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Kaizen Implementation in Small and Medium Enterprises at PRAN RFL Group in Bangladesh.

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Abstract

Kaizen, a Japanese concept signifying continuous improvement, has emerged as a key strategy for boosting productivity and efficiency across industries globally. In Bangladesh, Small and Medium Enterprises (SMEs) like PRAN-RFL Group play a vital economic role by generating employment and supporting livelihoods. However, the abundant labor force within SMEs often poses significant productivity challenges. Addressing these issues requires the adoption of methodologies such as Kaizen, which focuses on continuous improvement through active worker participation in analyzing, redesigning, and implementing more efficient processes. Despite its proven benefits, the application of Kaizen faces various challenges that affect organizations of all sizes. This paper explores the implementation of Kaizen methodologies at PRAN-RFL Group, analyzing lessons learned and best practices to enhance productivity while addressing associated challenges. The study demonstrates how Kaizen optimizes processes, reduces waste, and improves overall performance, fostering organizational growth, competitiveness, and a dynamic corporate culture within the SME sector in Bangladesh.

Keywords
Productivity, continuous improvement, Kaizen, SME, PRAN-RFL Group.

1. Introduction
The global business environment is marked by rapid changes, increased competition, and technological advancements, particularly impacting Small and Medium Enterprises (SMEs). To navigate these challenges effectively, the concept of Kaizen, a Japanese philosophy emphasizing continuous improvement, has gained prominence. This research aims to investigate the implementation of Kaizen in Small and Medium Enterprises, drawing lessons and best practices from the experiences of PRAN RFL Group. PRAN RFL Group is one of Bangladesh's largest and most diversified business conglomerates. The company has a significant presence in various sectors, including agribusiness, food and beverage, plastics, real estate, and more. However, PRAN RFL Group, a prominent conglomerate in Bangladesh, has successfully implemented Kaizen principles, emphasizing continuous improvement across its diverse business sectors. Through a commitment to efficiency, employee engagement, and continuous refinement, PRAN RFL Group's adoption of Kaizen has contributed to enhanced productivity and competitiveness in the dynamic business environment.

1.1. Objectives

The primary objective of this study is to analyze the implementation of Kaizen in Small and Medium Enterprises (SMEs), with a focus on deriving actionable insights from the practices employed by PRAN RFL Group. To achieve this, the study will explore specific objectives: examining the key principles and methodologies of Kaizen as applied by PRAN RFL Group, identifying challenges SMEs encounter during Kaizen implementation, and assessing its impact on operational efficiency, employee satisfaction, and overall performance. Additionally, this paper aims to develop a set of best practices derived from PRAN RFL Group's experience and provide recommendations to support other SMEs in successfully adopting Kaizen for sustainable growth and enhanced productivity.

2. Literature Review

Frist of all, we were reading several papers from different journals about Kaizen Implementation, Practices, and outcomes. Thus, we select to PRAN RFL Group in Bangladesh for this recharge work. We also noticed that different countries have successfully replaced these Kaizen implementations in Small and Medium Enterprises by their best Practices. We have become more inspired by reading these papers. Paperwork has helped us a lot in the progress of our work. Kaizen is a Japanese word that has become common in many western companies. The word indicates a process of continuous improvement of the standard way of work (Chen et al., 2000). It is a compound word involving two concepts: Kai (change) and Zen (for the better) (Palmer, 2001). The term comes from Gemba Kaizen meaning 'Continuous Improvement' (CI). Continuous Improvement is one of the core strategies for excellence in production, and is considered vital in today's competitive environment (Dean and Robinson, 1991). It calls for endless effort for improvement involving everyone in the organization (Malik and YeZhuang, 2006). Kaizen encompasses a range of methodologies, such as Kanban, total productive maintenance, six sigma, automation, just-in-time, suggestion systems, and productivity improvement, among others (Imai, 1986), as illustrated in Figure 1.

