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Production Control Using the Kanban System in the Manufacturing Industry in Indonesia: Systematic Literature Review

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Abstract
The existence of the manufacturing industry in Indonesia is heavily influenced by productivity so that it can compete with other countries. Productivity will not be achieved if the production process workflow does not have a manufacturing system. This is what causes requests from customers not to be fulfilled because there is a production process flow that still has problems with a shortage of raw materials or the quality is still below standard. This study aims to identify and analyze related to the design of work systems in the manufacturing industry in Indonesia so that customer needs can be met according to their requests. This study uses the Systematic Literature Review (SLR) method starting with journal collection, sorting journals according to topic, processing journals, and analyzing articles according to research topics. This study found several journals related to research topics based on a focus on 2016-2023. This research resulted in the year 2022 being the most published research with 5 articles, while based on the type of industry the most frequently found was the type of automotive industry with 6 articles or 30%. The theoretical implications of this research hope to add references for other researchers in their observations on the Kanban system. While realized in practice, this research serves as a guide in improving the production process flow using the Kanban system, to increase productivity in the manufacturing industry.

Keywords: Manufacturing Industry, Just in Time, Kanban System, Productivity, Systematic Review

INTRODUCTION

Manufacturing is a company that produces raw materials into a product using equipment and in large quantities (Realyvásquez-Vargas et al., 2018). In manufacturing, there is a working system consisting of several components that are continuous and mutually support each other to achieve certain goals (Makhmudah et al., 2021). The work system is a series of work procedures that form arrangements regarding a field of work that can affect the increase in work productivity (Sofani et al., 2022). Productivity is production that is produced in a certain amount by considering the improvement in the quality of the product (Kurnia, Jaqin, et al., 2022). Technological developments in the industrial world occur very quickly, increasing the amount of production and the accuracy of delivery requires structured planning and control (Saintika et al., 2021). So the company must make significant improvements to be ready to compete in the future (Jaqin et al., 2023; Sjarifudin et al., 2022).

In general, the problems faced by companies come from internal and external factors (Wiyatno & Kurnia, 2022). Such as the lack of availability of goods resulting in unfulfilled consumer demand (I. Setiawan et al., 2022). Unclear implementation of Standard Operational Procedure (SOP) also results in wasted time, which hinders the production process (Kurnia et al., 2021). This also has an impact on the performance of manpower in meeting the achievement of production targets which will affect work productivity (Santos et al., 2019). One of the efforts made by the company to increase productivity is to use a just-in-time production system (B. Setiawan et al., 2022). The just-in-time method is a concept used for production activities to save on production costs (Chiarini et al., 2018). There are several technical components to

implementing Just in Time, namely: improving quality, reducing setup time, technology groups, workload uniformity, multi-functional workforce, company focus, Kanban, Total Productive Maintenance (TPM), Total Quality Control (TQC) and timely delivery (Salvador et al., 2017).

Based on the explanation above, to achieve Just in Time (JIT) in the manufacturing industry, a Kanban system is needed. The Kanban system is a workflow method used to control the production process to increase the productivity of a company. Kanban is also used to identify products related to lean manufacturing and can improve inventory system design (Kurniawan et al., 2022). Factors that must be considered in controlling the Kanban system include inventory management, supplier participation, improvement, and quality control as well as the commitment of employees and top management (Herdiansyah, 2020). The principle of the Kanban system is that the company provides information media in the form of a visualization board either manually from the operator or automatically outputs the results from the production machine (Lemadi, 2023). This Kanban requirement is to fulfill a controlled internal system, to fulfill JIT from customers who want product delivery according to a pre-made plan (Pratiwi & Santosa, 2019). Meanwhile, to optimize the target of the Kanban system, there must be a talk time check from calculating machine capacity by measuring production time for one product as an experiment (Sumanto & Marita, 2017). Single Minute Exchange of Die (SMED) is a Lean tool that was first introduced by Shigeo Shingo and attempts to minimize the changeover times of production equipment (Gabahne et al., 2014).

