

The vocabulary of post consumer packaging waste in the built environments: A qualitative study

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Abstract

Innovative applications of post consumer packaging units in architecture are traced from the Hellenistic period. Interpreting the Romans' eco sensitivity, post industrial revolution era witnessed the development of 'eco-centric ideal' and 'prospector's, cook's and nomad's approaches'. The primary objective is to study the unique strategies and techniques developed by architects, artists, technocrats and environmentalists in reusing the primary, secondary and tertiary packaging waste in the built environments. For the study, thematic analysis is adopted to investigate and consolidate the diverse practices in today's context. The summary of findings reveals the embedded design processes, the vocabulary created by such structures in the environment portraying the current use of post consumer packaging waste as building blocks in load and non load bearing components, techniques developed in erecting ephemeral spaces creating a dialogue with the environment, offering a variety of spatial experiences to the viewers, visitors and the users. We posit that a comprehensive understanding of such approaches and concepts give new directions to evolve and develop ideas with the used packaging materials in open ended prefabricated systems.

Keywords

Architecture, Design process, Packaging waste, Vocabulary.



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1. Introduction

According to the council directive (1994), 'packaging is anything to contain, protect, handle, deliver or present raw materials and processed goods'. They are classified as primary, secondary and tertiary as in Table 1 in a wider perspective. In addition, corrugated board, crushed paper, foam netting, bubble film, loose fill and air pouch cushion are classified as cushion packaging, which are used along with the secondary as well as the tertiary packaging. Based on the commodities, classification of primary and secondary packaging keeps interchanging. With respect to agricultural goods, baskets, barrels, jute bags and polymer bags are used which fall under the primary as well as tertiary packaging.

1.1. Origin of packaging waste use in built forms

The innovative application of post consumer packaging wastes can be traced from the Romans' era. They devised techniques to use the 'amphorae' in the built forms. Reuse A is using the packaging unit for the original purpose continuously, where as C and B refers to using it for an altogether purpose with and without modification. The former revolves around use of broke pieces of the earthenware in facades and pavements as paving materials, whereas the latter is about reducing the self weight of massive structures by placing the pot in inverted positions.

In the current scenario, post consumer waste is used in construction is in the nascent phase. The primary reasons for such applications are exhaustive use of natural and virgin materials in packaging industry, an alternative use to the materials which becomes a waste after the primary use, address the shelter crisis through developing appropriate construction techniques, to create an awareness to the public, use technology to develop the waste in to novel building materials, components etc.

The primary objective of this study is to explore the ideas, approaches and methods adopted by architects, environmentalists and artists in erecting permanent and temporary structures intuitively, poetically and as problem

Table 1. Classification of packaging materials.

Classification	Description	Examples
Tertiary	Designed to facilitate bulk handling as well as transport.	Containers, wood and metal pallets
Secondary	Generally removed by the distributor or retailer at or near the point of sale as it is used to transport primary packages locally	Paper based containers(cartons), wood based containers (crates) and polymer based containers (crates – collapsible, nesting and stacking)
Primary	Direct contact with the commodities. (Flexible packaging, stand up pouches, rigid containers)	Paper based (trays, tubes, cartons), plastic based containers (1-7), metal cans (collapsible metal tubes, cans, kegs, aerosol cans), composite containers (tetra packs), glass based containers, pots

Table 2. A chronological applications of packaging wastes in built environment.

Year	Packaging waste in built environment	Design application
1902	First glass bottle house at Nevada by William F. Peck	Load bearing structure
1905	Barrel house, Nevada	
1958	Beer crate pavilion	Temporary structure
1962	Container architecture	Building envelope
1968	Beer can house, Houston by John Malkovich	Facing
1973	beer can wall was patented	Space divider
2000	Paper tube by Shigeru pan was patented	Structural member
2002	PET bottle house by Andreas Froese	Load bearing wall
2008	Oil cans pavilion, India by Sanjeev Shankar Pallet house at Venice by Schnetzer Andreas Calus & Pils Gregor	Artistic temporary structure
2009	Glass bottle shrine, Thailand	Load bearing structure
2010	Beer crate pavilion at Belgium by SHSH architects Milk crates pavilion by Behin + HA Use of polli bricks in eco ark pavilion by Arthur Huang	Temporary structures
2013	Vegetable and PET bottle pavilion at Philippines	
2014	Plastic cups pavilion at Governor's pavilion by CDR studio	

solving strategy. The chronological application of post consumer packaging waste in construction, version to indicate the range and time scales is summarized in Table 2.

1.2. Architects' paradigms on packaging waste

According to Antoniades (1992), 'material' as a source of inspiration is identified as a tangible channel to creativity in architecture. Materials are broadly classified as those that affect the structural systems and functional organisation followed by those that determine the interior and exterior textures (p.214). Eco-centric logic (Guy & Farmer, 2001) propagates the use of renewable or recyclable materials. Carpenter (2009) posits that revolutionary outcomes which are developed through inductive process must work with nature and nurture human conditions. Jeanne Gang (2010) has postulated the cook's, the prospector's and the nomad's approach. The cook's paradigm is about incorporating the left over products in building industry for

