

Research Article

Analysis of Calendar Printing Defect Control Using FMEA Method at PT Grafilin Desa Putera

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Abstract

The printing industry plays a vital role in supporting various sectors such as commerce, education, and entertainment. The quality of printed products is a key factor in attracting customers and maintaining business competitiveness. PT Grafilin Desa Putera is a printing company that produces a variety of printed materials, with calendars being one of the most in-demand products recently. This study aims to identify failure modes in the calendar printing process and analyze their root causes to reduce defects. The method used is Failure Mode and Effect Analysis (FMEA), which evaluates risks based on the Risk Priority Number (RPN). The results show that the total RPN value across identified failure modes reached 910, with the highest individual RPN of 252 attributed to the issue of blanket smashing or blanket rupture. These findings serve as a foundation for developing corrective strategies to improve the quality and efficiency of the production process at PT Grafilin Desa Putera.

Keywords: failure mode and effect analysis (fmea), risk priority number, print defects, calender

INTRODUCTION

The development of the digital era has push change significant in various sector industry, including industry printing (Sheva Prasetyo Budi Rahayu et al., 2023). Although digital technology becomes dominant, need to product print physique still high, especially in sector commercial, educational, and promotional. One of



challenge main in industry This is maintain quality results print. Quality bad print, result existence disability production, can impact direct to level satisfaction customer as well as image company in a way overall.

PT Grafilin Village Son is one of company printing that produces diverse type product like books, calendars, folders, envelopes, brochures and letters sheet. In a number of time lastly, calendar be one of product with request highest. However, the printing process calendar Still face a number of problem related quality, marked with emergence various defects in results print during period production certain.

Type defects found in print process calendar among others is *blanket smashing* or *blanket broken*, *scumming*, *overink*, *underink*, *missregister*, block ink, *hickies*, and paper torn. Factor reason disabled This can originate from damage to blanket, quality ink, condition plate print, or quality material paper. Research previously by Rachmah Nanda Kartika et al. (2022) stated type disability like *missregister*, *dot gain*, *set off*, and color striped as problem general in production calendar. So, it is necessary approach systematic For identify and minimize potential failure in the production process use produce product print quality tall.

One of methods that can applied For identify and analyze potential failure in the production process is *Failure Mode and Effect Analysis* (FMEA). According to Vidya Paquita et al. (2022b), FMEA is the approach used For evaluate potential failure based on three indicator main, namely level severity (*severity*), possibility occurrence, and ability detection (*detection*). Method This give evaluation risk in form *Risk Priority Number* (RPN), which can used For prioritize action repair use prevent or reduce process failure .

A number of study previously has implementing FMEA and methods other in effort control quality results print. Kartika et al. (2022) used FMEA to control four type disability print on the calendar, with recommendation repair like use tool densitometer measurement and maintenance routine machine. Waruwu et al. (2022) applied method *Six Sigma* For analyze level damage product calendar, and get sigma level of 3.1, which indicates estimate disability amounting to 41,000 units from every 1,000,000 units of production. While that, Saeful Imam et al. (2020) used deep FMEA control quality print packaging, with strategies such as use *checksheet*, operator training periodic, and formation culture share knowledge between employee .

However, until moment This Not yet there is research that is specific discuss application of FMEA for control disabled print on product calendar at PT Grafilin Village Son . Therefore that, research This aiming For identify failure modes in the production process calendar in the company the as well as give proposal action repair based on results FMEA analysis, so that expected can increase quality product and production process efficiency in a way overall.

METHOD

This research was conducted at PT Grafilin Desa Putera to analyze the defective calendar printing results using the FMEA method. the first thing to do For do effort control calendar print defect with use FMEA method, namely data collection .

Data used in the research This namely primary data derived from interviews and observations (R. Elyas dan W. Handayani, 2020). The data from the interviews used are data from the results of interviews with offset printing machine operators at PT Grafilin Desa Putera to find information about what types of printing defects

occurred in the calendar results for 30 days in November 2024. Meanwhile, the observation data used is to directly observe what types of defects are found in the printed calendar results during November 2024.

After the data is collected, the thing to do is to sort the printing defects, especially in calendar printing, from the most frequent to the least frequent. Then continue with the calculation of the number of printing defects from the number of prints in November 2024. After that, continue by creating a background on why the printing defects can occur, continued by determining the formulation of the problem and the appropriate method for the problem of defects that occur in the calendar printing.

