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An Examination and Analysis of The Packaging Unit to Reduce Waste

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Abstract
This study investigates the current practices in packaging units with the aim of identifying and implementing strategies to minimize waste. By analyzing various stages of the packaging process, from material selection to design and production methods, the research highlights key areas where waste is generated. Utilizing a combination of quantitative data analysis, process mapping, and stakeholder interviews, the study identifies inefficiencies and proposes optimized practices to reduce material usage and waste. Recommendations include adopting sustainable materials, improving packaging design, implementing lean manufacturing principles, and enhancing recycling protocols. The findings suggest that significant waste reduction is achievable, leading to cost savings, environmental benefits, and improved operational efficiency. This study provides a comprehensive framework for packaging units seeking to enhance sustainability and minimize their environmental footprint.

Keywords: Packaging waste reduction, Environmental sustainability, Recycling protocols, operational efficiency, sustainable packaging.

Introduction

Packaging plays a crucial role in safeguarding products during transportation, storage, and display. However, inefficient packaging can lead to increased waste, particularly in the form of defective packs. These defects not only result in financial losses for manufacturers but also contribute to environmental degradation. Therefore, there is a pressing need to analyze and optimize packaging units to minimize the occurrence of defective packs and reduce waste.

1.2 Review of Literature

Nelson (2023), The author discusses the issue of defects in PT Nelson's finished goods packaging, highlighting the importance of analyzing defects using the Six Sigma approach. The current problem is 0.78% of defects, mainly due to handling issues. The study suggests alternatives to pallet pattern and wrapping, the addition of quality control packing, and increasing the height of secondary packaging to reduce pressure on the product

Saudi Arabia's (2023), vision aims for 34% non-oil revenue participation in GDP, requiring automation and digital transformation. Company ER, a leading dairy producer, invested in automating pallet handling procedures to increase production. This study uses lean management tools to analyze the automated pallet

handling system and identify areas for improvement. The results show a 12.8% increase in overall equipment effectiveness (OEE), addressing losses encountered in the production system. However, the study's generalization is limited due to time and resource constraints. It provides valuable insights for researchers and practitioners in understanding lean manufacturing.

1.3 Research Gap

This future research could concentrate on developing a comprehensive approach that takes into consideration how optimizing packaging practices, high-pressure processing effects, and automated pallet handling can work together synergistically to enhance overall efficiency and sustainability in dairy production facilities. Although the literature review offers useful insights into optimizing packaging unit waste minimization, the effects of high-pressure food processing on packaging, and improving automated pallet handling in milk factories, there is a research gap in exploring the integration of these areas.

1.4 Objectives of The Study

- To study the current packaging practices and identify areas contributing to packaging waste.
- To Investigate sustainable packaging alternatives, considering factors such as recyclability, biodegradability and environmental impact.

1.5 Research Methodology

Instrumental Design: Utilizing Likert's five-point rating system, five questions were formulated for each component of the structured questionnaire.

Data Collection Method: Both primary and secondary data were gathered on the variables affecting information obtained from both company employees and employers via questionnaires

Sample Size and Sampling Technique: A sample size of 150 respondents was selected for the study, employing the straightforward method of simple random sampling to acquire the data.

Data Analysis: Descriptive analysis techniques were employed to scrutinize the data. Percentage Analysis was utilized to construct a contingency table based on the frequency distribution, facilitating a clearer representation of the collected data.

Bar charts are utilized in chart analysis to enhance comprehension of percentage data, facilitating a clearer understanding of distributions and trends.

The Environmental impact of traditional packaging materials

Particulars	Frequency	Percent
Not aware at all	3	2.0
Slightly aware	41	27.3
Moderately aware	66	44.0
Very aware	34	22.7
Extremely aware	6	4.0
Total	**150**	**100.0**

