

REDUCING REWORK DURING PRODUCTION PROCESS THROUGH QUALITY CONTROL CIRCLE (QCC) IN PT. ARCON PERDANA GLOBALINDO

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ABSTRACT

The main aim of this research is to reducing rework during production process through Quality Control Circle (QCC) to enhance working performance in PT. Arcon Perdana Globalindo. Before this project started, a quick introduction and training was given to every member of the team. As pilot project, this case study will try to discuss the whole process from planning until execution and standardization for minimalizing losses up to 50%. In this first project, QCC team will try to reduce rework, especially for ducco painted finishing. The result of QCC implementation could reach the target set by the team, the percentage of losses reduce up to 50.57%. The amount of working time cut 16 hours or about 19.4% faster. Besides improvement in quality, the implementation of QCC also resulted in positive impact for the members of the team, especially in improving moral, efficient, and effectiveness. The quality improvement is at best when it done continuously, so for next step the team will select another theme for next problem solving for continuous improvement.

Keywords: Quality Control, QCC, Quality Management, Quality Improvement, Rework

INTRODUCTION

Economic growth in Indonesia helps to build a lot of infrastructure and raise public awareness of esthetic and quality. Other than that, Indonesia will face Asean Economic Community (AEC) this end of the year. According to an article on Jawa Pos on Monday, 25th May 2015, furniture industry is said to be one of the most prepared industry for fronting AEC. Right now Indonesia is in 13th world's position and still has a lot of potential, including great supply of raw material. PT. Arcon Perdana Globalindo is a company based in Surabaya, as the second largest city in Indonesia, which is the most growing country in Asia Pacific on 2013 based on Emerging Trends in Real Estate Asia Pacific 2013 Survey. PT. Arcon Perdana Globalindo works in design and manufacturing made-to-order furniture, especially for commercial use. For example, cosmetic counter, booth, shop, and office. Sometimes it has residential project too, but the main target market is for commercial.

Table 1. Comparison between Residential and Commercial Market Target

	Residential	Commercial
Consumer	Individual	Company
Target Market	General, common	Specific, few
Competitors	Many	Few
Repeat Order	Rarely, in a long period	Fast
Profit Margin	High	Low

To put it simple, made-to-order furniture is customizable furniture that designed and manufactured based on request. A specific product has specific target market too. Made-to-order furniture is more expensive than ready-to-use furniture, but it has a lot of benefit, like customizable design that suits customer’s brand image and size and shape that fits perfectly with site condition. With that condition, a lot of regular customer will expect a good and steady quality. In fact, there are still a lot of problems happen in company. Table 2 and Table 3 below will show the problems which occurred during 2013-2014.

Table 2. Cause of Problems that Occurred During January-December 2013

MONTH	PRO-JECT	ISSUE	INFORMATION	ADMIN	WORK PROCESS	SUB CON	UN CNT
January	5	1	• Waiting for permission				v
February	7	0	-				
March	7	2	• Material delay • Long ducco process	v	v		
April	12	1	• Ducco colour foggy		v		
May	10	2	• Waiting poster • Bubble air inside silicone		v	v	
June	11	2	• Damaged acrylic • Waiting poster		v	v	
July	25	4	• Decco rework • Damaged acrylic • Waiting poster • Damaged logo		v v v	v	
August	3	2	• Damaged acrylic • Bubble air inside silicone		v v		
September	11	0	-				
October	15	1	• Damaged logo		v		
November	18	1	• Site not ready yet				v
December	12	2	• Waiting poster • Waiting for permission			v	v
				1	10	4	3
				6.67%	66.67%	26.67%	

Table 3. Cause of Problems that Occurred During January-December 2014

MONTH	PRO-JECT	ISSUE	INFORMATION	ADMIN	WORK PROCESS	SUB CON	UN CNT
January	5	1	• Site not ready yet				v
February	5	0	-				
March	6	2	• Long ducco process • Material delay	v	v		
April	10	0	-				
May	6	2	• Top table glass left behind during shipment • Damaged glass		v v		
June	23	4	• Curvy glass failed, order again • Waiting poster • Silicone uneven • Canopy uneven, silicon problem			v v	
July	2	0	-				
August	13	3	• Damaged acrylic • Damaged logo • Bubble air inside silicone		v v v		
September	7	0	-				
October	12	0	-				
November	12	1	• Site not ready yet				v
December	8	2	• Site not ready yet • Waiting for permission				v v
				1	8	2	4
				9.09%	81.82%	18.18%	

There are mainly 3 problems, which is administrative, working process, and works that including sub-contractor. Number comparison of problems which occurred during 2013-2014 can be seen on Image 1 below.