Finally, make conclusions and suggestions that contain a summary of all the analysis and discussion of this study. The analysis and discussion made are expected to be able to answer the research objectives and suggestions given to researchers who will conduct further research.

Failure Mode and Effect Analysis (FMEA)

According to (Mochamad Basori, 2017) FMEA is a technique analysis used to find and overcome a problem or possibility of failure in a system, design, process, or service before it reaches the customer. This method helps find various possibilities of failure, analyze their impact, and determine the risk level based on priorities. FMEA also guides in taking effective action to reduce the possibility of failure, lower the risk level, and prevent failure.

FMEA is the method used to find the possibility of failure in a product or process, including problem design, external conditions specifications, or changes that affect its function (Frizkia Sepriandini, 2021). To understand risk failure in FMEA, three main components are analyzed:

1. Severity (Level of Severity)

Measure how much critical impact failure has on the user end. Its value is given from a scale of 1 to 10, where:

- **1** : The impact is very mild or not significant.
- **10** : The impact is very serious or critical.

Table 1 FMEA (Severity)

Ranking	Severity	Description
1	Negligible	Customer No found defective products
2	Mild	Customer consider the quality of the product is fine
3		
4		
5	Moderate	Customers are aware of the decline in product quality, but the product is still acceptable to customers.
6		
7		
8	High	Customers notice the downturn quality product And No can accept it.
9		
10		
	Potential	Customer No receive the product

2. Occurrence (Opportunity) Incident)

Measure how much often failure possibility occurs. The rating scale is also from 1 to 10, where:

- **1** : Very rare occurrence or almost No Once.
- **10** : Very frequent occurrence or general.

Table 2FMEA (Occurrence)

Ranking	Occurrence	Description
1	Remote	0.001 per 1000 Items
2	Low	0.1 per 1000 Items
3		0.5 per 1000 Items
4	Moderate	1 per 1000 Items
5		2 per 1000 Items
6		5 per 1000 Items
7	High	10 per 1000 Items
8		20 per 1000 Items
9	Very High	50 per 1000 Items
10		100 per 1000 Items

3. Detection (Ability) Detection)

Measure how much effective system or existing methods For detect failure before occurs. The rating scale is also from 1 to 10, where:

- **1** : Very effective in prevent failure.
- **10** : No effective or almost No There is prevention.

Table 3FMEA (Detection)

Ranking	Detection	Description
1	Method prevention very effective	0.001 per 1000 Items
2	Method prevention effective	0.1 per 1000 Items
3		0.5 per 1000 Items
4		1 per 1000 Items
5	Method prevention not enough effective	2 per 1000 Items
6		5 per 1000 Items
7	Method prevention No effective	10 per 1000 Items
8		20 per 1000 Items
9	Method prevention very ineffective	50 per 1000 Items
10		100 per 1000 items

To determine the RPN (*Risk Priority Number*) value, it is necessary to... p multiplication on the three value tables in above, namely *occurrence*, *detection* , and *severity*. The following is the RPN formula:

$$RPN = SEV (S) \times OCC (O) \times DET (D)..... (1)$$

RPN value helps determine level priority repair What should prioritized than can be done soon . We have find that RPN values correlate positive with mark severity, occurrence, and recognition. More RPN value tall show order priority more

improvements tall

RESULT AND DISCUSSION

Based on the data collection that has been collected from the results of interviews and observations conducted. The data is grouped based on type. to the defects that occur in the calendar print so that can known type to defect n often happened. Here is table results collection of report data collected from interview and observation results based on amount type defects that occur during the period November 2024 .

Table 4Types of Calendar Defects

Types of Disabilities	Number of Defects November 2024
Blanket smashing / blanket broken	3 05
Scumming	2 40
Overink/underink	192
Missregister	96
Ink block	28
Hick ies	23
Paper tears due to gripper biting too hard	30
Paper tears due to ink being too sticky and blanket being pressed too hard	11
Total	925

Based on the data above, it can be it is known that during November 2024, production of PT Grafilin Desa Putera experienced 8 types to the print notes on the calendar type print with a total of 925 defective print units out of 13,300 calendar prints printed. In addition that, has found that type disabled *blanket smashing / blanket* broken own scale the highest, namely 305, so that required investigation more carry on about components that cause disabled *blanket smashing / blanket* the breach.

