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Optimization of Production of A350 Aircraft Wing Components With *Interpretive Structural Modeling* Diagram at PT XYZ

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Abstract*: PT XYZ, which aims to optimize the production process of Airbus A350 aircraft wing components. The background of this research focuses on the importance of efficiency and effectiveness in the aviation industry, where each component must be produced to high standards to ensure aircraft safety and performance. In order to achieve this goal, the author applies several methods for completing the task, including system modeling and Interpretive Structural Modeling (ISM). This method allows for in-depth analysis of the structure and relationships between elements in the production system. Data processing is carried out through four main stages: model concept design, data collection, analysis, and evaluation. The raw data used includes the company layout and wing component production flow. The results of this data processing provide significant insights into potential improvements in the existing production system, as well as recommendations for improving operational efficiency. Thus, this report not only contributes to the development of knowledge in the field of systems engineering, but also provides practical advice for PT XYZ to improve their production performance.*

Keywords: *Airbus A350, Interpretive Structural Modeling, Production Efficiency, System Modeling*

1. INTRODUCTION

A company engaged in manufacturing commercial aircraft, fighter aircraft, and helicopters that can produce from component parts to assembly. PT XYZ itself was established by the 3rd president of Indonesia, B.J. Habibie on August 23, 1976 in Jakarta. PT XYZ itself has its head office located in Bandung, Jalan Padjajaran No. 154.

During the internship opportunity at PT XYZ, the author was placed in the SPIRIT Division as a component Project Manager. The material provided is about monitoring and evaluating the production process of aircraft components of various types. The production process starts from raw materials from the warehouse to assembly into whole goods in assembling.

This report aims to determine and optimize the production process of Ref D Nose aircraft components from the Airbus A350 aircraft from start to finish using a modeling approach using Interpretive Structural Modeling (ISM). Therefore, this internship report is entitled "Optimizing the Production of A350 Aircraft Wing Components with Interpretive Structural Modeling Diagram at PT XYZ."

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2. LITERATURE REVIEW

System modeling is a first step taken to create a software engineering of a system to be simulated. If the model formulation is carried out, the next stage will be an evaluation of the system model, including: accuracy, availability of estimates of variables, interpretation, and validation. In this case, model formulation is always carried out based on theories that apply in the region where the system is located. Some of the stages that are usually carried out to carry out model formulation are (Khotimah, 2015):

- From the point of view of the system and its environment: closed system & open system.
- From the point of view of system certainty: system deterministic & system probabilistic
- From the point of view of system dynamics: dynamic system & static system.
- From the point of view of system continuity: continuous system & discrete system.

According to (Patrobas et al., 2021), Interpretive Structural Modeling method It is used to analyze the elements in a system and break them down into a graph that shows the direct relationship between the elements as well as the level of hierarchy. This method is called interpretive because the relationship between elements in the problem under study is obtained through discussion with experts. This method is also called structural because it depicts complex problems in a system through carefully designed patterns using graphs. With the ISM technique, a model that was initially obscure is transformed into a visible system model, which is a depiction of the relationships between elements and their structures in the form of graphs. The following are the stages in the preparation of Interpretive Structural Modeling (ISM):

1. Identify elements
2. Building contextual relationships with the Structural Self Interaction Matrix (SSIM). SSIM is a matrix that contains relationships between elements that represent elements of respondents' perception of the objective element.
3. Building a Reachability Matrix (RM)
4. The Reachability Matrix (RM) is used to convert the codes in the SSIM into binary numbers.
5. Perform transitive analysis
6. Divide elements into levels
7. Creating a Canonical Matrix
8. Diagraph (Directional graph)
9. MICMAC Analysis

Using ISM, complex issues such as optimizing the production process of aircraft components can be simplified into a more structured pattern. The use of ISM will help in identifying the main priorities that need to be improved, as well as specific actions that must be taken to overcome obstacles or optimize existing elements. Where, ISM will allow models that may be difficult to understand at the beginning (e.g. the interaction of various production elements) into clearer and easier to analyze systems. This will help the management of PT XYZ in making more effective and data-driven decisions regarding measures to optimize the production of A350 aircraft wings.

Model analyst is the stage of testing a model that has been designed. The test target itself is shown to the person in charge of production. Model analysis is seen whether the recommendation model can be an alternative to the initial production process system. The output of this stage is the recommendation of an alternative model that is more efficient than the initial model (Triwibisono & Aurachman, 2020).