Table no.1.1 The Environmental impact of traditional packaging materials

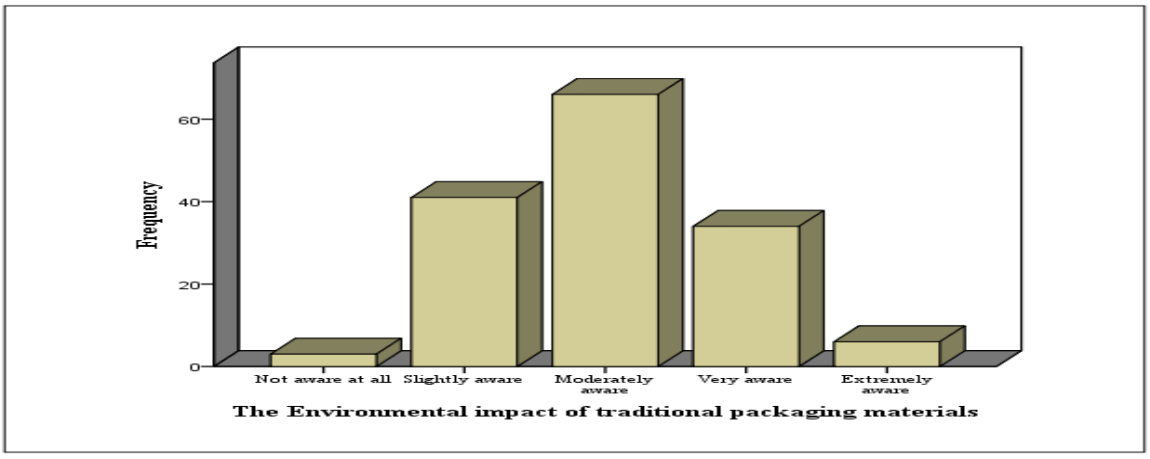

Figure no.1.1The Environmental impact of traditional packaging materials

Inference

From the above table it is inferred that 44% of the respondents Moderately aware, 27.3% of the respondents are Slightly aware, 22.7% of the respondents Very aware, 4% of the respondents Extremely aware and 2% of the respondents are Not aware at all for the Environmental impact of traditional packaging materials.

Overall effectiveness to minimizing waste and defective Packs

Particulars	Frequency	Percent
Very Dissatisfied	4	2.7
Dissatisfied	27	18.0
Neutral	64	42.7
Satisfied	53	35.3
Very Satisfied	2	1.3
Total	**150**	**100.0**

Table no.1.2 Overall effectiveness to minimizing waste and defective Packs

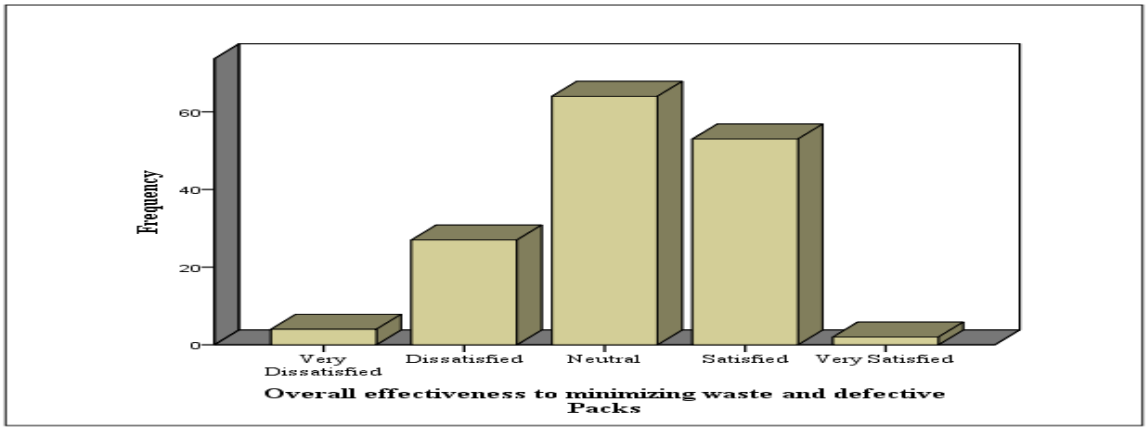

Figure no.1.2 Overall effectiveness to minimizing waste and defective Packs

Inference

From the above table it is inferred that 42.7% of the respondents are Neutral, 35.3% of the respondents Satisfied, 18% of the respondents Dissatisfied, 2.7% of the respondents Very Dissatisfied and 1.3% of the

respondents are Very Satisfied with Overall effectiveness to minimizing waste and defective Packs.

