Minimization of Blade Defects in L2 Blade Production Line Using Plan-Do-Check-Act (PDCA) Cycle at ABC Company

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Abstract: ABC Company is a manufacturing company engaged in producing high quality autofocus actuator and servicing mobile phones and tablet manufacturers. During operation in winding area, the company experiences a big loss that is caused by a high rate blade defects. This research study aimed to evaluate and analyze the cause of high rate blade defects mainly in L2 Blade Production Line. In relation with these problems, the researcher will help the company to determine the root cause/s of blade defects and improvements to minimize it. The researcher assess the problem with the help of different tools such as Ishikawa Diagram and Why why Analysis to find the root cause/s of the problem. After analyzing the data gathered and observation in the production line, the researcher identified that blade defects are results of different factors from the present set up of man, machine, materials and method in the production line. The researcher came up with the idea of making different proposed improvements for man, machine, material and method. Plan-Do-Check-Act Cycle is the main tool used in the study to know the needed actions and also serves as a guide in monitoring the progress of the study. The proposed improvements are implemented in the company for three months to know if there is a significant change or impact in the production line. The proposed improvements include providing weekly meeting for orientation of standard operating procedures (SOP) and the do's and don'ts in the processes, providing bed and smooth pathway in the surface of working table, re-positioning of blade bin in SOP, decreasing of temperature of the machine and additional days and tools in cleaning the jigs. The data gathered after the implementation of proposed improvements showed that simple and low cost improvements has a big impact in minimizing the number of blade defects in the company. The study reduces the blade defects from 9.58% to 2.76% of inputs, which is equivalent to 6.82% of inputs. The above-mentioned observations led the researcher to propose improvements using the principle Plan-Do-Check-Act (PDCA) Cycle is a great way to lessen the rate of blade defects in L2 Blade Production Line.

Keywords: Plan-Do-Check-Act (PDCA) Cycle, Ishikawa Diagram, Why-Why Analysis, Blade defects, productivity.

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Introduction

In today's technological and competitive business world, in order for a manufacturing company to survive is to be more competitive than others. A tough competition exists and different companies experience the pressure to improve their production in order to satisfy the overflowing demand of their customers. For a company to grow and increase its profitability, it must starts by increasing its productivity, giving its time and effort in making the most of their resources to fit in the completion and assuring its product's quality. Quality is the degree of excellence, distinctive attribute and characteristics possessed by something, but for a manufacturing company, quality is defined as fitness for purpose (Guru, 2017). It is understood differently by people, consumers see quality as their specification of a product or a service while producers see quality as their product's conformance or the degree which the product was produced correctly (Nandu, 2016). Therefore quality products are those products that can perform satisfactorily services and can suit its intended purposes.

There are constraints which hinder every company's growth, and one of those unwanted constraints is defects. Defect is a physical problem that causes something to be less valuable and effective. It is a physical, aesthetic or characteristic of a product or service which shows that the product or service failed to meet its desired specification or conformance (Waqas, 2016). For every manufacturer, defects simply imply a waste, a cost. And as one of the manufacturing company in the industry, ABC Company do suffer with this constraint.

The researcher use Plan-Do-Check-Act (PDCA) Cycle to analyzed and solve the problems of the production process, and also with the help of different engineering tools. It is based on "Shewhart Cycle" that is established by the father of modern quality control, Dr. W. Edwards Deming. In the early 1950s, Japanese shortened the Shewhart Cycle into plan, do, check and act. This PDCA Cycle has been around for 60 years, providing a defined and well tested process to achieve lasting improvements to the problems and challenges of the environment. There is a deliberate process that is based in a scientific method and help to ensure that improvements are conducted in a way where it will maximize the degree of success achieved.

There are four phases in the cycle. (1) The Plan phase, involves investigating and understanding the current situation and the nature of the problem to be solved. (2) The Do phase, involves developing and implementing action plan/s. (3) The Check phase, involves analyzing the effect of the action and comparing new data to the baseline data. And lastly, (4) The Act phase, involves acting upon what has been learned. Spending adequate time in each phase of the PDCA Cycle is needed in order to have a smooth and meaningful quality improvement process (Gorenflo and Moran, 2010).

PDCA Cycle is a tool used for product quality control and was recognized as production process improvement tool in enhancing knowledge work achievements as well as in nurturing the innovation capabilities of workers. The PDCA concept usually applied to industrial productivity improvement, also, it can be applied to individual knowledge work where mid-process performance is not easily observed or monitored (Maruta, 2012).

Based on the mentioned effectiveness of Plan-Do-Check-Act (PDCA) Cycle, the problems of the company that was encountered in the study could be possibly solved. With this, the researcher came up with the study which aims to use the Plan-Do-Check-Act Cycle in order to determine the possible root cause/s of the blade defects and to find improvements that will minimize the number of the mentioned defects in ABC Company.

Related Literature

According to the study of Dudin *et al.,* (2017) entitled "The Deming Cycle (PDCA) Concept as a Tool for the Transition to the Innovative Path of the Continuous Quality Improvement in Production Processes of the Agro-Industrial Sector", that aims in the account that the most developed countries and countries with the transitive economy have already overcome the problem of food deficiency, and still this problem exist in developing countries, this article suggest using a traditional tool for the quality management (Deming Cycle or PDCA) complemented by a strategically oriented approach. This article provides a strategic approach to the use of the Deming Cycle (PDCA) to solve the problem of deficiency and low availability of good quality food supplies in developing countries, optimize the structure of the business processes and the organization of services.

