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JK LAKSHMIPAT UNIVERSITY
Institute of Design
NAAC 'A' Grade Accredited

A Product and Systems Design Approach for Packaging Innovation

Sustainable Packaging Design Using Trayforma, Development of Marketing Collaterals, and Dispatch Systems Enhancement

VOL. 1

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Sponsor : **Lipi International Pvt. Ltd.**

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Consultant : **Mr. Sanat Kothari and Ms. Anisha Kothari**

Programme :

**Bachelor of Design (B.Des)
Product Design**

THE
**GRADUATION
PROJECT 2025**

The Evaluation Jury has recommended **Angel Prashant Jain**
for graduation from **Institute of Design, JK LAKSHMIPAT UNIVERSITY**
with specialization in **Product Design**

Herewith, for the project titled “**Sustainable Packaging Design Using Trayforma, Development of Marketing Collaterals, and Dispatch Systems Enhancement**” on fulfillment of requirements by

Jury Chairman

Jury Member

Jury Member

Subsequent remarks regarding fulfillment of requirements

Dean, Institute of Design
JK Lakshmipat University

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Introduction

1. Background and Context

The global packaging industry is experiencing unprecedented transformation driven by environmental consciousness, regulatory pressures, and consumer demand for sustainable alternatives to plastic packaging. The packaging sector generates over 350 million tons of plastic waste annually, with food packaging representing approximately 40% of this volume. In response to this crisis, innovative materials such as paperboard-based ovenable substrates are emerging as viable alternatives, offering temperature resistance capabilities.

This internship was undertaken within this critical context of packaging innovation, focusing specifically on the development and application of Trayforma, a proprietary paperboard-based ovenable material capable of withstanding temperatures suitable for conventional and microwave cooking applications. The project addressed both technical challenges in sustainable packaging design and broader organizational systems optimization requirements.

2. Internship Objectives and Scope

The primary objectives of this 5-month internship included:

(A) Product Design Innovation:

- Developing functional packaging solutions using Trayforma material for specific food applications
- Studying the causes of technical challenges related to corner sealing and structural integrity
- Creating prototypes ready for commercial development and testing

(B) Systems Design and Optimization:

- Analyzing and improving manufacturing dispatch systems
- Improvising standard operating procedures for operational efficiency

- Contributing to process optimization across packaging operations

(C) Communication Design:

- Creating comprehensive marketing collaterals including end-to-end brochure development
- Developing visual communication materials for product portfolio presentation
- Supporting brand development and market positioning initiatives

3. Research Methodology and Approach

The internship employed a comprehensive methodology combining theoretical frameworks with practical application:

- Design Thinking Framework: Applied the five-phase design process (empathize, define, ideate, prototype, test) to packaging development challenges, ensuring user-centered solutions while accommodating manufacturing constraints.
- Systems Thinking Approach: Utilized manufacturing system design decomposition principles to understand interdependencies between production, dispatch, and quality control processes.
- Lean Methodology Integration: Implemented lean principles focusing on waste reduction, process streamlining, and value maximization across packaging operations.
- Adaptive Research Methods: Developed innovative remote research techniques, including YouTube-based task analysis for frozen food packaging applications, demonstrating methodology adaptation under resource constraints.

Company Overview

About Lipi International Pvt. Ltd. (LIPL)

Lipi International Pvt. Ltd. (LIPL) is a leading name in the Indian printing and packaging sector, recognized for its commitment to quality, innovation, and sustainability. Headquartered in Central India, LIPL stands as one of the region's largest and most technologically advanced printing and packaging units, with a strong reputation both domestically and internationally.

Certified by TUV-SUD as an ISO 22000:2018 company and holding FSSC 22000 accreditation, LIPL ensures that its manufacturing processes meet the highest global standards for food safety and quality management. The company's dedication to excellence is further reflected in its FSC® certification (2024), which guarantees that its paperboard sourcing supports responsible forestry and sustainable supply chains.

LIPL's operations are structured around specialized teams, including a dedicated Pre-Press and Research & Development department, a Central Marketing Office, and a Central Control Office. This organizational framework enables the company to deliver tailored solutions and continuous improvement for a diverse clientele, ranging from local businesses to multinational corporations.