Figure 1. The continuous cycle of Kaizen activities

Newitt & Imai (1997) offers fresh insights into conventional thinking. The author outlines key factors determining business process management requirements and advocates for the integration of Kaizen philosophy into business process management. This integration, Newitt suggests, will emancipate the thinking of both management and employees across all levels, fostering an environment conducive to creativity and value addition.

3. Method

A cause-effect diagram is a graphical tool for displaying a list of causes associated with a specific effect

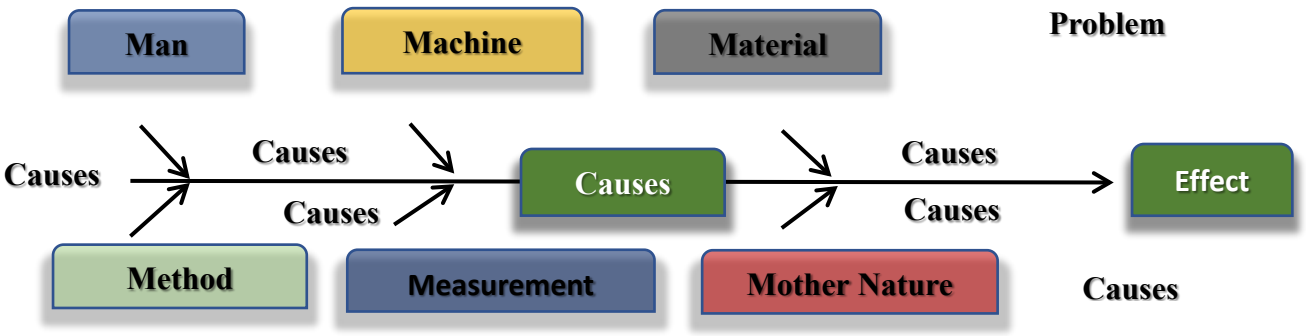

Figure 2. Method of Kaizen fishbone diagram.

It was developed by Dr. Kaoru Ishikawa, a Japanese quality control expert, in the 1960s. The diagram is named after its resemblance to the skeleton of a fish, with the "head" representing the problem or effect being analyzed and the "bones" representing the potential causes leading to that problem. The main categories of causes, often referred to as the 6M, are Manpower (or People), Machines, Materials, Methods, Measurements, and Mother Nature (Environment). Manpower (People): This category includes the human element involved in the process, such as skills, training, motivation, and communication among employees. Machines: Machines encompass the equipment, tools, and technology utilized in the process. Issues in this category might involve equipment malfunction, insufficient maintenance, or technological limitations. Materials: Materials refer to the raw materials, components, or resources used in the process.

Problems in this category could arise from poor quality materials, inadequate sourcing, or inconsistencies in supply. Methods: Methods pertain to the procedures, processes, and workflows employed to carry out tasks. Inefficient or outdated methods, lack of standardization, and ineffective procedures fall under this category. Measurements: Measurements involve the metrics, data, and performance indicators used to evaluate the process. Problems related to inaccurate measurement tools, insufficient data collection, or inadequate analysis may be identified here. Mother Nature is defined to the environment.

This category encompasses external factors beyond human control that may influence the process, such as weather conditions, natural disasters, or regulatory changes. By systematically analyzing each of these categories and their potential influences on the problem at hand, the Fishbone diagram helps teams identify root causes more effectively and develop targeted solutions. It encourages comprehensive thinking and collaboration among team members, ultimately leading to more informed decision-making and continuous improvement within organizations. Description of Mathematical Model: Improvement $= f$ (Time), Y = Production This equation suggests that the level of improvement (or efficiency, quality, etc.) is a function of time. As time progresses, the level of improvement increases, reflecting the essence of Kaizen.