The modeling stage is to describe the desired model which in this study has been obtained from the results of an interview with one of the organizers. In the modeling process using dynamic simulation. The output of this stage is the production system in company. For a more complete process is as follows:

1. Identify the production process
2. Modeling the production process
3. Design the production process
4. Modeling the production process

When conducting research, the author needs several methods for collecting the necessary data, including:

1. Interview

The interview stage is directly carried out with the foreman involved to find out problems related to inventory and what data is needed in the system to be created. The researcher asked several questions to the speakers with topics related to the research.

2. Observation

According to observation, it is a research method where the author goes directly into the field to observe the problems that occur. The observation technique is carried out by taking the primary data needed in the system to be created. (Pahleviannur et al., 2022)

3. Literature Study

Literature study is a search based on relevant sources such as documents, previous research, and books to understand and formulate a theoretical basis. Literature study can also be interpreted as collecting information by looking for literature and references to support data collection and as a basis and reference in compiling a scientific work or research. (Hayati & Lionie, 2023).

3. METHODS

In the data processing in the final report of the internship at PT XYZ. This time there are 4 stages of Indonesian Aerospace. Where the stage aims to model the production system of the wing components of the Airbus A350 aircraft so that it can be used as a material for evaluating and overhauling the production system if something is obtained that may be less effective and efficient. In this data processing, what becomes raw data is the Company's layout and production flow of A350 aircraft wing component materials.

The design of the A350 rapid component model concept itself is almost the same as its predecessor brothers, namely the A321 and A330. So their base is the same but has a slight difference.

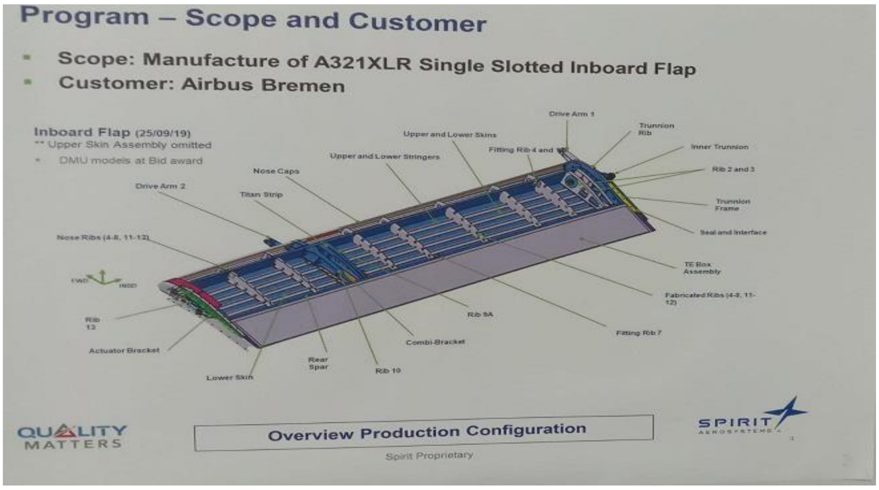

Figure 1 Component parts on the wing of the Airbus A321

Apart from that, the production of their components has very high standards. They have a fairly high level of quality control where starting from the raw material processing stage, drawing, cutting, heat treatment, to finishing have measurable workmanship standards recorded in NCOD (Numeral Component Opperator Document)). PT XYZ has 2 types of NCOD work, the first is manually passed along with component goods and the second is recording through integrated software.

For production work at PT XYZ itself entrusts the manufacture of A321, A330, and A350 wing components to the SPIRIT department. In order to facilitate the production and manufacturing phase, it must be assisted by the creation of the model concept system first. The concept of the model itself can be seen as shown below.

