Evaluation of Eco-Efficient Practices Adopted by Packaging Manufacturers

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Abstract:

The requirement for packaging is rising across different sectors with robust growth in retail and e-commerce and traditional businesses preferring packaged products. A few challenges have emerged that impacted the growth of this sector. Flexible plastics have always been viewed as a necessary evil in the environmental sense. Because of the poor recycling infrastructure and low weight of flexible films, this category of products is amongst the least recycled materials in India. It is estimated that a household consisting of four persons generates about 2.5 kilograms of waste per day, which includes 30% or 750 grams of recyclables.

In this research, the tool (eco-efficiency indicators) is developed to assess the eco-efficiency practices of manufacturers of packaging material with reference to the framework designed by World Business Council for Sustainable Development (WBCSD).

Keywords: Packaging, Eco-efficiency, Practices.

Introduction:

Packaging is the art, science, and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also signifies the process of design, evaluation, and production of packages. It can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use (Wikipedia, 2020). Packaging fulfils several important functions, such as containment, barrier protection, convenience, portion control, marketing, and information transmission.

Packaging Waste Generation in India

The requirement for packaging is rising across different sectors with robust growth in retail and e-commerce and traditional businesses preferring packaged products. The industry certainly offers potential growth opportunities to new entrepreneurs, and small and medium enterprises (PackPlus, 2019). A few challenges have emerged that impacted the growth of this sector. Flexible plastics have always been viewed as a necessary evil in the environmental sense. Because of the poor recycling infrastructure and low weight of flexible films, this category of products is amongst the least recycled materials in India.

As per the data revealed in 2019 by Ministry of Housing and Urban Affairs, it is estimated that a household consisting of four members generates about 2.5 kilograms of waste per day, which includes 30% or 750 grams of recyclables. This asserts that 94 million households in urban areas would generate about 26 million tonnes of recyclables per annum. According to the reports by CPCB for the year 2017-18, it has been estimated that India generated approximately 26,000 tonnes of waste per day and out of this approximately 15,600 tonnes of waste per day is recycled. About 60% is recycled, mostly by informal sector and other 40% remains uncollected and littered in the environment (Aishwarya, 2019). Post-consumer paper, or wastepaper, is an important raw material source for the paper industry and can contribute substantially towards reduction in its imports.

Eco-efficiency in Packaging

In compliance with the definition of the WBCSD, the eco-efficiency consists in supplying competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing environmental impacts of goods throughout the entire life cycle to a level at least in line with the earth's estimated carrying capacity. Eco-efficiency analysis in the packaging industry covers both production of packaging materials

as well as the final management of packaging waste (Kasprzak, et. al., 2018). McDonough and Braungart (2002), explicates eco-efficient packaging that emphases at the beginning of design in a cradle to cradle closed loop. The concept of cradle to cradle instead of cradle to grave is the ultimate goal of packaging sustainability.

In this research, the tool (eco-efficiency indicators) is developed to assess the eco-efficiency practices of manufacturers of packaging material with reference to the framework designed by World Business Council for Sustainable Development (WBCSD). Packaging industry remains competitive in an ever-expanding global market with a need for technological development. This led to increasing productivity, better product quality with enhanced safety assurance, advances in automation and intelligent on-line control, likely to transform conventional method to fully integrated and advanced manufacturing systems.

Objective:

To develop indicators of eco-efficiency for assessing the practices of packaging manufacturers.

Methodology:

A total of nine indicators were developed for the study to assess the eco-efficiency practices of packaging manufacturers.

Eco-efficiency Indicators
Raw material consumption
Selection criteria for raw materials
Labelling and printing on packaging
Use of recycled material
Technologies used in production
Eco-friendly packaging initiatives
Quality check measures
Logistics in packaging
Waste handling and management

A criterion was developed to score each indicator. The minimum and maximum obtainable scores for each indicator ranged between 9 to 45. The scores were categorised for better interpretation in three categories: poor practice, somewhat good practice, and good practice.

Validity of the Tool: The validity of the index was attained through content validity. Considering the research objective, indicators of eco-efficiency were listed and examined for content validity by a group of experts from packaging industries and academicians at packaging institutes. The standard indicators were assembled in 9 categories, ensuring that the contents represented all the important elements required to conduct the study.