As stated in the study of Mercado *et al.,* (2015) entitled "Process Level PDCA Plan-Do-Check-Act an approach to minimize high escapee rate of the top defects of nanya substrates at testech incorporated" that aims to ensure the decrease of the escapee rate of the top defects nanya substrates with the use of PDCA (plan-do-check-act) approach to easily track down the main causes of the problem. Along with this approach, the researchers used different quality tools for help of further analysis with regards to the main problem these tools are pareto analysis, root cause analysis, fishbone diagram and five why analysis. The study identified the actual causes and developed an effective solution for the minimization of escapee rate.

According to the study of Cruz *et al., (*2014) entitled "A System study on the Packaging of Nestle Breakfast Cereals of Fast Services Corp." that aims to minimize the number of defects in every process in packagingarea to maximize the cost incurred in packaging the products. The researchers assessed the problem through fish bone diagram, interviews, five why analysis and Kepner-Tregoe Decision Analysis. The study determined that the defects occur due to frequent machine downtime and defective cardboard box that leads in proposing a new method that gives better outcome and has lesser number of defects during production.

In the study of defects through Root Cause analysis for TBR Models of Isuzu Philippines by Culla *et al.,* (2014) focused on how to reduce the defects. The researchers formulated a proposed plan of action to reduce the product defects in which the company may consider for application. Each defect was assessed through tabulated Five Why analysis and Pareto analysis was used to determine the most occurring defect which composed 80% of problem. The study helps to know the causes of defects and possible way to reduce and with these the quality of the product will be maintained by improving the material handling and providing efficient method. After improving the material handling and proposed a new action the product defect reduced.

Another study of De Chavez *et al.,* (2013) entitled "Efficiency of Industrial Engineering Quality Tools in Reducing Defects Rates at WP23 Department of Fort Wayne Wire Die (Philippines) Inc." used different industrial engineering tools on the research to minimize the number of defects occurring in the process. The proponents made an evaluation test between the three primary types of dusts used by the operators. The test was conducted to know which dust are more effective to use and can have more satisfactory results. The study focused on analysis of factors causing defective products, and proved that there are possible solutions like notify operators, valid dust table for inventory rooms, charge large pull dies and periodic pull die accuracy check which could be a great help in solving the problem. The study conducted by Arguelles *et al.,* (2014) focused in evaluating and analyzing the cause of the occurrence of oil spill at Phoenix Petroleum Philippines Incorporated. The study aim to determined solution in order to eliminate or minimize oil spill and with these the researchers used IE tools such as Pareto analysis, Fishbone Diagram and Five Why analysis to find the root cause, the researchers are able to propose solution that may be helpful in solving the problems with regards to oil spill. The researchers propose a standard operation procedure (SOP) provide in gantry area during loading operation will lessen the problem in oil spill since the operator guided by the standard operation procedure.

Statement of the Problem

This study dealt with the analysis and documentation of production processes in L2 Blade Production Line at ABC Company. It aimed to determine the root cause/s of blade defects and determine right and appropriate improvements that would minimize the number of the mentioned defects through Plan-Do-Check-Act (PDCA) Cycle.

This study sought to answer the following questions:

1. What is the current percentage of Blade Defects in L2 Blade Production Line?
2. What is the current set up in L2 Blade Production Line in terms of its:
   2.1. manpower;
   2.2. machine;
   2.3. material; and
   2.4. method
3. What are the possible root causes of blade defects?
4. What improvements can be made to prevent such causes and will minimize the number of blade defects?
5. After implementing the proposed improvements, how will it affect the L2 Blade Production Line in ABC Company?

Significance of the Study

This study aimed to be beneficial to the following specifically the company which became the instrument of the study.

This study would be beneficial to ABC Company because the proposed device would help lessen their defective product, maximize its productivity and achieve its total quality.

To the operators/ employees of L2 Blade Production Line, the study would remind them the importance of quality and efficiency because it is now the demand in competitive business.

To the customers of ABC Company, for the study would expand and deepen their understanding, knowledge and information about how different scenario is being assisted concerned in meeting their expected good quality products.

To the researchers/proponents, this study would help them understand the importance of analyzing, finding solutions and decision making. It will also amend the researcher's ability in the aforementioned concepts and provide experiences, guidelines and broad ideas on how to deal problem regarding defects that might occur in an industrial company.

Lastly, to the future researchers, it would become the basis of their study specifically the information needed in modifying same study.

Scope and Limitations of the Study

This study is conducted in the L2 Blade Production Line of ABC Company was focused on Man, Machine, Material and Method (4Ms) of the processes in the production line. Those processes are the blade attach process, winding process, detach and cutting process, visual inspection and putting into its temporary storage. The researcher was assigned to production area and based from their observations there are uncontrollable number of blade defects that causes the company to experience a big loss.

This study focused on the problems encountered in the production line specifically on determining the root cause/s of blade defects and the improvements that will minimize the number of the mentioned defects through Plan-Do-Check-Act (PDCA) Cycle.

The company allowed the researchers to observe some process in the production line during office hours from 7 in the morning until 4 in the afternoon, where the first shift of the production was covered. The researchers were allowed to study and observe the entire production line without disturbing the operators while working.