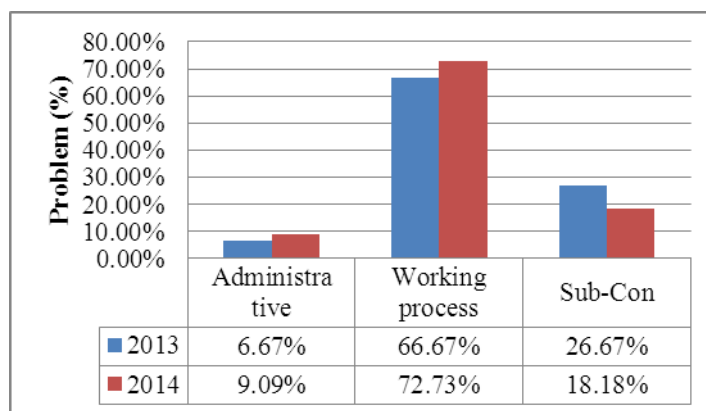


Figure 1. Case Number Comparison of Problem Happen During 2013-2014

Working process is having the biggest number of problem, so this research will aim mainly on working process. A lot of mistakes happen during production process would result in rework, and that's means more money, energy, and time wasted. For illustration, two tables about production cost calculation are made. Table 4 contains calculation on normal condition, Table 5 contains calculation of rework on acrylic.

Table 4. Cost Calculation of 2 La Tulipe's Tower size 45 x 45 cm h= 110 cm on May 2015

Stage	Operation	Element	Name	Number / Duration	Cost (Rp)	Total (Rp)
1	Cutting	Material	Multiplex 6 mm 120 x 240 cm	8	72.000	576.000
1	Cutting	Material	Multiplex 12 mm 120 x 240 cm	5	157.500	787.500
1	Cutting	Worker	Foreman	10	16.500	165.000
1	Cutting	Worker	Carpenter	50	15.000	750.000
1	Cutting	Machine	Electric chainsaw	10	900	9.000
2	Assembling	Material	Nail	5	18.000	90.000
2	Assembling	Worker	Foreman	24	16.500	396.000
2	Assembling	Worker	Carpenter	60	15.000	900.000
2	Assembling	Machine	Electric chainsaw	12	600	7.200
3	Finishing	Material	Acrylic 120 x 240 cm	3	420.000	1.260.000
3	Finishing	Worker	Foreman	12	16.500	198.000
3	Finishing	Worker	Painter	20	12.500	250.000
3	Finishing	Worker	Electrician	12	12.500	150.000
3	Finishing	Machine	Grindstone	12	750	9.000
3	Finishing	Machine	Paint compressor	12	1.800	21.600
3	Finishing	Outsource	Sticker cutting		750.000	750.000
					Total cost	6.319.300

Table 5. Cost Calculation of 2 La Tulipe's Tower size 45 x 45 cm h= 110 cm with Acrylic Rework on May 2015

Stage	Operation	Element	Name	Number / Duration	Cost (Rp)	Total (Rp)
1	Cutting	Material	Multiplex 6 mm 120 x 240 cm	8	72.000	576.000
1	Cutting	Material	Multiplex 12 mm 120 x 240 cm	5	157.500	787.500
1	Cutting	Worker	Foreman	10	16.500	165.000
1	Cutting	Worker	Carpenter	51	15.000	765.000
1	Cutting	Machine	Electric chainsaw	11	900	9.900
2	Assembling	Material	Nail	5	18.000	90.000
2	Assembling	Worker	Foreman	24	16.500	396.000
2	Assembling	Worker	Carpenter	62	15.000	930.000
2	Assembling	Machine	Electric chainsaw	12	600	7.200
3	Finishing	Material	Acrylic 120 x 240 cm	4	420.000	1.680.000
3	Finishing	Worker	Foreman	12	16.500	198.000
3	Finishing	Worker	Painter	21	12.500	262.500
3	Finishing	Worker	Electrician	12	12.500	150.000

