Analysis of printing product quality control using the seven tools method on CV. XYZ

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ABSTRACT
This research aims to identify the elements that influence product flaws in printing outcomes, comprehend the findings of a seven-tool analysis, and establish what can be done about the defects that exceed the limits applied. This descriptive study employs both qualitative and quantitative methodologies. This study was investigated using the Seven Tools analysis. This study's findings are research that can be conducted using the seven-tool method. The conclusion that can be taken is about four factors that affect product defect, obtained the analysis of seven tools to make quality control and improve human, machine, work methods, and raw materials.

KEYWORDS
Seven Tools; Product Defect; Quality Control

1. INTRODUCTION

In this day and age of increasingly fierce globalization, businesses must pay closer attention to the problems that arise in their operations. Product quality issues are a frequent occurrence in businesses. According to Afrianti L. H (2013), quality products will be produced with good quality control, so many companies use specific methods to produce high-quality products. As a result, quality control is required to maintain the company's quality per the established standards to reduce the risk of loss to the company.

According to Tampubolon (2014: 96), the definition of quality is the ability of a product, be it goods or services, to fulfill the desires of its customers so that every product or service is always referred to fulfill the wishes of its customers.

Quality is a significant variable in supporting the business's success. With good quality, the company can compete and have a competitive advantage in local and international markets. The long-term goal, of course, is to dominate the existing market. The main purpose of a company is basically to obtain optimal profits in accordance with the company's growth in the long term.

Quality control is performed to ensure that production and operating activities are carried out as planned. According to Assauri (2008: 25), if there is a deviation, the deviation can be corrected to achieve what is expected.

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Damaged products are created during manufacturing when the products produced do not meet the quality standards set. However, the product can be economically repaired with certain costs, where the costs incurred tend to be greater than the selling value after the product is repaired (Bastian & Nurlela, 2009, p. 69).

According to Girish (2013), the seven tools are useful tools for mapping the scope of the problem, compiling data in diagrams to make it easier to understand, exploring various possible causes of problems, and clarifying authentic facts or phenomena in an issue.

Gerry and Colledani, Coupek, Verl, Aichele, and Yemane (2014) research analyzes the decrease in production defects at PT. Cipta Lestari Packindo explained that the seven tools method could improve and reduce the number of production defects experienced by the company, ranging from skin problems to the root of the problem. Previous research by Shahin, Arabzad, and Ghorbani (2010) said that with the seven tools, up to 95% of the quality problems in production would be eliminated.

CV. XYZ is a company engaged in printing, one of the printing products produced by CV. XYZ is a banner printing product. Therefore CV. XYZ must pay attention to the quality of its products by minimizing problems related to defective products.

CV. XYZ has set the limit for the types of defects, which is 3% of the total monthly production. If defects exceed 3% of the total production, it can negatively impact the company.