Another research on the application of the Kanban system in the service industry makes service applications so that all service users can see their performance results on monitoring television displays (Gurumurthy et al., 2020). In the manufacturing industry, especially the automotive industry, the Kanban system is widely used as a medium of information on the results of achieving productivity for each production line, so that all employees can know their performance achievements (Thadeus & Octavia, 2018). On the other hand, the Kanban system can also act as a medium of reward information for achieving employee performance every day so that employees are motivated in their work (Herdian, Fadhil, et al., 2021). The Kanban system is considered an innovation in increasing productivity performance and a tool for monitoring product fulfillment of customer orders (Mohan Prasad et al., 2020). The success of the Kanban system in various industrial sectors has provided significant benefits to the industry in terms of productivity (Romeira et al., 2021). By using Kanban a project manager can visualize each stage/flow to complete a project (Hartono, 2022). To reduce delays in the process delays in the delivery of parts from the warehouse to the production line due to an unstructured material supply system, resulting in production delays resulting in delays in product completion (Herdian, Fadhil, et al., 2021).

This research focuses on the application of the Kanban system in the manufacturing and service industries in Indonesia in the form of a bibliography that has been carried out by many researchers. The theoretical implications of this research are additional reference insights related to research that takes the theme of implementing the Kanban system in industry. The practical implications can be utilized by manufacturing or service industries in deepening the functions and benefits of the Kanban system in supporting the fulfillment of orders from customers and increasing the motivation or productivity of its employees' performance. The novelty of this study is the systematic review of several articles based on the design of work systems in the implementation of the Kanban system seen from the literature review and the benefits of implementing it in increasing employee performance productivity. This study aims to identify and analyze related to the application of work systems in the Kanban system in various manufacturing companies. With this Kanban system, it is hoped that it can improve the course of the production process increase work productivity, and fulfill product orders from customers.

RESEARCH METHOD

This research is a literature review of various articles related to the design of work systems on the Kanban system in the manufacturing and service industries in Indonesia. The research data includes a collection method with a literature study approach, namely by collecting data from reference journals related to the research topic (Kurnia & Hardi Purba, 2021). A systematic review starts with collecting several articles according to the topic to be taken (Kurnia, 2021).

This study aims to explore more deeply the implementation of the Kanban system in the manufacturing or service industry. The research was conducted using the Google Scholar, Researchgate, ProQuest, and Elsevier databases. The database was chosen because it provides open-access services and provides quality articles (Dias, Indra, Hibarkah, Welly Atikno, 2022). Based on the purpose of this study, the keywords "Just in Time", "Kanban System" and "Manufacturing and Service Industry" were used to search for articles. These keywords were selected based on the topic and purpose of this research. Article searches were limited from 2015 to 2015 2020 to obtain articles that are still new to research. A thorough search of these articles was carried out then the findings were collected and sorted into several categories regarding the implementation of the Kanban system in the manufacturing and service industries. Articles from various sources were studied in various ways to understand how the Kanban system is implemented in the field of production and services, especially studying the application and benefits in the manufacturing and service industries.

The preparation of this paper follows the basic research steps, which include determining the research objectives; conducting a literature review on the application of the Kanban system in the manufacturing and service industries: creating a conceptual framework; conducting analysis and discussion related to mapping of value streams; and identification of gaps and suggestions for future research. This paper has several systematic stages in its preparation which can be seen in Figure 1.

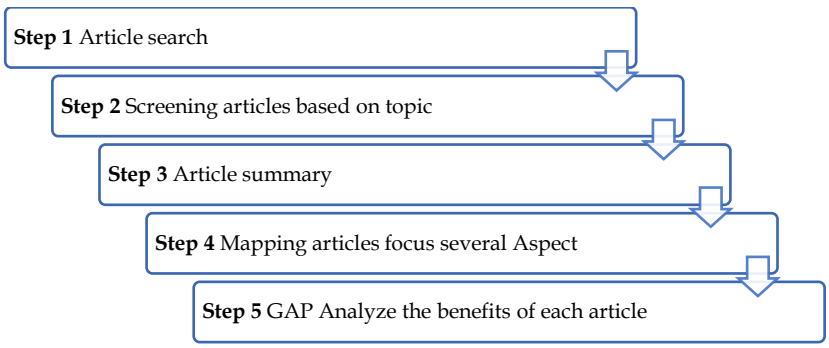

Figure 1. Literature framework study

Based on Figure 1, this scheme also explains how to get the journals needed to become references for other researchers. The explanation of the research in the form of a Systematic Literature Review (SLR) can be explained below.