3	Finishing	Machine	Grindstone	14	750	10.500
3	Finishing	Machine	Paint compressor	12	1.800	21.600
3	Finishing	Outsource	Sticker cutting		750.000	750.000
					Total cost	6.799.200

As seen on Table 4 and Table 5, rework will cause more cost, material, energy, and time wasted. Workers need time to release damaged acrylic and another working process on raw material until it can be attached to half-finished good. Cost production escalating from Rp 6.319.300 to Rp 6.799.200 or about 7.6%. This figure may not seem enormous, but a lot of time wasted and that can't be replaced. Hence the company attempted to do quality control to reduce, event preventing rework.

Quality can be improved through Quality Control Circle (QCC). QCC is a small number of workers that working together to solve problem that happens during work. Approach of QCC for company is focused on quality, based on participation of all members and aiming at long term success through benefits to all the employees, organization, and to society as well. PT. Arcon Perdana Globalindo as a company that relies on worker's skills is really compatible for using QCC, because QCC is done by field workers whom really understand problems that happen at workshop on daily basis rather than managements whom sit in office. Besides that, workers can give opinions and involved in decisions making, therefore they will motivated and felt involved. Hopefully this will lead to more participating and more quality.

Problem Statement

How to reduce percentage loss in rework up to 50% through Quality Control Circle (QCC) to improve company performance?

LITERATURE REVIEW

Quality Control Circle

The QC Circle headquarters of Union of Japan Scientist and Engineers (JUSE), which serves as the center for continuing education on QC Circles as written by Ryu Fukui et al. (2009), defines a Circle as "a small group of frontline operators who continually control and improve the quality of their work, products and services; they operate autonomously and utilize quality control concepts, tools and techniques." According to definition above, which has been adopted in many countries, the QCC Headquarters enumerates the following features of a QC Circle:

1. Small group
2. Continual control and improvement in the quality of work, products, and service
3. Autonomous operation
4. Utilization of quality control concepts, tools, and techniques
5. Part of TQM or company-wide QCC
6. Self-Development

Objectives of QCC Activities :

1. Establishment of a pleasant workplace
2. Establishment of a state of control
3. Enhancement of morale
4. Establishment of sound human relations
5. Better income
6. Improvement in Quality Assurance

Deming Cycle

Deming Cycle, which is called Plan, Do, Act, Check (PDCA) is a 4 stepped recurrent management method which is used at business process to control and continuous improvement.

PDCA is guidance to process of continuous improvement and to a better way. Problem identification must based on facts to avoid subjectivity.

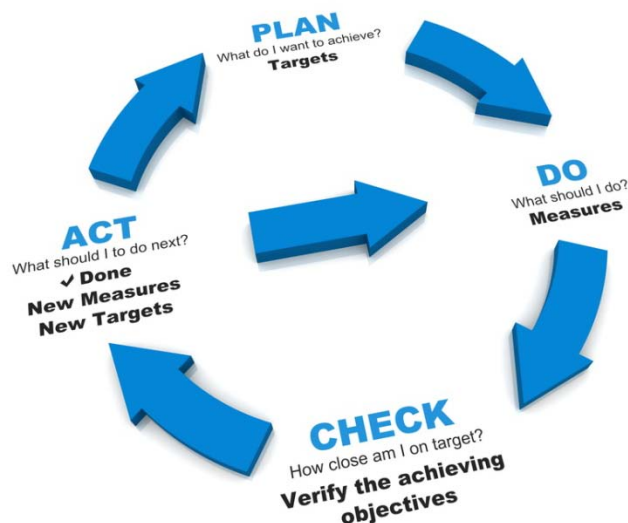


Figure 2. Deming Cycle

1. Plan

Plan is a purpose planning stage and whatever process needed to get to the target. Plan was done to identify the issues and figuring out a solution or ideas to overcome these problems. This stage refers to the activity of identification an opportunity for growth and ways to reached increase and improvement. As well as the last step is figuring and choosing problem solving.

2. Do

Do is a stage to do whatever has been planned on the Plan stage. This stage contains the implementation process through performing which has been arranged before and monitoring implementation process on a small scale for trial.