The researcher gathered some data and information through observation, interviews and different engineering tools which help in the completion of the study. They were also allowed to use microscopes to observe things that cannot be seen by the naked eye. For further questions, the researchers could allow to ask the engineers technicians and the team leader in the area and they are very approachable when it comes to giving information. Historical information is provided by the company for the accomplishment of the study however, the researchers were not be able to get some information due to its confidentiality.

Materials and Methods

There are factors to be considered in achieving reliable result, these factors include the Plan Do Check Act (PDCA) Cycle. This framework provides basis on how does the study will be conducted and what are the processes to attain the aim of the study.

In the planning phase, the researchers identified first on which production line would be the focus of their study. With this, the researchers came up to the idea of doing research study which is entitled "Minimization of Blade Defects on the L2 Blade Production Line through Plan-Do-Check-Act (PDCA) Cycle at ABC Company".

After knowing the subject of the study, the data and information were gathered and analyzed specifically during observation on the existing process done in the production line. Through the use of Ishikawa Diagram and Why - why Analysis, the researchers identified the root causes of the blade defects.

The Do Cycle phase, includes choosing potential improvements that can be applied to prevent the root causes of blade defects with the guide of Conflict Resolution Method. Also, it involves the application of proposed preventive improvements for the root cause/s found and data gathering after the proposed improvements are implemented.

The Check phase includes checking the effectiveness of the improvements by studying the baseline result and comparing it with the actual results. Also, it includes identifying whether blade defects on the L2 Blade Production Line of ABC Company was minimized through Plan- Do- Check- Act (PDCA) Cycle.

The Act phase, the management decides if the preventive action/proposed improvements will be adapted, abandoned or the cycle will be repeated for continuous improvement.

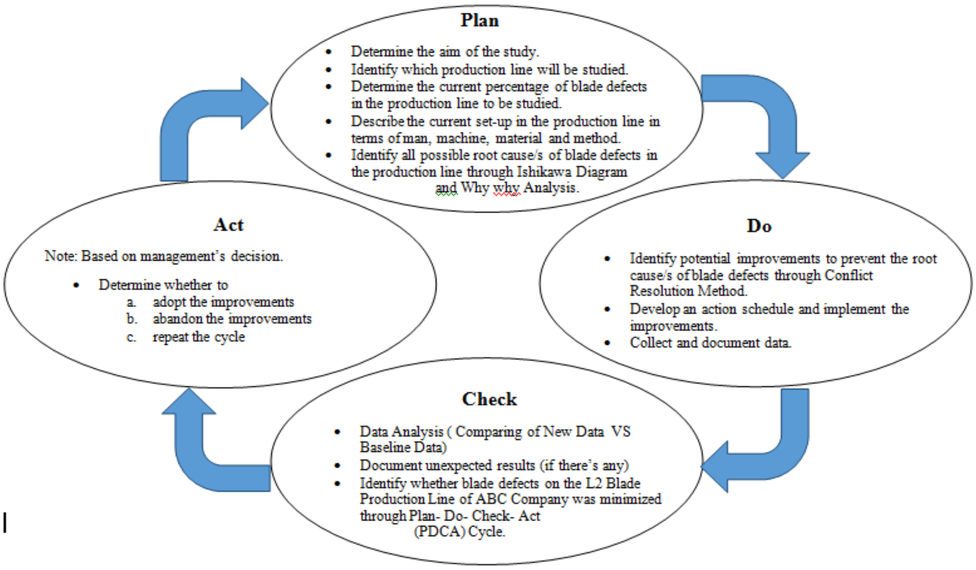


Figure 1. Theoretical Paradigm

Data Gathering Instrument

To attained the necessary data, analysis and careful researches were performed by the researches. The instruments used in data gathering are (1) Informal interview to the production management/personnel, (2) The Document Control Center of ABC Company (3) Ishikawa Diagram and (4) Why-Why Analysis. Different research material such as researches on web, article, journals and other related studies are used to gather more relevant information. These are used to gather proofs about the line which produces number of deformed blades and to obtain more information on how to deal regarding the current situation of the production line.

Data Gathering Procedure

In order to gather good information for the study, the researchers collect data by means of the following procedures:
The researcher gathered historical data from the document control center of ABC Company and identified which production line encountered numerous problems specifically defects on products. The researcher conducted series of observations particular in the L2 Blade production area. The researcher allowed to observe an actual operation and the flow process of the line and focused only on manpower, machine, material and methods used. Interviews from the line leaders and production engineers were conducted by the researchers to further prove the reliability of what they had observed.

The researcher used different engineering tools such as Ishikawa Diagram and Why-Why Analysis to deepen their understanding about the factors in the production line that may be the root cause/s of blade defects. Relevant data from books, web and other studies focusing on defects minimization were gathered to further understand the process and requirements needed to come up with the desired output of the study.

While the implementation is ongoing the researchers monitored and documented the data and information observed.

After the implementation, the researchers gathered a 3-month data from the document control center of ABC Company to be used in evaluation and assessment if study was achieved.

Results and Discussion

Plan Phase

As one of the manufacturing company in the industry, ABC Company do suffer with defects issues. One of the defects encountered by the company is the blade defects which they call as deformed blades. Deformed blades are defected blades that are incapable to rework which gives a big loss in the company. This is the reason why the researchers decided to focus on this defects and to study the current situation in the production line where blade defects are encountered. So, the researchers came up with the study which aims to determine the possible root cause/s of blade defects and to find potential improvements that will minimize the number of blade defects in the company through Plan- Do- Check- Act (PDCA) Cycle.