Table 1. 2015 Supporting Data

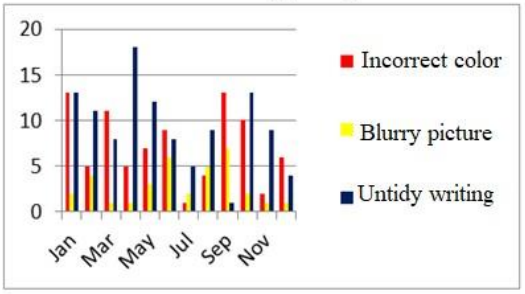

Table 2. 2016 Supporting Data

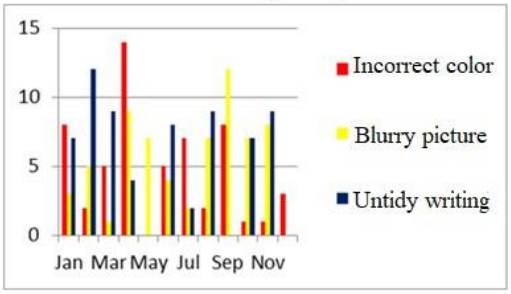

Table 3. 2017 Supporting Data

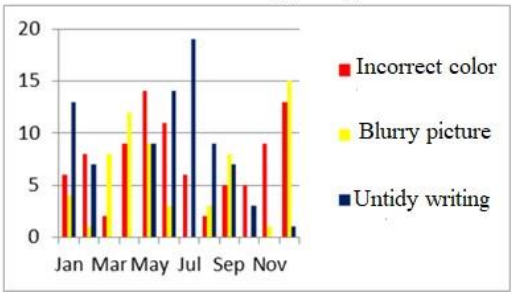

Figure 1. Supporting Data

Research conducted on CV. XYZ has a problem formulation: (1) What factors affect defects in CV. XYZ printing, (2) how the analysis results of the seven tools on the CV. XYZ, (3) what types of defects that exceed tolerance limits can do. The aims of this research are: (1) to determine what factors influence defects in CV printing. XYZ, (2) to determine the results of the seven tools analysis on CV. XYZ, (3) to find out what

can be done about the type of disability that exceeds the tolerance limit

2. RESEARCH METHODS

It is critical to plan and carry out research in order for it to function smoothly and systematically. The type of research used in this research is descriptive research. The research methods used is quantitative and qualitative. Descriptive research is carried out to find and describe the features of the variables under study (Sekaran, 2009, p. 158). According to Li and Mohanram (2014), a cross-sectional time horizon is a type of research that emphasizes the time of measurement/observation of independent and dependent variable data only once at a time. This study was conducted to ascertain the relationship between one variable and another.

Table 1. Unit of Analysis

Research purposes	Type of Research	Unit of Analysis	Time Horizon
Knowing what factors affect product defects CV.XYZ	Descriptive	Printing Section CV.XYZ	*cross-section*
Knowing how the results of the Seven Tools analysis on CV.XYZ	Descriptive	Printing Section CV.XYZ	*cross-section*
Controlling the defects that occur in the CV. XYZ so as not to cross the line.	Descriptive	Printing Section CV.XYZ	*cross-section*

The research was conducted at the company CV. XYZ, Manado on printing products. The data studied are on the number of monthly defective printing products for three years, 2015, 2016, and 2017.

3. RESULT AND DISCUSSION

The authors immediately begin data processing after collecting data from CV. XYZ. Data processing is carried out in accordance with the data obtained using the seven tools method, which includes check sheets, Pareto diagrams, flow charts, cause-and-effect diagrams, bar charts, control charts, and scatter charts.

