LIST OF TERMINOLOGY

Order	:	Ordering product.
Due-date	:	The date on which something falls due, especially the delivery of order
Part	:	Part of a product.
Tools	:	A device or implement used to carry out a particular function or for industrial production
Raw material	:	The basic material from which a product is made.
Machining	:	Process for industrial production by using machine.
Pre operation	:	Tooling hole process for hanger part on fixture.
Roughing	:	Cutting operation or shaping to achive final dimension.
Main Operation	:	Main operation of material cutting fit to form of part.
Simulator	:	A device to perform simulation
Sequencing Job	:	Squencing production on machines accordance to the priority
Rescheduling	:	Perform scheduling again.
Monitoring	:	Activity to monitor and measure performance of the process.
Barcode	:	A set of readable barcode by machine or device.
Database	:	A structured ser of data held in a computer, especially one that is accessible in various ways.
Interface	:	A media or program enabling a user to interact and communicate with computer.
Andon	:	Visualization.

Chapter I Introduction

I.1 Background

Indonesian Aerospace .Ltd (PT. DI) is one of the manufacturing company in Indonesia which is engaged in the manufacture of aircraft design, development and manufacturer of civil and military aircraft. Indonesian Aerospace .Ltd often called as PT. Dirgantara Indonesia has several production sections, such as logistics, machining, surface treatment and quality control. (Indonesian Aerospace, 2013)

Each part of the production process has a different activity. The production process starting from pre-cutting processes, pre-operation, operation until the final inspection as shown on Figure I.1. The machining process is the main process in the manufacturing process of raw materials into airplanes parts.

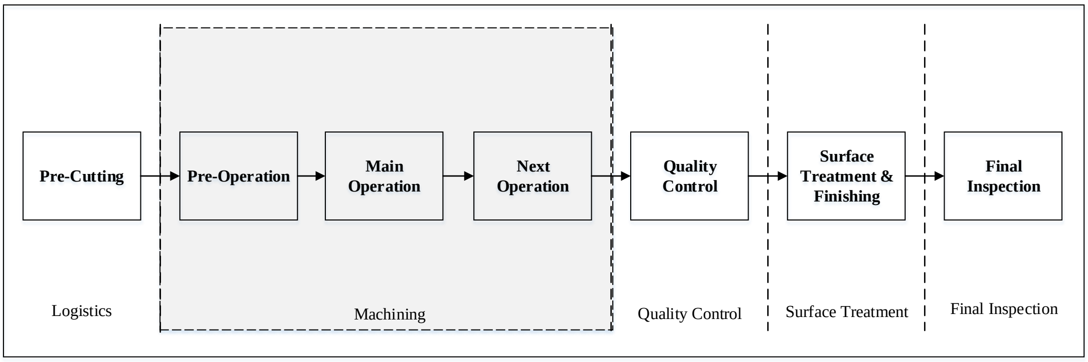


Figure I. 1 Production Process Flow
(Documentation of machining, Indonesian Aerospace .Ltd, 2013)

In this machining part, the production process is transforming raw material into parts due to the prescribed order. Machining process is done by using CNC machines (Computer Numerical Control). The machines are grouped into three divisions based on the dimensions of products and the processes on its path, there are Small Perismatic Machines (SPM), Medium Perismatic Machines (MPM) and Large Perismatic Machines (LPM).

There are problems in the production process at the Machining section, one of the problems is delaying of parts delivery. Figure I.2 shown the delivery parts in Machining section on February 3 to 17, 2014.