1. First step: Search for articles with the keywords "Just in Time", "Kanban System" and "Manufacturing and Service Industry." A total of 50 articles related to Kanban system cases were collected and reviewed from all over the world.
2. The second step: screening articles that are not related to the research theme are omitted because they do not follow the topic of the Kanban system in Indonesia. From the results of

the screening, there are 20 articles related to case studies of the application of the Kanban system in the service industry.
3. Third step: article summary of all relevant articles based on each manufacturing or service industry. Then analyze the benefits of each sector.
4. The fourth step: mapping of articles according to the focus of several aspects including the type of industry, year of publication, and area of publication.
5. Fifth step: identify GAP gaps in the summary of the article, and the strengths and weaknesses of the journal Kanban system.

RESULT AND DISCUSSION

In this section, the results of the research will be discussed in the form of identification of journals based on systematic reviews of various journals. Furthermore, it provides information related to the results of data processing in the form of journal data based on those grouped based on several aspects of the review.

3.1 Identification of Journals Based on Systematic Studies

This paper resulted in the screening of 20 papers from a total of 50 papers collected. Before the analysis was carried out, the papers were grouped first so that they were easy to analyze. The following is a summary of each selected paper, which can be seen in Table 1.

Table 1. Identification of journals based on systematic review

No	Author, Year	Object of research	Research result
1	(Dewantoro et al., 2020)	Making agricultural electronic (e)-commerce applications	Facilitate transactions between sellers and consumers in the agricultural sector
2	(Faizah et al., 2019)	Project management application system development	Can visualize each stage or flow to complete a project
3	(Putrawan et al., 2020)	E-Kanban design on the Aileron component assembly line	Streamlining the flow of information and easily accessible by parties involved in the assembly process
4	(Rudi et al., 2021)	Application of lean manufacturing in production lines	Designing a Kanban system that can anticipate the occurrence of a stop line
5	(Kurniawan et al., 2022)	Implementation of work instructions in the inventory system	Can minimize the occurrence of goods parking
6	(Latifa et al., 2021)	Web system for lead time tracking and monitoring	Reducing delays and improving the accuracy of production process data
7	(Hartono, 2022)	School Mapping Information System Design	There is a System User Interface in the Application
8	(Tabah Raharjo et al., 2022)	Changing the push system into a pull system in the production line	There was a decrease in Work in Process (WIP) buildup of 10.5%
9	(Prasetyawati & Damayanti, 2016)	Application of the line balancing method in the production line	Production targets per day can be achieved on time

No	Author, Year	Object of research	Research result
10	(Pratiwi & Santosa, 2019)	Improved improvements in the picking delivery process	There has been an increase in productivity as well as client trust and satisfaction with warehousing and shipping services
11	(Herdiansyah, 2020)	Inventory System design for inventory control	Can reduce lead time and increase productivity during the production process
12	(Rihansyah et al., 2022)	Web development in the form of PHP and MySQL	Reducing cycle times when operators check Re-Order Points (ROP)
13	(Sumanto & Marita, 2017)	Implementation of the just-in-time system in the company	There was a decrease in WIP of 25.85%
14	(Sutisna et al., 2022)	Kanban system in food SMEs	Reducing waste and maximizing value
15	(Thadeus & Octavia, 2018)	Inventory system in the company	There are procedures and provisions contained in work instructions
16	(Tombeg, 2017)	Lean manufacturing approach in the production line	Material supply is faster with the back card
17	(Puar, Zahidi Putra. Siregar, 2017)	E-Kanban system design	E-Kanban is more efficient and effective and has increased 54%
18	(Widodo & Rahardjo, 2023)	Implementation of VSM future state mapping in the pegging process	Production lead time has increased
19	(Zahidah et al., 2017)	VSM's current state mapping in the production process	Minimize buildup of WIP product on oil bottle caps
20	(Herdian, Dayana, et al., 2021)	Application of the JIT system in the packing process	Minimizing the occurrence of stop lines in the packing section