1. Current Percentage of Blade Defects in L2 Bade Production Line

Figures 1, 2, 3 and 4 shows the daily percentage of blade defects in the production line from April to mid of July. From the three-and-a-half-month data, the average blade defects percentage is computed as 9.58 % of input. The days with zero percentage (0%) doesn't mean that there is no defects in the line, it denotes that there is no production on that day. As seen on the figures, months of April and May do have numerous days of no production yet the percentage of defects in this month's are still high.

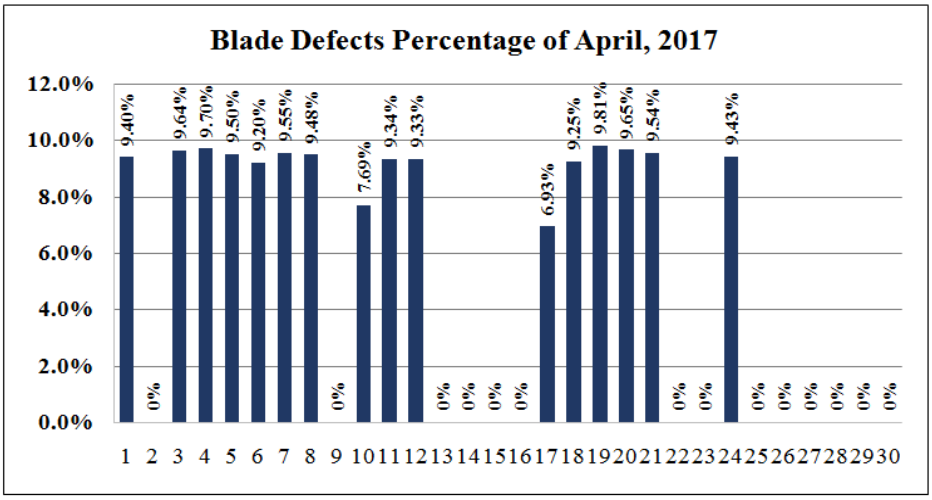


Figure 1. Blade Defects Percentage (April, 2017)

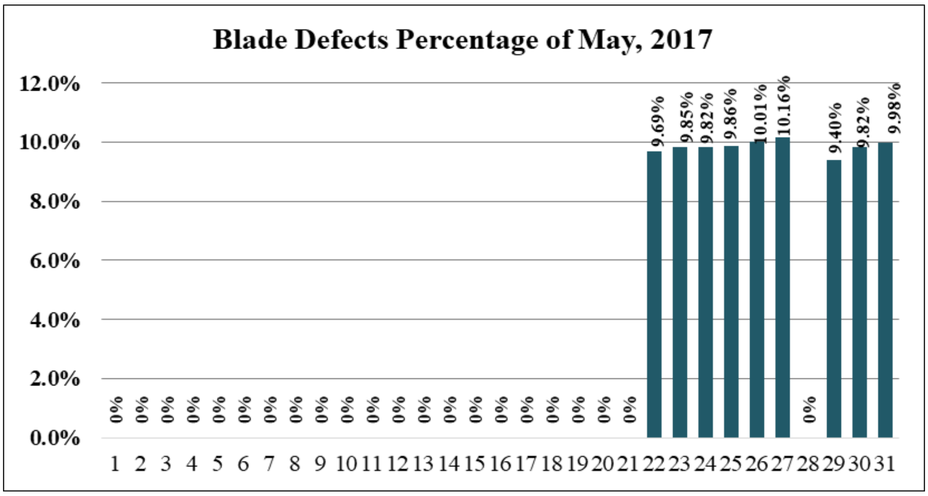


Figure 2. Defects Percentage (May, 2017)

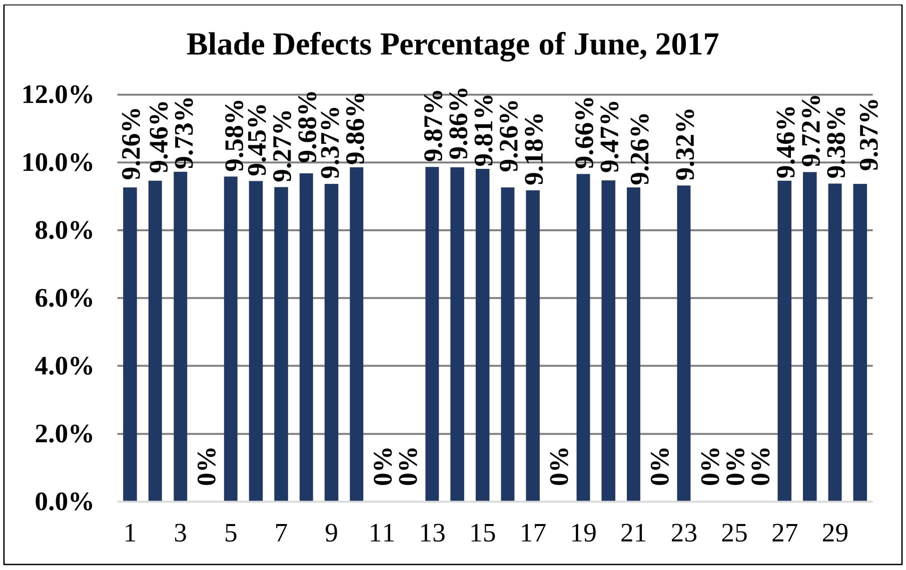


Figure 3. Blade Defects Percentage (June, 2017)

