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The Effect of the Implementation of TMS Model Edopipdera, Cold Storage, Temperature Sensor, and Automation on the Distribution Efficiency of King Food of PT Dua Putra Perkasa

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Abstract: Problems in the efficiency of cold chain distribution are very important to maintain the quality of frozen food products, but PT DPP King Food still has difficulties in maintaining the right temperature when distributing products. Therefore, the implementation of the TMS model of EDOPIPDERA (Efficiency, Distribution, Operator, Maintenance, Induction, Service, Database, Emergency response, Reporting, and Action) can be a promising solution. The purpose of this study is to analyze the influence of TMS, *Cold storage*, Temperature Sensor, and Automation on Distribution Efficiency. Research methods between qualitative primary data with interviews, observations and as a descriptive quantitative descriptive analysis of secondary data from *libraries* with searches sourced from *e-books, an*alysis of research objects in online library literature. The results of this article: TMS, *Cold Storage,* Temperature Sensor and Automation together with the EDOPIPDERA model affect Distribution Efficiency with R^2 result in 88.8% and the remaining 11.2% affected by other factors.

Keywords: Cold Storage, Distribution Efficiency, Automation, Temperature Sensor, TMS

INTRODUCTION

Background of the Problem

Indonesia has great potential in the food sector, but still faces challenges in the cold chain distribution system (*Cold Chain*). Process *Cold Chain* Includes good production results, keeping products frozen, and safe transportation during delivery (Shi, 2024). In the context of logistics, queue theory is also used to identify sources of congestion and optimize service capacity (Samosir, Kuntohadi, et al., 2020).

Distribution efficiency is an important factor in maintaining logistics performance, especially in the cold chain *industry,* which is highly dependent on temperature stability and delivery speed (Arif Hernawan et al., 2022). According to (Kurniawan Liauw, 2017), efficient distribution can reduce mileage, reduce operational costs, and improve delivery timeliness. Further, (Kurniawan et al., 2023) emphasize that the sustainability of logistics distribution performance can only be achieved through the implementation of an adaptive, integrated distribution system, in line with the findings of the (Samosir, Sijabat, et al., 2020).

Along with technological developments, logistics digitalization has been proven to improve distribution efficiency. Research (Liauw et al., 2018) shows that the application of digital systems such as *Terminal Operating System* able to improve logistics efficiency through automation and data integration, especially in the distribution of frozen food products. This is reinforced by (Liauw et al., 2023) which states that the integration of logistics information systems with queue theory can reduce service congestion and improve distribution efficiency. Studies on the implementation of *Halal Logistics* show that the integration of distribution systems, cold storage, and refrigerated transportation is able to improve the quality of frozen food products (Kurniawan et al., 2023). Route planning and selection of the right mode of transportation play an important role in improving the timeliness and efficiency of distribution (Noviyanti, 2020). In addition, optimizing distribution routes and selecting the right mode of transportation plays an important role in maintaining logistics efficiency (Abdul et al., 2020). Proper handling of warehouse density can improve the smooth flow of goods (Rizaldy et al., 2018).

In practice, King Food PT Dua Putra Perkasa still faces obstacles such as product temperature instability, a suboptimal travel monitoring system, and distribution queues that cause delays. There are several methods that can be used to streamline distribution, including the EDOPIPDERA method (Djadjuli & Naufal, 2025). In this case, EDOPIPDERA can be an integrated approach to overcome these challenges (Kurniawan, 2018).

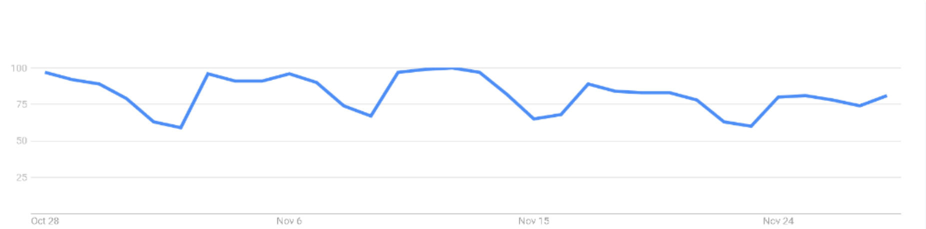

Figure 1.1 Trend Transportation Management System (TMS)
Source : (Google, 2025)