With a mission to provide world-class packaging that is both practical and innovative, LIPL emphasizes a blend of technical expertise and a human-centric approach. The company's philosophy centers on empowering clients through effective, knowledge-driven solutions that enhance both product appeal and operational efficiency.

Commitment to Sustainability and Social Responsibility

Environmental stewardship and social responsibility are core values at LIPL. The company operates energy-efficient manufacturing units and maintains lush green campuses, reflecting its ongoing commitment to reducing environmental impact. LIPL prioritizes the use of raw materials that are least hazardous to the environment and actively pursues initiatives that contribute to a greener, safer planet.

As the largest exporter of printed cartons from Central India, LIPL regularly serves clients in the UK, UAE, Africa, the US, and other global markets. Exports account for approximately 10% of the company's annual revenue, with this share growing each year. LIPL also engages in various social initiatives, underscoring its dedication to community development and ethical business practices.

Certifications and Quality Standards

LIPL's commitment to quality and sustainability is validated by several prestigious certifications:

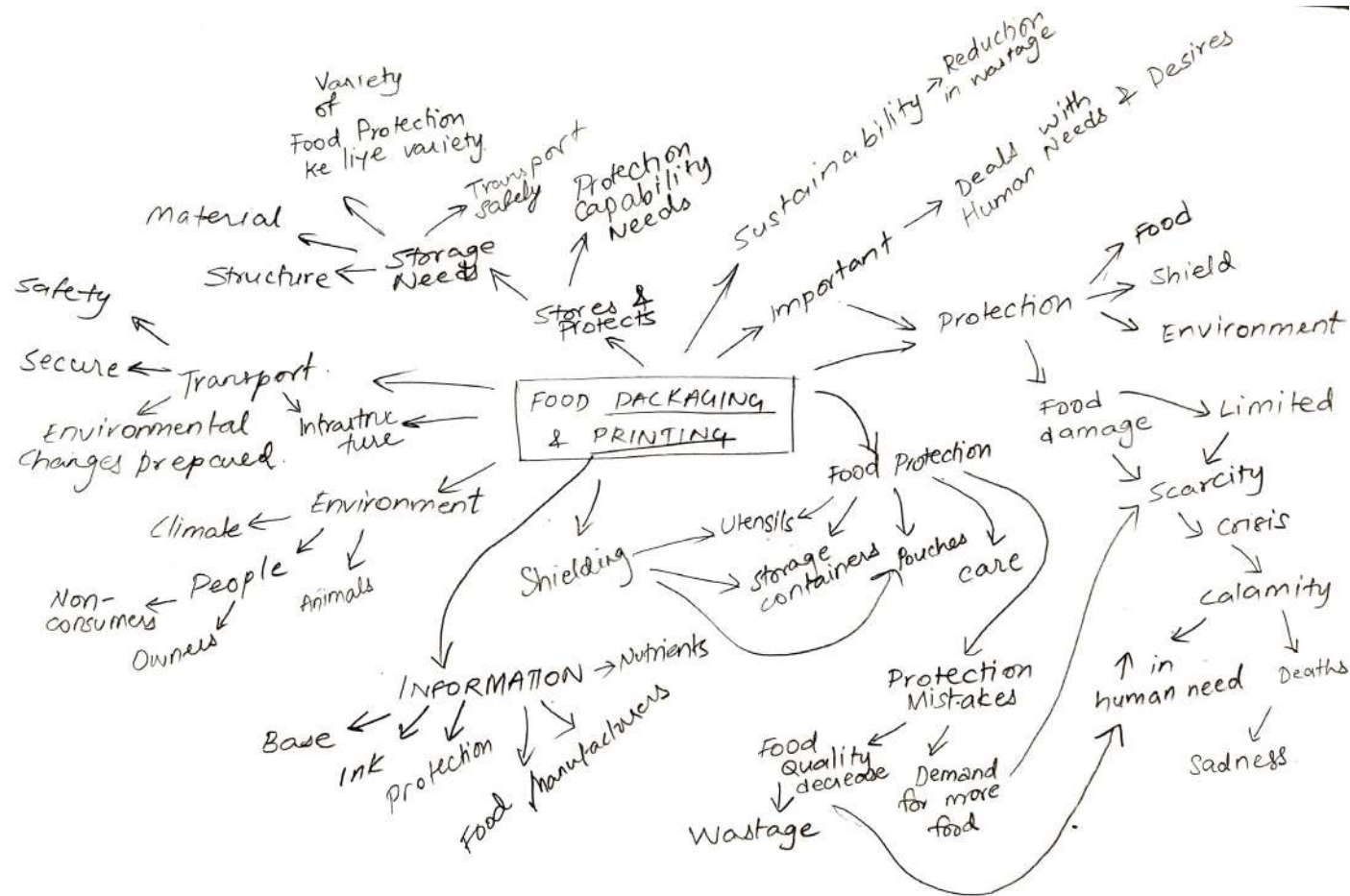
- FSSC 22000 Certified Facility: Ensures globally recognized food safety standards throughout the production process, from raw material handling to final packaging.
- ISO 22000:2018 Compliant: Aligns with international food safety management standards, ensuring traceability, hazard control, and consistent quality.
- FSC® Certified (2024): Guarantees responsible sourcing of paperboard from sustainably managed forests, supporting environmental and social equity.



