



Reimagining 'Method' in the 4M Framework: Integrating Packaging Design into Traditional Craft Production Systems

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Abstract

This research examines the need to redefine the "Method" element of the 4M model (Man, Machine, Material, Method) by integrating packaging design into traditional toy craft production systems. The study aims to examine existing production practices, identify gaps in packaging integration, and explore design-led strategies for enhancing product value, sustainability, cultural identity, and market competitiveness. A descriptive and exploratory research design was adopted, with primary data collected through a structured questionnaire administered to 20 traditional toy artisans. Data were analysed using frequency and percentage methods to understand production processes, packaging practices, and artisans' attitudes. The findings indicate that traditional toy production remains largely product-oriented, with most artisans considering finishing as the final stage of production and only a small proportion integrating packaging into the manufacturing process. Existing packaging practices are largely informal, with limited branding, product information, and use of environmentally friendly materials. However, artisans demonstrate a positive attitude towards improved packaging and express interest in training and design support. The study identifies packaging as an underdeveloped component of the "Method" element and highlights its potential as a value-adding design intervention. Integrating packaging design from the initial stages of production can promote sustainable material use, strengthen cultural identity, improve user experience, and enhance market appeal. The research concludes that redefining "Method" as an integrated process encompassing production and packaging can transform traditional toy-making into a more sustainable, competitive, and market-oriented system while contributing to cultural preservation and artisans' economic development.

Key Words

4M Framework (Man, Machine, Material, Method), Method Optimization, Packaging Design Integration, Holistic Design Approach, Life Cycle Assessment (LCA).

Introduction

The worldwide manufacturing industry is now in a major shift, leaving the linear extract-manufacture-discard model, to a circular economy with a greater focus on sustainability and resource efficiency. The keystone of this change is the 4M framework-Man, Machine, Material, and Method- that has long been the means to study and streamline production systems. But within the framework of traditional craft production, this scheme should be re-considered. Although much effort has been directed at enhancing “Material” and Machine, the Method especially how packaging design can be incorporated into the production processes is poorly developed. It is thus critical to redefine the concept of Method in order to make sure that unsustainable packaging habit does not compromise the sustainability of handmade products.

The traditional craft systems have a natural inclination to sustainability because of the use of local sources and biodegradable materials. But, there is a chink in the post production stage especially in packaging. Sustainable packaging, as Mudgal et al. (2024) suggested, should be a holistic approach that takes into account the overall product life cycle and evolving consumer preferences. In reality, craftsmen tend to consider packaging as an epilogue, using plastic substances which do not correspond to the environmentally-friendly character of the work. To solve this problem, it is necessary to incorporate packaging into the manufacturing process. According to Zhang and Han (2025), the packaging must contain environmental functionality and cultural aesthetics, so that it represents sustainability and identity of the craft.

Functionality is not the only role of packaging as it also impacts consumer perception. With the introduction of traditional crafts into international markets, particularly via online shopping, packaging forms the front line of interaction between the product and the consumer. As Branca et al. (2023) noted, sustainability indicators have become an important factor that influences consumers, with many relating sustainable packaging to the quality of products. The use of traditional methods like the use of natural fibres in binding or handcrafted attributes in packaging reinforces the authenticity narrative. This is in line with Lau and Wong (2024), who, in the Natural-Resource-Based View (NRBV), highlighted that environmentally responsible practices have a potential to give small-scale producers a competitive edge. Logistically, the “Method” also has to deal with the problems of transportation and supply chains. The traditional crafts are usually delicate and non-uniform, causing packaging and distribution to be inefficient. Morashti et al. (2022) indicated that sustainable packaging in logistics is an under-researched area, especially in minimizing wastes and emissions. Artisans can reduce environmental impact in transportation by creating a modular and space-efficient design of packaging. This is aligned with the principles of Design for Environment suggested by Lindh et al. (2016), who have highlighted the need to combine packaging with logistics to attain sustainability.