3. Check

Check is a stage to evaluate aim and process and to report the results. Check on the process has been done to see conformity with standard or there are still inconsistencies. Upon checking, there are 2 things that has to be noted, monitoring and evaluating the process and results against targets and specifications.

4. Act

Act is a total evaluation towards targets and process and followed up with improvements. If there are still any unmatched with standard, an act is taken to fix it. Follow up also means to review all the stages and modify the process before the next implementation. In addition, it also needs to monitor changes by doing measurements and control on a regular basis.

Product Quality

According to Golder et al (2012), there are 4 dimensions in product quality, namely defect, durability, matchness, and consistency.

1. Defect

Defect is a degree where there are disability on product . If there any, then how much customer can tolerate against that defect. This degree is really suitable to be applied for company that production process is carried along by consumers and labour intensive.

2. Durability

Durability is a degree of resistance to a variety of factors damage later. Consumer goods have expiration date, but for things which is not a consumer goods, need a better durability because they have a longer durability period, even sometimes permanently.

3. Matchness

Matchness is a degree of conformity of product with what consumer ordered. Made-to-order things may be different with what consumers expected. Therefore company needs to pay extra attention to design, colour, texture, finishing quality, and ease of delivery and installation.

4. Consistency

Consistency is a degree of company's ability to provide same and stable quality consistently. Quality consistency could be maintained by obeying the standard specified.

Seven Tools

Seven Tools for Quality Control are tools that usually used to help solving problems. The aim for using Seven Tools for Quality Control are increasing competency, reducing cost and price flexibility, and increasing working productivity. Seven Tools for Quality Control consist of flowcharts, cause and effect diagrams, checklists, Pareto charts, histograms, scattergrams, and control charts.

RESEARCH METHODS

Type and Research Methodology

This research is a description study case. According to Basuki (2010:110), description research is a research which tries to describe accurately of all activity, object, and human. Case study, according to Sutedi (2009:61) is included in analyze descriptive research, which focusing on a special case to observe and analyze carefully. As a study case, data collected derived from many sources and the results of this research is only valid for this case only and cannot be generalization.

Research Method Stages

According to Juster, Charles (2012), there are 8 important steps in the process of resolving the problem. They are theme selection, understanding and determine purposes, scheduling activity plan, cause analysis, plotting countermeasures, countermeasures implementation, assessment of effectiveness, and standardization.

FINDINGS

Theme Selection

From a lot of problem which occurred during production process, will be chosen 1 most vital problem using Pareto Diagram to solve and will be the theme for this research. To determine most dominant problem, financial calculations is used to reveal which factor caused the biggest financial lost if rework happened. Based on Table 3, factors from working process were calculated on Table 6.

Table 6. Problem Comparison on Financial Loss during Production Process

No	Problem	Material Price		Labor Cost		Tools Cost		Total Cost (Rp)	Perc (%)	Perc Cum (%)
		Sum	Price (Rp)	Hou r	/hour (Rp)	Hou r	/hour (Rp)			
1	Finishing ducco	1 1.5	400,000 68,000	10	12,500	10	1,800	611,002	50.57	50.57
2	Damaged acrylic	0.55	400,000	2	15,000			250,000	20.69	71.26
3	Damaged logo	0.18	1,200,000	2	15,000			246,000	20.36	91.62
4	Damaged glass	0.48	85,000	1	15,000			55,800	4.62	96.23
5	Silicon problem	0.5	31,000	2	15,000			45,500	3.77	100.00
6	Left behind on shipment							-	-	
TOTAL								1,208,302	100.00	