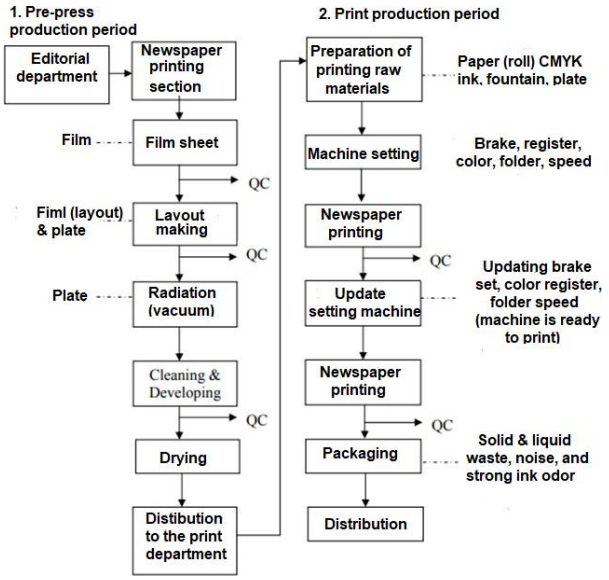

Figure 2. Flowchart

3.1. Check Sheet

Table 2. Sheet

Month	Incorrect Color	Blur Image	Untidy Writing	Total Defect	Production Quantity
Jan-15	13	2	13	28	283
Feb-15	5	4	11	20	288
Mar-15	11	1	8	20	276
Apr-15	5	1	18	24	290
May-15	7	3	12	22	311
Jun-15	9	6	8	23	303
Jul-15	1	2	5	8	289
Aug-15	4	5	9	18	303
Sep-15	13	7	1	21	317
Oct-15	10	2	13	25	322
Nov-15	2	1	9	12	327
Dec-15	6	1	4	11	333
TOTAL	**86**	**35**	**111**	**232**	**3,642**
Month	Incorrect Color	Blur Image	Untidy Writing	Total Defect	Production Quantity
Jan-16	8	3	7	18	312
Feb-16	2	5	12	19	290
Mar-16	5	1	9	15	298
Apr-16	14	9	4	27	276
May-16	0	7	0	7	281
Jun-16	5	4	8	17	293
Jul-16	7	2	2	11	273
Aug-16	2	7	9	18	290
Sep-16	8	12	0	20	301
Oct-16	1	7	7	15	322
Nov-16	1	8	9	18	329
Dec-16	3	0	0	3	327
TOTAL	**56**	**65**	**67**	**188**	**3,592**
Month	Incorrect Color	Blur Image	Untidy Writing	Total Defect	Production Quantity
Jan-17	6	4	13	23	290
Feb-17	8	1	7	16	277
Mar-17	2	8	0	10	293
Apr-17	9	12	0	21	310
May-17	14	9	9	32	281
Jun-17	11	3	14	28	274
Jul-17	6	0	19	25	307
Aug-17	2	3	9	14	269
Sep-17	5	8	7	20	271
Oct-17	5	0	3	8	283
Nov-17	9	1	0	10	317
Dec-17	13	15	1	29	272

TOTAL	**90**	**64**	**82**	**236**	**3,444**
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TOTAL	**90**	**64**	**82**	**236**	**3,444**