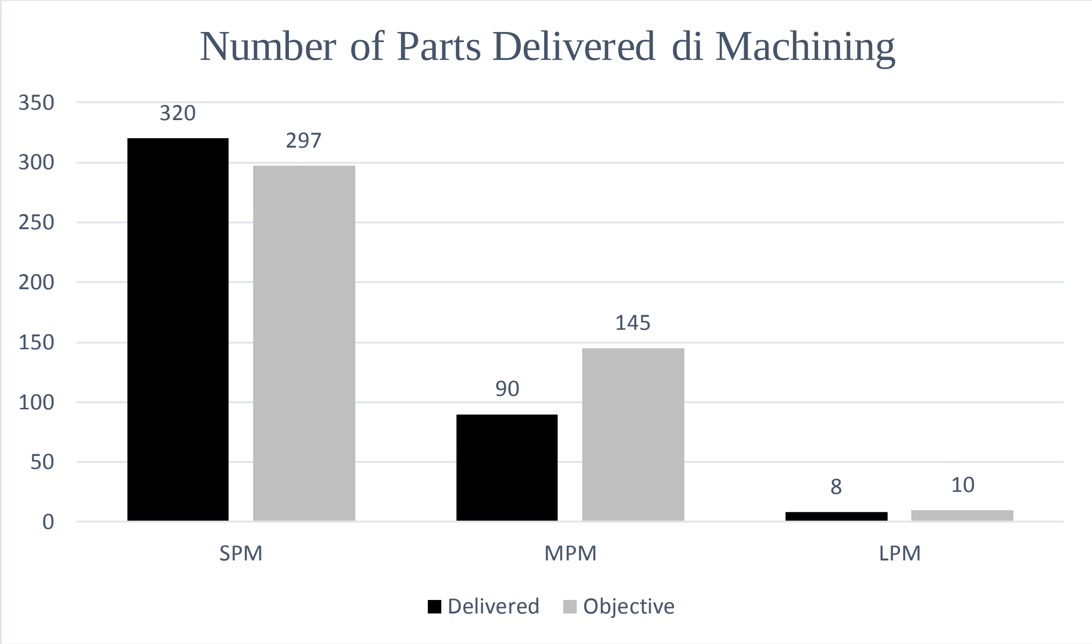


Figure I. 2 Delivered Parts in Machining Section
(Documentation of machining, Indonesian Aerospace .Ltd, February 2014)

Based on Figure I.2, there still order that has not reach delivery targets yet. Each division on the machining has different order completion target. The division that has not reach yet the target delivery yet are MPM and LPM divisions. MPM division has been successfully sent 90 parts while delivery target is equal to 145, thus the performance of the delivery orders in MPM division are late 55 parts or only achive 62% of the target. Furthermore, LPM division has work out at 8 parts of order while the delivery targets is 10, it means that the performance of orders delivery in LPM division is late 2 parts or just managed to achive 80% of the target. While delivery performance parts in SPM division exceeds the pre-determined targets, it means that in order completion, SPM division does not have a delaying problem. Therefore, there are some division in machining that still have delaying problem, they are MPM and LPM, while the SPM division does not have a delaying problem.

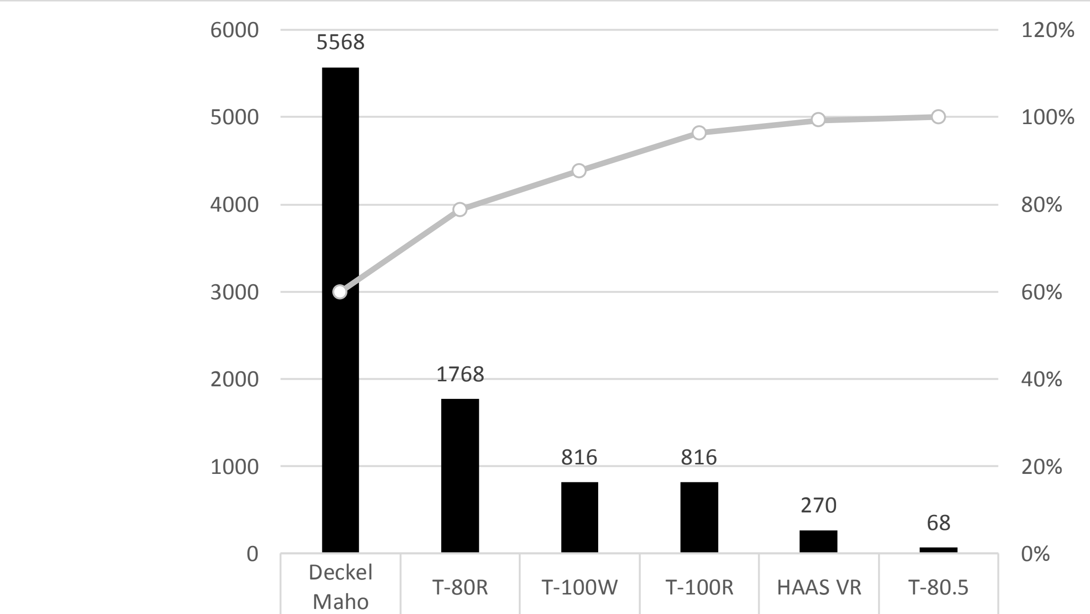
The delaying problem that occurs in one of the machining division is MPM division which had already occurred for almost along 2013.