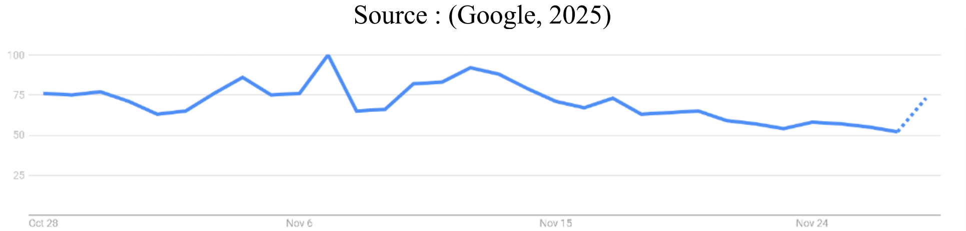

Figure 1.2 Cold Storage Trend
Sources: (Google, 2025)

Figure 1.3 Temperature Sensor Trends
Sources: (Google, 2025)

Figure 1.4 Automation Trends
Sources: (Google, 2025)

Based on the experience of many students and authors, many have difficulty finding supporting articles for their scientific work as references for previous research or relevant research. Relevant articles are needed to strengthen the theory being studied, to see the relationship or influence between variables, and to build hypotheses. This article discusses the effect of TMS, *Cold Storage*, Temperature Sensors, and Automation on Distribution Efficiency, a literature review study in the field of cold supply chains.

Based on the background, the purpose of writing this article is to build a hypothesis for further research, namely to formulate: 1) The Effect of the TMS of the EDOPIPDERA model on Distribution Efficiency; 2) The Effect *of Cold Storage* on Distribution Efficiency; 3) The Effect of Temperature Sensors on Distribution Efficiency; and 4) The Effect of Automation on Distribution Efficiency;

METHOD

The method we use in writing articles is the search and review of relevant information from online sources, such as Google Scholar, Mendeley, and journals. Then we analyzed information using numbers and statistics supported by data processing with 31 respondents and qualifications including age 20-30, gender of men and women, level of education of S1, and work experience working in the cold chain field.

Systematic Literature Review (SLR) is a research approach that is structured and transparent in identifying, selecting, evaluating, and synthesizing various relevant studies to provide a comprehensive and objective picture of a research topic (Teppati Losè & Rinaudo, 2025).

Qualitative research methods focus on meanings, concepts, definitions, characteristics, metaphors, symbols, and various descriptions that describe the depth of a fact or event with interviews and observations in the field, so that the results are local and not intended for generalization; In contrast, quantitative research methods emphasize quantity and size, attempting to unravel the breadth of findings and generalize them as empirical facts that apply more generally. (Firmansyah et al., 2021)

Methods used Structural Equation Modeling (SEM) namely statistical techniques to combine factor analysis and path analysis to test and examine the pattern of causal relationships (Ul Haq et al., 2024). SEM can be used to describe a simultaneous linear relationship between an observed variable (an indicator) and a variable that cannot be directly measured (a latent variable)

According to (Sofyani, 2025) Partial Least Square (PLS) is one of the alternative solutions or methods of model estimation to manage SEM modeling with reflective or formative indicators. PLS was created to overcome the limitations that exist in the SEM method.

According to (Muhammad et al., 2023) Structural Equation Modelling-Partial Least Square (SEM-PLS) is a powerful method of analysis because it allows modeling of structural equations assuming that the data used does not have to be normally distributed, SEM-PLS can use a relatively small sample size, and the indicators used are reflective, formative, or a combination of both.

RESULTS AND DISCUSSION

Results

Based on the background, objectives and methods, the results of this article are as follows:

TMS

Transportation Management System (TMS) is software or systems used to manage, optimize, and monitor the transportation process of goods, including route planning, shipment tracking, and integration with the supply chain (Ranjangaonkar, 2024).

Research (Liauw et al., 2018.) shows that the implementation of the Terminal Operating System improves service accuracy and accelerates port operations, thus proving the important role of transportation management systems in logistics efficiency. This factor is especially important in cold chain distribution applications where safety, delivery duration, and consistency are vital (Zhu et al., 2023).