Quality Consistency

Impacting the Performance

- **Standard recipe**
- **Poor packaging**
- **Weather**
- **Raw materials**
- **R & D**

$Y = f(X)$

X= Independent Variable, Y = Production

Y is the function of X

- s (sigma) - A Greek letter (the eighteenth letter of the Greek alphabet (Σ, σ)
- In statistics - the “standard” deviation from the average/mean
- s– Standard Deviation, a measure of variability
- Six Sigma Methodology uses to define the capability of a process

4. Data collection and processing

PRAN RFL Group practices Kaizen tools and awareness spread on the worker level to top management employees. Also, they are encouraging all of employees to use Kaizen tools and implementation in his/ her work field. Additionally, Ahsan Khan Chowdhury, CEO of PRAN RFL has instituted a rewarding system including recognitions such as Best Employee of the month and the Best Kaizen Award, as well as cost saving meetings, held almost monthly.

Seema Chowdhury, the Director of PRAN RFL Group, organizes training programs and Six Sigma Exams across all factories including HIP, PIP, PIP-2, AMCL, DIP, DIP-2, PAL, NAL, PAL-2, and the Badda head office. Through the implementation of Six Sigma and Kaizen methodologies, the production output at PRAN RFL Group has surged, marking the highest levels in the past 15 years. This achievement reflects optimized production processes, reduced idle time and wastage of raw materials and power, as well as the development of AI and Automation Systems for the industry. These efforts underscore the group's commitment to sustainability, enhancing sustainability management, and yielding a positive impact across PRAN RFL Group.

Project Name: CNC Band Machine functional & side part leveling by updating software & Die**.**

In the long time, The CNC Band machine was shutting down due to under maintenance. So, we were taking support from CLF maintenance team, they also try to solve but still side part leveling problem, so again try to DIP-DPL production team to function and successfully has been completed by our team work.

Table 1. Cost Saving of CNC Band Machine

SL	Machine Name	Monthly save (HR)	Total Value (BTD)/ Months	Total Investment Vale (BTD)
1	CNC Side part Band Machine	1	15,000 Taka (BTD)/	2,500 Taka

Technical Application
1. Upgrading Software and Dimension modification
2. Sensor measuring
3. Additional Hardware (flat bar) adjustment

Previous Condition
1. Machine was shutting down long rime
2. Side Part Leveling problem
3. Machine speed was very slow

Present Condition
1. Machine is functional & smoothly working
2. Time Save & Side Part measurement is now accurate
3. No need to rework for leveling

4.1 DATA Analysis & Outcomes

Table 2. Data Analysis by Anova Single Factor of CNC Band Machine

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Monthly save (HR)	1	1	1	#DIV/0!
Total Value (BTD)/ Months	1	15000	15000	#DIV/0!
Total Investment Vale (BTD)	1	2500	2500	#DIV/0!
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*
Between Groups	129155000.7	2	64577500.33	65535
Within Groups	0	0	65535	
Total	129155000.7	2		

Here,
DF means - "the degrees of freedom in the source."
SS means "the sum of squares due to the source."
MS means "the mean sum of squares due to the source."
F means "the F-statistic."

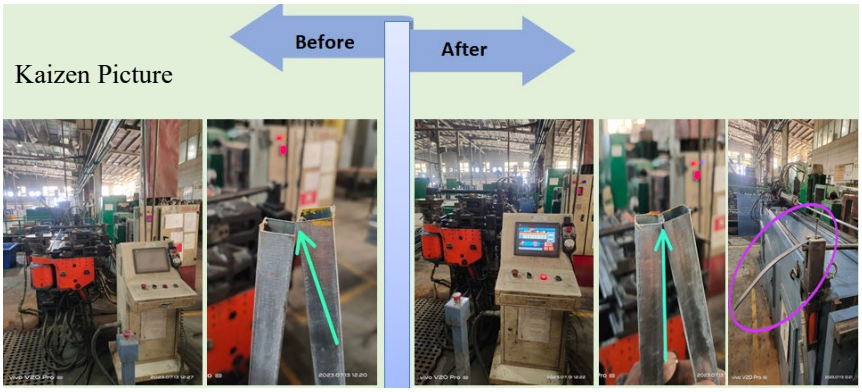

Figure 3. By implementing kaizen, CNC Band Machine functional & side part leveling by updating software & Die.

