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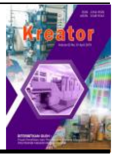

Reducing Sorting and Return of Sauce Packed Products As a Green Production Strategy In Flexible Packaging Industry

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A B S T R A K

Industri manufaktur kemasan fleksibel *(Flexible Packaging).* menghadapi tantangan signifikan terkait mutu produk, yang berdampak pada tingginya angka sortir dan retur serta mempengaruhi kelancaran pengiriman. Tingginya angka return menjadi perhatian utama karena tidak hanya menurunkan kepuasan pelanggan, tetapi juga memengaruhi pencapaian *Key Performance Indicator* (KPI) perusahaan, yaitu *On Time Delivery* dan *Zero Return.* Analisis awal menunjukkan bahwa proses Slitting merupakan titik kritis dalam proses produksi kemasan fleksibel, dengan dua masalah utama, yaitu gulungan tidak rapi dan paper core sempit. Kedua masalah ini menjadi penyumbang terbesar terhadap angka sortir dan retur pelanggan. Untuk mengatasinya, perusahaan menerapkan dua pendekatan, pertama yaitu dengan menghilangkan akar penyebab teknis dari kedua masalah tersebut, dan kedua dengan mencegah agar masalah tidak lolos ke pelanggan, sekaligus mengurangi pemborosan dan potensi pencemaran lingkungan menggunakan metode *fish bone diagram* dan *root cause analysis*. Hasil implementasi menunjukkan perbaikan yang signifikan. Rata-rata sortir per bulan turun dari 18 roll menjadi 7 roll, dan pencapaian retur yang sebelumnya mencapai 6 roll berhasil ditekan hingga 0 roll selama periode Mei 2025 hingga September 2025. Melalui upaya *Continuous Improvement* dilakukan oleh perusahaan, perusahaan berhasil mengatasi masalah gulungan tidak rapi dan paper core sempit yang sebelumnya menyebabkan retur produk dan penurunan kualitas. Dengan langkah-langkah yang terukur dan terdokumentasi, perusahaan tidak hanya mengoptimalkan proses produksi, tetapi juga meningkatkan kepuasan pelanggan secara signifikan. Keberhasilan ini mencerminkan komitmen perusahaan terhadap kualitas dan keberlanjutan operasional yang efisien dan ramah lingkungan

A B S T R A C T

The flexible packaging manufacturing industry faces significant challenges related to product quality, resulting in high sorting and return rates and impacting smooth delivery. High return rates are a major concern as they not only reduce customer satisfaction but also impact the achievement of the company's Key Performance Indicators (KPIs) of On-Time Delivery and Zero Returns. Initial analysis showed that the slitting process was a critical point in the flexible packaging production process, with two main problems, namely a messy roll and a narrow paper core. These two problems were the largest contributors to the number of customer sorting and returns. To overcome these, the company implemented two approaches, first by eliminating the technical causes of both problems, and second by preventing the problems from being passed on to customers, while reducing waste and potential environmental pollution using fishbone diagrams and root cause analysis methods. The implementation results showed significant improvements. The average monthly sorting rate decreased from 18 rolls to 7 rolls and returns were reduced from 6 rolls to 0 rolls between May 2025 and September 2025. Through Continuous Improvement efforts, the company successfully addressed issues with messy rolls and narrow paper cores that previously led to product returns and

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quality degradation. With measurable and documented steps, the company not only optimized its production processes but also significantly improved customer satisfaction. This success reflects the company's commitment to quality and sustainability, efficient and environmentally friendly operations.

1. INTRODUCTION

Companies that can win the competition are those that consistently find ways to advance. One way to determine whether a company is advancing is through its productivity growth. Productivity is the number of units of goods or services produced by employees in a given period of time using various types of machines and equipment available in the workplace (Pardede, 2007). Many companies are looking for effective and efficient methods or methods in increasing productivity. Productivity cannot be measured without a standard or benchmark, namely Key Performance Indicator (KPI).