Based on Table 1 it can be seen that this paper summarizes 20 articles related to the implementation of the Kanban system as a whole in various industrial sectors and is summarized based on the identity of the paper, the industrial sector, and the research results obtained.

3.2 Grouping of Articles in Several Aspects

In this paper, articles on the most widely implemented Kanban system that focus on the industrial sector can be seen in Figure 2. Then the most dominant focus based on 2016-2023 can be seen in Figure 3.

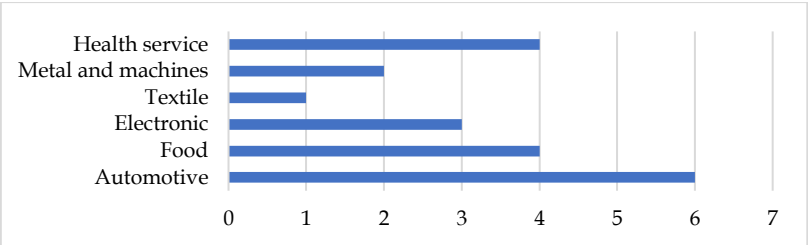

Figure 2. Focus on the industrial sector

Based on the results of the data collection that has been done, the majority of this research takes industrial manufacturing journals concerning the automotive, food, electronic, textile, metal & machine, and service sectors. As seen in Table 1, the most dominating is the automotive

industry with 6 articles with a percentage of 30%. The industrial sector requires work system design to create a more effective and efficient work system to increase work productivity (Sunadi et al., 2021). If applied in the automotive industry, the Kanban system can increase employee performance productivity by 40% and increase product fulfillment of customer orders by 20% (Thadeus & Octavia, 2018). When applied in the food and beverage industry, the Kanban system can analyze the main factors causing failure or defective products on the Kanban monitoring display (Perez-canchanya & Urbina-suarez, 2023). When applied in the healthcare industry, the Kanban system can improve device performance so that the services provided increase (Dewantoro et al., 2020). Meanwhile, the results of the journal collection based on the focus of the research year can be seen in Figure 3.

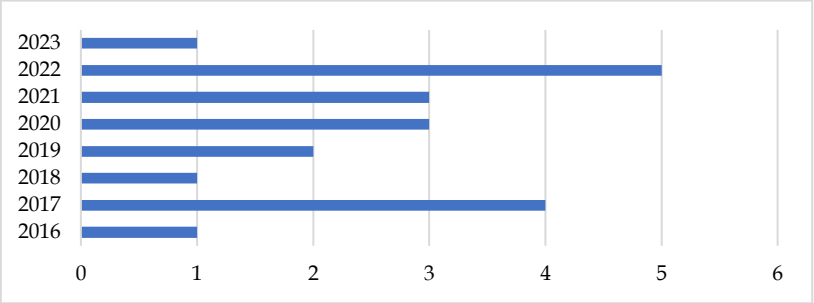

Figure 3. Year of the article publisher

Based on Figure 3, the processing of journals based on the year of publication is the most dominant in 2022 with 5 articles, in 2017 with 4 articles, and in 2021 with 3 articles. In 2022, all countries have started towards epidemic conditions, which means that all industries have started to carry out production on their respective lines (Kurnia, Setiawan, et al., 2022). The automotive industry is starting to rise and develop again, as evidenced by researchers who have started doing research in the automotive industry. Meanwhile, in Indonesia, there are several regions whose industry has started to increase again, especially in Java. Based on the results of journal data processing based on a focus on regions or cities in Indonesia, the results can be seen in Figure 4.