Note: For silicon problems, happen 3 times

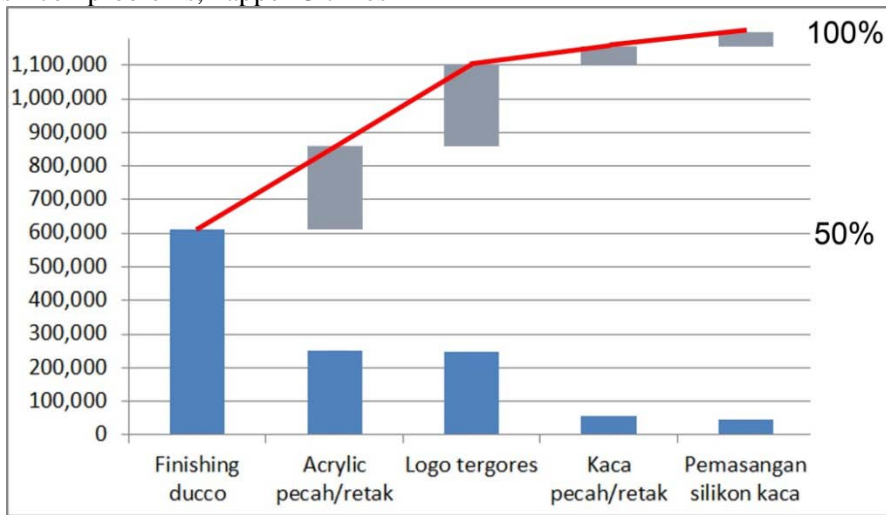


Figure 3. Pareto Diagram Problem Comparison

As seen on Table 6 and Image 3, could be concluded that the biggest financial loss caused by problem in finishing ducco. Finishing ducco chosen to be theme in this first QCC project.

Cause Analysis

Factors that could be the cause of error in finishing ducco will be elaborated using Fishbone Diagram. In general there are 5 factors, man, machinery, material, method, and environment. In its use, not necessarily to elaborate all of 5 factor, just the relevant factors only.

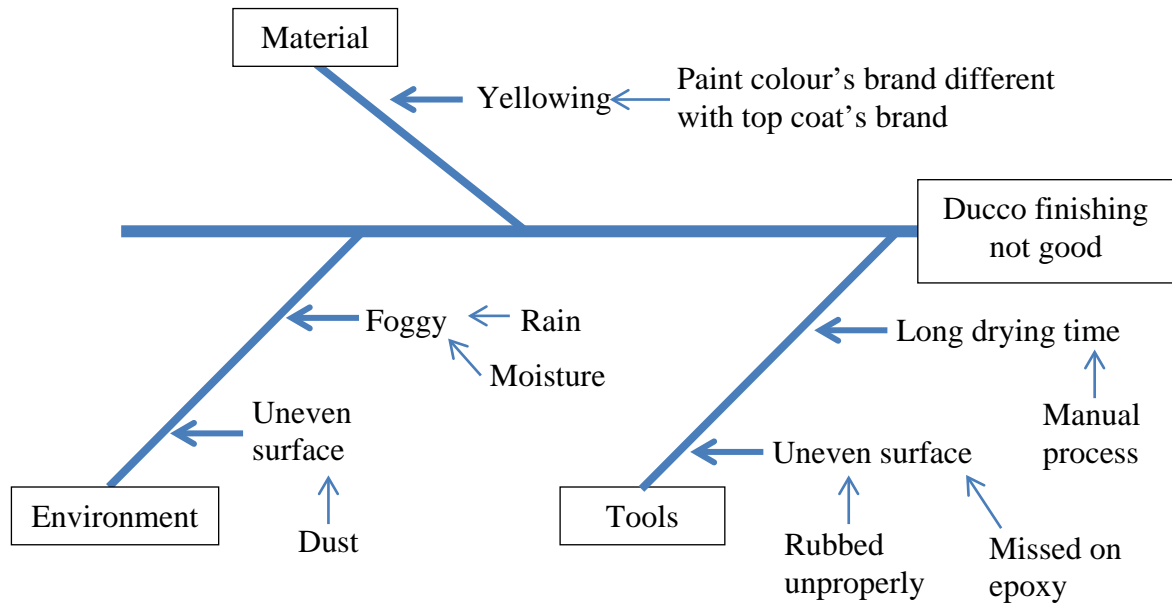


Figure 4. Fishbone Diagram (Cause-and-effect diagram)

Dominant Cause Factor

After elaborated using Fishbone Diagram, a table was made to record cause, analyze, and result from every factor that causing ducco finishing not good enough. The factors were elaborated are material, tool, and environment.