In the modern manufacturing industry, the biggest challenge is not only maintaining productivity but also ensuring efficiency while maintaining environmental sustainability. For many years, the flexible packaging manufacturing industry in Indonesia has faced classic product quality issues, including sorting and high return rates. This situation not only hinders production and shipping, but also creates significant costs and waste, contrary to the spirit of the green industry, as stipulated in the Regulation of the Minister of Industry of the Republic of Indonesia No. 55 of 2020 concerning Green Industry Standards. The gradual implementation of the green industry will help increase the efficiency, profitability, and competitiveness of industrial companies in the global market (Lina Saptaria, Sopiah, 2022). Green management focuses on management efforts to reduce the impact of environmental problems arising from organizational activities. The implementation of green industry is carried out through the concept of green production through the application of 4R, namely Reduce (waste reduction at the source), Reuse (waste reuse), Recycle (waste recycling), and Recovery (separation of a material or energy from a waste) (Aminah, Yusriadi, 2018). The clean industrial system is also expected to provide savings in terms of environment and economy, such as the application of green production in a tofu factory that has been improved so that it results in water savings per month which automatically also reduces production costs incurred (Rahayu, 2016). It is also stated that green production is the overall environmental efficiency of a company through a comprehensive pollution prevention approach (Geng et al., 2010). According to Wu et al. (2013), all forms of human activity certainly have risks, including green production. Therefore, risk management is needed to address all forms of risks that may occur in the future. Christiani, 2017 has conducted an industrial environmental performance measurement in Indonesia based on green industry standards for the medium industry category, so this time for large industries operating in the plastic packaging category, it will be seen an overview of what has been done in the production process based on green industry criteria. Recent developments in the green industry by determining indicators as a tool to prevent or reduce with better product design, better process optimization, better monitoring, better training and management, combined with developing and uniform government regulations, applicable to industrial and business facilities (Klemes et al., 2012).

High sorting and customer return achievements are a major concern for the company because they not only reduce customer satisfaction, but also affect the achievement of the company's Key Performance Indicators (KPIs), namely On Time Delivery and Zero Return.

Tabel 1. Percentage of Untidy Roll Sorting Problems by FG Product Type in the period Jan 2025 - April 2025

No	Product Type FG	Problem Desc	Number of FG sorting rollers	Std Roll length of roller FG (m)	Total Roll Length	% Sortir
1	Sauce Pack	Messy rolls	113	6.000	534.500	41,65
2	Noodle	Messy rolls	287	1.500	430.500	34,72
3	Group Non Noodle	Messy rolls	213	1.000	213.000	17,18
4	Oil Pack	Messy rolls	32	2.500	80.000	6,45
	Total				1.258.000	100

Based on Table 1 above, the problem of messy rolls on Sauce Pack products has the highest percentage of separation problems compared to other types of products.

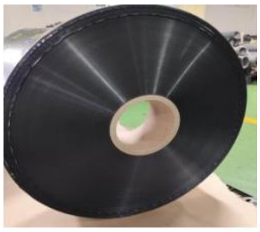


Figure 1. FG Roll Sauce Pack Product problem, messy roll

Tabel 2. Number of FG Roll Sauce Pack product returns in the period Jan 2025 - April 2025

No	Return Problems	Number of FG Rolls
1	Narrow paper core	21
2	Asymmetrical cut	9
3	Torn	1
	Total	31

Based on Table 2 above, customer returns due to narrow paper core issues for Sauce Pack products are the highest compared to other return issues. Narrow paper core issues involve paper cores with defects on the inner surface, reducing the core diameter, making them difficult for customers to use during production.

Through a Continuous Improvement (CI) activity titled "Reducing Sorting and Returning Sauce Pack Products as a Green Production Strategy in the Flexible Packaging Industry," a leading Indonesian flexible packaging company, PT ABC Tbk, identified the interleaving process as a critical point in the production process, with two main issues and messy paper. Both of these issues significantly contributed to the number of sorting and customer returns for Sauce Pack products.

2. METHOD

To address the above-mentioned issues, two approaches have been taken: first, eliminating the technical causes of both issues, and second, preventing the issues from reaching the customer, while reducing potential waste and environmental pollution. Silva (2013) conducted research on the most suitable methodology for assessing green production, namely the standard methodology, compared to various other individual methods because its methodology is broader and easier to implement than other individual methods. It can be said that the main focus of the development of the standard methodology is the planning phase of the PDCA (Plan, Do, Check, Action) cycle.

The improvement stages carried out in this CI activity are as follows:

1. Plan Stage
   Conduct field observations and data collection to formulate the background of the problem, analyze potential causes of the problem, determine improvement targets, and create improvement plans..
2. Do Stage
   Carrying out repair activities by testing the use of air shafts and friction ring type shafts in the sauce pack product process for 20 working days. Shaft type testing is carried out by directly observing each activity during the process, starting from observing the work methods carried out by the operator, the equipment used, until the final results of a process in the activity as well as testing various existing core plug residues (using core plug Ex jumbo roll Plain Raw

Material Film) with the FG dropping test method vertically (height approximately 100 cm) and horizontally (height approximately 50 cm).