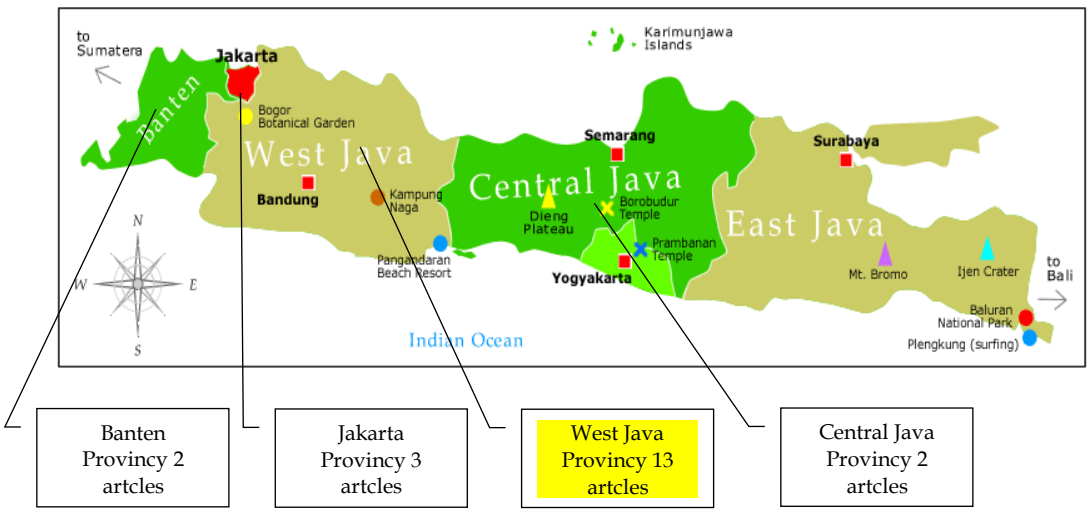

Figure 4. Regional focus in Indonesia

Based on Figure 4 regarding the implementation of the Kanban system in the context of industrial services, this paper finds that the West Java region is an area with a significant contribution. The author notes that the West Java region supplies 13 articles. The West Java and Jakarta regions are also growing in published proportions. These two areas have also made important contributions to the development of knowledge in this field, especially in recent years. Region. The Banten and Central Java regions show a small contribution with 2 articles each.

3.3 Automotive Industry Kanban System Application

The application of the Anban system to the automotive industry is already familiar, almost all automotive companies use it. It is evident from several journal samplings in Indonesia that the most dominant application of the Kanban system is in the automotive industry. Its use provides many benefits to fulfill customer order fulfillment. The characteristics of the Kanban system consist of: each container or pallet has only one Kanban and the Kanban must always be with the part. The amount (quantity) in the container must be the same as the quantity stated in the Kanban. The Kanban post contains the Kanban whose part is being processed when production begins in the downstream process. The transport Kanban is placed at the transport Kanban post to signal the upstream process to send the part. The production Kanban is placed in the production Kanban post in the order in which the parts are used. Production in the upstream process is carried out in the order in the Kanban post (Romeira et al., 2021). To explain the main functions of the e-Kanban system and the interactions that occur between the user and the platform, a use case diagram in Figure 5 is developed. The e-Kanban system consists of 3 main menus and a functional login.