Project Name: Kaizen of Automatic press drill machine**.**
Previously, our side part drill process by manual Hand press Drill machine. It was very manual system that marking drill position, than put into jig and press by hand. As it was industrial branch type hand drill machine, so the operation function was much lengthy and default to physical activities. Now we are innovating an automatic press drill machine which is very user free and to operate by a single push switch.

Material List & Size
1. Drill Machine (RFL) 800 Watt. -8 pcs
2. Air Cylinder (12*16) - 4 pcs s
3. Liner Bearing - 16 pcs
4. Others Mechanical Accessories

Previous Condition
1. 9 No's drill by manually- one by one ss
2. Average drill time per set 55 sec
3. Ricks to accident

Monthly cost saving value

Table 3. Cost Saving of Auto Press Drill Machine

SL	Machine Name	Monthly save (HR)	Total Value (BTD)/ Months	Total Fixed Investment Vale (BTD)
1	Automatic press drill machine	1	14,000 Taka (BTD)	1,50,000 Taka

DATA Analysis & Outcomes

Table 4. Data Analysis by Anova Single Factor of Auto Press Drill Machine

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Monthly save (HR)	1	1	1	#DIV/0!
Total Value (BTD)/ Months	1	14000	14000	#DIV/0!
Total Fixed Investment Vale (BTD)	1	150000	150000	#DIV/0!

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*
Between Groups	13730557334	2	6865278667	65535
Within Groups	0	0	65535	
Total	13730557334	2		

Kaizen Picture
Project Name: 12x12x0.5 MM Tube Rejection Reduce of Royal Kitchen Shelf.

For the Mig welding Machine, Mig holder need to support bar to do properly Mig welding. So, set up a Support bar into jig, also we think that to modified the jig can be save the 7mm to 12MM length tube and cutting disk. Thus, brainstorming the idea and implementation on our Mig process line.
Material List & Size: EM Box Tube 12x12x0.5 MM

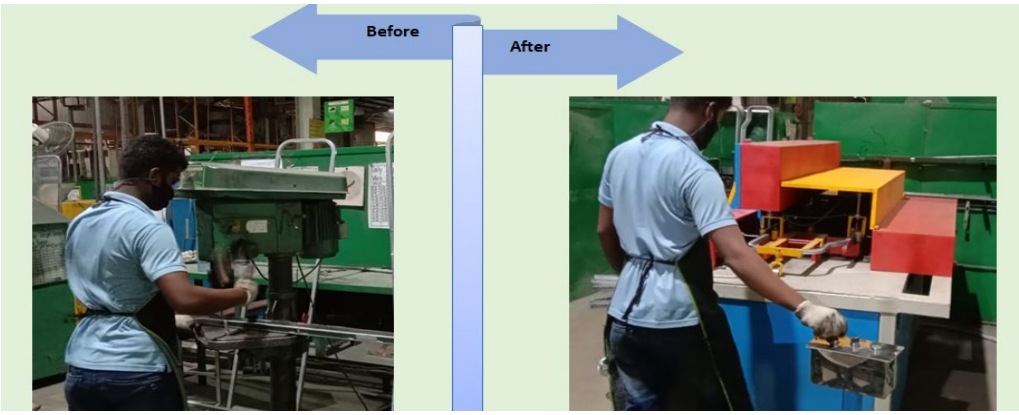

Figure 4. Kaizen of Automatic press drill machine

Previous Condition:

A. Mig welding is not properly
B. For door part excess tube reduce.
C. Need also cutting disk to remove excess tube.
D. Need a manpower to do the compile processing
E. Need Hand Grinding machine & power save.

