

## CHAPTER 6

### CONCLUSION AND RECOMMENDATION

This chapter will summarise the implementation comparing to the objective and the scope of study. In addition, some recommendations are proposed for suggestion of the further study.

#### 6.1 Conclusion

This thesis studied plastic injection process of the electric appliance to perform the quality improvement and also tried to reduce the defective product in the sample company. It started from using cause and effect diagrams to explore all the potential influence factors affect on the silver streaks defect of the front cabinet 14-inches television in injection process. Then, the improvement team used the failure mode and effect analysis (FMEA) demonstrated the risk priority number (RPN) of each flaw because the team needed to focus on the high RPN number. There are five highest RPN numbers that were chosen: injected gas at the needle of shut off valve, shut off valve slowly close, delayed time of gas injection, heater's temperature, and qualification of raw material, respectively. After that, the relation diagrams were used to show the relation between all factors.

Next, the chosen RPN numbers were analysed by the Why-Why analysis for finding the root cause of each failure. Referring to the analysed results, their root causes were: the mould design, shut off valve system, set the gas option by themselves, irregular maintenance, and believed in certificated too much. All of these root causes can be eliminated by the proper solution. Therefore, the team used the decision tree diagrams for deciding proper strategies to get rid of the root causes. The best recommendations are: redesign mould, adjust the closing speed of shut off valve, change to use the full option machine, pay attention to the component, increase the sampling size of quality test, and request the supplier to identify the qualification of raw material. In addition, the relationships between all of influence factors were shown in the relation diagrams.

After that, all recommendations were applied to the chosen failure. However, the team could not redesign the mould because the customer did not cooperate. For the closing speed, the team could not tune it. Therefore, the shut off valve system were changed from the hydraulic to mechanic system. Lastly, the result after the taken actions would show in the FMEA again, it shown in the reducing RPN number. The following figure shows the RPN number between before and after improvement of the chosen failure.

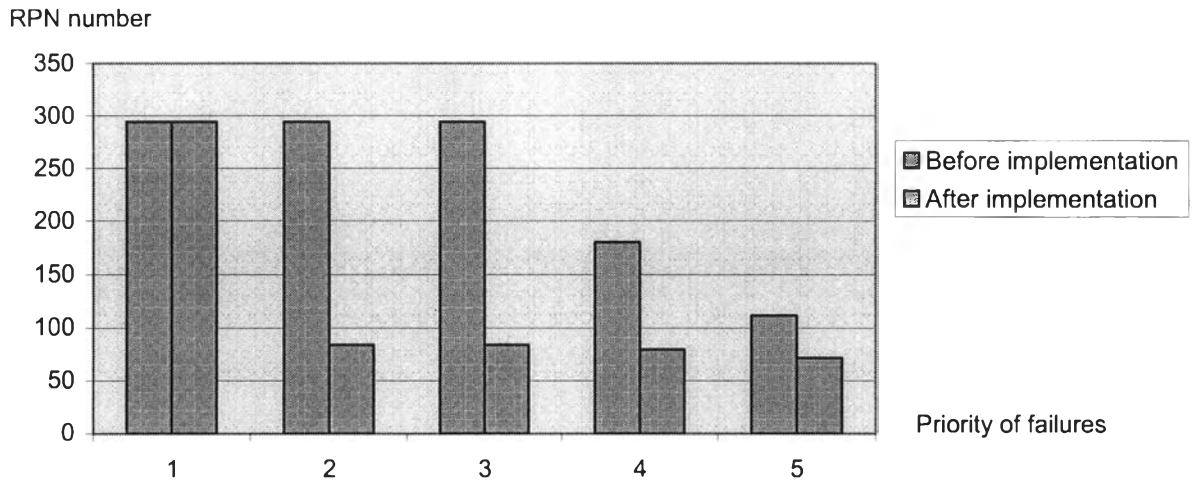


Figure 6.1: The RPN number between before and after implementation

According to the figure 6.1, the first priority is the injected gas at the needle of a shut off valve for which the RPN number is 294. The RPN number is still 294 because the owner refused to redesign the mould. The second priority is the shut off valve system and the RPN number is 294. After the implementation by using the mechanic system instead of the hydraulic system, it reduced the RPN number from 294 to 84. The third priority is the delayed time of gas injection, which the RPN number is 294. The team used the full option machine for improvement, which the delayed time has become stable. The RPN number is reduced from 294 to 84. The fourth priority is the heater's temperature that the RPN number is 180. By taking caution, it reduced the RPN number from 180 to 80. Last priority is the qualification of raw material, which the RPN number is 112. The team improved it by increasing the sampling size of quality test and requiring of more specify qualification. On the former action, it reduced the RPN number from 112 to 72 and the latter action is still in progress.

However, the defective products were reduced when the team applied the recommendation. For example, the highest percentage of silver streaks was 7.5% on the 1<sup>st</sup> day of September 2003 but it reduced to 3.33% on the 6<sup>th</sup> day when the team changed to use the mechanic system and the lowest was 0.67% on 13<sup>th</sup> day. On the same hand, the concerned of heater's temperature and stabled delayed time of gas injection could reduce the silver streaks as well. The number and percentage of defective products between before and after implementation are shown in the following table.