Table 7. Dominant Cause Factor and Result

No	Factor	Cause	Analyze	Result
1	Material	Paint colour's brand different with top coat's brand	Application using paint colour and top coat layer from different brand	Yellowing
2	Tool	No special tool for drying	Manual, aerated	Long drying time
		Rub paper not smooth enough	Rubbing result not smooth enough	Uneven surface
		Workshop lighting not bright enough	During epoxy application, small holes were missed	
3	Environment	Weather	Rain cause high moisture	Foggy ducco result
		High moisture	High moist because in enclosed space to avoid dust	
		Dust	Exposed to dust even though in enclosure space	Uneven surface

According to Table 7, it could be concluded that the dominant cause are:

1. Using different paint colour with different brand from top coat's brand.
2. Long drying time because done manually, only aerated.
3. Rubbing result not smooth enough
4. During epoxy application, some small holes were missed.

For factor that caused by environment like weather and high moisture, it can't be overcome because it is a natural factor which is uncontrolled or need a really high cost to try to control it.

Plotting Countermeasures

Countermeasures were planned using 5W and 2H, which is what, why, when, where, who, how and how much.

Table 8. Countermeasure Plan using 5W+2H

What	Why	How	When	Where	Who	How much
Material	Application using paint colour and top coat layer from different brand	Using same brand in one process	3 rd week June 2015	Admin office	Admin	0
Tool	Long drying time	Need drying tool	3 rd week June 2015	Gg. 17	Admin	@ Rp 500.000
	Rubbing result not smooth enough	Change rub paper type	4 th week June 2015	Gg. 17	QCC Team	Rp 10.000
	During epoxy application, small holes were missed	Adding lamp	4 th week June 2015	Gg. 17	QCC Team	@ Rp 30.000
Environment	Rain cause high moisture					
	High moist because in enclosed space to avoid dust				Natural factor is uncontrolled	
	Exposed to dust even though in enclosure space					

Countermeasures Implementation

For Material problem, which colour undergone yellowing in small amount of time caused by usage different brand of paint colour and top coat layer, will be countermeasure with using same brand product. To ensure material stock and usage of products with same brand, administration made sure and controls it.

For long drying time because of manual aerating, company bought and installed fan to accelerated drying time. For uneven ducco finished surface because rubbing result not smooth enough, company change the rub paper type. For 2nd time rubbing, it used to using p180 rubbing paper, then changed into p240 rubbing paper. And for 3rd time rubbing, it used to using p320 rubbing paper, then changed into p400 rubbing paper. The greater the number, the smoother rubbing paper so it will result in smoother surface.

For uneven ducco finished surface because of small holes were missed during epoxy application, company installed more downlight lamps 18W. it used to be 4 lamps in workshop, now it has 8 lamps.

Table 9. Countermeasure Implementation

No	Plan	Action	When	Executor
1	Using same brand in one process	Ensure material stock and usage of products with same brand	3 rd week June 2015	Eva Wina
2	Need drying tool	Buy and install fan	3 rd week June 2015	Eva Yayuk
3	Change rub paper type	Change p180 with p240 and p320 with p400	4 th week June 2015	Samsul Latief

4 Adding lamp	Buy and install 4 lamps 18W	4 th week June 2015	Minto
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Assessment of Effectiveness

On Image 5 and 6 will be seen comparison before-after QCC implication on finishing ducco working process.