Present Condition

A. Mig welding has no problem
B. Now to excess tube in door part
C. Save Cutting disk.
D. Save HR.
E. No need Hand Grinding machine & power save.

Monthly Cost Saving Value

Table 5. Cost Saving of Tube Rejection

SL	Material Name	Per Day save (RFT)	Monthly save (RFT)	Total Value (BTD)/Day	Total Value (BTD)/Month	Total Investment Vale (BTD)
1	EM Box Tube 12x12x0.5 MM	73.5	1,910	7,71.25 (BTD)	20065.5 (BTD)	0

DATA Analysis & Outcomes

Table 6. Data Analysis by Descriptive Statistics of Tube Rejection

Particulars	
Mean	3805.166667
Standard Error	3265.866291
Median	422
Mode	#N/A
Standard Deviation	7999.70598
Sample Variance	63995295.77
Kurtosis	5.818276529
Skewness	2.404022147
Range	20065
Minimum	0
Maximum	20065
Sum	22831
Count	6

Kaizen Picture

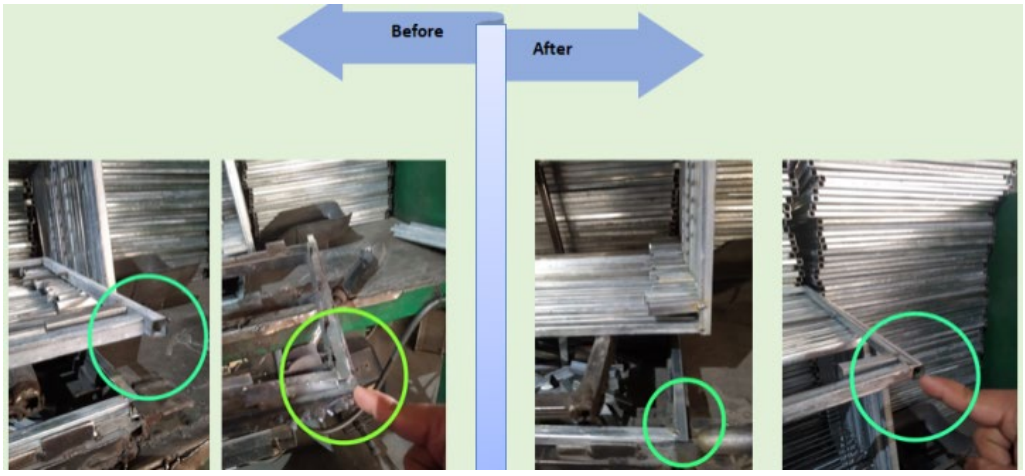

Figure 5. 12x12x0.5 MM Tube Rejection Reduce of Royal Kitchen Shelf.

Project Name: Process Developing the De-watering screw net by Washing Machine.

Indicates a leakage issue occurring within the machinery, as evidenced by material seeping through the mesh. This suggests a potential malfunction or inefficiency in the equipment's containment mechanisms. Additionally, the volume

of rejected material points to a significant operational challenge, potentially impacting productivity and product quality. Identifying the root cause of the leakage and rejection is critical for addressing the issue effectively and optimizing the manufacturing process. Detailed analysis and troubleshooting of the machinery and production line may be necessary to rectify the situation and prevent further material loss.

Previous Condition

A. The material was leakage with the machine through mesh.
B. There was a lot of material rejection.

Present Condition

A. We have making the Function De-watering screw net by washing m/c.
B. A lot of material rejection has been reduced after making the net.
C. Production has increase.
D. The work activity of the maintenance team has decreased.