Dimensions, indicators, synthesis or factors affecting the TMS based on delivery time, shipping costs and resource utilization are recorded by (Ranjangaonkar, 2024)

This TMS has been researched a lot, including (Dorofeev et al., 2024), (Liauw et al., 2018.) and (Ranjangaonkar, 2024).

Cold Storage

Cold Storage is a device consisting of a building and a cooling machine that accommodates objects that will undergo a cooling process (Al Maqbali et al., 2023). Effectiveness *Cold Storage* greatly affect the quality of the product that will be passed on to the next stage of distribution.

In the journal (Mulyaningtyas et al., 2020) states that cold warehouses play a crucial role in the cold chain by reducing the rate of product damage and improving logistics efficiency.

According to (Scott, 2024) dimensions, indicators, synthesis or factors that affect the *Cold Storage* are temperature stability, equipment reliability, and storage quality.

Cold Storage This has been researched a lot by previous researchers, including the (Al Maqbali et al., 2023) and (Mulyaningtyas et al., 2020).

Temperature sensor

Temperature sensors are sensors to record temperature in a timely manner *real-time*, as part of the storage system *Cold Chain* This shows that the temperature sensor functions to measure and monitor the storage temperature continuously to maintain product quality and safety (Mulyaningtyas et al., 2020).

Temperature sensors can measure and monitor the temperature conditions of the storage or shipping environment at regular intervals to detect temperature deviations that may compromise product quality (Gillespie et al., 2023).

According to (Susanto et al., 2021) Dimensions, indicators, synthesis or factors that affect the temperature sensor are real-time monitoring, accuracy and temperature stability.

This temperature sensor has been researched a lot by previous researchers, including (Mulyaningtyas et al., 2020), (Gillespie et al., 2023) and (Susanto et al., 2021).

Automation

Automation is a system in which both physical processes and information flows in logistics operations and supply chain management are transferred from human manual control to automated machines or systems (Hermawan et al., 2023).

Automation is the application of automated technology in the supply chain and logistics to replace manual human intervention so that logistics systems become more effective, reduce human error, speed up distribution flows, and support cost optimization and delivery time (Atieh et al., 2025).

According to (Helo & Thai, 2024) Dimensions, indicators, synthesis or factors that affect automation are the reduction of manual activities, speed and operational consistency.

This automation has been researched a lot by previous researchers, including (Hermawan et al., 2023), (Atieh et al., 2025), and (Helo & Thai, 2024)

Distribution Efficiency

Distribution efficiency is a characteristic of a distribution system that is able to optimally meet the demand for delivery of goods from source to final destination with ideal delivery times, minimal logistics costs, and a high level of delivery reliability so that services remain consistent and satisfy customers (Tian et al., 2024).

According to (Ayubi & Sari, 2023) Distribution efficiency involves integrating logistics management, transportation infrastructure, and information technology. Elements such as logistics information systems, infrastructure quality, and supply chain coordination have been proven to have an important influence on the efficiency level of distribution implementation.

According to (Li et al., 2023) dimensions, indicators, synthesis or factors that affect distribution efficiency, namely distribution costs, optimal distribution routes and time speed.

The efficiency of this distribution has been researched by many previous researchers, including (Tian et al., 2024) (Ayubi & Sari, 2023) (Li et al., 2023)

Relevant Article Review

Analyze the literature related to the foundation to determine the research hypothesis by describing the findings of previous research, as well as describing the similarities and differences with the research design based on relevant previous research, as shown in table 1 below.

Table 4.1: Relevant Research Results

Yes	Author (Year)	Previous Research Results	Similarities To This Article	Differences With This Article	H
1	(Julian, 2025)	TMS and FMS have a positive and significant impact on Distribution Efficiency	TMS affects Distribution Efficiency	FMS affects Distribution Efficiency	H1
2	(Kalyca Prima et al., 2024)	TMS and Cloud Computing have a positive and significant impact on Distribution Efficiency	TMS affects Distribution Efficiency	Cloud Computing Affects Distribution Efficiency	H1
3	(Mustafa et al., 2024)	Cold Storage and Blockchain have a positive and significant impact on Distribution Efficiency	Cold Storage affects Distribution Efficiency	Blockchain affects Distribution Efficiency	H2
4	(Faizah et al., 2023)	Cold Storage and Air Blast Freezer have a positive and significant impact on Distribution Efficiency	Cold Storage affects Distribution Efficiency	Air Blast Freezer has an effect on Distribution Efficiency	H2