Perceiveing issue in defective packaging of production process

Particulars	Frequency	Percent
Not significant at al	5	3.3
Slightly significant	71	47.3
Moderately significant	65	43.3
Very significant	7	4.7
Extremely significant	2	1.3
Total	**150**	**100.0**

Table no.1.3 Perceiveing issue in defective packaging of production process

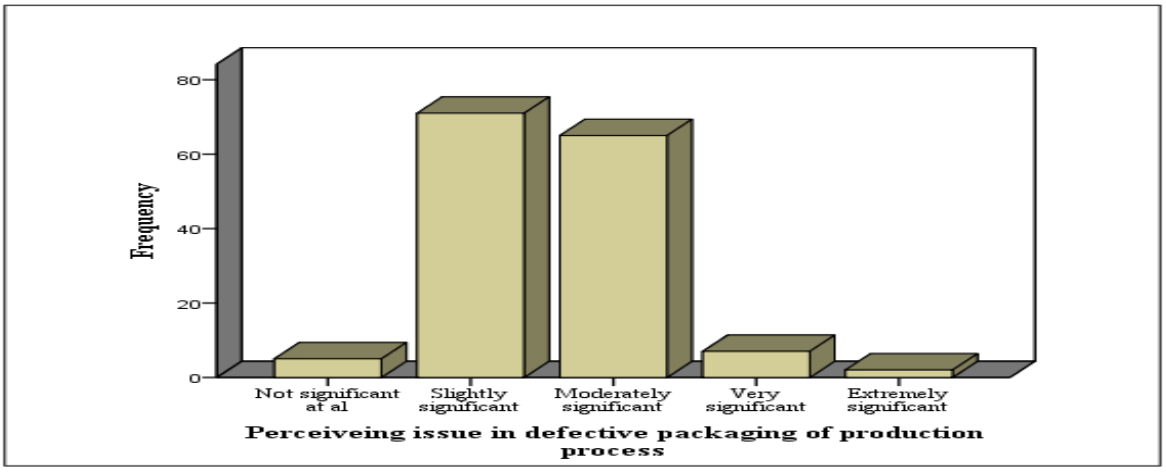

Figure no.1.3 Perceiving issue in defective packaging of production process

Inference

From the above table it is inferred that 47.3% of the respondents Slightly significant, 43.3% of the respondents Moderately significant, 4.7% of the respondents Very significant, 3.3% of the respondents Not significant at all and 1.3% of the respondents are Extremely significant for Perceiveing issue in defective packaging of production process**.**

Biodegradable packaging material product in preserving quality

Particulars	Frequency	Percent
Very ineffective	5	3.3
Ineffective	40	26.7
Neutral	58	38.7
Effective	40	26.7
Very effective	7	4.7
Total	**150**	**100.0**

Table no.1.4 Biodegradable packaging material product in preserving quality

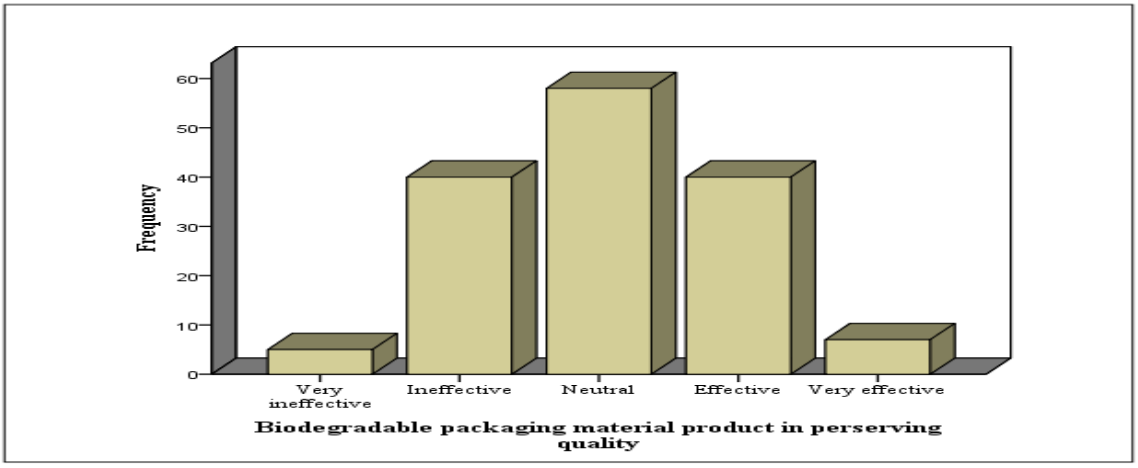

Figure no.1.4 Biodegradable packaging material product in preserving quality

Inference

From the above table it is inferred that 38.7% of the respondents Neutral, 26.7% of the respondents Ineffective, 26.7% of the respondents Effective, 4.7% of the respondents Very effective and 3.3 % of the respondents are Very ineffective with Biodegradable packaging material product in preserving quality.