The development of environmentally-friendly materials also implies alterations in the production process. Aguilar et al. (2025) recorded some innovations in biodegradable packaging material like cellulose-based and starch-based products. But to enable the traditional artisans to utilize these materials, the application techniques need to be easy and capable of operating in low-technology settings. Nordin and Selke (2010) pointed that sustainable packaging solutions should be socially and culturally acceptable to make sure they are implemented successfully in craft communities. Economic viability is one of the biggest concerns to artisans. Sonneveld et al. (2005) contended that sustainability should be balanced with the cost. A reformulation of “Method” would be to develop low-cost, efficient packaging, like the interlocking designs which do not require more materials like adhesives. Verghese and Lewis (2007) also highlighted the importance of designing the packaging in the whole lifecycle such as disposal and recyclability, at the very first stage of the packaging design.

Literature Review

Recent studies highlight the growing integration of sustainability, consumer preferences, material innovation, and design in packaging research. **Mudgal; et al. (2024)** developed a multi-criteria decision-making model combining the Kano model, Ashby plots, Life Cycle Assessment (LCA), Life Cycle Costing (LCC), and TOPSIS to systematically

evaluate sustainable packaging materials based on consumer, environmental, and economic factors.

Morashti; et al. (2022) examined sustainable packaging and supply-chain management using quantitative and qualitative methods. They identified limited operational-management research and highlighted increasing attention to circular economy, life-cycle impacts, and transportation.

Branca; et al. (2023), through a systematic review of 52 studies, identified four major research areas: consumer sustainability knowledge, green packaging, packaging cues, and consumer attitudes. Their findings emphasize the need to align environmental responsibility with consumer expectations.

Lau and Wong (2024) classified sustainable packaging research into materials, management, consumer behaviour, and waste management, emphasizing the need to connect technological innovation with commercialization.

Aguiar; et al. (2025) reviewed over 5,000 studies on sustainable packaging technologies and found a strong focus on films, while alternative formats such as trays and cups remain underexplored. They also identified increasing interest in multifunctional and bioactive packaging.

Zhang and Han (2025) further integrated environmental aesthetics, arguing that sustainable packaging should balance ecological responsibility with aesthetic value.

Objectives

1. To analyse the existing production processes of traditional toy artisans in terms of Man, Machine, Material, and Method.
2. To examine the current role of “Method” in traditional toy production, particularly in relation to post-production activities.
3. To assess the existing packaging practices adopted by toy artisans and their impact on product presentation and sales.
4. To identify gaps and limitations in the integration of packaging within the traditional production system.

Methodology

Research Design

The current research has incorporated descriptive and exploratory research design to investigate what happens during the production process of traditional toy artisans and how packaging fits in the 4M framework. This research has aimed at the perception of current practices, the gaps in the Method aspect as well as the possibilities of incorporating packaging design into the conventional toy manufacturing systems. Such a design has allowed to study real-life practices and perspective of artisans in detail.

Nature and Source of Data

Primary data has also formed the basis of the study and it has been gathered through direct interviews with the traditional toy artisans via a structured questionnaire. Moreover, the secondary data has been employed to corroborate the study such as studies in research, reports on craft sector and literature on packaging design and production systems. The primary and secondary data have given an in-depth insight into the research problem.

Sampling Design

In the current study, purposive sampling method has been adopted. The survey has been chosen to survey 20 traditional toy artisans. They have been chosen because they are actively engaged in the production of toys and also because they have experience in the traditional craft practice. This sample size has been deemed sufficient to make significant findings on production processes and packaging strategies in the context of the chosen craft.

Data Collection Method

A structured questionnaire (close ended questions) has been used to gather the primary data via a questionnaire. The questionnaire has been categorized into various areas, such as production process (Man–Machine–Material), method analysis, packaging practices and awareness and improvement aspects. The questions are aimed at eliciting the information about raw materials, tools, production phases, packaging, and the attitude of artisans to the design of packaging. The survey method has provided uniformity as well as easy analysis of data.

Sampling Design

A purposive sampling method has been used to select individuals in the current study. The respondents

will be 20 traditional toy artisans conducted according to their participation in the activities of production of toys and their experience with practicing traditional craft. The choice has been taken so as to represent competent artisans who are involved in various phases of making toys. The primary data of these respondents has been given by a structured questionnaire and this has enabled them to comprehend the production process, packaging practices and level of awareness regarding packaging design.

