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Analysis of Production Control, Quality Control, and Total Quality Management Against Product Failure

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ABSTRACT

Product quality and productivity are the keys to success for various production systems in the manufacturing world. The phenomenon that occurs in the production process at a manufacturing company located in the Jababeka I Cikarang industrial area is product failure because it does not comply with the standards set by the company. Continuous improvement needs to be done in both production control and quality control, and the implementation of Total Quality Management to reduce the number of product failures and the delivery of OK products to the next process is timely. This study aims to determine how much influence production control and quality control have on the quantity of failed products and how much influence the implementation of total quality management has on Product Failure in the Machining Department. The type of research used is quantitative, and research data were obtained from a sample of 150 respondents. Employees are selected randomly and proportionally in the production department. Data collection includes observation, distributing questionnaires, and literature study. Data processing using the Equation Modeling (SEM) program using the AMOS V.24 program. This study found that Production Control, Quality Control, Total Quality Management have a significant effect on Product Failure. The analysis of the full model shows the study results that the full model meets the goodness of fit. The results of the CR and VE tests showed that the value of (CR & VE) 1st CFA of the Production Control variable (1.0 & 0.9); 1st CFA Quality Control Variable (0.8 & 0.6); 1nd CFA variable Total Quality Management (0.9 & 0.7) and 1nd CFA variable Product Failure (0.7 & 0.6). Hypothesis testing shows results by following under theoretical studies that Production Control, Quality Control, Total Quality Management have a significant effect on Product Failure.

Keywords: Production Control, Quality Control, TQM.

INTRODUCTION

The development of the business world that is currently happening in the fields of trade, manufacturing/industry, and services, supported by the development of science and technology, encourages the business world of free trade areas with fairly tight competition at this time. The free market requires companies to place and maintain the quality of their products intense global market competition. A Competition that occurs today is due to the large number of products offered by manufacturers with brands, models, quality, price differences, etc. Companies must remain competitive and survive in the global market; producers are required to understand products (goods and services) that can meet consumer needs and satisfy consumer needs. Product quality and productivity are the keys to success for various production systems (Cyrilla 2012).

The manufacturing production process always strives for zero defects (no defective products), but it is difficult to avoid product failures in the production process, which will indirectly cause losses for the company. To minimize losses that will occur from things like that, it is necessary to have good cooperation between management and the employees concerned. In addition, the losses that occur must be accounted for through a reporting system so that better control can be implemented over these losses (Carter 2009).

Problems in the form of product failure or NG can occur in the production process of manufacturing companies engaged in the automotive brake system and aluminum casting parts for two and 4-wheeled motorized vehicles. According to the standards set by the company. Achieving the increasing number of failed products requires the Internal Production Department to make repairs as quickly as possible. However, the fact shows that from the data on the number of products produced by the Machining Department, there are still failed products that exceed the tolerance limits set by the company in every production activity as it is known that the annual target of rejecting all product lines is 0.29% of the entire production line of the Machining Department.

From 2017 to 2019, the achievement of internal reject for all lines experienced increased product failures. Therefore, from the data on the achievement of internal rejects, the condition of the Production Department needs to be improved and further investigated. This condition can occur because product failures in the Production Department have increased, making the delivery of OK products to the Department of the next process hampered.

The emergence of the above problems shows that production control, quality control, and Total Quality Management in companies in the Jababeka I area have not been fully implemented effectively to improve quality performance as expected. The involvement of all workers, the process approach, the procedural approach, the management system approach, continuous improvement, fact-based decisions, and mutually beneficial relationships with suppliers require a change in the work culture of all levels of workers.

Literature Review

In achieving company goals, many factors can affect the company's success in achieving these goals, one of the important factors in supporting the success of achieving company goals is the quality factor. Quality plays a very big role in supporting the smooth operation of the company's products so that quality needs to get serious special monitoring. Assauri (2011) expressed an opinion in his book "Production and Operations Management" stated: Control is an activity that ensures whether policies in terms of quality (standards) are reflected in the final result, in other words, production control makes efforts to maintain the quality or quality of the goods produced—produced by following per product specifications that have been determined based on company leadership policies.