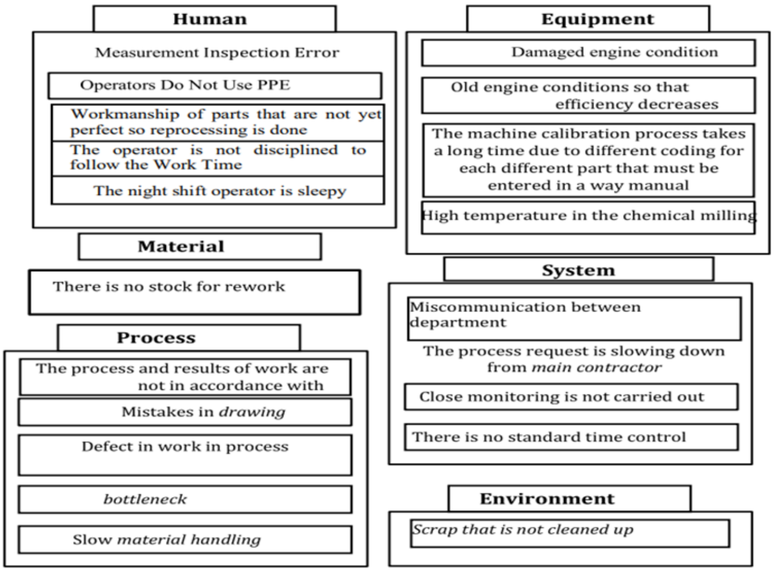

Figure 2 Ref D NOSE Production affinity diagram

Based on the diagram above, it can be concluded that failures in the production process of manufacturing Ref D Nose components in general can be grouped into 6 sub-systems. human, equipment, Material, process, systemand Environment. The sub-systems are continuous with each other, where each can affect the occurrence of failure during the production process of Ref D Nose aircraft wing components.

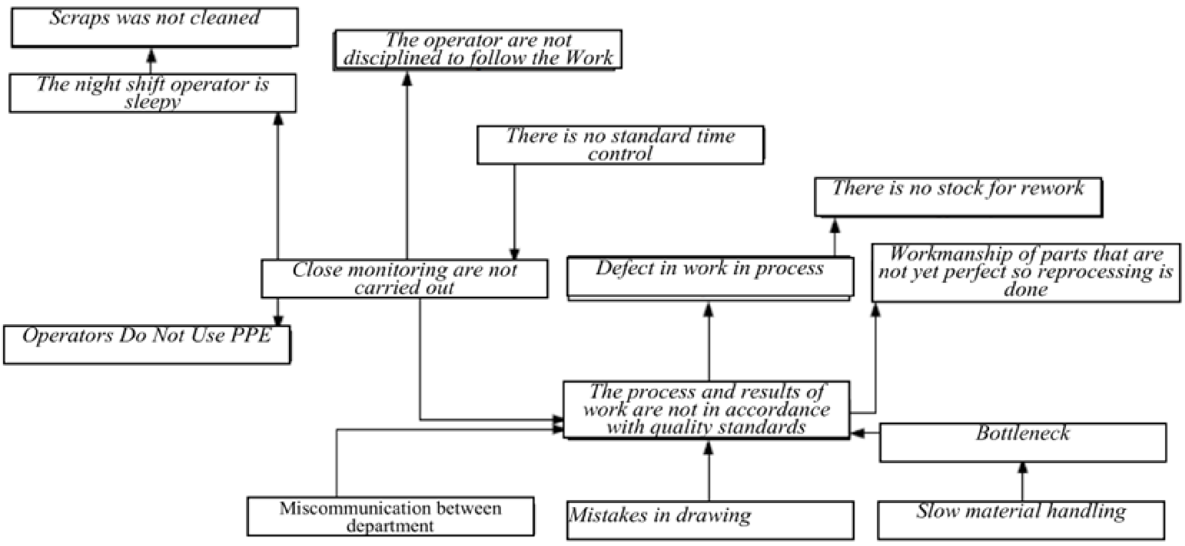

Figure 3 Interrelationship Diagram

Based on the image above, it shows the causal or reciprocal relationship between events that cause damage or defects in the wing components of the A350 aircraft, namely the Ref D Nose. Where the most crucial factor if the picture above is not strictly supervised is the most crucial. Based on this statement, to prevent defects in production significantly is to carry out strict and periodic supervision and quality control in production.