The list of selected artisans is presented below:

Table 1: List of Selected Toy Artisans

S.N.	Name of Artisan	Address
1	Sonu Prajapati	Khojawa
2	Rameshwar Singh	Kashmiriganj
3	Sunita Prajapati	Khojawa
4	Amrita Singh	Kashmiriganj
5	Savita Prajapati	Kashmiriganj
6	Vaishali Jaiswal	Kashmiriganj
7	Anjali Singh	Kashmiriganj
8	Hema Devi	Kashmiriganj
9	Jyoti Prajapati	Kashmiriganj
10	Mamata Jaiswal	Kashmiriganj
11	Gudiya Singh	Kashmiriganj
12	Savita	Kashmiriganj
13	Bharati Singh	Kashmiriganj
14	Ruby Devi	Kashmiriganj
15	Suman Devi	Kashmiriganj
16	Hiramani Devi	Kashmiriganj
17	Asha Devi	Kashmiriganj
18	Shila Devi	Kashmiriganj
19	Om Prakash Sharma	Katuapura
20	Raja Babu	Luxa

Data Analysis Techniques

The data obtained has been processed with statistical methods like frequency and percentage analysis. The information is coded and inputted into SPSS software to be systematically analysed. The findings have been enlisted in form of tables in order to clearly show patterns that revolve around production approaches, packaging gaps, and artisan knowledge. The responses have been interpreted using simple descriptive statistics and used to make meaningful conclusions that are in line with the objectives of the study.

The research has been narrowed down to the conventional toy artisans and has been specific on the incorporation of packaging design into the production process. It has analyzed a few respondents only and not all forms of crafts. The main focus has been on the concept of the Method part of the 4M framework and how it is being changed with the integration of packaging.

Results / Findings

Table 2: Production Process (Man–Machine–Material)

Variable	Category	Frequency	Percentage
Raw Material	Wood	12	60%
	Clay	6	30%
	Natural Colours	2	10%
Tools Used	Hand Tools	12	60%
	Semi-automatic	2	10%
	Mixed	6	30%
Production Stages	4–6	8	40%
	7–10	10	50%
	>10	2	10%
Fixed Method	Yes	14	70%
	No	6	30%
Participants	Family	6	30%
	Family + Workers	14	70%

(Source: Primary Data)

The analysis of Man, Machine, and Material within the 4M framework shows that traditional toy production remains largely handicraft-based and environmentally conscious. Wood is the primary material used by 60% of artisans, followed by clay (30%) and natural colours (10%), indicating dependence on locally available resources. Regarding tools, 60% use hand tools, 30% employ a mixed approach, and only 10% use semi-automatic machines, reflecting limited technological integration. Production involves multiple stages, with 50% completing 7–10 steps, while others follow fixed processes. Additionally, 70% employ family members and hired workers, indicating a shift towards semi-organized production with limited standardization.

Table 3: Method

Variable	Category	Frequency	Percentage
Final Step	Direct Selling	6	30%
	Finishing	14	70%
Packaging as Part of Production	Yes	2	10%
	No	18	90%
Stage of Packaging	After Production	2	10%
	At Sale	6	30%
	No Packaging	12	60%
Planned Packaging	Yes	2	10%
	No	18	90%

(Source: Primary Data)

The discussion of the “Method” element demonstrates that the conventional production cycle of toy artisans is overall product-focused and incomplete thus, justifying the fundamental aim of investigating the incorporation of packaging. The results reveal that 70 percent of artisans view the finishing as the last stage and it means that the production is done when the product is complete without the need to include post-production functions like packaging. The packaging is considered as a part of the production process by only 10% of the respondents, and is considered as an external activity by 90% of them, which is a significant shortcoming of the “Method dimension of the 4M framework. Moreover, 60 percent of artisans do not package, 30 percent package only when they make sales and only 10 percent package after production, indicating its informal and inconsistent character. Further, 10% have a systematic packaging strategy and 90% do not have a systematic strategy meaning that they are not that aware and design has not been incorporated in their strategy. In general, these results show that packaging is not procedurally integrated into the production process, diminishing its possibilities of adding value and improving the market.