5	(Cil et al., 2022)	Temperature sensors and Wireless Sensor Networks (WSN) have a positive and significant impact on Distribution Efficiency	Temperature sensor affects Distribution Efficiency	Wireless Sensor Networks (WSN) Affect Distribution Efficiency	H3
6	(Kusuma Budi et al., 2022)	Temperature and Blynk sensors have a positive and significant impact on Distribution Efficiency	Temperature sensor affects Distribution Efficiency	Blynk has an effect on Distribution Efficiency	H3
7	(Kalila Maysa Amadia et al., 2025)	Automation and WMS have a positive and significant impact on Distribution Efficiency	Automation affects Distribution Efficiency	WMS affects Distribution Efficiency	H4
8	(Enoch Oluwademilade Sodiya et al., 2024)	Automation and AI have a positive and significant impact on Distribution Efficiency	Automation affects Distribution Efficiency	AI affects Distribution Efficiency	H4

Discussion

Based on the theoretical study, the discussion of *this literature review* article is to review relevant articles**,** analyze the influence between variables and make conceptual thinking of the research plan:

State of the Art:

Based on the results of the research, there are differences and novelties with the previous research article, from several variables X (extrogenous variables) that make this article different, so that any variable is shown as a differentiator. The main focus of this research article example lies in three important things, namely: (1) How TMS with the EDOPIPDERA model affects Distribution Efficiency (2) How *Cold Storage* can maintain product quality in distribution efficiency (3) how temperature sensors can monitor conditions in distribution, as well as (4) how automation can speed up delivery in distribution. The four are advanced technology elements that have a direct impact on Distribution Efficiency at PT Dua Putra Perkasa, and become **Updates** (**State of the Art**) which has not been specifically researched specifically in relation to Cold Chain Distribution Efficiency.

The novelty (**State of the Art**) of this sample research article lies in its focus on improving distribution efficiency in cold chain networks. This approach emphasizes the importance of integration between distribution planning, temperature control, frozen product storage, and faster and more accurate operational workflows. Thus, this study is expected to be the foundation for the development of a more comprehensive EDOPIPDERA model. This model includes the utilization of technology, efficiency in the supply chain, as well as the improvement of Distribution Efficiency in the Cold Chain network.

Based on the results of the research, the discussion *of this* article is to review relevant articles**,** analyze the influence between variables and make conceptual thinking of the research plan:

The Effect of TMS on Distribution Efficiency.

TMS with the EDOPIPDERA model is Automation in the field of logistics and supply chain management is about moving the control of physical processes and information flows that were previously carried out by humans to be fully managed by machines or automated technology systems

The principle or concept of TMS is to help companies or organizations to increase the amount of production in a certain time, speed up the work process, maximize the utilization of labor and materials, so as to overall increase efficiency and effectiveness in manufacturing products or providing services.

TMS affects Distribution Efficiency, if TMS is perceived well, then Distribution Efficiency will be perceived well. It can be explained that the indicators of Distribution Efficiency are safety, delivery duration, and consistency.

The factors that affect TMS with the EDOPIPDERA model are 1) Data and information: data and information must be accurate so that mistakes do not occur. 2) Planning and routes: traffic conditions, distance, and travel time affect route planning. 3) Integration with other systems: TMS must integrate with other systems to be effective. This can be explained that TMS is an indicator of Distribution Efficiency.

TMS affects Distribution Efficiency, this is in line with research conducted by: (Dorofeev et al., 2024),(Liauw et al., 2018.), (Ranjangaonkar, 2024), and (Zhu et al., 2023),

The Effect of Cold Storage on Distribution Efficiency.

Cold Storage is a large, low-temperature storage space that uses a refrigeration system to keep products such as meat fresh, quality, and last longer without damage.

The principles or concepts of *Cold Storage* are to help improve distribution efficiency by maintaining quality and extending the shelf life of products through low temperature control.

Cold Storage affects Distribution Efficiency, if *Cold Storage* is well perceived, then Distribution Efficiency will be perceived well. It can be explained that *Cold Storage* is an indicator of Distribution Efficiency.