Monthly cost Saving Value

Table 7. Cost saving of washing machine

Cost Saving Report						
SL	Save	Unit	Qty.	Rate	Total Value (TK)	Remarks
1	Small Chips	KG	50	20	1,000/- (BTD)	
2	De-watering net Process Development purpose cost	Set	1	40,000	40,000/-	
		Total save			41,000/- (BTD)	

DATA Analysis & Outcomes

Table 8. Data Analysis by Descriptive Statistics of washing machine

Qty.		*Rate*		*Total Value (TK)*	
Mean	25.5	Mean	20010	Mean	20500
Standard Error	24.5	Standard Error	19990	Standard Error	19500
Median	25.5	Median	20010	Median	20500
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	34.64823228	Standard Deviation	28270.12911	Standard Deviation	27577.16447
Sample Variance	1200.5	Sample Variance	799200200	Sample Variance	760500000
Kurtosis	#DIV/0!	Kurtosis	#DIV/0!	Kurtosis	#DIV/0!
Skewness	#DIV/0!	Skewness	#DIV/0!	Skewness	#DIV/0!
Range	49	Range	39980	Range	39000
Minimum	1	Minimum	20	Minimum	1000
Maximum	50	Maximum	40000	Maximum	40000
Sum	51	Sum	40020	Sum	41000
Count	2	Count	2	Count	2

Kaizen Picture

Study Outcome

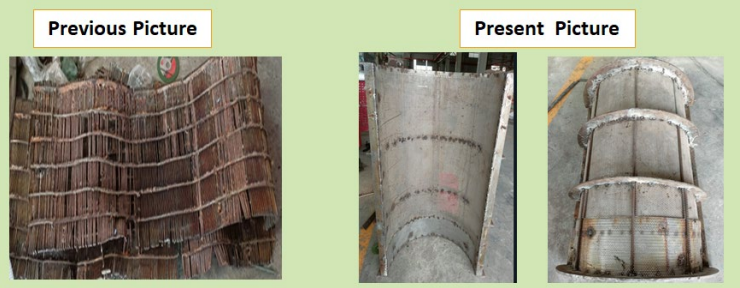

Figure 6. Kaizen- Process Development of Net by Washing Machine

Figure 7. To implementation Kaizen by Improving Production Quality

Implementation Visual Management System: The implementation of a visual management system represents a key strategy for enhancing transparency, communication, and operational effectiveness at PRAN RFL Group.

By leveraging visual cues and indicators, the company facilitates real-time understanding and decision-making across its workforce. Through the use of visual controls such as signage, color coding, and display boards, PRAN RFL Group communicates critical information related to production schedules, quality standards, and performance metrics. By creating a shared visual language, the visual management system promotes alignment and accountability among employees at all levels of the organization.

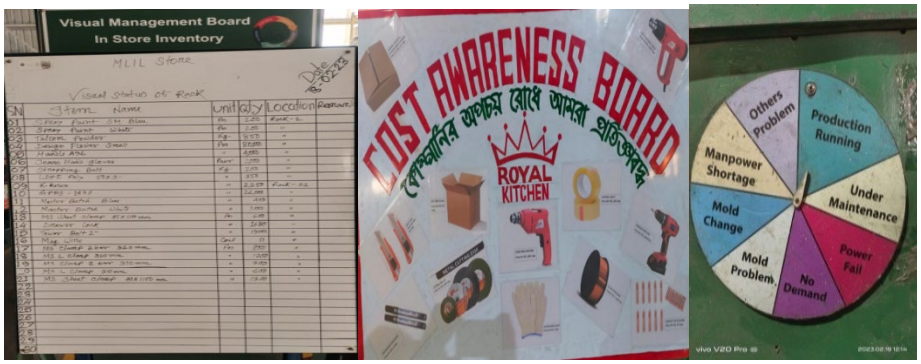

Figure 8. Cost awareness board for Kitchen Shelf Production.