The importance of reducing plastic usage in packaging

Particulars	Frequency	Percent
Not important at all	5	3.3
Slightly important	58	38.7
Moderately important	58	38.7
Very important	20	13.3
Extremely important	9	6.0
Total	**150**	**100.0**

Table no.1.5 The importance of reducing plastic usage in packaging

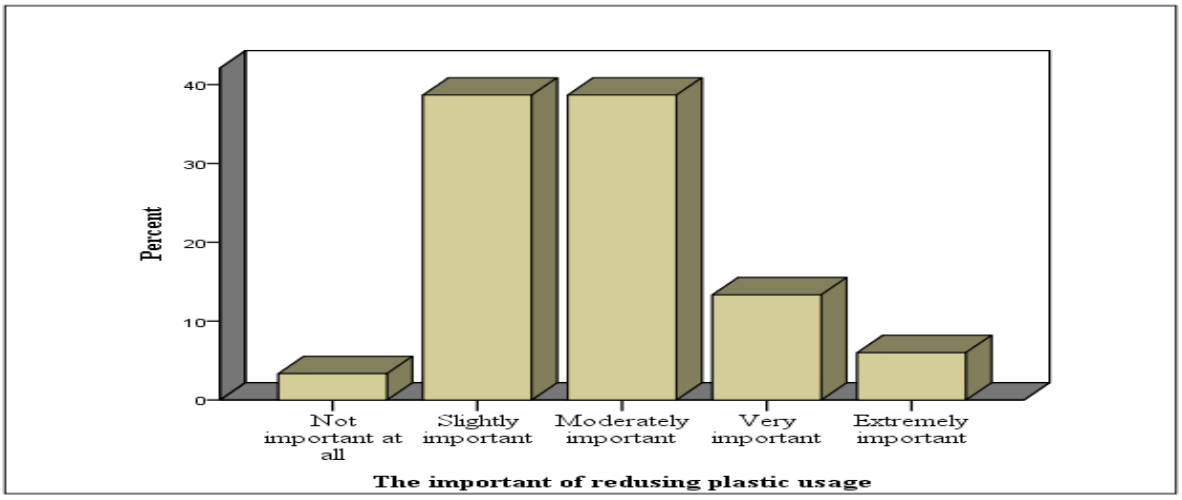

Figure no.1.5 The importance of reducing plastic usage in packaging

Inference From the above table it is inferred that 38.7% of the respondents are Slightly important, 38.7%

of the respondents Moderately important,13.3% of the respondents Very important,6% of the respondents Extremely important and 3.3% of the respondents are Not important at all for reducing plastic usage in packaging.

The Current Availability of Sustainable Packaging

Particulars	Frequency	Percent
Very Dissatisfied	6	4.0
Dissatisfied	47	31.3
Neutral	61	40.7
Satisfied	33	22.0
Very Satisfied	3	2.0
Total	**150**	**100.0**