Quality Control

Assauri (2011) suggests several indicators in quality control, including process capability, product specifications, incompatibility. Companies in the production process must check the product by sampling using 7 Quality Control Tools to know how much the process capability in producing products that comply with standards. Companies are also required to experiment (trial) produced products with good function. The company is carrying out the production process, which then produces the product, and the company ensures that the product produced meets the product quality standard specifications. The purpose of quality control is to reduce products that have the substandard quality to a minimum. The level of control applied depends on the quantity of product below the acceptable standard. The resulting product is adapted to the standards set and approved (approved) by the customer, and the customer needs to limit the product sample as a reference when there is a discrepancy or deviation from the product.

Total Quality Management (TQM)

A quality management system that focuses on customers (customer-focused) by involving all employees in making continuous improvements or improvements. A way to improve performance (performance) continuously at every level of operation or process, in every functional area of an organization, by using all available human and capital resources (Dinata 2016). Total Quality Management uses effective strategy, data, and communication to integrate the quality discipline into the company's culture and activities. All members of the organization or employees of the company in the implementation of Total Quality Management must actively participate in making improvements to processes, products, services, and culture to produce the best quality in achieving customer satisfaction (customer satisfaction). Gaspersz (2001), in his book, suggests that Total Quality Management is an activity of the overall management function, which determines quality policies, objectives, and responsibilities and implements them through tools, such as quality planning, quality control, quality assurance, and quality improvement.

Product Failure

Product development is the top priority; by producing quality products, these products become marketable. The second priority is to avoid product failure during production activities; if the resulting product is damaged or defective, consumers will switch to competing products whose product quality is not damaged or not defective. Action to reduce failure in the field has become a very urgent need; the success of service companies and business processes depends on the continuous operation of their equipment to produce products that meet the wishes of the company or customers. Juran stated in his book "Juran On Leadership For Quality" Product failure is "Product failures that can occur internally or externally, internal failures can be proven by rework (repair), delays and waste of raw materials, while external failures are additional costs. For the company as well as for the client. (Purwaji, Agus, Wibowo and Sabarudin 2016) Those damaged products do not meet quality standards, which technically and economically cannot be repaired. In technical terms, products that have physical damage cannot be repaired. From some of these opinions, it can be said that a failed product is a product that does not meet the standards, so that it must be discarded or sold at a price far below the selling price of the final product.

Structural Equation Model (SEM)

The analysis technique used to interpret and analyze the data in this study is Structural Equation Modeling (SEM). Structural Equation Modeling (SEM) is a system of modeling the effects of two or more variables. Sem is a continuation of linear regression (or linear regression in the special case of SEM) in several many regression equations calculated simultaneously (Lodewijks 2008). SEM analysis aims to examine the relationships between complex variables to find a comprehensive picture of the whole model. The variables in question consist of latent variables and observation variables. The latent variable is a variable formed from several proxies which are formulated as observed variables. Observed variables are observed and measured variables that can form a new variable (surrogate or latent variable) (Ferdinand 2014). Unlike ordinary multivariate analysis (multiple regression and factor analysis), SEM can perform joint tests, namely the structural model that measures the relationship between the independent construct and the dependent construct and the measurement model that measures the relationship (loading value) between indicator variable with a constructor latent variable (Ramadiani 2010)

METHOD

This type of research is a quantitative descriptive study to obtain an overview of the effect of production control, quality control, and total quality management on product failure in manufacturing companies in the Jababeka Satu area. In addition, this research includes studies explanation (explanatory research), the research to explain the relationships between two or more symptoms or variables that were analyzed and tested hypotheses have been formulated previously (Silalahi 2012).

Research design

Research design is a detailed work design of all that must be done in carrying out research. Research design provides convenience for researchers because it can adjust to the ability of researchers, the scope of research, and the level of depth of research to be carried out, while the content of the research design consists of planning and implementation. For example, the research design on the study of the Effect of Production Control, Quality Control and Total Quality Management on Product Failure in a manufacturing company in the Jababeka Satu Cikarang area is as follows:

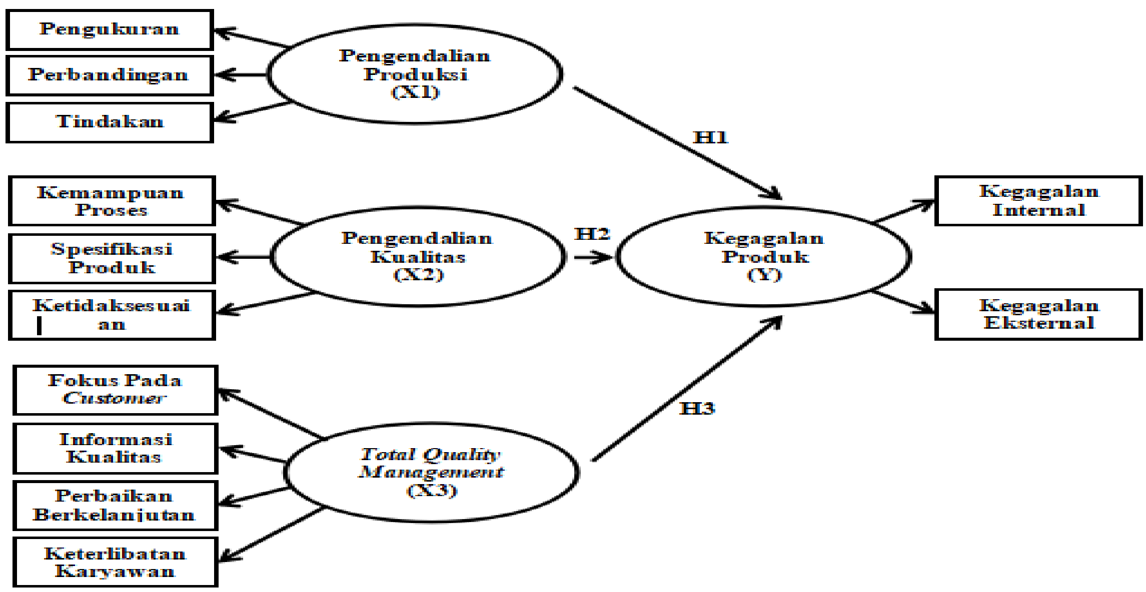

Figure 1. Research Design

RESULT and DISCUSSION

In this section, the research results are explained, and at the same time, a comprehensive discussion is provided. Results can be presented in numbers, graphs, tables, and others which make the reader understand easily. Furthermore, the discussion can be made in several sub-chapters.

Confirmatory Factor Analysis Test

The CFA test was carried out on the variables of Production Control (PP), Quality Control (PK), Total Quality Management (TQM), and Product Failure (KP). The results of the CFA test on Production Control (PP) can be seen in table 1.

Table 1 Output Probability & Standardized Estimate Production Control Variable (PP)

			Estimate	SE	CR	P	Label	Std
PP1	<---	PP	1,540	1.123	1.371	***	par_2	757
PP2	<---	PP	1,000					,629
PP **3**	<---	PP	1,293	,245	5,274	***	par_1	,752

Source: Results of data processing (2021)

Output Regression Weight Variable PP shows that the probability value of all indicators and operational, tactical, and strategic dimensions is 0.001 (***). Then all indicators and

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dimensions are declared valid. The value of loading standardized estimate indicator PP1 (0.757), PP2 (0.629), PP3 (0.752) Output Standardized estimate are all above 0.5. This shows that all indicators can explain the Production Control (PP) variable (Haryono 2017) (Ghozali 2017). The results of the CFA test on Quality Control (PK) can be seen in table 2.

Table 2. Output Probability & Standardized Estimate Quality Control (PK)

			Estimate	SE	CR	P	Label	Std
PK1	<---	PK	1,000					,611
PK2	<---	PK	,839	,646	1,298	***	par_4	,978
PK3	<---	PK	1.020	1.032	1.005	***	par_3	,777

Source: Results of data processing (2021)

The Output Regression Weight of the Quality Control (PK) variable shows that the probability value of all indicators is 0.001 (***). With this, all indicators are declared valid. The value of standardized estimate indicators PK1 (0.611), PK2 (0.978), and PK3 (0.777) on Quality Control Variables (PK). In the Standardized Regression Weight, all loading factor values (estimates) are above 0.5. By showing that all indicators can explain the Quality Control Variable (PK) (Haryono 2017) (Ghozali 2017). The results of the CFA test on Total Quality Management (TQM) can be seen in table 3.