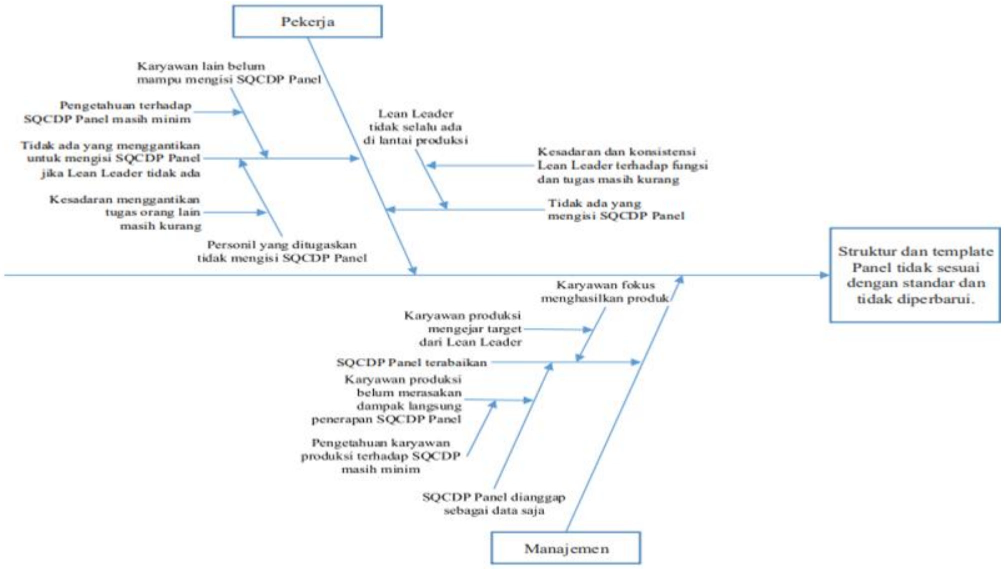

Figure 4 Fishbone Diagram

With the Fishbone diagram above, it can be easier to analyze and follow up on problems that exist in the production phase as well as defects in aircraft components. With the help of the fishbone diagram above, it can be easier to make improvements in terms of component production that can cause losses and suboptimal component production processes. In the future, PT XYZ is expected to improve the quality and quantity of their production in order to get maximum profits.

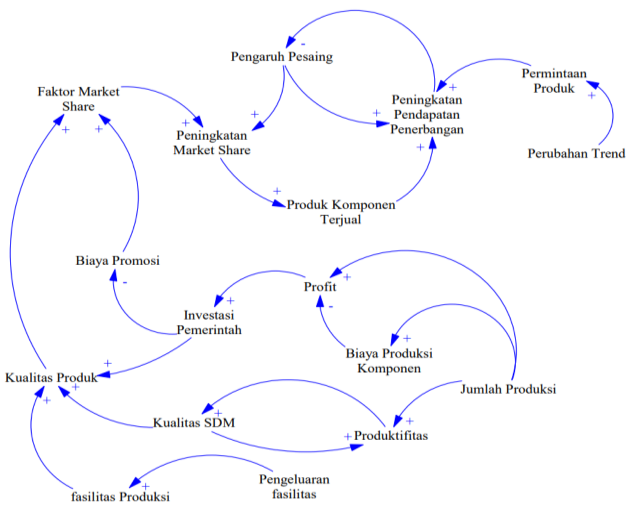

Figure 5 Causal Loop Diagram

The simulation model is designed according to the characteristics of a real system where the capacity of Resources and the scheduling of each process is adjusted to a real system. Model view causal loop. The overall diagram can be seen as shown in the image above. From the CLD model above, it was made stock overflow diagrams that illustrate real systems. This discrete model is used to model the production process in detail in use Resources and Production time. It is hoped that the system modeling above can become a real production base at PT XYZ to optimize the real and specific system through the analysis process of the production modeling system.

Table 1 Variables

It	Variable
A1	Production Defects
A2	Communication Between Divisions
A3	Production Recording System
A4	Inventory Levels
A5	*Demand*

Table 2 Structural Self Interaction Matrix

NO	A1	A2	A3	A4	A5
A1		X	V	V	X
A2			V	V	A
A3				V	A
A4					A
A5					

Information:

a) V indicates that element i affects element j

b) A indicates that element j affects element i

c) X signifies that element i affects element j and vice versa

d) O indicates that the elements i and j do not affect each other.

SSIM (Structural Self Interaction Matrix) is an important element in Interpretive Structural Modeling (ISM). The goal is to illustrate the relationships between elements in a complex system. Each element in the system is connected to all other elements, including itself. Then after the SSIM is already in place, the Reachibility Matrix is made.