The factors that affect *Cold Storage* are 1) Temperature and humidity are stable so that the product is not damaged, 2) Overloaded Storage Capacity can reduce cooling performance, 3) Good air circulation can maintain an even temperature

Cold Storage plays a role in Distribution Efficiency, this is in line with research conducted by: (Collins et al., 2021), (Alamsyah, 2022), (Al Maqbali et al., 2023) and (Mulyaningtyas et al., 2020).

Effect of temperature sensors on distribution efficiency.

A temperature sensor is a device that converts temperature changes into electrical signals to be monitored. In the monitoring system, this sensor ensures accurate and real-time temperature monitoring, especially in cold storage, so that the quality of materials is maintained without the need for manual checks thanks to integration with IoT technology.

The principles or concepts of temperature sensors include real-time monitoring, the ability to connect to systems such as IoT, as well as providing early warnings when temperatures are not suitable. Thus, the temperature sensor helps to keep the quality of the product under control.

Temperature sensors affect the Distribution Efficiency, if the temperature sensor is well perceived, the Distribution Efficiency will be perceived well. It can be explained that the temperature sensor is an indicator of Distribution Efficiency

The factors that affect the temperature sensor are 1) Sensor type: Each type has different sensitivity and accuracy. 2) Measurement environment: Humidity, dust, and vibration can affect the results. 3) Calibration: Uncalibrated sensors may produce inaccurate data.

Temperature sensors play a role in Distribution Efficiency, this is in line with research conducted by: (Chuzaini & Dzulkiflih, 2022), (Harahap & Hakim, 2023), (Mulyaningtyas et al., 2020), and (Gillespie et al., 2023)

The Effect of Automation on Distribution Efficiency.

Automation is the use of specialized technology and equipment to run work or production processes in an iterative manner without much human intervention. The system is implemented to improve efficiency and productivity, especially in mass production, through faster, precise, and consistent operation.

The principles or concepts of Automation are working by utilizing specialized technology and equipment to run repetitive work processes consistently. These systems improve efficiency and productivity by speeding up workflows, reducing human intervention, and lowering production costs in the long run. Through the integration of various process stages, automation results in more accurate, fast, and structured operations.

Automation affects Distribution Efficiency, if Automation is perceived well, Distribution Efficiency will be perceived well. It can be explained that Automation is an indicator of Distribution Efficiency.

The factors that affect Automation are 1) Technology quality: The better the automation system, the faster and more accurate the distribution process, 2) System integration: Automation connected to TMS, WMS, or IoT improves coordination and monitoring, 3) HR competence: Trained operators ensure the system runs optimally.

Automation plays a role in Distribution Efficiency, this is in line with research conducted by: (Ginting, 2024), (Jambak et al., 2024), (Hermawan et al., 2023), (Atieh et al., 2025), and (Helo & Thai, 2024)

CONCLUSION

From the results and discussion, it can be concluded that the TMS Variable, Cold Storage, Temperature Sensor and Automation have a simultaneous effect on the Distribution Efficiency Variable at the Company's location researched by PT Dua Putra Perkasa, where the conclusion of this article is to formulate a hypothesis for further research.

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DESCRIPTION OF TABLES AND FIGURES

Research Conceptual Framework

Based on the formulation of the problem, relevant research and discussion, then in the conceptual framework of this article as in figure 1.