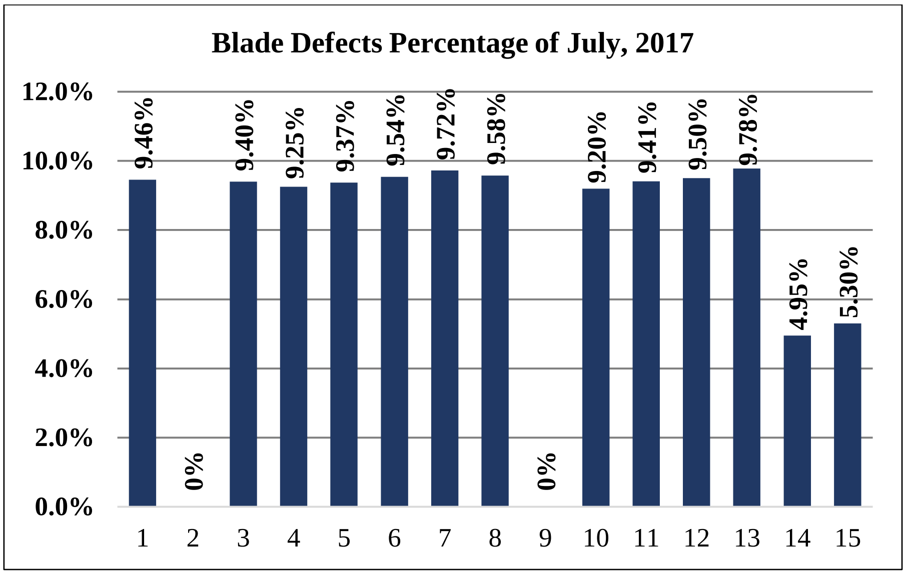


Figure 4. Blade Defects Percentage (1st half of July, 2017)

2. Current Set-up in L2 Blade Production Line

2.1 Manpower

During the study of the researcher, there are only nine (9) operators in L2 Blade Production Line. But the number of operators varies according to the number of target output of the line. All nine operators are regular and stayed in the company for 3-5 years. Each operator was given a specific process to master, but each are also trained in all processes in the line.

Operators are trained in all process to prevent production delay due to sudden absent of other operator. There are two (2) working shifts in the company, the morning shift (7am-4pm) and the night shift (7pm-4am). And as you can notice, all the operators are female. It’s because the management believes that the work of females are more detailed and thorough than males. Management likes most the work of females especially their outputs are tiny and most of their processes are microscopic.

2.2 Machine

The machine used by L2 Blade Production Line is named as the TANAC Machine. The machine was used to remove the adhesive of the coil while putting on the blade. It releases hot air which causes the adhesive to melt and the turns of coil to stick together. The production line uses 3 machines per shift. It runs from 7am to 4pm and 7pm to 4am only, which means that the machine rests from 4pm to 7pm and 4am to 7am or approximately 3 hours every after a shift.

The machine was used in the production line for about 10 years. Its maintenance was done twice a month by their technician, but it was checked every day before use to assure its effectivity and safety of the employees. Also, employees do know a bit of maintenance of the machine, such as changing and fixing of placement of coils, cleaning of excess coils and setting of machine's temperature.

2.3 Material

The inputs to create a blade/assy are coil and raw material-blade. This two are ordered from a supplier and undergo a sampling method for quality assurance. A blade/ assy is consist of one piece raw material-blade and a minimum of 60 turns of coils.

The combination of this two raw materials in a piece of blade/assy costs Php 48.00. Jigs was used to hold the blades tightly when putting in the machine for coil attachment. There are 39 jigs in the line but only 38 jigs are used, it means that the other one jig is damaged. There's no inspection on the jigs.

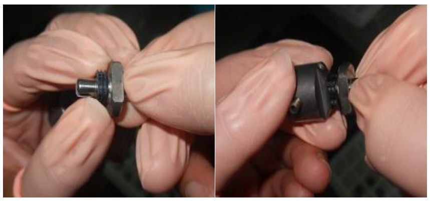
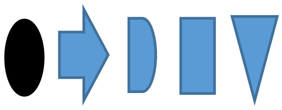
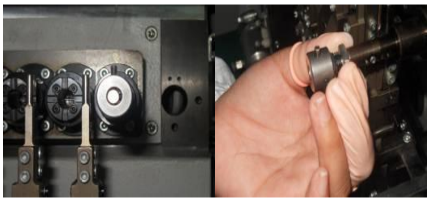
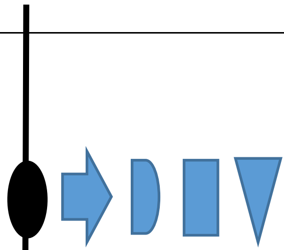
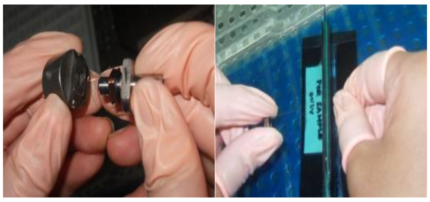
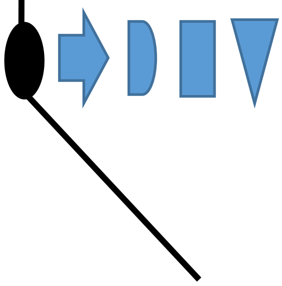
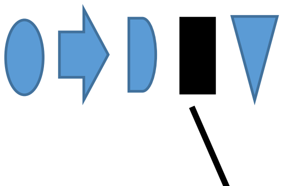
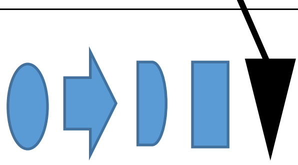
A damage will only be seen if the operators noticed it, but if no operator cares about the state of jigs, the damage jigs might still be used. The jigs are cleaned twice a week by the operators. An IPA (100% alcohol) and brush used in cleaning the jigs. The jigs are used for 5 to 7 years and cost almost Php 4 000.00 each.