3. Check Stage
   Conduct an evaluation of the results of the improvement by conducting a Why-Why analysis using the 5W + 1H method, conducting an improvement impact assessment analysis (before and after the improvement), and conducting a financial review analysis (cost savings analysis).
4. Acton Stage
   Carrying out standardization and follow-up on improvement results by creating new process procedure standards based on the achievement of improvement results and carrying out socialization of improvement activities in other plant work units.

3. RESULT AND DISCUSSION

Tabel 3. Analyze the potential cause of the problem

Factors	Item	Standard	Actual Conditon	Remark
Man	Operator's ability to operate the slitting machine	Operators work according to SOP and WI	Efficient operator controls machine parameters	Suitable
Material	Paper core	No change in inner diameter	There is a change in the inner diameter	Problem
Methode	Machine Parameter	Taper tension parameters according to existing WI	Produces rolls with good roll flatness	Suitable
Machine	Roll flatness stability during the slitting process in the shaft rewinder	Stable roll flatness during the grooving process in shaft rewinders	Unstable roll flatness during grooving process in shaft rewinder	Problem

Based on Table 3 above, from a material perspective, the changing inner diameter of the paper core causes the Sauce Pack product to have a narrow paper core. Furthermore, from a machine perspective, the unstable roll flatness causes the Sauce Pack product to have a messy roll. Based on the analysis of these potential causes, the next step is to analyze the cause-effect relationship using a fishbone diagram.

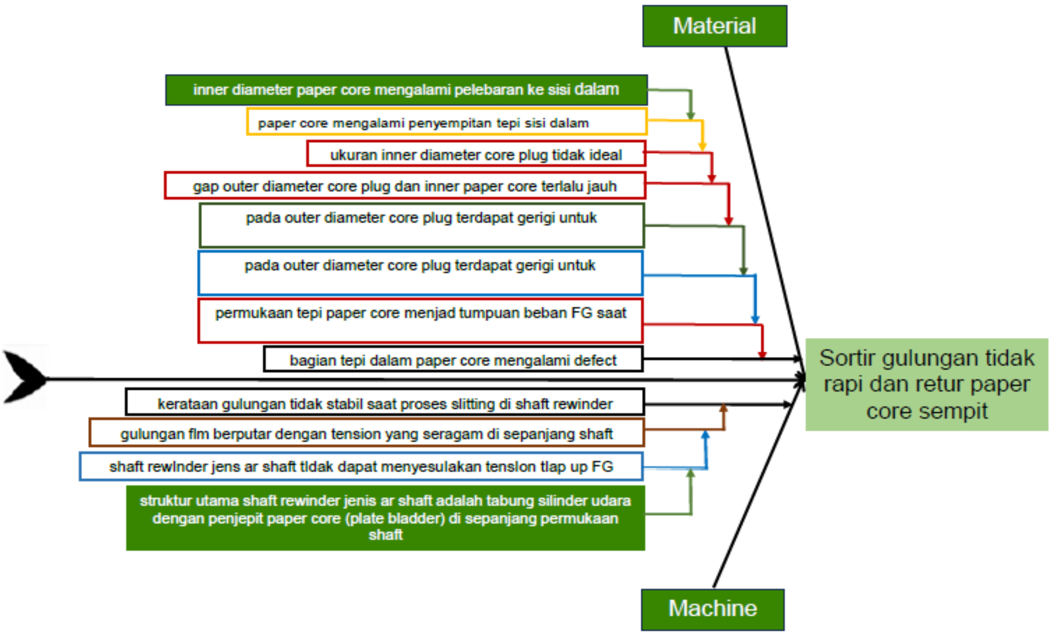


Figure 2. *Fishbone diagram (cause and effect analysis diagram)*

Based on Figure 2 above, from a machine perspective, the use of air shafts causes unstable roll flatness on the rewind shaft during grooving. This type of shaft operates by simultaneously locking the paper core using a pressurized air cylinder mechanism along the surface of the shaft.

Figure 3. Air shaft type with air tube mechanism and single model paper core clamp

From the material factor, the condition of the paper core that is defective (change in inner diameter) causes the problem of narrow paper core in Sauce Pack products. Narrow paper core occurs due to the use of ineffective core plugs, improper handling and high mobility of the goods. Core plugs are pads in the form of plastic rings placed on both sides of the FG which are useful to protect the paper core from damage during handling activities (when the FG packaging is produced, the FG storage in the warehouse until the FG delivery to the customer).