Based on the work program of order, each division has different number of order it can be seen in Table I.1 below.

Table I. 1 Number of order execution in LPM and MPM in 2013
(Documentation of Machining, PT.DI, 2013)

Division	Program	Number of Order	Total
LPM	CN235	110	2037
	Airbus	1924	
	C212	3	
MPM	CN 235	827	9894
	Airbus	8976	
	CN212	50	
	MK-II	27	
	CN295	14	

Table I.1 shows that the number of orders completion in MPM division is much bigger than the LPM division. There are 9894 pieces of orders is done by MPM division along 2013, while LPM has done as many as 2,037 orders. Based on program, the order that has been done consists of CN235, Airbus, CN212, MK-II, and CN295 program. The highest orders is Airbus program. Thus, in MPM which is one of division in machining has huge and repetitive work load. The orders number of the Airbus program in MPM is equal to 8976 and these orders are charged into machines as shown on Figure I.4 below.



	Deckel Maho	T-80R	T-100W	T-100R	HAAS VR	T-80.5
Number of order	5568	1768	816	816	270	68
% Cumulative	60%	79%	88%	96%	99%	100%

Figure I. 3 Airbus Order Number in Main Operation Machine MPM in 2013
(Evaluation Data of MPM PT. DI, 2013)

MPM division is like cells so the orders that entering MPM will be done by passing several processes and machines. In 2013, Indonesian Aerospace .Ltd MPM has 20 machines. The process' and machine's name can be seen on Table I.2

Table I. 2 MPM Machines and Process (Indonesian Aerospace, 2013)

Process	Machines
Pre-operation	4VS, 5VS, 6VAT, Liecthy
Roughing	6VAT, YD800, YD1225, BMC 100 W
Main operation	BMC 63, BMC 80 R, BMC 100R, BMC 80.5, BMC 100.5, BMC 100.5E, Drop & Rhein, Deckel Maho

Those machines will be used in due to instructions from the orders made by planner in the process sheet. Process sheet is a document in a shape form that contains informations about production activities such as operation procedures of machining, machinery, tools, routing, and start and finish time schedule of each order. However, there are many problems occurred in shop floor when orders are being executed that led disrupted to the production activity so affect mess execution and delivery plan that have been made by the planner.

Problems that occur on the shop floor can be seen on Table I.3. Based on Table I.3 shows that despite the release order system planning is done properly, there is no guarantee that the execution of the order on the field is also running as it should.

Problems often occur on the shop floor, it can be caused by operator and not operator error such as incorrect routing and machine errors as shown on Table I.3. Errors may be caused by missed information received by the operator, such as the routing errors on T100-R engines are supposed to 100R, but actual instead to the 1005-E. One of errors on Table I.3 can also be caused by the actual information in the field is not delivered in real-time to the party that has the responsibility for handling those problems so that the problems will easily known as a problem in the engine 6VAT, DR-2, MPM , and DM-1 & 2.

Currently, Indonesian Aerospace .Ltd is not having a monitoring system that can giving an early warning or notice automatically if there is abnormal condition or a discrepancy with the actual operation that was planned by the planner. Thus, the events like incorrect routing that happened on machine T100-R on Table I.3 is not easy to handle and avoided. Beside that, information delivery systems is lack of delivered in real time and it done manually. It is very important to handle the delaying problem that caused many problems. One of the problems is overload, for example if the overload information or actual delivery time information is too late to be delivered to the planner, then, it can be handled quickly because the planner can do some actions to handle such as splitting or reschedule.