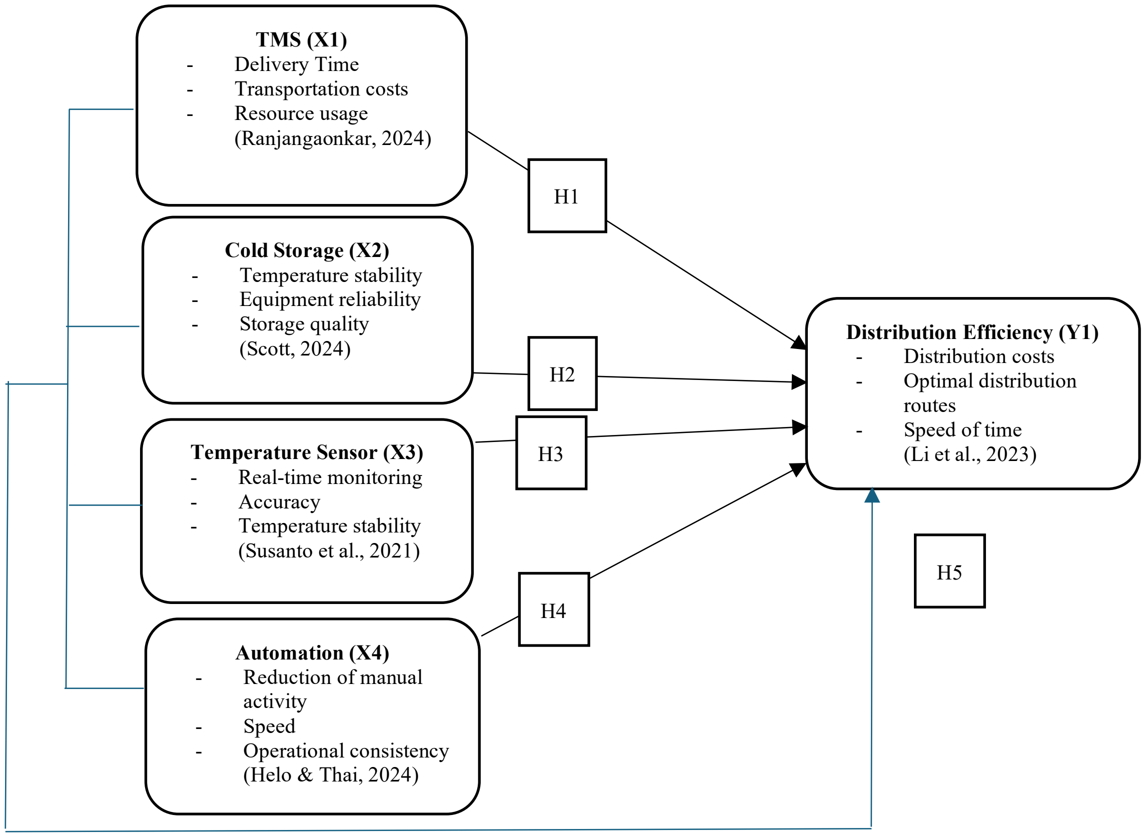

Figure 4.1: Conceptual Framework
Source : Researcher, 2025

Based on the conceptual framework image above, then: TMS, Cold Storage, Temperature Sensor, and Automation affect Distribution Efficiency. Apart from the four exogenous variables that affect Distribution Efficiency, there are many other variables, including:

1) x5: FMS (Julian, 2025)
2) x6: Blockchain (Mustafa et al., 2024)
3) x7: Wireless Sensor Networks (WSN) (Cil et al., 2022)
4) x8: WMS (Kalila Maysa Amadia et al., 2025)

Testing Measurement Model (Outer Model)

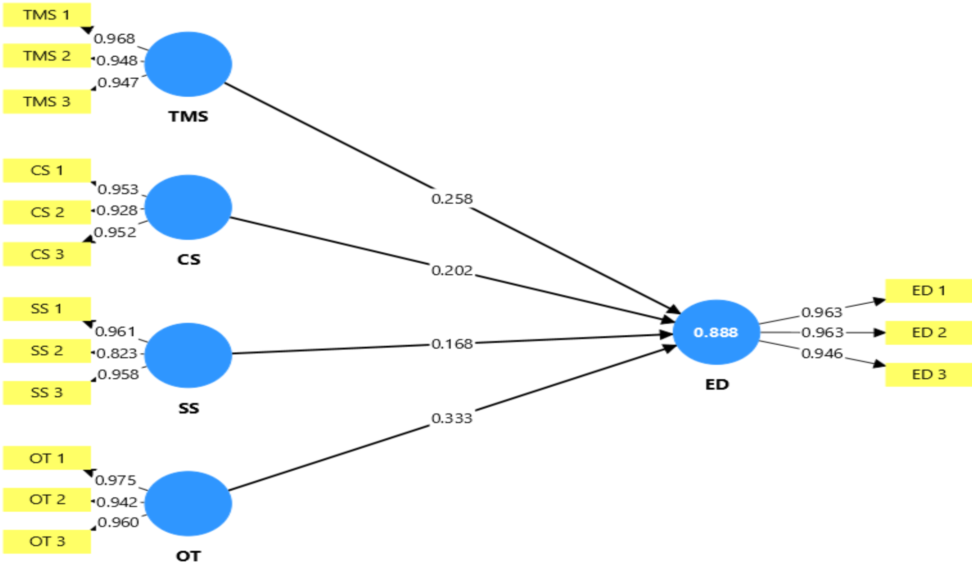

Figure 4.2 : Testing the Measurement Model (Outer Model)