3.2. Pareto Diagram

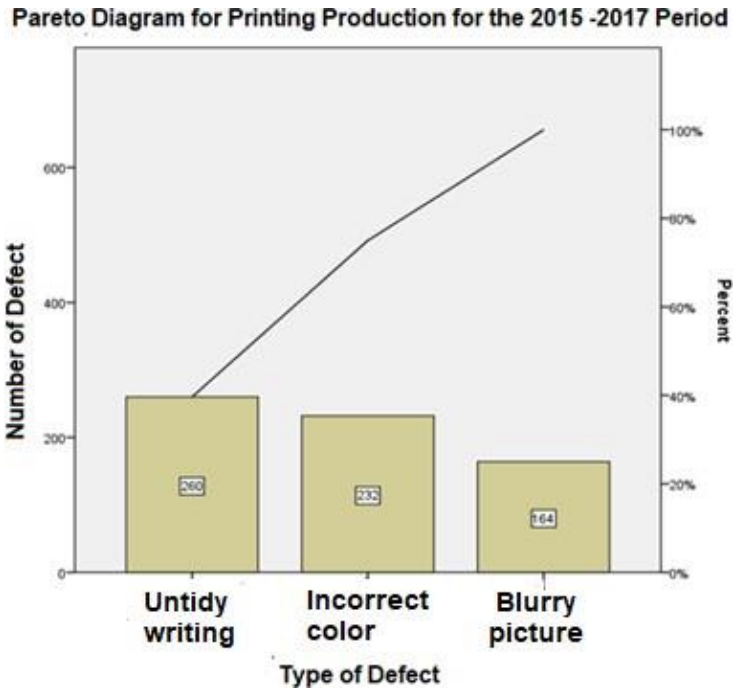

Figure 3. Pareto

3.3. Histogram

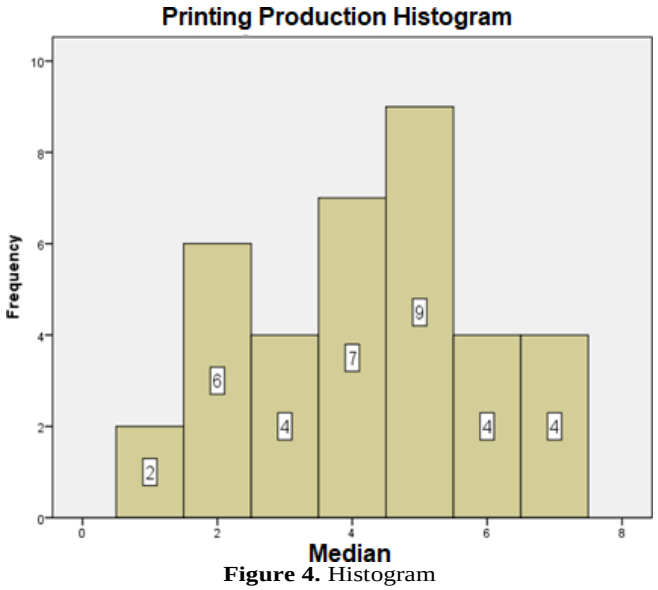

Figure 4. Histogram

3.4. Scatter Diagram

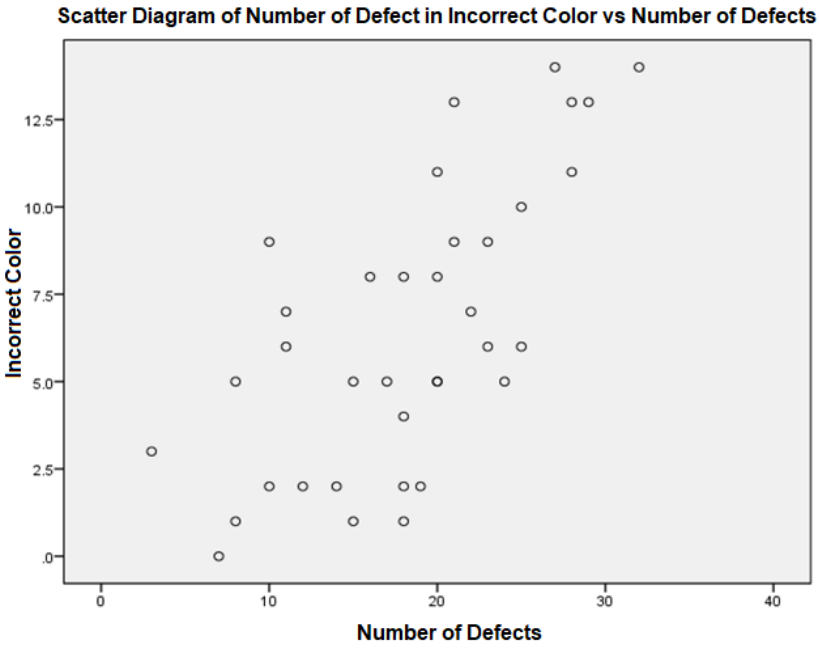

Figure 5. Scatterplot

Table 3. Correlations

		Incorrect Color	Total Defect
Incorrect Color	Pearson Correlation	1	.688**
	Sig. (2-tailed)		.000
	N	36	36
Total Defect	Pearson Correlation	.688**	1
	Sig. (2-tailed)	.000	
	N	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the results of the calculations above, it can be seen that the significant value of the correlation between the number of defective printing production in the production process and the number of defects in the color type that does not match during the 2015 - 2017 period is 0.000 which is worth less than 0.05, which means there is a significant relationship between a large number of defective printing production in the production process and a large number of defects in the type of color that do not match during the period 2015 – 2017. From the Pearson correlation test above, the number of color defects positively correlates with the Pearson Correlation value of 0.688, which belongs to the Strong category. The correlation coefficient value, which is positive, indicates that the relationship between a large number of defective printing productions in the production process and a large number of color defects during the 2015 – 2017 period has a unidirectional relationship.

Based on the results of the calculations above, it can be seen that the significant value of the correlation between a large number of defective printing production in the production process and a large number of defects in the type of sloppy writing during the 2015 – 2017 period is 0.001 which is worth less than 0.05, which means there is a significant relationship between a large number of defective printing production in the production process and a large number of defects in the type of sloppy writing during the 2015 – 2017 period. From the Pearson correlation test above, the number of color defects positively correlates with the Pearson Correlation value of 0.520, which belongs

to the Enough category. The correlation coefficient value, which is positive, indicates that the relationship between a large number of defective printing production in the production process and a large number of defects in the type of sloppy writing during the 2015 – 2017 period has a unidirectional relationship.