Improvement for jigs was a long range deliberation. It was studied very well by the higher ups in Korea because modification of jigs is a big risk to the company. They will risk not just the cost of and availability of supplier of the jigs but the highest risk is the quality of the product they produced.

2.4 Method

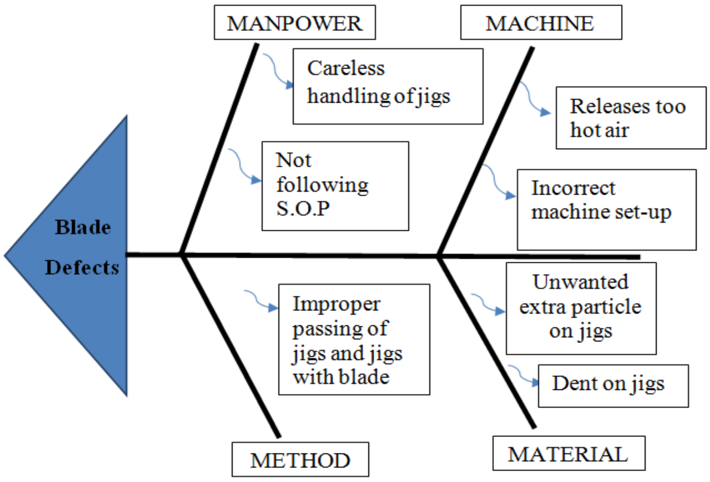
Table 2.1 shows the flow process of L2 Blade production line. The current process is composed of blade attach process, winding process, detach and cutting process, visual inspection and temporary storage.

Table 2.1. L2 Blade Production Line Process

Process	Photo	Flow Process
1. **Blade Attach Process –** process where the blade was attach on the b-part and c-part jig.		
2. **Winding Process –** process where the b and c part with blade was attach to a-part and winding of coil to the blade happen.		
3. **Detach and Cutting Process –** process where the b-part and c-part jig was detach on the blade and the excess coil was cut on the cutting jig.		
4. **Visual Inspection –** process where the NG blade and Good blade assy where separated.		
5. **Temporary Storage**		

Root Cause/s of Blade Defects

The figure 3.1 shows the causes that contribute to blade defects in terms of 4Ms (Man, Machine, Material and Method). The researcher chose Ishikawa Diagram to address the causes of blade defects. The causes are identified base on the observations and interview done by the researchers. Most of the causes are controllable which means that proposal of improvements are possible.



But in order to identify the root cause/s of blade defects, the researchers use the Why why Analysis.

Table 3.1 shows the potential root causes identified through Why why Analysis for Man. As seen in the table, to expose more root cause/s why operators handle jigs carelessly, the researcher consider two faces why operators drop the jigs directly into the blade bin. The last statements are the identified root causes which came up based on the observations and interviews done in the production line.

Table 3.1. Why Why Analysis for Manpower

Cause	**Operators Handle Jigs Carelessly**		**Operators Do Not Follow Standard Operating Procedure**
1st WHY	Operators drop the jigs directly into the blade bin.		Operators short cut some process
2nd WHY	Operators suffer fatigue	Blade bins are placed vertically on the process of blade attachment into the jig.	Operators perform what's easier for them.
3rd WHY	Fast movements of both hands	Written on the standard operating procedure	Team leaders are not strict regarding on the compliance of the operators to the standard operating procedure.
4th WHY	Operators thinks it will result into bigger output	Management doesn't expect the occurrence of dropping jigs.	---
5th WHY	Operators are not well informed in the contrary of what they did.	----	---
6th WHY	Management doesn't inform the operators	---	---

Table 3.2 shows the potential root causes identified through Why why Analysis for Machine. The researcher stop on the last statements in the table because the data and information they gathered can't answer why supplier supplies coils with inconsistent diameter. Also they chose to stop on the statement "The six roll of coil…" because if continuously asked why, it will only end up on supplier's issue, which signifies that it was impossible for improvements. Since the company doesn't mind the inconsistency of the diameter of coil supplied to them, the researcher just treat the inconsistency of diameter of coil as a constant characteristic of the coil to be able for improvements.

Table 3.2. Why Why Analysis for Machine

Cause	**Machine Setup Is Incorrect**	**Machines Releases too High Temperature Gas**
1st WHY	Temperature is set inconsistently.	Operators set the highest possible temperature of machine that blade and coil can handle.
2nd WHY	Coil diameter is inconsistent. (Note: Temperature depend on coil diameter)	Management cannot set a standard temperature for the machine.
3rd WHY	Suppliers supply coil with inconsistent diameter.	The six roll of coil that is used at a time don't have the same diameter.