Table I. 3 Production Process Incompatibility Problems in the Shop Floor (Indonesian Aerospace Document, 2010 – 2011)

No	Machines	Part Number	Problem
1	T100-R	L574-51445-20001	Routing supposed to 100R, but the actual to the 1005-E
2	6VAT	35-62204-0101	Process orders delayed due to the location physical part was not found
4	T100-W	D5744368220401/501	T63 is damaged, moved to T100-W, overload. HF NCOD.
5	DR-2	D5744368220401/501	Overload T100-W moved to DR-2. HF NCPR.
6	T100-5E	L5745162220101	Overload T80-T100-5 moved to 5E. HF NCP.
7		L5745162320001	
8		L5745162320101	
9		L5745162420001	
10		L5745162620001	
11		L5745162620101	
12		L5745162820101	
13		L5745162920001	
14		L5745162920101	
15	MPM	WIP	WIP parts that has entered the garage and has not been scheduled in the load plan was transferred to another place.
16	DM-1 & 2	332A21107373/74	DM over-load, transfer to another machine.

Up to now, the order status reporting at the Indonesian Aerospace .Ltd MPM which to monitor the performance of the work order is still not real time. Checking the actual order status still passed a long process. Based on Figure I.5 shows that in the order status checking process, first of all, the operator report the actual order status to the leader, in case there is delivery or processing orders which is delay. After the leader receives reports of delay, then the leader needs to input order status actual data into SAP (system). After updating the actual order status data, the planner can determine the actual status condition from SAP. Thus, current status information in the field will easily come late to the planner. In addition, up to now the reporting was done traditionally (manually) through periodic SQCDP evaluation meeting every work day. The results of these evaluations are reported on a SQCDP panel. SQCDP evaluation meeting schedule can be seen on Table I.4.