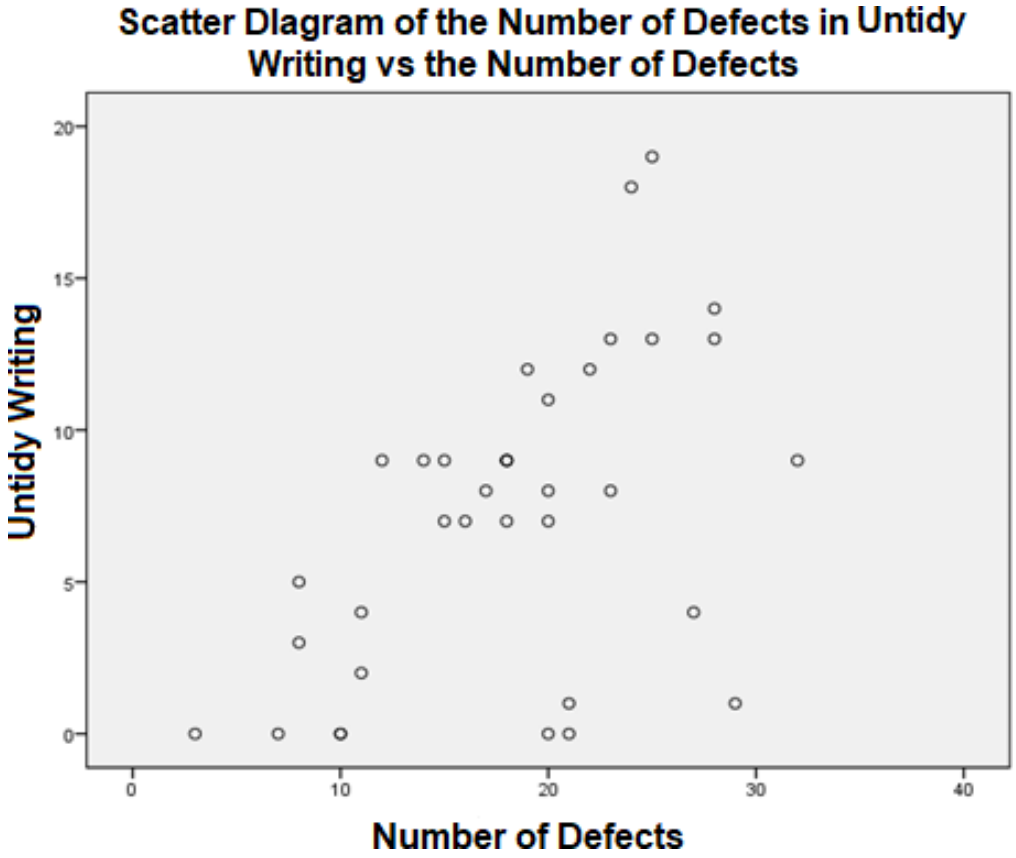

Figure 6. Scatter Diagram

Table 4. Correlations (b)

		Untidy Writing	
Number of defects Untidy Writing	Pearson Correlation	1	.520**
	Sig. (2-tailed)		.001
	N	36	36
Number of defects	Pearson Correlation	.520**	1
	Sig. (2-tailed)	.001	
	N	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the results of the calculations above, it can be seen that the significance value of the correlation between a large number of defective printing production in the production process and a large number of blurry image defects during the 2015 – 2017 period is 0.027, which is worth less than 0.05, which means that there is a significant relationship. There is a significant difference between the large number of defective printing production in the production process and the large number of blurry image defects during 2015 – 2017. From the Pearson correlation test above, the number of

color defects positively correlates with the Pearson Correlation value of 0.370, which belongs to the Low category. The correlation coefficient value, which is positive, indicates that the relationship between a large number of defective printing production. in the production process and a large number of defects in the type of blurry image during the 2015 – 2017 period has a unidirectional relationship.