Table 3.3 shows the potential root causes identified through Why why Analysis for Material. The analysis is limited since it is the standard and existing composition of material even before the conduct of the study.

Table 3.3. Why Why Analysis for Material

Cause	**Jigs Contain Unwanted Particles**	**Surface of the table is Hard and Slightly Rough**	**Jigs Has Dents**
1st WHY	Jigs are not properly cleaned.	The table is perforated and made up of metal.	Jigs collides into hard surface of the table.
2nd WHY	Jigs are clean only with IPA and brush twice a week.	---	Jigs are thrown on the table.
3rd WHY	Management doesn't give significance in the maintenance of jigs.	---	---

Table 3.4 shows the potential root causes identified through Why why Analysis for Method. The researchers decided to stop on why operators do not follow standard operating procedure because it was already discussed in the Why why Analysis for Man.

Table 3.4. Why Analysis for Method

Cause	The Method of Passing of Jigs to the Next Process are Improper	The Method of Passing of Jigs With Blade to the Next Process are Improper
1st WHY	Operators throw jigs on the surface of the table.	Operators throw jigs with blade on the surface of the table.
2nd WHY	Operators do not follow standard operating procedure	Operators do not follow standard operating procedure

Do Phase

Proposed Improvements

The causes identified in Ishikawa Diagram and other concerns of the researchers in proposing improvements are written on the remarks. Provide a weekly meeting regarding on the do's and don'ts of the operators and possible contrary of the don'ts processes. Re-positioned of blade bin (change in Standard Operating Procedure).

Provide a weekly meeting for orientation of standard operating schedule. Adjust temperature of the machine decreasingly. Daily cleaning of jig with IPA brush and air pressure. Provide bed and smooth pathway in table for jigs and jigs with blade for protection against hard and rough surface of table.

The production line after the proposed improvements are implemented. The span of implementation is from 2nd half of July to 1st half of October, with a total of three months of implementation. Also, the days with zero percentage (0%) doesn't mean that there is no defects in the line, it denotes that there is no production on that day.

Check Phase

5. Evaluation of Results

The researchers evaluated the improvements implemented for almost 3 months (July to October 2017). Since some of the improvements are intangible, only the following data are documented.

Figure 5.1 shows the percentage of blade defects in L2 Blade Production Line for the month of April to October, 2017. As observe, the percentage of blade defects in L2 Blade Production Line decreases in the month of July to October 2017 (after the study).

It proves that the implemented proposed improvements gives a big impact on minimization of blade defects in the production line. But you can notice that the percentage of defects on October increases, it can be concluded that it is because of removal of bed in the working table last September 2017.

The decrease of defects percentage is equivalent to an average of 6.82% of input, from 9.58% down to 2.76%. It means that for every 200 000 units of inputs, 13 640 units will be prevented from defects and will save a cost of Php 654 720.00 (cost of wasted raw materials only).

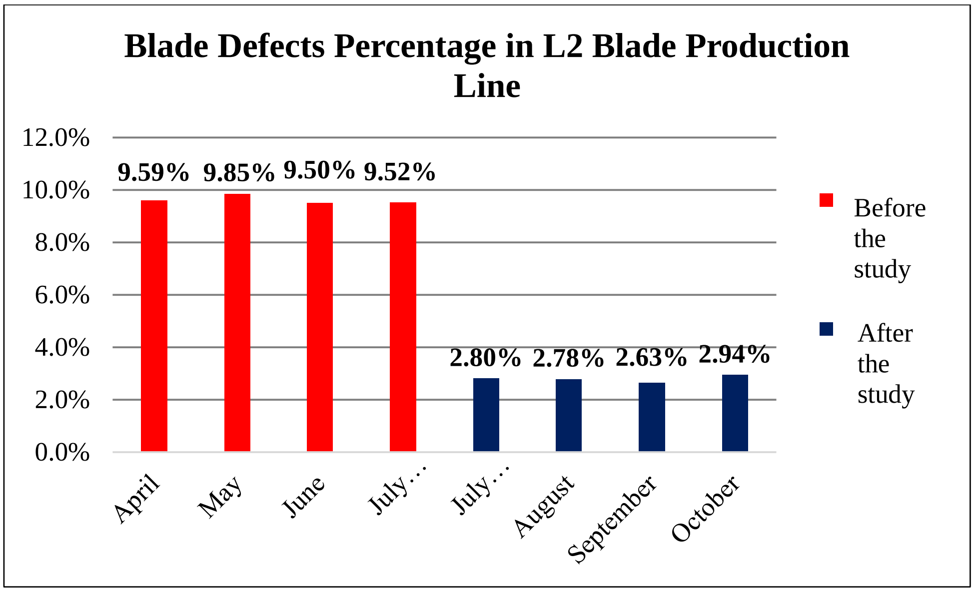


Figure 5.1. Comparison of Before and After Blade Defects Percentage

Figure 5.2 shows the percentage of productivity of L2 Blade Production Line for the month of April to October 2017. As observe, the percentage of productivity of the line increases in the month of July to October (after the study). It proves that the implemented proposed improvements gives a big impact on the productivity of the production line. The increase in productivity is equivalent to an average of 6.82%, from 90.43% up to 97.24%.