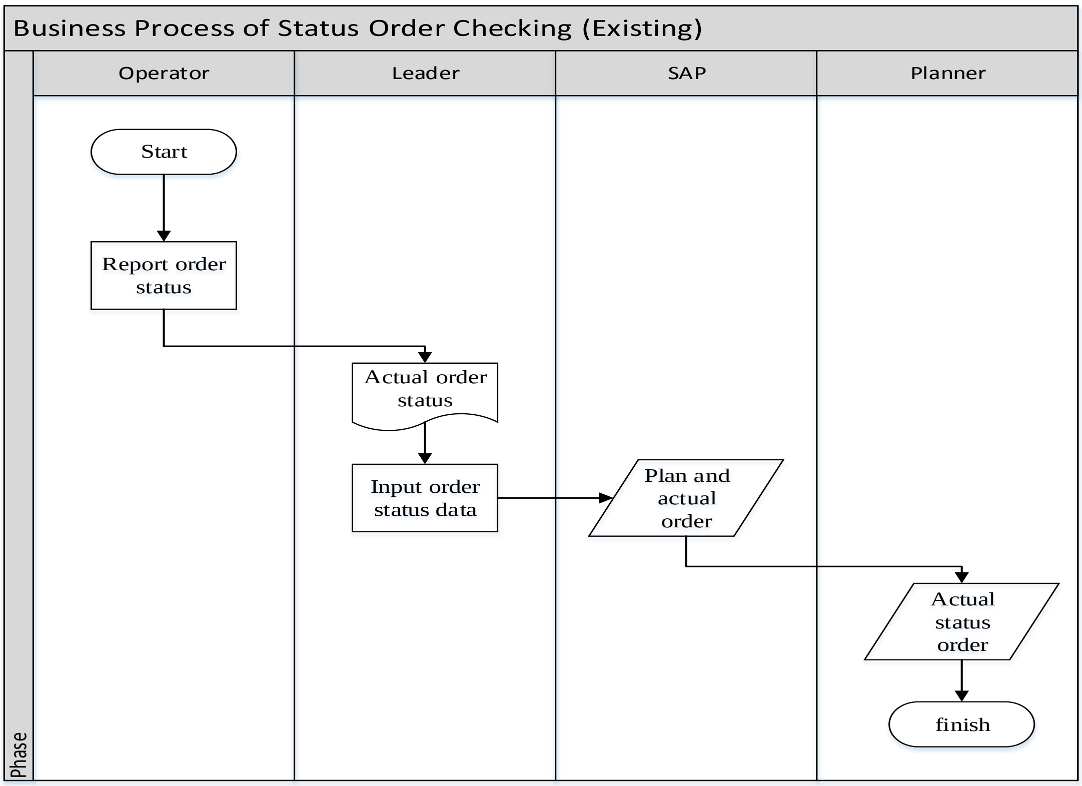


Figure I. 4 Business Process of Status Order Existing MPM
(Documentation of Machining, Indonesian Aerospace .Ltd, 2013)

SQCDP panels which can be seen on Figure I.5 is a KPI that shows the performance of the Safety, Quality, Cost, Delivery, and People. Safety panel shows the incidence rate of accidents at work. Quality panel shows the reject rate of the product. Cost panel shows the level of the actual cost and the objectives that have been set.

Table I. 4 SQCDP Evaluation Conducted Periodically In Every Work Day (Documentation of PT.Dirgantara Indonesia, 2013)

SQCDP Level	Scope	Meeting guide	Schedule
1	Work Center	Leader	07.45 - 07.55
2	MPM Group	Supervisor	08.00 - 08.15
3	Machining Group	Manager	08.30 - 08.45

Delivery panel shows the performance of successful delivery of parts shipped. And the People panel shows the employee absenteeism level. The evaluation is done by conducting regular meetings every work day.

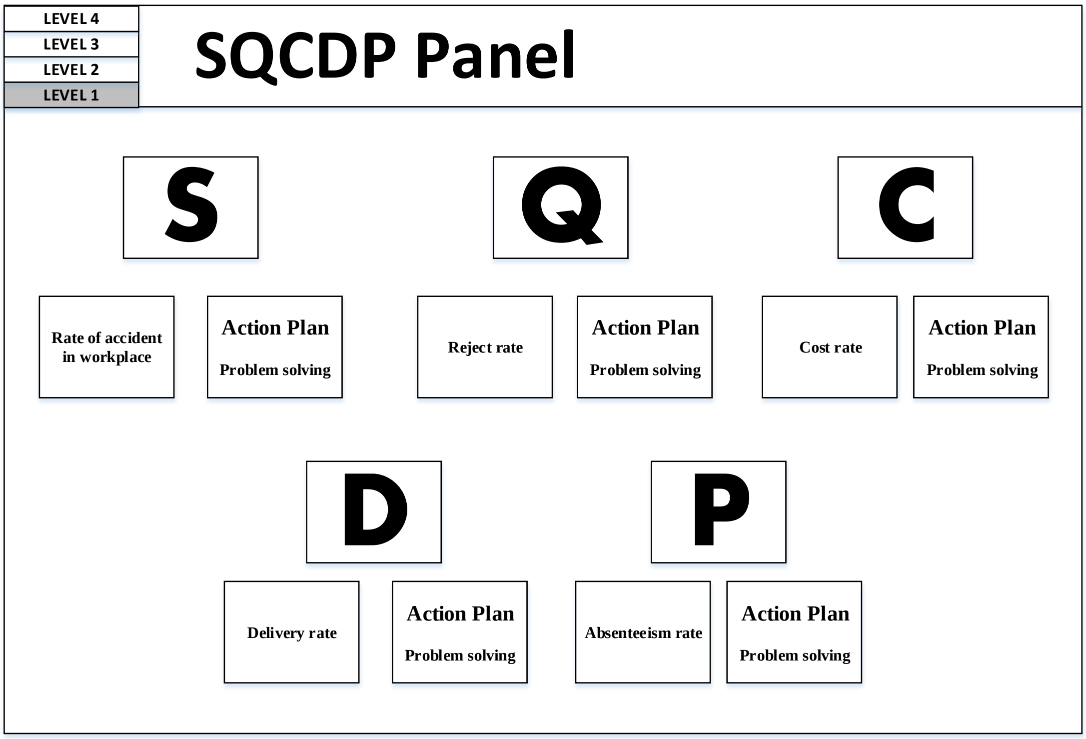


Figure I. 5 SQCDP Panel as KPI in Machining (Documentation of Machining PT.DI, 2014)