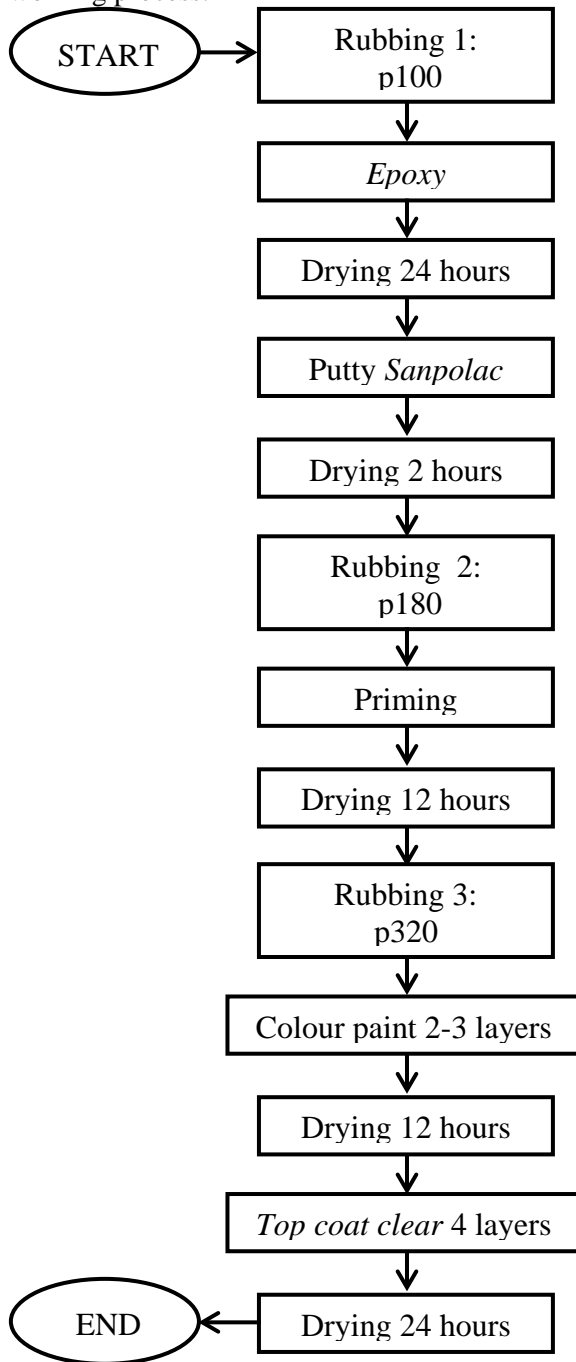


Figure 5. Flowchart of Finishing Ducco Process White Melamic on Multiplex Before QCC

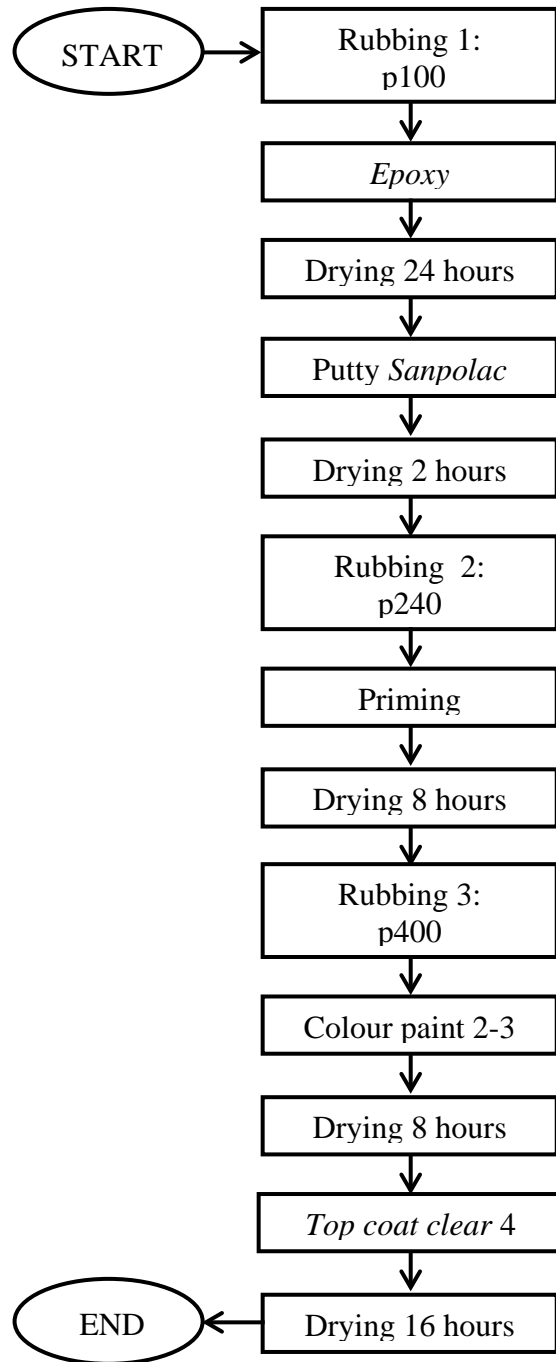


Figure 6. Flowchart of Finishing Ducco Process White Melamic on Multiplex After QCC