4.3 Outcome: Downtime Save

Minimizing downtime is crucial to maximizing productivity and resource utilization at PRAN RFL Group. Through the implementation of Kaizen principles, the company adopts a proactive approach to identifying and mitigating factors contributing to downtime events. By analyzing historical data and root causes of downtime, PRAN RFL Group gains insights into patterns and trends that inform preventive measures. Through the implementation of predictive maintenance programs and asset management strategies, the company reduces the likelihood of equipment failures and unplanned downtime. By empowering frontline employees with the authority and tools to address minor issues promptly, PRAN RFL Group minimizes the impact of downtime on production schedules. Through the use of real-

time monitoring and alert systems, the company detects anomalies and potential failure points before they escalate into downtime events.

Figure 9. Machine wise SMV & Save Down Time.

Product Wise Target Board: The implementation of a product-wise target board provides a clear roadmap for operational performance and goal attainment at PRAN RFL Group. By defining specific targets and objectives for each product line, the company aligns its workforce towards common strategic priorities. Through the visual representation of targets and key performance indicators, PRAN RFL Group fosters transparency and accountability throughout the organization. By cascading targets down to individual teams and departments, the company ensures alignment and coordination across various functional areas. Through regular monitoring and review sessions, PRAN RFL Group tracks progress towards targets and identifies potential bottlenecks or areas needing additional support. By promoting a sense of ownership and responsibility among employees, the product-wise target board encourages proactive problem-solving and collaboration towards goal achievement.

Through continuous feedback and performance evaluation, the company identifies best practices and areas for improvement in its target-setting processes. By celebrating milestones and achievements, PRAN RFL Group reinforces a culture of excellence and performance-driven mindset among its workforce. Through iterative refinement and adjustment, the company ensures that its product-wise target board remains relevant and responsive to changing market dynamics and strategic priorities. These boards serve as visual aids, outlining individual operator goals and performance metrics within the production process. By delineating targets specific to each operator, the system fosters accountability, motivation, and a clear understanding of expectations. Moreover, such targeted boards facilitate effective communication and teamwork, as operators collaborate to achieve collective objectives while honing their individual skills.

5.Results:

Table 9. Overall Equipment Efficiency (OEE) Report

Overall Equipment Efficiency (OEE) Report -2023						
OEE Report		76%				
SL	Machine Name	Availability %	Perf. %	Quality %	OEE %	Average OEE %
1	Tube Banding Machine	96%	89%	98%	84%	76%
2	Tube Cutting Machine	95%	76%	98%	71%	
3	Mig Welding Machine (DNG)	95%	88%	98%	83%	
4	Mig Welding Machine (CLF)	96%	84%	97%	77%	
5	Hand Grinding Machine (DNG)	96%	89%	98%	84%	
6	Hand Grinding Machine (CLF)	96%	83%	97%	76%	
7	Drill Machine (DNG)	96%	89%	98%	84%	
8	Drill Machine (CLF)	96%	84%	97%	77%	
9	Bangla Spot Machine (DNG)	96%	91%	98%	85%	
10	Bangla Spot Machine (CLF)	95%	84%	97%	76%	
11	Multi Spot Machine	96%	88%	98%	83%	
12	Net Cutting Machine (DNG)	96%	90%	98%	85%	
13	Net Cutting Machine (CLF)	95%	84%	97%	77%	
14	Net Trimming Machine (DNG)	96%	82%	98%	78%	
15	Net Trimming Machine (CLF)	96%	84%	97%	77%	
16	Air Band Machine (DNG)	97%	80%	98%	76%	
17	Air Band Machine (CLF)	95%	84%	97%	77%	
18	Auto Spot Machine	94%	54%	99%	51%	
19	Belt Machine	95%	78%	98%	73%	
20	Pulverize Machine-1	94%	80%	100%	76%	
21	Pulverize Machine-2	94%	53%	100%	50%	

6.Discussion

Kaizen practices and implementation at PRAN RFL Group exemplify a commitment to continuous improvement deeply embedded within the organization's ethos. Through the systematic application of Kaizen principles, PRAN RFL Group strives for incremental advancements in its processes, products, and employee capabilities. By fostering a culture of continuous learning and innovation, the company empowers its workforce to identify inefficiencies, propose solutions, and implement improvements at every level of operations. At PRAN RFL Group, Kaizen extends beyond mere productivity enhancements; it embodies a philosophy of relentless pursuit of excellence. By encouraging employees to seek out even the smallest opportunities for improvement, the organization harnesses the collective intelligence and creativity of its workforce to drive sustainable growth and competitive advantage.