Collecting data manually has many weaknesses, such as: low efficiency and the error probability is very high (Wang, 2012). Inaccuracies order status on the system caused by the way of data capture is not going well. Entry-data is manually done based on recapitulation data of the work order form that has been done. So it feared that order status information in the system does not describe the actual status on the shop floor.

Indonesian Aerospace .Ltd needs to design an improvement to the existing monitoring system. Improvement can be done by changing the data capture procedures (data collection) in the monitoring system and also equip this system with a visualization of data so that information on the system will be easily to be processed and delivered in real time.

The generated output from this research is a simulator design for application monitoring system. Systems are designed using the data capture process automatically along with data visualization order status. Thus, the order status become more a real time and accurately, so that the information can be processed by Production Planning and Production Control in order to the problems that cause delays in order completion delays is not happened again.

I.2 Problems Formulation

Problem formulation in this research such as follows:

1. How to design a data capture system of release order to improve the accuracy of data on the machining order MPM at Indonesian Aerospace. Ltd?
2. What kind of display and warning system that appropriate to monitoring and providing order status performance information to the planner so the planner always know the actual information in real time on the machining MPM at Indonesian Aerospace. Ltd?

I.3 Research Objectives

Based on the above problem formulation, can be seen the purpose of this study are as follows:

1. Designing an appropriate monitoring system model to improve the accuracy of the order at the MPM Indonesian Aerospace. Ltd.
2. Designing a problem notification system which come up in shop floor related to the production process in Indonesian Aerospace's MPM in order to press down the delaying of problem handling.

I.4 Problems Boundaries

The boundary problems in this study are as follows:

1. The study was conducted in the aerostructure area of machining at Indonesian Aerospace’s MPM.
2. The used order data is the order release data of Airbus program which done on February 3 - February 14, 2014 on the shop floor machining at MPM Indonesian Aerospace.
3. The used machine on the main operation as a research object is the Deckel Maho machine.
4. Routing activity is started from pre-cutting processes to quality control.
5. Problem handling that concerned in this research are machine, tools, and program.
6. Cost analysis is not discussed.
7. The output of this research is a simulator system.

I.5 Research Benefits

The expected benefits of this research are as follows:

1. As proposed for machining MPM Indonesian Aerospace. Ltd in order to improve the level of data accuracy.

2. As proposed for Production Planning and Control at Indonesian Aerospace. Ltd to improve emergency response system in dealing problems that often occurs on the shop floor.

I.6 Writting Systematics

Stages for this study described the systematic writing as follows:

Chapter I **Introduction**

This chapter described about the research background, problem formulation, research objectives, research limitations, the benefits of research, and writting systematics.

Chapter II **Literature Review**

This chapter contains the literature relevant to the study and also discussed the results of previous studies. The study of theory is a method of execution used in this study consist of the Production Activity Control (PAC), Computer Integrated Manufacturing (CIM), monitor, jidoka, andon, BPI, and barcode.

Chapter III **Research Methodology**

In Chapter III described the steps in detail the research include: stages of formulating research problems, data collection, data processing and an application to be a simulator for monitoring system and andon.

Chapter IV **System Design**

Chapter IV contains the data collection and processing from the company. This chapter describes the design of the monitoring system, the andon proposed as an improvement of the existing system, and design of improvement process.

Chapter V **Analysis**

This chapter described the analysis of the proposed system in Chapter IV. The analysis includes the analysis of existing systems, activity and streamlining analysis, the advantages and weaknesses of the proposed system analysis.

Chapter VI **Conclusions and Recommendations**

This chapter explained the conclusions as a result of research. Moreover, it also explain the continuation and improvement suggestions from the system.