Table 3. *Interpreting the ideologies of packaging waste in built environment.*

Classification	Material	Components of buildings	Romans' principles	Gang's postulates
Primary	Pots	Fillers	Reuse B	Prospector's approach
	Glass	Load bearing (walls)		
	Polymer	Load bearing (external walls) Non load bearing (external and internal)	Reuse B / Reuse C	Prospector's approach/ Nomad's approach
	Paper	Structural elements Skin (roof)		
	Wood	Non load bearing (external and internal) Envelope (pavilions)	Reuse C	
	Metal	Non load bearing (internal) Skin (roof)	Reuse B / Reuse C	
Composite	Skin (roof)	Reuse C		
Secondary	Polymer	Load bearing (external walls) Non load bearing (external and internal)	Reuse B / Reuse C	
	Paper	Structural elements Skin (roof)	Reuse C	
	Wood	Non load bearing (external and internal) Envelope (pavilions)	Reuse B / Reuse C	
Tertiary	Metal	Envelope	Reuse C	

construction. The curiosity, persistence in locating the used materials, evaluating their potential, giving them new life in architecture and portable structures in relation with the climate and ecology are the prospective architect's and nomad's approaches respectively addressing 'form follows materials'.

Yatin Pandya (2013) has framed five approaches, namely A, B, C, D and E addressing sustainable architecture. The approach C indicates the use of recycling waste as environmental and economical way in buildings. Reuse and recycling is identified as a strategy by Chithra Viswanath.

The intent of this paper is to explore the diverse approaches, consolidate, interpret and find new directions to use packaging waste in architecture.

2. Method

The primary objective of qualitative research is to seek illumination, comprehensive understanding and extension to similar conditions (Golafshani, 2003). It is specific to a particular context (Thomas, Harden, 2007). The details of data collection are reported systematically (Patton, 1999). Researcher is the data gathering instrument (Brick, 1993). Intensive engagement with the data is important (Roberts, Priest & Traynor, 2006). It is determined by the purpose of the study (Krefting, 1991). Placing the raw data logically in a holistic fashion requires creativity (Hoep-

fl, 1997), sensitivity and remain open (Morse, Barrett Mayan, Olson Spicers, 2002).

Thematic analysis is the most common method adopted in qualitative studies (Brick, 2007). It widely used as an analytical approach to yield insightful interpretation (Mills, Durepose & Weibe, 2010). It is a flexible method and a useful tool for analysing and reporting patterns (Braun, V. & Clarke, V., 2006). We have adopted both inductive and deductive processes (Thorne, 2000) using domain analysis (Leydens, Moskal & Pavelich, 2004) to identify the patterns and themes.

Data is collected and interpreted from diverse secondary sources like websites, magazines, articles, research papers and interviews which is the limitation of this study. The gathered ideas, approaches and concepts are consolidated inductively like the techniques adopted to construct the different components of the building such as foundation, wall, roof, light diffusers, fillers in slabs etc in permanent structures for a comprehensive understanding. In addition, various temporary pavilions using packaging waste by professionals, design build workshops in academics is included to interpret the design processes. Following this, for the deductive analysis, Romans' principles and Gang's postulates are adopted to analysis the prior findings.

3. Findings

The consolidation of the ideas and approaches are through inductive and deductive process are summarised in Table 3. It is observed that primary, secondary and tertiary packaging waste are used in constructing walls, roofs, structural elements, fillers, skin, light diffusers, portable structures etc as in Table 3. Positive outdoor spaces, wings of light, arcades, half open wall, tactile surface, filtered light, seat spots, ornament, pools of light, warm materials, trellised walks etc offering a variety of spatial experiences to the viewers, visitors and users (Alexander, Ishikawa, Silverstein, Jacobson, King & Angel, 1977) are the patterns created to etch unique vocabularies in the built environments.

4. Discussion

A study on the design processes and erection of temporary pavilions or portable structures is interpreted as in Figure 1. It is posited that they are mostly 'Do-it-yourself' activities for awareness, academic 'Design-build' workshops or experimentation with advanced software and fabrication in academics as well as in construction industry by professionals.

The study portrays that even though the ideals, design processes and approaches are diverse, the ultimate goal of is to reduce the use of virgin building materials. Technology plays a vital role in designing new structural components such as the 'paper tubes' by Shigeru Ban and prefabricated 'polli bricks' curtain wall glazing by Arthur Huang, which are either interdisciplinary or multidisciplinary in nature is challenging.

According to Kronenberg (2009, p.12), there is a lack of coordinated research activities in using recycled materials in portable structures, which are as valuable as high tech solutions. The study posits that there is a strong potential for reusing packaging waste in designing open prefabricated systems which are dry assembled site, giving a new direction to explore various possibilities in ephemeral structures and spaces.

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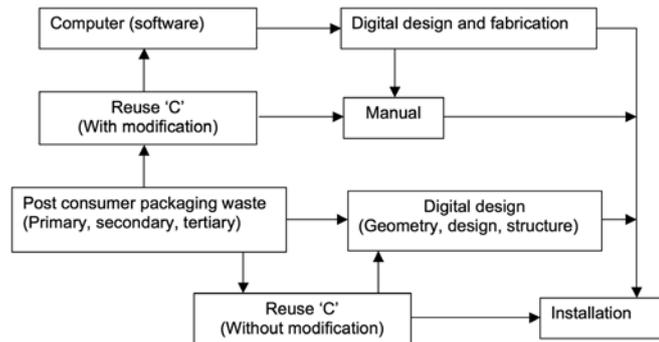


Figure 1: Design processes and temporary pavilions.

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