Industry Context

BRAINSTORMING

I initiated understanding the Packaging and Printing Industry by brainstorming. It covered the foundations, purpose and environment of packaging. It was understood that packaging plays a pivotal role in protection and communication. Packaging is also highly present in garbage and wastage, thus sustainability and eco-friendliness is also a major lens to consider.



ABOUT THE INDUSTRY

The global packaging and printing industry serves as a critical nexus between product protection, consumer engagement, and environmental stewardship. Valued at \$351.90 billion in 2023, the market is projected to reach \$509.60 billion by 2031, growing at a CAGR of 4.77%. This growth is fueled by e-commerce expansion, demand for sustainable solutions, and advancements in digital printing technologies. The industry's role extends beyond containment, it drives brand differentiation through innovative designs while addressing regulatory pressures to reduce plastic waste



Image Source: <https://packagingdiscussions.com/>

KEY COMPONENTS AND TECHNOLOGICAL FRAMEWORKS

MATERIAL INNOVATION

Packaging materials span paperboard, plastics, metals, and biodegradable alternatives, each selected for specific functional and environmental profiles. Paper and cardboard dominate sustainable applications, holding 30% of the materials market due to recyclability and FSC® certification compliance. Flexible plastics, though scrutinized for environmental impact, remain prevalent in food packaging for their barrier properties and cost efficiency.

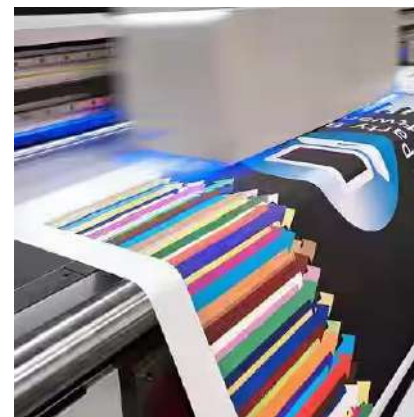


PRINTING TECHNIQUES

Four primary methods define modern packaging printing:

1. Flexography: Ideal for high-speed production on corrugated boards and labels, utilizing water-based inks for reduced VOC emissions.
2. Digital Printing: Enables short-run customization and variable data printing (e.g., QR codes), growing at 9.1% CAGR due to demand for personalized packaging.
3. Offset Lithography: Delivers premium print quality for folding cartons, favored in cosmetics and luxury goods for its color accuracy.
4. Gravure: Used for high-volume flexible packaging, offering precise graphics reproduction but requiring significant upfront plate costs.

Emerging technologies like 3D printing are gaining traction for prototyping and small-batch production, reducing material waste by 30% compared to traditional methods.