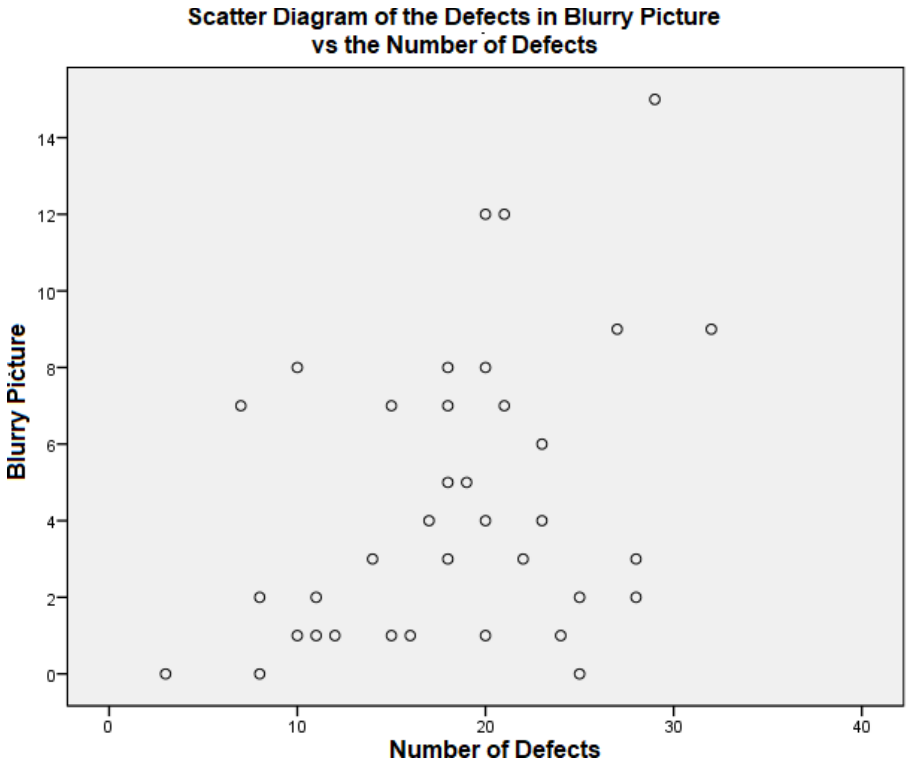

Figure 7. Scatter Diagram (b)

Table 5. Correlations (c)

		Blurry Picture	Number of defects
Blurry Picture	Pearson Correlation	1	.370*
	Sig. (2-tailed)		.027
	N	36	36
Number of defects	Pearson Correlation	.370*	1
	Sig. (2-tailed)	.027	
	N	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

Based on the results of the calculations above, it can be seen that the significance value of the correlation between a large number of defective printing production in the production process and a large number of blurry image defects during the 2015 – 2017 period is 0.027, which is worth less than 0.05, which means that there is a significant relationship. There is a significant difference between the large number of defective printing production in the production process and the large number of blurry image defects during 2015 – 2017. From the Pearson correlation test above, the number of color defects positively correlates with the Pearson Correlation value of 0.370, which belongs to the Low category. The correlation coefficient value, which

is positive, indicates that the relationship between a large number of defective printing production in the production process and a large number of defects in the type of blurry image during the 2015 – 2017 period has a unidirectional relationship.