Reliability of the Tool: Cronbach's α (alpha) tool was used to test the reliability of all the eco-efficiency indicators used in the research. The indicators were found to have a reliability score of 0.816 as shown in table below. As per standards the reliability score was considered as 'good' ensuring the reliability of the tool (refer Table 1). Closer the score of the test to 1, the more is the reliability of the test.

Table 1: Reliability of Eco-efficiency Indicators

S. No.	Study Tool	Reliability Score	N of Items
1.	Eco-efficiency Indicators	0.816	9

Study Findings:

The eco-efficient practices of 10 packaging manufacturers were studied at different stages of production. The tool developed for investigating the eco-efficiency practices of manufacturers was validated and ratified by the experts.

Evaluation of Eco-efficient Practices Adopted by Manufacturers

Eco-efficient practices focus on supplying products at competitive price, bring quality of life and significantly reduce environmental impacts. In this study, practices of 10 packaging manufacturers were assessed with respect to the production stage of life cycle assessment. For this purpose, a five-point Likert scale on eco-efficient practices was constructed by listing nine indicators. A criterion was developed to score each indicator on a scale ranging from 1 to 5. The responses of all the 10 manufacturers (refer Table 2) taken for the study were measured with the help of likert scale and gaps in practices of manufacturers were identified.

Table 2: Evaluation of Eco-efficiency Practices Adopted by Manufacturers

S. No.	Manufacturers	Packaging material developed by manufacturer	Eco-Efficiency Indicators									Total Score
			I1	I2	I3	I4	I5	I6	I7	I8	I9	
1.	M1	Paper	5	5	3	2	4	2	3	3	2	29
2.	M2	Paper	5	4	4	2	4	2	2	3	3	29
3.	M3	Paper	5	5	3	3	3	2	2	4	2	29
4.	M4	Paper	4	4	3	2	2	3	1	3	2	24
5.	M5	Plastic	2	3	3	3	2	3	2	3	2	23
6.	M6	Plastic	2	2	3	2	1	3	1	3	3	20
7.	M7	Plastic	1	2	4	2	1	4	3	2	3	22
8.	M8	Glass	3	4	2	1	1	3	5	4	3	26
9.	M9	Metal	4	3	4	4	2	5	3	4	5	34
10.	M10	Metal	3	3	3	2	2	4	2	3	4	26

* M(n): Manufacturer number, I(n): Indicator number

Criteria for Rating of Indicators

Indicator 1. Primary and Ancillary Raw materials: Responses were obtained based on usage of raw materials during processing i.e., on a rating scale of 1 to 5 indicating usage of virgin materials to use of recycled materials.

Indicator 2. Use of Recycled Raw Materials: According to quantity of recycled content, the responses were coded. The manufacturer who developed packaging by using less than 10% recycled material were rated as 0 whereas those who used more than 40% were given 5 score.

Indicator 3. Selection Criteria of Raw Materials: The rating was obtained on the basis of number of criteria considered important by the manufacturer before selecting a raw material. Those who considered 0-1 criteria were provided least rank as compared to those who used more than 7 criteria were provided highest rank.

Indicator 4. Technologies used in production: As per the age of machinery, manufacturers were rated on a scale of 0 to 5. Those using machinery older than year 1980 were given least score and those using machinery obtained after year 2010 were provided highest score.

Indicator 5. Labelling and Printing on Packaging: Number of labelling and printing techniques that were used by manufacturer was the criteria for obtaining responses. Use of more advanced techniques led to more scores.

Indicator 6. Quality Check Measures: The responses were obtained on the basis of number of quality check measures considered very important by the manufacturer.

Indicator 7. Logistics in Packaging: It was rated as per the number of damages encountered by the manufacturer during distribution. More number of damages resulted in lesser score.

Indicator 8. Waste Handling and Management: The responses were obtained on a scale of 1 to 5 according to the number of good practices performed by the manufacturer in handling waste generated in their unit.