Table 3. Output Probability & Standardized Estimate Variable Total Quality Management (TQM)

			Estimate	SE	CR	P	Label	Std
TQM1	<---	TQM	1.044	,531	-,021	***	par_6	,658
TQM2	<---	TQM	1,000					,714
TQM3	<---	TQM	1.034	,815	,274	***	par_5	,685
TQM4	<---	TQM	1.037	,588	,968	***	par_10	,682

Source: Results of data processing (2021)

The output Regression Weight in Table 3. above shows that the probability values are all indicators and dimensions of 0.001 (***). With this, all indicators are declared valid. The value of standardized estimate indicators TQM1 (0.658), TQM2 (0.714), TQM3 (0.685), and TQM4 (0.682) on the Total Quality Management (TQM) variable. The loading factor (estimate) value is above 0.5, indicating that all indicators explain the Total Quality Management (TQM) variable. (Haryono 2017) (Ghozali 2017). The results of the CFA test on Product Failure (KP) can be seen in table 4.

Table 4. Output Probability & Standardized Estimate Product Failure Variable (KP)

			Estimate	SE	CR	P	Label	Std
KP1	<---	TQM	1,000		2,276	***		,765
KP2	<---	TQM	,785	,345			par_9	,752

Source: Results of data processing (2021)

The output Regression Weight in Table 4 above shows that the probability values are all indicators and dimensions of 0.001 (***). With This, all indicators are declared valid. The value of standardized estimate indicators KP1 (0.765) and KP2 (0.852) on the Product Failure Variable

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(KP). The loading factor (estimate) value is above 0.5, indicating that all indicators can explain the Product Failure Variable (KP) (Haryono, 2017, Ghozali 2017).

Reliability Construct Test

The reliability test is a test to measure the internal consistency of the indicators of a variable that shows the degree to which each of these indicators indicates a general variable (Haryono 2017). Two test methods can be used, namely composite (construct) reliability (CR) and variance extracted (AVE). The cut-off value of construct reliability is at least 0.70, while the variance extracted is at least 0.50 (Ghozali 2017).The results of the CR and VE tests showed that the value (CR & VE) of 1 st CFA of the Production Control variable (1.0 & 0.9); 1 st CFA Quality Control Variable (0.8 & 0.6); 1 and CFA variable Total Quality Management (0.9 & 0.7) and 1nd CFA variable Product Failure (0.7 & 0.6). All indicators of the research construct have a Construct Reliability test result factor value of more than 0.7 and variance Extract more than 0.5, meaning that all indicators and dimensions in this study are reliable.

Normality and Outlier Assumption Test

Analysis of multivariate normality in AMOS 24 was performed using the critical ratio (cr) criteria of Multivariate in kurtosis. If the car value is in the range between ± 2.58, it means that the data is normally distributed in a multivariate manner (Haryono 2017). The normality test results show that the value of cr is at a value of ± 2.58. Thus, it can be said that the multivariate normality of the research data has been met. The coefficient of multivariate kurtosis is -1.031, or in other words, all the data used are normal; it can be said that the conditions for multivariate normality are met. Research data that meet multivariate normality means that the following assumptions are met:

- All variables meet univariate normality.
- The shared distribution for any pair of variables satisfies bivariate normality.

In other words, the data in this study are normally distributed

The Goodness of Fit Test

The results of the complete model structure test and model modification obtained Goodness of Fit data as shown in table 5.

Table 5. Goodness of Fit

Goodness of Fit	Required acceptance limit*)	Results after modification of the model	Decisions
CMIN/DF	2.00	1,213	Good Fit
GFI	0.90 (0 - 1)	0.932	Good Fit
AGFI	0.90 (0 - 1)	0.898	Marginal Fit
NFI	0.90 (0 - 1)	0.985	Good Fit
RFI	0.90	0.946	Good Fit
IFI	0.90 (0 - 1)	0.842	Marginal Fit
TLI	0.90 (0 - 1)	0.910	Good Fit
CFI	0.90 (0 - 1)	0.903	Good Fit
RMSEA	0.08	0.038	Good Fit

Source : Ferdinand, 2014; Widarjono, 2015; Haryono, 2017; Ghozali 2017; Santoso, 2018