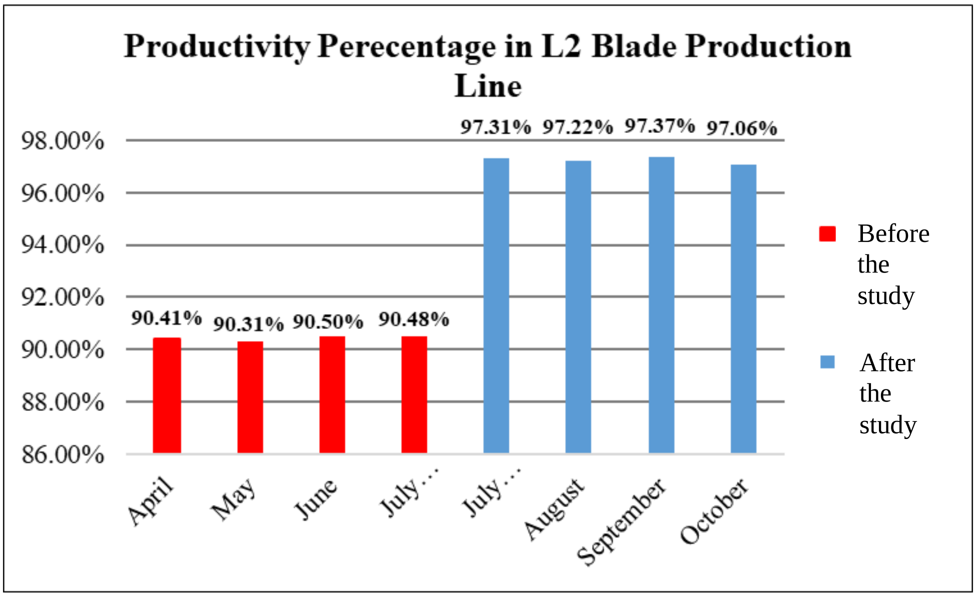


Figure 5.2 Comparison of Before and After Productivity Percentage

Act Phase

After the three phases of the cycle, the researchers identified the root causes of blade defects, proposed and implemented potential improvements and proved that the proposed improvements minimize the number of blade defects. The Act phase is now under the decision of management. The management will determine whether the company will:

A. Adopt the improvements
B. Abandon the improvements
C. Repeat the cycle.

Conclusions

After the analysis of the problem, the researchers were able to answer all the problem statements and find the following results.

1. The current defects percentage of L2 Blade Production Line per month has an average of 9.58% of inputs which signifies a high quantity of defects. It is much higher than the percentage of L3 Blade production line that is 3.33% of inputs.

2. The current set-up of L2 Blade Production Line in terms of:
2.1 Since operators do most of the process, man greatly contributes to the blade defects. Most of the operators do not follow the standard operating procedure and do not handle jigs and jigs with blade carefully.
2.2 Machine contributes to the blade defects. It releases too hot air that makes the blade become softer which is prone for dents. This releasing of too hot air also can cause of incorrect machine set-up, that's why incorrect machine set-up is also a factor of blade defects.
2.3 Raw materials also contribute to the blade defects. The inconsistency of the coil's diameter gives a big impact on the temperature of the machine, because temperature of machine is dependent on the diameter of coil. Jigs that are used in the coil winding process doesn't have enough cleaning maintenance that poorly results in extra particles in the jigs in which the blade are being hold. Also, the table contributes to the blade defects. Dents are the result of throwing the jigs into the hard and slightly rough surface of the table.
2.4 The method of the process do not contribute to the blade defects, if the operators follow the standard operating process. Since the operators do not follow the SOP, passing of jigs and jigs with blade are factors of blade defects because instead of passing it properly, they throw it into another process.

3. In order to address the root cause/s of blade defects, the proponents uses Ishikawa diagram and Why why analysis. Analysis of the data gathered from observation and interview done leads the researchers in identifying the root causes of blade defects.

4.The proponent conceptualized and developed possible improvements for the root causes that may help the company to reduce the high percentage of blade defects. The potential improvements implemented in the production are (a) providing a weekly meeting of operators and management regarding on the do's and don'ts in the processes and possible contrary of the don'ts processes, (b) providing a weekly meeting of management and operators for orientation of standard operating schedule. Since man is the hardest contributor to control and managed, the researchers look into another view where they can provide another improvements for the root causes such as: (c) re-positioning of blade bin in the standard operating procedure, (d) providing bed and smooth pathway in table for jigs and jigs with blade for protection against impact to hard and rough surface of table, (e) daily cleaning of jig with IPA brush and air pressure, and (f) adjusting the temperature of the machine decreasingly. After the implementation of proposed improvements the gathered new data of blade defects in L2 Blade Production Line has an average of 2.76% of input. It means that out of 1 181 013 units of input, only 32 595 units are blade defects which costs to Php. 1 564 606.00 (cost of wasted raw materials only). The defects rate in general, decreases from 9.58% of inputs down to 2.76% of inputs which shows a difference of 6.82% of inputs.

5. Based on the results of the study, proposed possible improvements can really help the company to reduce the percentage of defects and cost due to defects and increase the line's productivity with the least possible cost and without sacrificing the quality of the product. After the implementation of the proposed improvements, the percentage of blade defects at

ABC Company. has declined by 6.82% of input, also the productivity of the production line increases.

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