Figure 4. Narrow paper core problem with core plug on the side

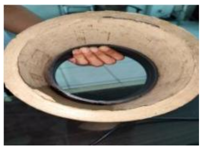


Figure 5. Existing core plug (before repair)

Based on the results of the fishbone analysis above, the next step is to determine the improvement targets (before and after improvements)

Tabel 4. Determining Improvement Targets

<table>
<tr><th>Improvement targets</th><th colspan="7">Prerequisites</th><th>Target to be achieved</th></tr>
<tr><td>(Depending on the size used)</td><td colspan="7">Sorting 113 rolls of Untidy Rolled Sauce Pack products in the Slitting process and Returning narrow paper core problems totaling 21 rolls during the period January 2025 to April 2025.</td><td>Reduce sorting of Messy Roll Sauce Pack products in the Splitting process to an average of 8 rolls per month and 0 rolls of narrow paper core issues returned on Sauce Pack products for the period May 2025 to September 2025</td></tr>
<tr><td colspan="9">Overview of Targets Based on SMART Elements</td></tr>
<tr><td>Specific</td><td colspan="8">Reducing the Problem of Sorting Untidy Gaps on Topact Sauce Pack Products in the Splitting Process and Eliminating Narrow Return Paper Cores on Sauce Pack Products</td></tr>
<tr><td>Measureable</td><td colspan="8">Reduce the problem of messy roll stacking by 50% from an average of 18 rolls per month and reduce the problem of narrow paper core returns from 21 rolls to 0 rolls in line with the Zero return management target.</td></tr>
<tr><td>Achievable</td><td colspan="8">Based on the analysis to be conducted, it shows that the target of achieving an average of 8 rolls of Untidy Roll Sorting and 0 rolls of narrow paper core problem returns within a three-month period is realistic and can be achieved through several improvements in the slitting process.</td></tr>
<tr><td>Reasonable</td><td colspan="8">Based on the nature of the problem, the messy roll and narrow paper core problem does not occur on all rolls because the problem is influenced by, among other things, the thickness and packaging treatment as well as the delivery time.</td></tr>
<tr><td>Time Base</td><td colspan="8">Target achieved May to September 2025</td></tr>
<tr><td rowspan="3">The impact of the repair will affect: (if there is an impact, mark (√) , there can be more than one impact)</td><td>Q</td><td>C</td><td>D</td><td>P</td><td>S</td><td>E</td><td>M</td><td>Others (Specify)</td></tr>
<tr><td>√</td><td>√</td><td>√</td><td>√</td><td>-</td><td>√</td><td>√</td><td>-</td></tr>
<tr><td>Q: Quality</td><td>C: Cost Efficiency</td><td>D: Delivery (Shipping, transfer, transportation)</td><td>P: Productivity</td><td>S: Safety</td><td>E: Environment</td><td>M: Moral</td><td></td></tr>
</table>

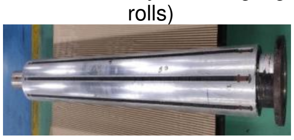
Based on table 4 above, the target to be achieved is to reduce the problem of messy roll separation on Sauce Pack products to an average of 8 rolls per month and 0 returns of narrow paper core problem rolls on Sauce Pack products in the period May 2025 to September 2025. The next step is to determine an improvement plan using 5W + 1H analysis.

Tabel 5. Determination of Repair Plan

No	What		Why	How	Where	When	Who	How Much
	Problem	Solution	Reason	Detail Activity	Location	When	Who	Cost
1	The main structure of the air shaft type rewinder is an air cylinder tube with a plate strip as an intermediary.	Replacing the air shaft type winding shaft with a friction ring type	The flatness of the roll is unstable during the cutting process on the rewinder axle.	Conducted tests using shaft friction rings on sauce pack product process for 20 days	Slitting Machne	May 25	Spv and Operator	Downtime Rewinder Axle Replacement Rp.462,852 (for 1 hour)
2	The inner surface of the Paper Core is expanded inward.	Change the outer diameter of the Core Plug to a more ideal size	The inner edge of the Paper Core is damaged (Paper Core Ex)	Conduct observations on the most ideal outer diameter of the Core Plug without disrupting the functional use of the core plug.	Slitting Dept	May 25	Slitting Dept	Lathe Machine Electricity Cost Rp. 50,000 (Rp. 10,000/hour x 5 Hours)
		Finding alternative materials for existing core plugs	Existing core plug materials are not strong enough to withstand impact.	Conduct core plug quality testing with vertical and horizontal FG drop tests	Slitting Dept	May 25	Slitting Dept	

After determining the repair plan, the next step is to carry out repair activities according to the determined solutions.