Month	Monthly productivity	Silver streaks (Piece)	% Defect	% Accumulate	% Of total productivity
March	16792	950	5.66	5.66	0.64
April	14079	954	6.78	12.44	0.65
May	20181	1650	8.18	20.62	1.11
June	22142	1430	6.46	27.08	0.97
July	18297	925	5.06	32.14	0.63
August	18509	1236	6.68	38.82	0.84
September					
week 1	6746	454	6.73		
week 2	8217	183	2.23		
week 3	8121	279	3.44		
week 4	8090	310	3.83		
Total	31174	1226	3.93	42.75	0.83
October					
week 1	8132	268	3.30		
week 2	7063	137	1.94		
Total	15195	405	2.67	45.42	0.27

Table 6.1: Data collection of silver streaks defect on selected product from March to the first two weeks of October 2003

According to the table 6.1, the total productivity from March to the first two weeks of October 2003 was 148,000 pieces and the total defective product was 8776 pieces. The highest influence implementation that affected on the number of silver streaks was the mechanic-shut off valve system. It could reduce the huge amount of silver streaks on the second week of September. In addition, the stable delayed time and ready-to-use heaters were influenced to the defective product as well. After the implementations, the total defective products were reduced from 6.68% in August to 1.94% in the second week of October 2003, which were reduced 1631 pieces of silver streaks or equal to 277,270 baht (One piece is 170 baht) on the selected product with in six weeks.

Moreover, the number of defects reduction by the mechanic-shut off valve implementation was the highest amount and followed with the stable delayed time and ready-to-use heaters implementation respectively. It would show in the percentage of defect in every week of that month. For example, it reduced from 6.73% in week1 to 2.23% in week2 of September when changed to use the mechanic-shut off valve system. After that, it increased to 3.34% in week3 and 3.83% in week4 of September, respectively, when changed to use the ready-to-use heaters. Finally, it reduced to 3.30% in week1 and 1.65% in week2 of October, respectively, when change to use the stable delayed time. In addition, the last week of implementation was the lowest percentage of defect because it was not operated in full week that the total amount of product was lower than the other week.

## 6.2 Alternative suggestion

According to the implementation, the proper solutions for the company's defects improvement were three choices. There were using the mechanic-shut off valve, the ready-to-use heaters, and the stable delayed time of gas injection.

There were 244 pieces of the defects, or equal to 41,480 baht, in ten days of the mechanic-shut off valve implementation. That means the company could save the money amount 120,000 baht per month, averagely. If the company applied this shut off valve for the future operation, the company would get the return on investment for this asset with in 3 months because the mechanic-shut off valve was 300,000 baht per one set.

In case of the ready-to-use heaters implementation, there were 711 pieces of the defects or equal to 120,870 baht in fifteen days. That means the company could save 240,000 baht per month, averagely. However, this implementation could not success in the long term because this action depended on the man factor that was very difficult for controlling. It would success in the beginning step or short term because every people in the implementation were still interested. In contrast, the feeling was run out because they were sluggish in their jobs. However, the company would have the training course for the workers many times if they really needed to use this action. That means the company would spend more money and time for motivating the staff.

The implementation of the stable delayed time of gas injection was 272 pieces of the defects, or equal to 46,840 baht, in ten days. It was nearly amount by applied the mechanic-shut off valve implementation. However, this implementation was not suitable for the company because the planning department could not swop the production plan with in this year. There were fully operating queue in the full option machine. Finally, the defective products were an urgent problem for the company. Therefore, the best alternative suggestion for the company was the mechanic-shut off valve implementation.

## 6.3 Limitation of the study

All of these successes were from the collaboration of every related person. They were really concerned in the effect of defective product and also had an intention to reduce it. However, there were obstacles in the improvement. For instance, the quality improvement tools were very new for the team such as the FMEA, the Why-Why analysis, and the decision tree diagrams. Sometime an argument and confusion was happened in the meeting but finally everything went on smoothly.

More over, the time limitation was one obstacle in the implementation such as the mechanic-shut off valve could run on two weeks because it was a supplier's property. On the same hand, the full option machine could operate the front cabinet 14-inches television in two weeks because it was a main

machine for operating the other product. Similar to the previous, the staff could pay more attention and observation to the heater's temperature within two weeks because every people had many works in hand.

In addition, the obstacles were not only from the company's factors. It might be from the uncontrollable factors such as the mould design of the selected product. The implementation could not done any things on it because the mould of selected product was a customer's property. The silver streaks would reduce if the recommendation could do.

#### **6.4 Recommendations**

According to the implementations, it can be noted that the team did many things to reduce the silver streaks of the front cabinet 14-inches television in the injection process. These implementations can be the basis and reference for the further study. For example, study the brown streaks or other defects of the cover of copy machine in injection process or in painting process. The team may study on the man category or inventory control and apply the new quality tools such as six-sigma and seven new quality improvement tools. In addition, the member in the team should spend more time to understand the quality improvement tools that they use. It will help the team easy to get the goal.