No	Activity	Duration (hour)	No	Activity	Duration (hour)
1	Rubbing 1: p100	2	1	Rubbing 1: p100	2
2	Epoxy	0.2	2	Epoxy	0.2
3	Drying	24	3	Drying	24
4	Putty Sanpolac	1	4	Putty Sanpolac	1
5	Drying	2	5	Drying	2
6	Rubbing 2: 180	2	6	Rubbing 2: 240	2
7	Primer	0.33	7	Primer	0.33
8	Drying	12	8	Drying	8
9	Rubbing 3: 320	2	9	Rubbing 3: 400	2
10	Colour paint 2-3 layers	0.5	10	Colour paint 2-3 layers	0.5
11	Drying	12	11	Drying	8
12	Top coat clear 4 layer	0.5	12	Top coat clear 4 layer	0.5
13	Final Drying	24	13	Final Drying	16
TOTAL		82.53	TOTAL		66.53

It can be seen on Table 10 and Table 11 there was a significant increasing in working time duration. Before QCC it would takes 82.53 hours, but after QCC it only takes 66.53 hours or 16 hours shorter.

Table 12. Comparison Before and After QCC

	Before QCC	AfterQCC	Benefit
Quality	Uneven surface and yellowing	Even surface and colour suits	Ducco painted quality increasing
Cost	Rework cost Rp 611.002	No rework	Cut Rp 611.002 or 50.57% every case
Duration	Working duration 82.53 hours	Working duration 66.53 hours	16 hours or 19.4% faster
Morale	Worker lack of morale because often rework	More enthusiasm and efficient	Increasing moral and productivity

The Following Theme Selection

After the main problem is solved, the next step is to select theme for next QCC project.

Table 13. Problem Comparison on Financial Loss during Production Process

No	Problem	Material Price		Labor Cost		Tools Cost		Total Cost (Rp)	Perc (%)	Perc Cum (%)
		Sum	Price (Rp)	Hour	/hour (Rp)	Hour	/hour (Rp)			
1	Damaged acrylic	0.55	400,000	2	15,000			250,000	41.86	41.86
2	Damaged logo	0.18	1,200,000	2	15,000			246,000	41.19	83.04
3	Damaged glass	0.48	85,000	1	15,000			55,800	9.34	92.38

4 Silicon problem	0.5	31,000	2	15,000	45,500	7.62	100.00
	1.5	68,000					
TOTAL					597,300	100.00	

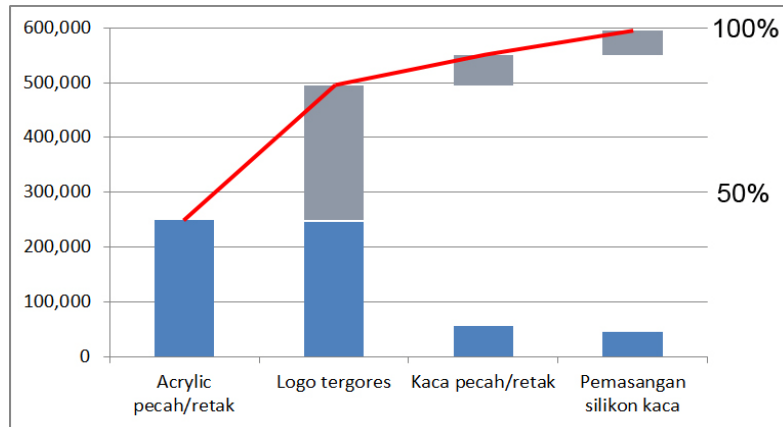


Figure 7. Pareto Diagram Problem Comparison

The new theme for the next QCC project is hor to reduce rework because of damaged acrylic. This was chosen based on calculation on Table 13 and Pareto Diagram on Image 7.

CONCLUSION

1. Quality Control Circle is really suitable for company which really depends on their human resource ability and labor-intensive. Workers get an opportunity to give advice and making decision in working process.
2. Tools that were used in QCC are Deming Cycle, Checksheet, Pareto Diagram, Fishbone, and 5W+2H.
3. QCC helps company saves up to Rp 611.002 or about 50.57% and reducing time up to 16 hours or 19.4% in production process so it is more effective and efficient.
4. QCC improving quality, product cost, working duration, and worker's moral.
5. Administration need attention too because they held a major role in purchasing raw material and controlling quality and stocks.

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