Table no.1.6 The Current Availability of Sustainable Packaging

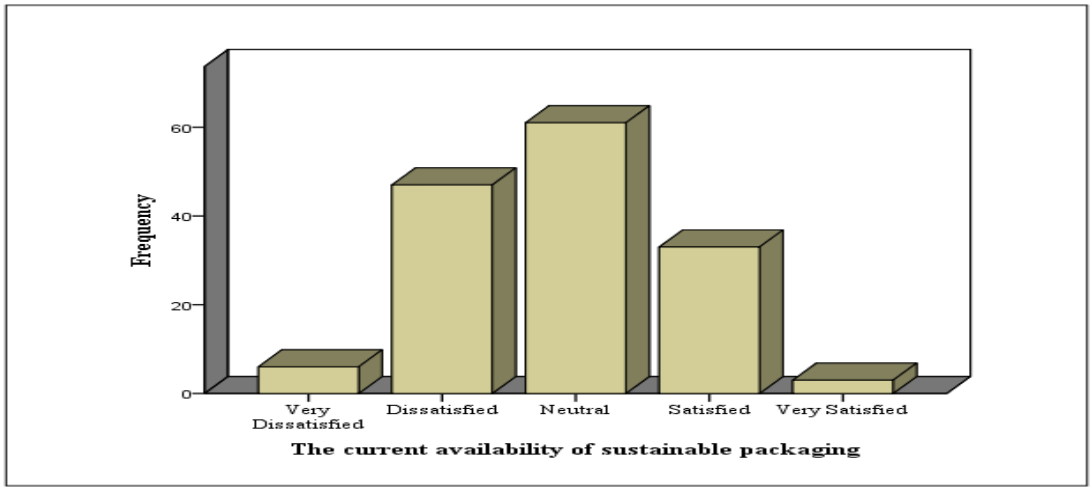

Figure no.1.6 The Current Availability of Sustainable Packaging

Inference

From the above table it is inferred that 40.7% of the respondents are Neutral, 31.3% of the respondents Dissatisfied,22% of the respondents Satisfied,4% of the respondents Very Dissatisfied and 2% of the respondents are Very Satisfied with the current availability of sustainable packaging.

Chi-Square Tests Null hypothesis

H0: There is no significant association between the impact of sustainable package practices and consumer willingness to buy eco-friendly package.

Alternative hypothesis

H1: There is significant association between the impact of sustainable package practices and consumer willingness to buy eco-friendly package.

Summary of chi-square						
	Cases					
	Valid		Missing		Total	
Particulars	N	Percent	N	Percent	N	Percent

consumer willingness to buy eco-friendly packaging * Impact of sustainable packaging practices	150	100.0%	0	0.0%	150	100.0%

Table. No.1.7. Summary of the chi-square

Particulars	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.588[a]	16	.008
Likelihood Ratio	31.081	16	.013
Linear-by-Linear Association	4.046	1	.044
N of Valid Cases	150		

Table. No. 1.8 Test statistics

Inference: From the above table 1.8, the significant value is p=0.008 is less than 0.05 which is less than 0.05. So, alternative hypothesis is accepted, it reveals there is a significant association between the impact of sustainable package practices and consumer willingness to buy eco-friendly package.

Correlation Null hypothesis

H0: There is no significant correlation between the use of technology and automation solutions in reducing defective packs and perceiving issues in defective packaging of the production process.

Alternative hypothesis H1: There is a significant correlation between the use of technology and automation solutions in reducing defective packs and perceiving issues in defective packaging of the production process

Correlation

Correlation values		**Reduction in defects**	**Company's Productivity**
Important technology and automation solutions in reducing defective packs	Pearson Correlation	1	.218
	Sig. (2-tailed)		.007
	N	150	150
Perceiving issues in defective packaging of the production process	Pearson Correlation	-.057	1
	Sig. (2-tailed)	.482	
	N	156	150

Table. No. 1.9 Correlation

Inference:

From the above table, it is inferred that, r= 0.218(r value lies between -1 to +1) hence it is clear positive correlation relationship between the use of technology and automation solutions in reducing defective packs and perceiving issues in defective packaging of the production process. So, H0 is accepted there is

a significant between the use of technology and automation solutions in reducing defective packs and perceiving issues in defective packaging of the production process

1.6 Suggestions

- Improve Advanced technology, such as automated pallets that assist in identifying defective packs and packaging waste, should be improved.
- Regularly monitoring the machine's air pressure temperature helps reduce packaging waste and keep an eye on packaging flow in the dairy industry.
- Provide onboarding training to new hires so they can operate the machine more skilfully when low-filling and empty packs are being produced while the machine operator is away.
- Material Optimization: Utilize eco-friendly materials such as biodegradable plastics or recyclable packaging to reduce environmental impact.
- Reusable Packaging: Explore options for reusable containers or packaging that consumers can return for refills, reducing single-use waste.

1.7.Limitations of the study

- Few respondents were illiterate and were unwilling to provide accurate data.
- Some of the information are kept confidential
- The data collected for the research sample is given by employees and there is a chance for personal bias.

1.8 Conclusion

In summary, the study on optimizing packaging practices to minimize waste, identifying key areas for improvement such as excess packaging materials and inefficient processes. Proposed strategies include using eco-friendly materials, streamlining operations, and embracing innovative technologies. By reducing waste, the company can enhance its environmental sustainability, realize cost savings, and strengthen its position in the dairy industry. Continuous stakeholder engagement and a commitment to ongoing improvement are essential for long-term success in waste minimization efforts.

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