3.5. Full Map

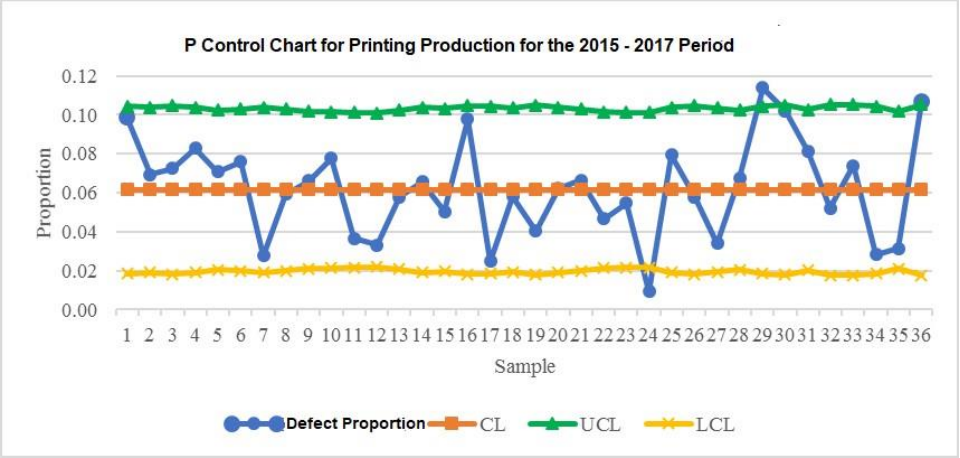

Figure 8. Full Map

Based on the graph above, it is clear that the data are out of the statistical control limits of the control chart p. There is 1 point outside the lower control limit, namely in December 2016. Meanwhile, 2 points are outside the upper control limit, namely in May 2017 and December 2017.