Table 3 Reachibility Matrix

NO	A1	A2	A3	A4	A5	DP	R
A1	1	1	1	1	1	5	1
A2	1	1	1	1	1	5	1
A3	0	0	1	1	0	2	2
A4	0	0	0	1	0	1	3
A5	1	1	1	1	1	5	1

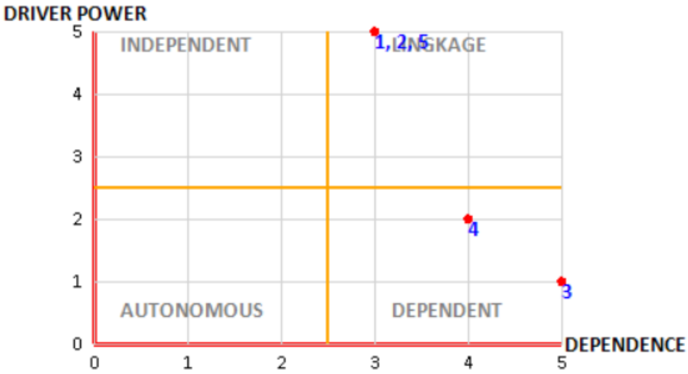

Figure 6 Plot Of Dependence Power and Driving Power

MICMAC (Matrix of Cross Impact Multiplications Applied to Classification) analysis is a matrix that can help identify relationships between elements in a system. This quadrant includes dependence power and driving power. Based on the matrix above, the elements of production defects (A1) and the elements of communication between divisions (A2) and demand (A5) are in quadrant I which means Scope or relatedness. Meanwhile, the elements of the production recording system (A3) and inventory level (A4) are in the second quadrant, which is included in the dependent variable group. The following are the levels of the ISM model for the model formed. The following is an ISM model to pay attention to production design policies. Based on the MICMAC we can makes the Model for production planing from the software. ISM model its based from the variable at the first table. From the model we can choose either policy who can gift the best output for the companies

4. RESULTS

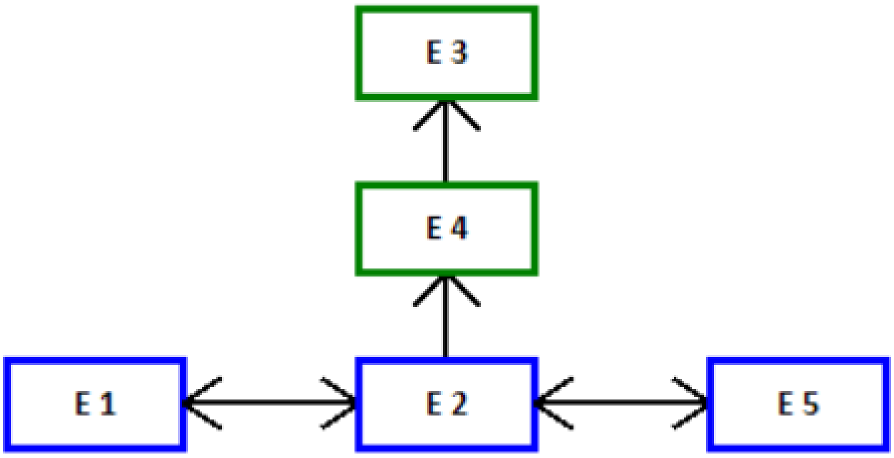

Figure 7. ISM Model for Production Planning

Companies must pay more attention to aspects of production defects, communication between divisions and demand to form production policies to be more effective and efficient. Because these 3 aspects are the center of a Ref D Nose component production system in the

SPIRIT department. Recommended for PT. Dirgantara Indonesa to support integration between various departments, such as production, sales, and procurement, ensuring that all parties have access to the same and up-to-date information. As well as PT XYZ must ensure to adjust its production strategy to conduct simulations dynamically, in accordance with market changes and customer demands, so as to increase the company's responsiveness and competitiveness in the market.

5. CONCLUSION AND SUGGESTIONS

Conclusion

An in-depth analysis of the production system for manufacturing A350 aircraft wing components at PT XYZ revealed a number of crucial challenges. The high level of production defects, the lack of effective communication between divisions, and the mismatch between market demand and production capacity are the main highlights. This study shows that the complex interactions between elements in a production system, such as humans, machines, materials, and methods, significantly affect the final result. By using the right analysis tools, the root cause of the problem was successfully identified and a more effective solution was formulated. The results of this study underscore the importance of strict quality control and the implementation of clear operational standards to achieve optimal efficiency and productivity. Recommendations include better integration between departments, adoption of dynamic simulation approaches in production strategies, and the use of accurate and up-to-date information to improve responsiveness to market needs. The implementation of this recommendation is expected to improve operational efficiency, reduce production costs, and strengthen the company's competitiveness in the increasingly competitive aviation industry.

Suggestions

From the data processing research in this case study for PT XYZ includes several strategic steps that can be implemented to improve the production system of A350 aircraft wing components. First, companies are advised to strengthen quality control processes by implementing stricter supervision systems to detect and prevent production defects. Second, it is important to improve communication and collaboration between divisions through an integrated platform so that all departments have access to accurate and up-to-date information.

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