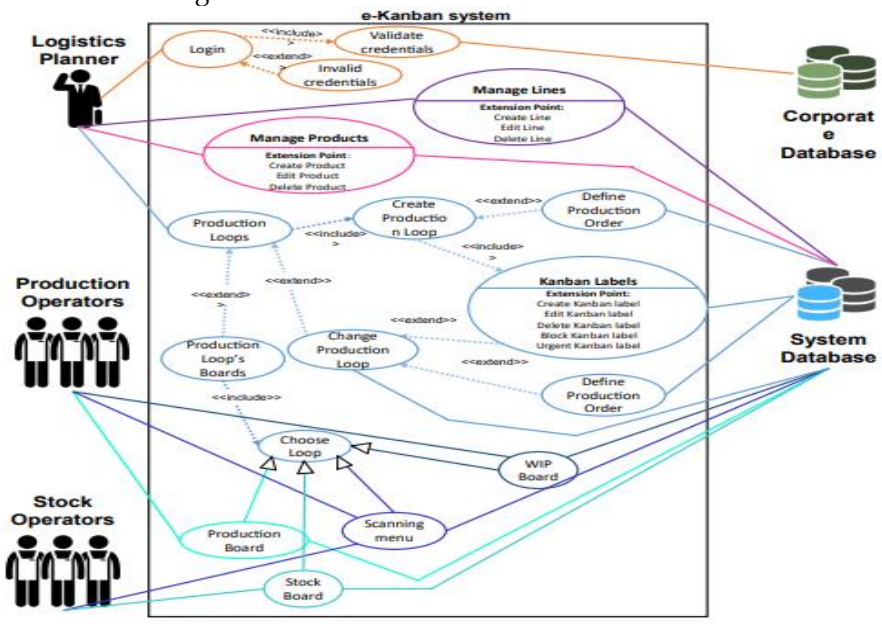

Figure 5. Application of e-Kanban in the automotive industry

Based on Figure 6, every process from upstream to downstream, for example from the logistics center, production process, and product stock in the Warehouse. All goods movements are managed by e-Kanban, and all data is entered by the operators of each section so that all production supervisors can see the movement of goods and the balance of goods on the e-Kanban application. The operator's work is very effective because it is assisted by the e-Kanban system to

retrieve the materials needed to complete the product. If any blocked labels cannot be scanned and therefore cannot be moved to another stage until they are unblocked (Romeira et al., 2021). In terms of data, it can be stopped first because the disposition of the item cannot be used until there is a decision from Management. The specific process of implementing the Kanban system both before the process and after the process can be seen in Figure 6.

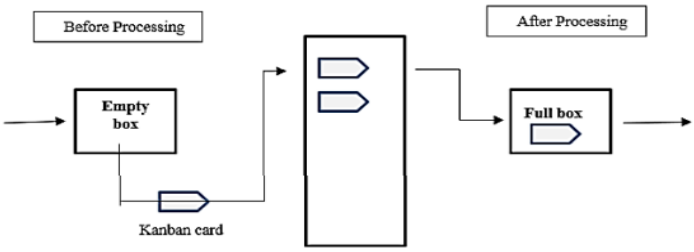

Figure 6. Full system in the material delivery process in the automotive industry

Based on Figure 6 after producing what is needed, the Kanban card is moved again and pasted on the box, indicating the product it is carrying. This full box is ready to be moved to the front. For eg the product that comes out of the injection workstation has to be transferred to the super-injection market for refueling painting machines (Martins et al., 2021).

3.4 Food Industry Kanban System Application

There are two types of applications of the Kanban system in the food industry, consisting of manual Kanban and digitized Kanban. It all depends on the company's budget to invest in Kanban system equipment. For example, the food industry below uses a manual Kanban system by moving materials or products using order cards from customers (Perez-canchanya & Urbina-suarez, 2023). More details regarding the Kanban system manually in the form of a board card can be seen in Figure 7.

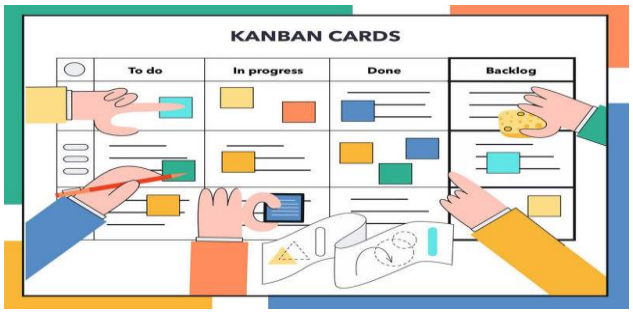

Figure 7. The use of Kanban cards in the food industry

Based on Figure 7, the pull Kanban is the Kanban used for the process of sending raw materials from inventory to the production line. The things that must be on a withdrawn Kanban card so that there are no problems during the preparation and delivery of raw materials. Production Kanban, namely the Kanban used in the production process, the contents of the production Kanban are not all the same as the withdrawal Kanban. After the Kanban card has been designed, the next step is to add designs to the pull Kanban card and the production Kanban card in the form of different coloring for each day. The determination of the number of Kanbans follows the equation for the number of Kanbans issued for certain raw material requests, usually