Tabel 6. Repair Activities for Loose Coil and Narrow Core Plug Problems

Aspect	Before the repair	After repair	Effect
Shaft Type	Using the Air shaft (unstable tension, messy visual zigzag rolls)  	Using a Sliding Ring type shaft (more stable tension, neat and accurate winding)  	Sorting dropped from 18 rolls per month to 7 rolls per month, or a decrease of 72.2%
Core plug	Using PP/LLDPE material (fragile and easily broken) 	Using ABS material (sturdy, not easily broken) 	There was no change in the inner diameter of the paper core with FG drop tests vertically and horizontally.
Cost Saving	Rework costs of IDR 13.6 million and potential loss of sales of IDR 216 million	Rework costs of IDR 4.1 million and potential loss of sales of IDR 21 million	Total cost savings of 236 million over 3 months

Based on the data in Table 6 above, the use of the friction ring shaft type has an impact on the quality of the resulting rolls, with the sorting problem decreasing from 18 rolls to 7 rolls per month, a decrease of 72.2%. Furthermore, the use of ABS material in the core plug has significantly improved the condition of the inner diameter of the paper core, preventing defects or deformation.

Table 7 shows the activity of selecting core plugs to replace existing core plugs from existing waste (derived from Ex Ordinary Film Raw Materials) by conducting FG drop tests vertically (height approximately 100 cm) and horizontally (height approximately 50 cm), with each test frequency (vertical and horizontal) 5 times.

Tabel 7. Core Plug Selection Activity (derived from Common Film Raw Materials)

No.	Core Plug Ex	RM Film Supplier	Inner Diameter (mm)	Material	RM Film Weight (kg)	Surplus	Mnus
1		*Jisung*	151,45	PP/ HDPE	600	Lightweight, easy to reprocess, moisture resistant	The shape is not round, symmetrical/sometimes oval, the inner diameter of the core plug is smaller
2		*Inamulti*	151,8	PP/ HDPE	600		
3		*Kencar*	149,8	PP/ HDPE	600		
4		*SRF*	153,0	PP/ HDPE	600		The surface of the ear is irregular/tends to be concave
5		*Indopoly*	152,2	ABS	2.000	Very strong, impact resistant, constant inner diameter size	Serrated (serrated diameter 153.7 mm)

Based on the activity data in Table 7, ABS core plugs have better advantages than others, namely the ability to withstand loads of up to 2 tons and a constant inner diameter. The next step is to modify the dimensions of the ABS core plug to match the dimensions of the existing core plug using a lathe.

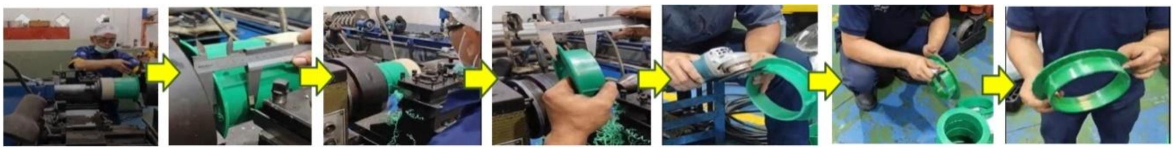


Figure 6. Activity of making ABS core plugs from Ex RM Plain Film using a lathe

Figure 7. FG Vertical and Horizontal Drop Resistance Test Activity

After conducting the vertical and horizontal FG drop tests, the inner diameter of the paper core was checked using a gonogo (a tool for measuring the diameter of holes made of nylon). The test results found that there was no defect or deformation in the paper core.

4. CONCLUSION

Based on the results of the improvements made, two dominant factors were the main cause of the problem of messy roll separation and the problem of narrow paper core return, namely the old type rewinder system (airshaft) that could not maintain tension stability, as well as the type of core plug material that was less strong than ideal. Both conditions caused visual and mechanical defects in the final FG results so that the product was sorted and returned by the customer. From the test results, it was found that the use of the friction ring type shaft successfully reduced sorting from 18 rolls per month to 7 rolls per month, or a decrease of 72.2%, and also the use of ABS material on the core plug had a significant impact on the condition of the inner diameter of the paper core where the inner diameter of the paper core did not experience any defects or defects.

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