Indicator 9. Eco-friendly Packaging Initiatives: Ranking of this indicator was done on the basis of number of eco-friendly initiatives taken by the manufacturer. This was coded as 0, 1, 2, 3 and more than three.

Weightage Matrix Analysis for Eco-efficient Practices Adopted by Manufacturers

The total of scores was obtained for each indicator wherein lowest and the highest scores achieved by manufacturers ranged between 20 and 34. The mean of scores were calculated for each indicator and categorised to obtain range for easy interpretation of findings. The scores were grouped in three categories - poor practice, somewhat good practice, and good practice (refer Table 3).

Table 3: Categorization of Scores for Weightage of each Manufacturer

Categories	Calculated range	Manufacturers adopting the given category of practice
Poor practice	20.0-24.7	M4, M5, M6, M7
Somewhat good practice	24.8-29.5	M1, M2, M3, M8, M10
Good practice	29.6-34.2	M9

A simple weightage matrix was developed for easy interpretation of findings. All the packaging manufacturers were listed and checked against the level of eco-efficient practices as per the calculated range. The relative practice level of manufacturers could be understood with the help of weightage matrix represented in Table 4. It was noted that only one metal packaging manufacturer was observed with good eco-efficient practices while three paper packaging manufacturers and one glass packaging manufacturer displayed somewhat good practice with respect to eco-efficiency. Poor practice was observed in case of one paper packaging manufacturer and all three plastic packaging manufacturers.

Table 4: Weightage Analysis Matrix for Eco-efficiency Practices Adopted by Manufacturers

Manufacturers	**Eco-efficiency Practices of Manufacturers**		
	Poor practice	**Somewhat good practice**	**Good practice**
M1		×	
M2		×	
M3		×	
M4	×		
M5	×		
M6	×		
M7	×		
M8		×	
M9			×
M10		×	

* M(n): Manufacturer number

Conclusion:

Packaging manufacturers have varied perceptions of eco-friendly packaging and the concept of eco-efficiency, their knowledge is limited and more related to packaging materials (biodegradability and recyclability), and market appeal (attractive graphics and good price). They express petite

knowledge about manufacturing technologies but still desire an eco-friendly manufacturing process. Manufacturers are under pressure not only from government to develop environment friendly packaging but also from the consumers who are looking forward to this change. In this study, nine indicators were developed for packaging manufacturers to assess their eco-efficiency practices. Also, the practices of 10 selected manufacturers were evaluated and their level of practice was interpreted with the help of a weightage matrix. Those packaging manufacturers with good eco-efficient practices used less virgin raw materials and worked with improved production methods, generated less waste or have the provision for recycling. They also worked towards a better supply chain management with minimal physical and environmental hazards.

Therefore, the eco-efficiency indicators developed for packaging manufacturers could be recognized as an important tool for measuring the level of practice for the protection of environment and efficient use of resources. Manufacturers that successfully manage to implement good practices will have increased profitability and sustainable growth. In this way, there is an opportunity for them to be productive while substantially minimizing the environmental damage.

References:

1. Aishwarya, V. (2019). India produces 25,000 tonnes of plastic waste daily, 40% uncollected; says Government. Retrieved from https://www.packaging360.in/news/india-produces-25-000-tonnes-of-plastic-waste-daily--40--uncollected--says-
2. Kasprzak, J., Lechman, K. J. & Selech, J. (2018). Eco-efficiency analysis of an innovative packaging production: case study. Clean Technologies and Environmental Policy. 21. 339-350. Retrieved from https://link.springer.com/ article/10.1007/s10098-018-1639-7.
3. McDonough, W. & Braungart, M. (2002). Cradle to Cradle. New York, NY: North Point Press
4. Ministry of Housing and Urban Affairs. (2019). Plastic Waste Management: Issues, Solutions and Case Studies. Swachh Bharat Mission – Urban. Retrieved from http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Plastic%20Waste%20Book.pdf
5. PackPlus. (2019). Plastics and Polymer Consumption. Retrieved from https://www.packplus.in/responsive/Industry.php.
6. Wikipedia. (2020). Packaging and labelling. Retrieved from https://en.wikipedia.org/wiki/Packaging_and_labeling