Table 4: Packaging Practices

Variable	Category	Frequency	Percentage
Packaging Type	Plastic	9	45%
	Paper	5	25%
	No Packaging	6	30%
Branding Use	Yes	5	25%
	No	15	75%
Information on Packaging	Product Info	5	25%
	None	15	75%
Packaging Affects Sales	Yes	14	70%
	Not Sure	6	30%
Main Problem	Cost	8	40%
	Knowledge	10	50%
	Time	2	10%

(Source: Primary Data)

The packaging practices analysis shows that there are major gaps in it, which directly aid the aim of the study: to investigate the role of packaging in the traditional production of toys. The results show that 45 percent of artisans package in plastic, 25 percent in paper, and 30 percent do not package at all, indicating inconsistency of the practices of using packaging materials and sustainable packaging. Most of the artisans (75 percent) do not have any branding, neither do most of them (75 percent) label their products on packaging meaning packaging is not being used as a communication, value addition or market differentiation tool. Even with these restrictions, 70 percent of the respondents believe that packaging influences sales demonstrating a clear understanding of the

significance of packaging in influencing consumer behavior. Additionally, as the primary obstacles, knowledge deficiency (50%), high price (40%), and time constraints (10%), it appears that the problem is more of an awareness and skills gap than of financial restrictions. A general finding of the results is that although packaging is an acknowledged aspect, it is still in its developing, unstructured state, and thus the necessity to include packaging design in the 4M framework in the method section.

Table 5: Awareness & Improvement

Variable	Category	Frequency	Percentage
Eco-friendly Awareness	Yes	5	25%
	No	15	75%
Willingness to Adopt	Yes	20	100%
Training Need	Yes	15	75%
	No	5	25%
Suggestions	Better Packaging	11	55%
	Online Selling	3	15%
	Training	6	30%

(Source: Primary Data)

The discussion of awareness and areas of improvement creates an important insight into the aims of the study of assessing the preparedness of the artisans and determining the perspectives of integrating packaging in the future. The results indicate that one-fourth of artisans have heard of environmentally friendly packaging, and three-quarters of them have not, and there is a lack of knowledge pertinent to the specifics of the traditional toy-making industry, which is inherently sustainable. Nevertheless, the most positive effect is that 100% of the respondents are ready to implement the better approaches to packaging that proves the possibility of openness to innovation and contributes to the goal of implementing packaging into the production system. Moreover, 75 percent of artisans reported that they need to be trained in packaging design, which indicates a lack of skills and knowledge and supports the capacity-building programs. The recommendations also show that 55 percent of artisans believe that improved packaging is the key to increased sales, 30 percent of the participants believed that training is the key, and 15 percent recommended online sale. Generally, these results indicate that although the level of awareness is low, there is a high willingness and demand to improve which substantiates the necessity to incorporate packaging design into the Method aspect of 4M framework.

Conclusion

The study demonstrates that packaging can play a significant role in strengthening design practice, innovation, and sustainable production within the traditional toy craft sector. The findings reveal a major gap in the “Method” component of the 4M framework, where packaging is generally treated as a post-production activity rather than an integrated part of production planning. Therefore, packaging should be considered alongside product design, materials, aesthetics, functionality, and market requirements from the early stages of production. The study also highlights the potential of culturally responsive packaging to communicate the heritage, identity, and uniqueness of traditional toys. Incorporating local motifs, regional art forms, and craft narratives can enhance product value while supporting cultural preservation. Sustainable packaging is another important area of intervention, particularly because the use of plastic contradicts the environmentally friendly nature of wooden toys. Locally available materials such as recycled paper, cardboard, and natural fibres can provide affordable and sustainable alternatives.

Furthermore, artisans’ positive attitude toward improved packaging indicates strong potential for designed innovation. Training, workshops, and collaborations between designers and artisans can address gaps in knowledge, branding, and packaging skills. Finally, user-centred packaging can improve protection, safety, attractiveness, information, and overall consumer experience. Thus, integrating sustainable, culturally relevant, and market-oriented packaging into the 4M framework can enhance the competitiveness, value, and long-term sustainability of traditional toy crafts.

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