Through regular training sessions, workshops, and cross-functional collaboration, PRAN RFL Group ensures that Kaizen principles are not just understood but actively embraced by all members of the organization. Furthermore, the implementation of Kaizen at PRAN RFL Group is characterized by its holistic approach, encompassing aspects of quality management, process optimization, and employee engagement. Through the establishment of feedback mechanisms and performance metrics, the company monitors the impact of Kaizen initiatives and iteratively refines its improvement strategies. By aligning individual goals with organizational objectives, PRAN RFL Group fosters a sense of ownership and accountability among its employees, driving continuous improvement as a collective endeavor.

Overall, Kaizen practices at PRAN RFL Group serve as a catalyst for organizational excellence, enabling the company to adapt to changing market dynamics, enhance customer satisfaction, and sustain long-term growth.

7.Conclusions

Kaizen, as a methodology for continuous process improvement, provides transformative opportunities for industries seeking to optimize operations. By adopting Kaizen principles, organizations can achieve significant benefits, including reduced raw material consumption, enhanced manufacturing systems, improved time efficiency, seamless machine automation, and overall productivity growth. Kaizen emphasizes the active involvement of employees at all levels, encouraging them to continuously improve the quality and efficiency of their work. For Small and Medium Enterprises (SMEs) like PRAN-RFL Group, integrating Kaizen into workstation practices and process development strategies can deliver substantial cost savings and operational improvements. By consistently streamlining processes and maximizing resource utilization, SMEs can enhance their efficiency and competitiveness. Cultivating a culture of Kaizen not only drives operational excellence but also serves as a foundation for sustainable growth and long-term success across businesses of all sizes.

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Biographies

Nazmul Akter Shahin completed B. Sc. in Electrical and Electronic Engineering (EEE) from Green University of Bangladesh. He earned a Postgraduate Diploma (PGD) in Industrial Management from the Bangladesh Institute of Management. He is also pursuing M. Sc. in Electronics and Communication Engineering (ECE) at Hajee Mohammad Danesh Science & Technology University, Bangladesh. Additionally, he holds a Diploma in Engineering specializing in Electro Medical Technology.

Nazmul commenced his professional career in the engineering sector with PRAN-RFL Group in Bangladesh, where he acquired extensive expertise in production and operational management across the engineering divisions of four industrial parks, including the PRAN-RFL headquarter. With over 8 years of practical experience in diverse fields such as Biomedical Engineering, Power Plant Operations, Metal Manufacturing, and Operational Management. Until August 2023, he served as the DPL Production Manager at the RFL Danga Industrial Park. Currently, Nazmul is employed as a Biomedical Engineer at the 250 Bedded General Hospital in Dinajpur, under the Health Directorate of the People's Republic of Bangladesh.

Dr. Engr. Md. Mamunur Rashid, a Bangladeshi national, is globally recognized as an expert in Engineering Management, Project Management, Quality Control, Supply Chain Management, Occupational Health and Safety, and Productivity. He has conducted over 200 professional training sessions and served as a faculty member at renowned institutions, including King Saud University, AUST, BUBT, and IUT. Holding a Doctor of Engineering in Manufacturing Engineering from Japan, Dr. Rashid has 93 publications in reputed journals and conferences. A National Trainer and Assessor of NSDA, he is affiliated with professional bodies like IEB, JSPE, and BSME, reflecting his unwavering dedication to excellence.