3.6. Cause-and-effect diagram

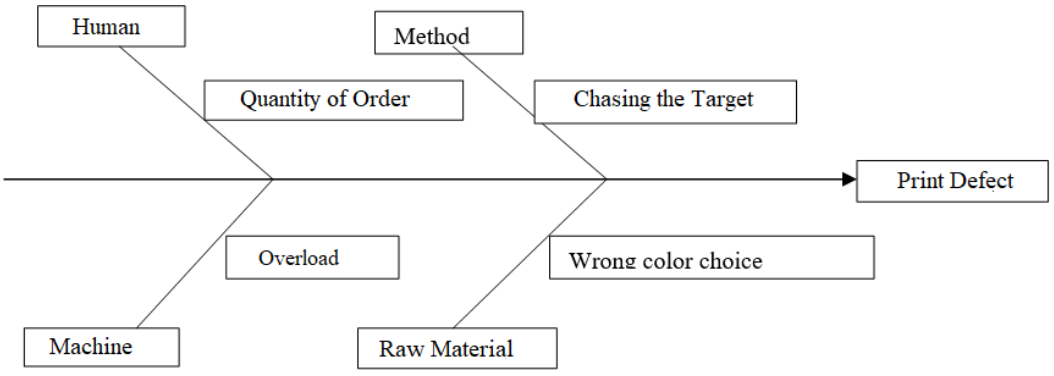

Figure 9. Incorrect Color

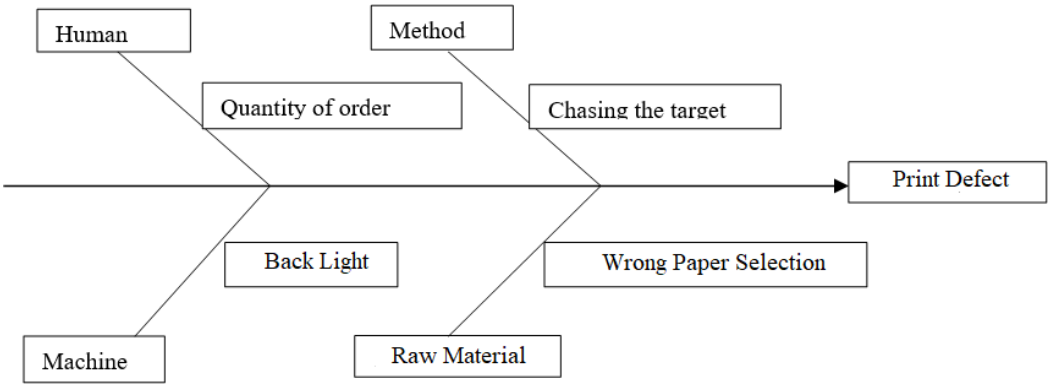

Figure 10. Blurry Picture

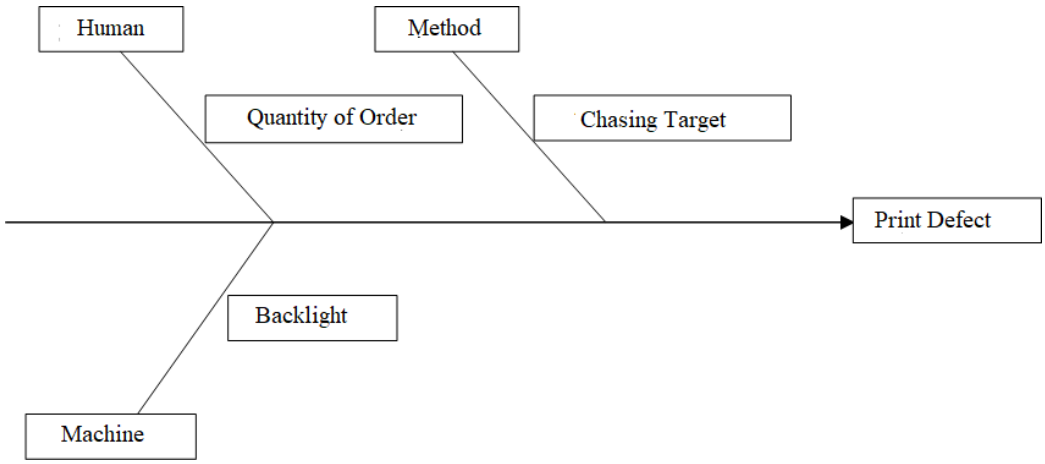

Figure 11. Untidy Writing

4. CONCLUSION AND SUGGESTION

4.1. Conclusion

Based on research, data processing, and analysis of results, the following conclusions can be drawn:

1. Four factors cause problems with blurry images, sloppy writing, and inappropriate colors: humans, machines, work methods, and raw materials.

2. The scatter diagram pattern of three variables, namely the variable number of defective printouts in the production process with a large number of defects in the type of sloppy writing during the 2015-2017 period, has a positive correlation pattern of scattering diagrams, from the calculation of the p control chart for digital printing CV printing products. XYZ 2015 – 2017, some data are outside the limits of statistical control. 2 points are outside the upper control limit, namely in May 2017 and December 2017. Meanwhile, there is 1 point that is outside the lower control limit, namely in

December 2016. From the results of the Pareto diagram, the most types of defects from 2015-2017 were writing not neat as much as 260 or 39.63%, followed by defects with inappropriate colors as much as 232 or 35.37%, and finally, blurry images with defective products, namely 164 or 25%. From the results of the histogram diagram, the highest frequency is found in the middle value of 21.64 or in the interval class 19.57 – 23.71, while the lowest frequency is found in the middle value of 5.07 or the interval class of 3.00 – 7.14. Based on the cause-and-effect diagram, four factors are causing the problem of blurry images, sloppy writing, and inappropriate colors. Four factors cause the problem of the emergence of this type of defect, namely humans, machines, work methods, and raw materials.

3. From a human perspective, employees must concentrate more on work and be thorough because most of the production process is done by human or manual labor. In terms of machines, pay attention to the machine's condition, maintain the machine, and carry out routine maintenance so that the production machine can work properly. In terms of work methods, it is adjusting to conditions, namely by adjusting the amount of production and the number of workers. So that all orders can be sent to customers with good quality conditions. In terms of raw materials, choose raw materials of good quality.

4.2. Suggestion

Suggestions that can be given to CV. XYZ is as follows:

1. To reduce the number of defects that occur, the company must make improvements to the factors that cause defects, starting from the most important, namely raw materials, then increasing the number of machines so that overloads do not occur frequently, then multiplying or improving the quality of human resources in CV. XYZ in the face of solid demand and targets and improving work methods in the production process to achieve predetermined targets.

2. Companies must pay more attention to and improve supervision of machine maintenance regularly so that the printing process can run smoothly and no problems hinder it.

3. The company should be more strict in supervising the work of its employees in terms of selecting raw materials, such as the type of ink or paper used, paying attention to the condition of the machine and the performance of the machine while doing the printing process, accuracy in viewing the printing results. All is done to reduce employee errors in the production process. Companies should focus more on the type of damage or sloppy writing because this type of defect has the largest percentage.

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