AVE (Average Variance Extracted) analysis in structural Equition modeling (SEM) plays an important role in determining the convergent validity of the measured constructors. The AVE value measures how much variation or diversity is captured by the constructor relative to the variation caused by measurement errors. Based on the diagram given, it can be seen that the loading factor values for all indicators (TMS 1, TMS 2, TMS 3, CS 1, CS 2, CS 3, SS 1, SS 2, SS 3, OT 1, OT 2, OT 3, ED 1, ED 2, ED 3). This shows that the indicators have a strong correlation with the constructors they measure, making them eligible for convergent validity.

The constructors analyzed include Tansport Management System (TMS) with indicators TMS 1 to TMS 3 and loading factors between 0.968 to 0.947, Cold Storage (CS) with indicators CS 1 to CS 3 and loading factors between 0.953 to 0.952, Temperature Sensor (SS) with indicators SS 1 to SS 3 and loading factors between 0.961 to 0.958, Automation (OT) with indicators OT 1 to OT 3 and loading factor between 0.975 to 0.960 and Distribution Efficiency (ED) with indicators ED 1 to ED 3 and loading factor between 0.963 to 0.946. AVE is calculated as the average of the square of the factor loading of each indicator in the constructor, and to meet the criteria for convergent validity, the AVE value must be greater than 0.5, which means that more than 50% of the indicator variants can be explained by the constructor.

The diagram also shows the relationships between constructors with values of 0.258, 0.202, 0.168, and 0.333 indicating connections between constructors. A value of 0.888 on "distribution efficiency" indicates a level of variability that can be explained by other constructors. Overall, this diagram indicates that all indicators have a loading factor above 0.7, indicating that the constructors are valid in measuring what they should ukur.ini to reinforce the convective quality of the constructors used in this study.

Results of the Discriminant Validity Test

Table 4.2 Discriminatory Validity

	TMS	Cold Storge	Temperature Sensor	Automation	Distribution Efficiency
TMS		1.027	0.978	1.001	0.968
Cold Storage					

Temperature Sensor	0.991		1.012	0.964
Automation		1.015		0.974
Distribution Efficiency	0.978			

Source: Processed by Researchers Using SmartPLS

The correlation value of each construct is quite large, so it can be concluded that latent constructs predict the size of their blocks (measurement dimensions) better.

Composite Reliability Test Results

Table 4.3 Composite Reliability

	Cronbach's alpha	Rho_A	Composite Reliability	Average Variance Extracted (AVE)
TMS	0.951	0.955	0.968	0.911
Cold Storage	0.939	0.939	0.961	0.891
Temperature Sensor	0.903	0.934	0.940	0.839
Automation	0.957	0.958	0.972	0.920
Distribution Efficiency	0.955	0.955	0.971	0.917

Source: Processed by Researchers Using SmartPLS

The reliability of composite data is considered very reliable if the reliability of the composite is greater than 0.6.

Table 4.4 Crossloading

	TMS	Cold Storage	Temperature Sensor	Automation	Distribution Efficiency
TMS 1	0.968	0.912	0.894	0.947	0.935
TMS 2	0.948	0.929	0.822	0.876	0.824
TMS 3	0.947	0.937	0.901	0.906	0.882
CS 1	0.917	0.953	0.844	0.916	0.878
CS 2	0,931	0.928	0.885	0.879	0.879
CS 3	0,898	0.952	0.882	0.929	0.867
SS 1	0.910	0.926	0.961	0.961	0.927
SS 2	0.695	0.677	0.823	0.664	0.661
SS 3	0.888	0.903	0.958	0.955	0.875
OT 1	0.906	0.926	0.915	0.975	0.890
OT 2	0.956	0.935	0.932	0.942	0.858
OT 3	0.888	0.908	0.896	0.960	0.934
ED 1	0.864	0.859	0.854	0.880	0.963
ED 2	0.897	0.899	0.825	0.853	0.963
ED 3	0.894	0.902	0,923	0.943	0.946