The value of CMIN/DF or Normed Chi-Square generated by the structural model in this study is 1.370, and this value is below the reference value (≤ 2), which indicates a good level of model suitability. The level of good suitability of the model shows that there is no difference between the theoretical model and the empirical data, which means that it supports the model as a representative of the data (Ferdinand., 2014), or in other words, the model proposed in this study is by following per under reality. Therefore, the conclusion for cases where the number of samples is large and the number of indicators is large must be equipped with other test tools such as Goodness of Fit (GFI), Adjusted Goodness of Fit Index (AGFI), and Root Mean Residual (RMR) (Santoso, 2018). The GFI test results obtained a value of 0.932 and AGFI of 0.898. The GFI and AGFI values range from 0 to 1; with guidelines closer to 1, the model will be better at explaining the existing phenomena. Therefore, a value close to 1 indicates that the model can be considered fit. The RMR test aims to calculate the residual or the difference between the sample covariance and the covariance estimate. The RMR test results obtained a value of 0.038. The smaller the RMR result, the better it indicates the closer the sample number is to the estimate. A very small RMR value close to 0 indicates a fit model. The RMSEA value is 0.038 below 0.08, so the model can be considered fit (Santoso 2018).

Hypothesis testing

The results of the analysis in Table 4.7 show that hypothesis 1 (H1) is accepted, that the Production Control Variable (PP) has a significant effect on Product Failure (Y) in the Machining Department. The estimated parameter value is -0.263 that each increase of one unit of Production Control (PP) can reduce Product Failure by -0.263. The results of this study are supported by research (Pambudy 2017) which states that production control has a positive effect on the failure of skullcap products. Quality Control Variable (PK) significantly affects Product Failure (KP) in the Machining Department. Here it is explained that each increase of one Quality Control (PK) unit can reduce Product Failure by -0.163. (Julianti, Silvi, and Haryadi 2019), the results of this study state that maintenance has a significant effect on the level of failed products, and quality control affects the level of failed products. Total Quality Management (TQM) also has a significant effect on Product Failure (KP) with a parameter value of -0.169, that each increase of one unit of Total Quality Management (TQM) can reduce Product Failure by -0.169. This explains that PP, PK, and TQM affect KP. Supported by (Dinata 2016), who states that total quality management can fully affect product defects if the organization can analyze customer needs, fully implement a quality culture, and build unlimited Human Resources cooperation, lack of training for training employees can also hinder full implementation. Quality management is not optimal.

CONCLUSION

Based on data analysis, this research can be concluded that the variable of Production Control (PP) has a significant effect on Product Failure (Y) in the Machining Department. Each increase in one unit of production control can reduce Product Failure by -0.263. The strongest relationship is explained by the measurement indicator (PP1) of 0.757 and the weakest comparison indicator (PP2) of 0.629. Furthermore, the quality Control Variable (PK) significantly affects Product Failure (KP) in the Machining Department. Each increase of one Quality Control unit (PK) can reduce Product Failure by -0.163. The strongest relationship is explained by the product specification indicator (PK2) of 0.978 and the weakest indicator of process capability (PK1) of 0.611. Finally, total Quality Management (TQM) has a significant effect on Product Failure (KP) with a parameter value of -0.169, that each increase of one unit of Total Quality Management (TQM) can reduce Product Failure by -0.169. The strongest relationship is explained by the quality information indicator (TQM2) of 0.714, and the weakest indicator focused on the customer (TQM1) was 0.658.

Suggestion

The suggestion that the author can convey regarding the results of the research that has been done is that the company needs to compare the minimum rejection of the previous product and compare the actual product specifications by determining the company's standards. The company needs to refresh the understanding of the standards set by the company; it aims so that every employee understands which standards must be used before production starts. Companies need to implement statistical quality control continuously; this is done to suppress product losses so that the product is not damaged. Improvements to the customer focus aspect are carried out through coaching by superiors, education, and training to improve the competence of production line employees in continuous quality checks on work, analysis, and processing of product defect rate data that occur using relevant quality control tools so that they can focus more on the customer regarding the improvement of quality problems. Make the absorption of the values of employee responsibility in achieving and improving quality a top priority from the start as an employee, for example, when employees undergo job training so that each employee can improve quality through process improvement as a shared value within the company.

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