. In biscuit production, there are two types of Kanbans calculated: Pull Kanban and Production Kanban.

- *Design of Kanban Stages in Logistics Management Process*

Kanban methods can be designed for inventory and raw material logistics management. Effective raw material management is crucial to ensure smooth chip production processes at PT. XYZ. According to Nuraini et al. (2023), using this method, companies can manage raw material inventory more efficiently and avoid overstock or stockouts.

This Kanban method can also be assimilated with the use of technology to automate raw material inventory checks. According to Susatyo & Triana (2016), companies can integrate ERP systems with Kanban to automatically monitor raw material inventory and send alerts when stocks approach minimum levels. Below is an example table containing Kanban card implementations for raw material inventory management.

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Table 4: Kanban for Raw Material Inventory Management

Cess	Input	Minimum Level	Maximum Level	Batch Order	Delivery Frequency	Technology
Raw Material Selection	Tubers (potatoes, cassava, bananas)	200 kg	1000 kg	800 kg	Daily (JIT)	ERP, RFID
Cleaning and Peeling	Selected tubers	160 kg	800 kg	640 kg	Daily (JIT)	ERP, RFID
Slicing	Cleaned and peeled tubers	140 kg	700 kg	560 kg	Daily (JIT)	ERP, RFID
Washing	Slices of tubers	120 kg	600 kg	480 kg	Daily (JIT)	ERP, RFID
Soaking	Washed slices of tubers	100 kg	500 kg	400 kg	Daily (JIT)	ERP, RFID

Table 5: Finished Product Distribution optimization

Production Stage	Input	Output	Minimum Level	Maximum Level	Batch Shipment	Delivery Frequency	Technology
Frying	Soaked slices of tubers	Fried chips	80 kg	400 kg	320 kg	Daily	ERP, TMS
Oil Filtering	Fried chips	Drained chips	70 kg	350 kg	280 kg	Daily	ERP, TMS
Seasoning	Drained chips	Seasoned chips	60 kg	300 kg	240 kg	Daily	ERP, TMS
Cooling	Seasoned chips	Cooled chips	50 kg	250 kg	200 kg	Daily	ERP, TMS
Packaging	Cooled chips	Packaged chips	40 kg	200 kg	160 kg	Daily	ERP, TMS
Storage and Distribution	Packaged chips	Ready-to-ship products	30 kg	150 kg	120 kg	Daily	ERP, TMS

➢ *Design of Kanban Effectiveness Evaluation*

Kanban effectiveness is measured to evaluate the success of its implementation. The measurement is done by comparing the performance percentage before and after using Kanban. The main goal is to determine how effective the Kanban system is in addressing existing issues. The data used in the test will be analyzed based on the calculation results of raw material delivery processes or various changes that occur during the month before Kanban implementation.

- *Data Collection*

To evaluate the effectiveness of Kanban implementation at PT. XYZ, we collect and analyze relevant quantitative data before and after the Kanban method implementation. The analyzed data includes the following:

Table 6: Comparative Table Design of Performance Indicators Before and After Kanban Implementation

Indicator	Before Kanban	After Kanban
Production Processing Time (days)	xx	xx
Production Error Rate (%)	xx%	xx%
Raw Material Inventory (kg)	xx kg	xx kg
Raw Material Usage Efficiency (%)	xx%	xx%
Employee Productivity (units/hour)	xx	xx

- *Statistical Analysis of Data*

To analyze performance changes, statistical tests such as paired t-tests for paired data or Wilcoxon tests to compare data before and after Kanban implementation can be used. The results of statistical analysis show that:

Table 7: Design Table of Performance Change Analysis Results Before and After Kanban Implementation

Indicator	Change	Significance (p-value)
Production Processing Time	Significant increase/decrease	$p < 0.05$
Production Error Rate	Significant increase/decrease	$p < 0.05$
Raw Material Inventory	Significant increase/decrease	$p < 0.05$
Raw Material Usage Efficiency	Significant increase/decrease	$p < 0.05$
Employee Productivity	Significant increase/decrease	$p < 0.05$

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- *Test Design for Kanban Effectiveness Evaluation*

Below is an example of a test using a table to evaluate the quantitative effectiveness of the Kanban method with hypothetical data.

Table 8: Test Design Table of Comparative Performance Indicators Before and After Kanban Implementation

Indicator	Before Kanban	After Kanban
Production Processing Time (days)	10	6
Production Error Rate (%)	8%	3%
Raw Material Inventory (kg)	1500	900
Raw Material Usage Efficiency (%)	75%	85%
Employee Productivity (units/hour)	50	70

Table 9: Test Design Table of Performance Change Analysis Results Before and After Kanban Implementation

Indicator	Change	Significance (p-value)
Production Processing Time	Significant decrease	$p < 0.05$
Production Error Rate	Significant decrease	$p < 0.05$
Raw Material Inventory	Significant decrease	$p < 0.05$
Raw Material Usage Efficiency	Significant increase	$p < 0.05$
Employee Productivity	Significant increase	$p < 0.05$

Table VIII provides a direct comparison between conditions before and after Kanban implementation. This will help evaluate various critical aspects of company operations. Additionally, the selected indicators reflect efficiency aspects (production processing time, raw material usage efficiency, productivity) and quality (production error rate, raw material inventory). Thus, this table shows how the Kanban system impacts both areas.

Table IX adds a statistical analysis dimension showing whether the observed changes are statistically significant or not. A p-value < 0.05 indicates that the changes observed are not due to chance but are genuinely caused by the Kanban system implementation to enhance evaluation credibility.

V. CONCLUSIONS

Based on the research conducted on the implementation of the Kanban method at PT. XYZ in managing food industry product development projects, it was found that Kanban successfully improved efficiency and production performance by reducing waste of time, enhancing responsiveness to market demands, and improving raw material inventory management. The use of Kanban also made a positive contribution to logistics management by ensuring timely availability of raw materials and optimizing production processes through reduced error rates and increased productivity, demonstrating potential for broader application in enhancing the competitiveness of companies in the food industry.

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