Source: Processed by Researchers Using SmartPLS

Cronbach Alpha

Table 4.5 Cronbach's alpha

	Cronbach's alpha
TMS	0.951
Cold Storage	0.939
Temperature Sensor	0.903
Automation	0.957
Distribution Efficiency	0.955

Source: Processed by Researchers Using SmartPLS

Declaring a value that the TMS variable alpha (α) is 0.951 or is included in the high reliability category, the Cold Storage Variable with a value of (α) 0.939 is included in the high reliability category, the temperature sensor variable with a value (α) 0.903 is included in the high reliability category, the Automation variable with a value of (α) 0.957 is included in the high reliability category The Distribution Efficiency Variable with a value of (α) 0.955 and is included in the category of having high reliability (Ayu & Rosli, 2020)

Evaluation of Structural Models (Inner Model)

Table 4.6 : *R-Square*

	R-Square	R-Square adjusted
Distribution Efficiency	0,888	0,871

Source: Processed by Researchers Using SmartPLS

Table 4.7: T-Count

	Original Sample (O)	***Sample Mean (M)***	***Standard Deviation (STDEV)***	***T Statistics (|O/STDEV|)***	***P Values***
TMS -> Distribution Efficiency	0.311	0.334	0.441	0.704	0.483
Cold Storage -> Distribution Efficiency	0.202	0.204	0.325	0.620	0.537
Temperature Sensor -> Distribution Efficiency	0.505	0.346	0.410	1.231	0.221
Automation -> Distribution Efficiency	0.333	0.012	0.574	0.580	0.563

Source: Processed by Researchers Using SmartPLS

The value at 0.888 in the table above indicates that the model has a good correlation. A value of 0.888 or 88.8% states that TMS, Cold Storage, Temperature Sensor and Automation variables contribute 88.8%, to the formation of the tendency of the Distribution Efficiency Variable is still 11.2% influenced by other factors that are not discussed and included in this study (Aziz et al., 2021).

It can be seen that of the three measurement variables are significant and the significant values are:

1. The TMS variable has an influence coefficient of 0.311 on Distribution Efficiency. The resulting T-calculation value was 0.704, smaller than the T-table (1.677), and the significance value of p was 0.483 (>0.05). Thus, it can be concluded that the effect of TMS on Distribution Efficiency is not statistically significant. Despite the positive direction of influence, TMS has not been shown to have a significant impact on Distribution Efficiency. The standard deviation of this variable is 0.441.

2. The Cold Storage variable showed a positive influence on Distribution Efficiency with a coefficient value of 0.202. However, the T-calculated value of 0.620 is smaller than the T-table (1.677), and the significance value of p is 0.537 which is greater than 0.05. This shows that the effect of Cold Storage on Distribution Efficiency is not statistically significant. Thus, despite the positive direction of influence, Cold Storage has not been proven to have a meaningful influence on Distribution Efficiency. The standard deviation of this variable is 0.325.
3. The Temperature Sensor variable showed a relatively greater positive influence than the other variables, with a coefficient of 0.505. However, the T-calculated value of 1.231 is still smaller than the T-table (1.677), and the p-value of 0.221 is greater than 0.05. This indicates that the influence of Temperature Sensors on Distribution Efficiency is not statistically significant. Nonetheless, a positive direction of influence shows the potential contribution of Temperature Sensors to Distribution Efficiency. The standard deviation of this variable is 0.410.
4. The Automation variable has an influence coefficient of 0.333 on Distribution Efficiency. The T value obtained was recorded at 0.580, which is lower when compared to the T-table (1.677), with a p value of 0.563 (>0.05). These results show that the effect of Automation on Distribution Efficiency is not statistically significant. As such, Automation has not been able to explain the significant change in Distribution Efficiency. The standard deviation for this variable was recorded at 0.574.

With a Q-square value of 0.888 greater than 0, this indicates that the structure model has accurate predictive capabilities. This means that there is a significant correlation between the dependent variables, showing good alignment in the model.bBy looking at these values, it can be concluded that this study has good or good observation values. (Aziz et al., 2021)