Calculation Analysis Risk with Method *Failure Mode and Effect Analysis* (FMEA)

FMEA is used For increase control disability calendar print so that consumer more satisfied . For determine priority risk, FMEA uses reject measuring *occurrence*, *detection*, and *severity*. After evaluation risk finished, can done analysis about potential components cause failure For each failure mode. Table following show calculation mark *Risk Priority Number* (RPN) values for FMEA.

Table 5 Failure Mode and Effect Analysis (FMEA)

Process Description	Failure Mode	Consequence from Potential Failure	S	Reason Potential Failure	O	D	RPN
Print defect	<i>Blanket smashing / blanket broken</i>	There are empty spots on the printed part	7	There is a part of the blanket that is concave due to printing pressure.	9	4	252
	Scumming	Ink spots on <i>non-image prints</i>	7	Plate oxidation	8	2	112
	<i>Overink/underink</i>	<i>Image</i> colors become thicker or thinner	2	Too much/too little printing ink is transferred due to too much/too little rotation of the feeding roller	8	3	48
	Missregister	Shadow image	4	Inaccuracy in perforating the printing plate	7	1	28
	Ink block	Ink blocks part or all of the paper	10	Dry wetting water	6	2	120
	Hick ies	There are patches almost like <i>scumming</i> in the image.	7	Dust paper sticks to the plate/ <i>blanket</i> and also the presence of dried ink deposits	5	2	70
	Torn paper	Damage to paper at <i>the cobb part</i> of the paper	10	<i>gripper</i> and corrugated paper	5	4	200

		Damages paper and <i>blanket</i> if wrapped around the roller.	10	The ink is too sticky and the <i>blanket</i> is too pressing	4	2	80
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Based on RPN calculation, the concave part of the blanket due to printing pressure is mark highest as big as 252. The calculation of the Risk Priority Number (RPN) value is calculated with multiplication SOD (Severity, Occurrence, Detection) value . Purpose from calculation RPN value is For determine order the most important fashion failure For handled (Muhamad Fajar Kurnianto, 2022).

Based on table 5, it is known that there are 8 causes of printing defects on the calendar analyzed using the FMEA method, namely the concave part of the blanket due to printing pressure , oxidation of the printing plate , too much/too little printing ink transferred, inaccuracy in perforating the printing plate , dry wetting water , paper dust sticking to the plate/ *blanket* , and *the gripper* biting too hard .

Improvements made to address calendar printing defects that have been analyzed using the method *Failure Mode and Effect Analysis* (FMEA) and calculations mark *Risk Priority Number* (RPN) . The following table provides repairs to handle these defects.

No	Types of Disabilities	How to Handle
1	Blanket smashing/blanket broken	Rubbing the blanket with sparegum , a liquid that makes the blanket rise again
		Replacing the packing paper on the blanket
		Replace the blanket with another blanket unit or a new blanket .
2	Scumming	Rub the entire plate using a rubber washing agent (RWA)
3	Overink / underink	Adjust the ink and wetting water levels again
4	Missregister	Adjust the register until it is appropriate and precise
5	Ink block	Run the machine a little longer by inserting the wetting water roller so that the water roller does not dry out.
6	Hickies	Rub the entire blanket using a rubber washing agent (RWA)
7	Paper torn	the cobb /front end of the paper downwards, giving WD to the gripper.
		If it tears and gets stuck in the roller, readjust the ink viscosity so it is not too sticky.

From the table above, it can be seen how to handle calendar printing defect problems in general can be handled by resetting, replacing, and cleaning the

components or parts of the 4-color separation printing machine. Therefore, handling can be done quickly by directly contacting the machine components.

CONCLUSION

Based on results analysis use FMEA method, found eight reason main disability in print process calendar at PT Grafilin Village Son. Cause with risk highest is concave blanket consequence pressure print, with RPN value of 252. Another problem that is also significant covers oxidation plate print, mismatch amount ink, and errors technical others. Through approach this, company can prioritize fix the cause with risk highest For increase quality print and reduce level disability product.

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