calculated using a formula (Lemadi, 2023). The calculation for determining the Withdrawal Kanban or production Kanban can be seen in the formula equation:

$$\text{The Whitdrawal Kanban (WK)} = \frac{D}{Q} \quad (1)$$

$$\text{The Production Kanban (PK)} = \frac{D}{Q} \quad (2)$$

Remarks:
WK = Withdrawal Kanban, PK = Production Kanban, D = Demand/Day (Batch), Q = Capacity per pallet.

3.5 Analysis of Strengths and Weaknesses

After identifying various journals, it can be concluded that the application of the Kanban system provides many benefits for organizations within agencies, namely as follows: 1) Facilitates managers in giving rewards and punishments, 2) Clear and directed employee development directions, 3) Facilitates managers in making decisions, 4) Appraisal of work becomes more objective and directed, 5) Increases organizational efficiency, 6) Increases productivity, 7) Improves customer service, 8 Becomes a medium of communication between employees.

In addition to the advantages possessed, it turns out that the application of the Kanban system also has weaknesses. In this work, the appraisal system is less practical because it has to go through a recapitulation process and requires more time than a direct assessment. The process monitoring of the Kanban system increases the work of employees because it requires regular daily recording.

3.6 GAPs in Current Research and the Future Research Agenda

In the current trend, the application of the Kanban system is more widely used in its implementation, measuring production machine performance, measuring production productivity, measuring sales products, and others measuring employee performance or management accountability. Opportunities for further research are that the Kanban system as part of JIT can produce customer satisfaction related to timely delivery with the application of Lean and Green manufacturing for continuity of orders from suppliers to customers. The scheme of the relationship between the Kanban system and customer satisfaction can be seen in Figure 8.

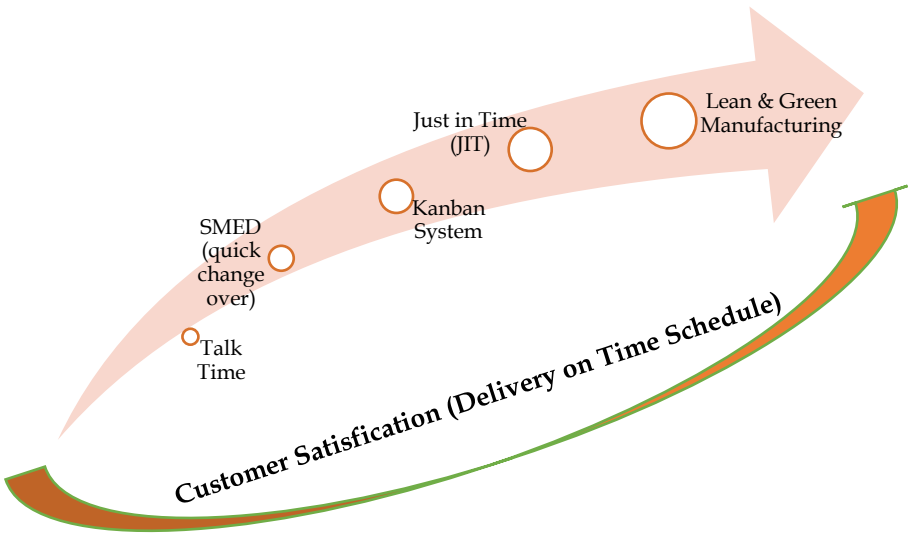

Figure 8. Correlation of the Kanban system with customer satisfaction

3.7 Kanban System Relations with Industry 4.0

In the Industry 4.0 era, all operations are currently IT-based. To manage and address important matters and radical changes in business processes and activities in the context of Industry 4.0, organizations need to have fast reactive capabilities through the agency. This can be achieved with a Performance Measurement System (PMS) which must be appropriate and reflect current digitalization and innovative trends. This PMS must be developed and explored due to changes in technology, business environment, and current processes (Yadav et al., 2018). Currently, the performance measurement system is being developed towards the three main functions of the performance measurement system in the context of Industry 4.0 namely Predictive analytics, Key Performance Indicators (KPI), and Real-time control and decision-making using the e-Kanban system (Kalunga et al., 2020).

The more intensive use of prediction methods in the planning process will help to see real-time data for decision-making because of the need for faster control and decision-making processes (Chauhan et al., 2021). In the industrial era 4.0, many IT-based performance measurements are used in performance measurement. An example is the creation of a monitoring dashboard as a system capable of recording and managing large amounts of data with the help of trends in the Big Data function which is applied in the e-Kanban system (Romeira et al., 2021).

Due to innovative solutions according to Industry 4.0, companies will be able to collect large amounts of data and various information in one system which can later be used when planning and making decisions. It is important to carry out future research into how performance measurement systems reflect: business processes and activities that have not been impacted by IT-based technological innovations. The relationship between the Kanban system and industry 4.0 can be seen in Figure 9.

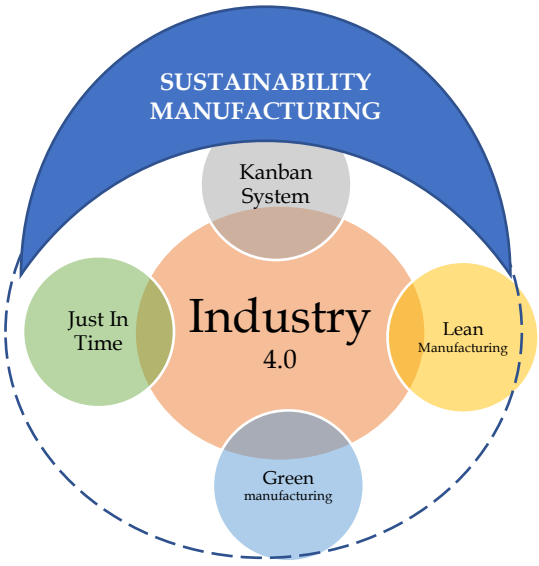

Figure 9. Correlation of the Kanban system with Industry 4.0

Based on Figure 9, the ultimate goal of an organization is sustainability manufacturing for the sustainability of the company, especially in increasing orders received by the company from several customers. The linkage of several applications ranging from the Kanban system, JIT, Lean Manufacturing, and Green Manufacturing is supported by the digitalization of Industry 4.0.

So that the company will get manufacturing efficiency and sustainability in operating the company.

CONCLUSION

Based on the data processing and data analysis that has been done, the results of the research can be concluded. This study has found various systematic aspects of literature review based on a focus on the type of industry, year of publication, and publication area of several journals. The collection of these journals based on research topics is very supportive of Kanban system information which is applied to several industrial sectors such as technology, process sustainability information, and digitalization which are useful in increasing work productivity and getting company efficiency targets.

This research resulted in 2022 being the most published research with 5 articles, while based on the type of industry the most frequently found was the type of automotive industry with 6 articles or 30%. The theoretical implications of this research are expected to add references for other researchers in their observations of the Kanban system. Even though it is realized in practice, this research is a guide in improving the production process flow using the Kanban system, to increase productivity in the manufacturing industry. For further research related to work system design, it is necessary to look more at various industrial sectors and look at development factors related to the industrial world. So that for further research it is hoped that the Kanban system as part of JIT can produce customer satisfaction regarding timely delivery with the application of Lean and Green Manufacturing for continuity of orders from suppliers to customers.

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