FOOD PACKAGING: A CRITICAL SECTOR

FUNCTIONAL AND MARKET IMPORTANCE

Food packaging accounts for 40% of global plastic waste, driving innovations in compostable materials and intelligent systems. The sector's value is projected to grow from \$505.27 billion in 2024 to \$815.51 billion by 2032, propelled by convenience food demand and urbanization. Key functions include:

- Contamination Prevention: Barrier films and modified atmosphere packaging extend shelf life by 50% in meat and dairy products.
- Consumer Engagement: Digital printing integrates augmented reality (AR) labels, enabling brands like Coca-Cola to enhance interactivity.
- Regulatory Compliance: FSSC 22000 and ISO 22000 certifications ensure safety across 90% of food-contact materials.

GENERAL FOOD MANUFACTURING WORKFLOW

The production chain involves:

- Understanding packaging needs
- Selecting Materials
- Packaging Development in Alignment with Manufacturing Processes
- Branding and Printing
- Quality Checks
- Packing and Shipping to client

SUSTAINABILITY AND MARKET SEGMENTATION

Segmentation by Material and Application

- **Plastics:** Hold 43% market share in food packaging but face substitution by paper-based alternatives.
 - **Flexible Packaging:** Dominates with 43% share due to lightweight properties and compatibility with retort processing.
- Regional Dynamics: Asia-Pacific leads with 32.97% market share, driven by frozen food demand in China

PURPOSE OF FOOD PACKAGING

- **Ensuring Food Safety:** Shields food from contamination, spoilage, and external factors like moisture and light
- **Extending Shelf Life:** Extends the shelf life of food products through barrier properties that prevent gas and moisture exchange.
- **Information Communication:** Provides necessary information about the product, including nutritional facts, usage instructions, and expiration dates.
- **Accessibility:** Enhances user experience through easy-to-open designs and resealable options.

KEY GROWTH DRIVERS

- **Sustainability Imperatives:** 67% of consumers prioritize eco-friendly packaging, accelerating adoption of biodegradable materials like FSC®-certified paperboard and mushroom-based composites .
- **E-commerce Boom:** Online grocery sales, projected to exceed \$1.2 trillion by 2030, require durable, temperature-controlled packaging solutions, particularly corrugated boxes and insulated mailers .
- **Smart Packaging Adoption:** Intelligent systems with QR codes and freshness sensors are growing at 10% CAGR, reducing food waste by 20% in cold chains .



PROJECT ONE – BRIEF

REPLACE PLASTIC TRAYS USED IN FROZEN FOODS, RETAIL AND QUICK-SERVICE RESTAURANT (QSR) TAKEAWAYS WITH TRAYFORMA.

First, I simplified the brief and started studying more addressing the following questions and many more one by one.

- What are plastic trays?
- What kind of plastic trays are present in the market?
- Why is there a need to replace them?
- What are frozen foods?
- How are plastic trays used in frozen foods, retail and quick service restaurants?
- What is Trayforma?
- What are the packaging needs of such foods?
- Current Competitor Brands?

WHAT ARE PLASTIC FOOD TRAYS ?

Disposable plastic food trays are single-use trays made from various types of plastic, designed to hold, serve, and transport food items. Once used, these trays are intended to be discarded rather than cleaned and reused. They are a common feature in fast-food restaurants, takeout services, catering events, cafeterias, and airline meal services



KEY CHARACTERISTICS

- **Material:** Typically made from lightweight plastics such as polystyrene, polyethylene, or polypropylene. These materials are chosen for their ability to insulate, preserve, and protect food while being cost-effective to manufacture.
- **Design:** Disposable plastic trays come in various shapes and sizes, often with compartments to separate different food items. They may have lids or be used with plastic wrap to cover and protect the contents.
- **Functionality:** Designed for convenience, these trays are easy to handle, stack, and transport. They are also often microwave-compatible, allowing for reheating of food directly in the tray.

COMMON USES

- Food Service and Takeout: Widely used in restaurants, cafeterias, and catering for serving meals, snacks, or desserts.
- Events and Catering: Popular at events and gatherings due to their ease of use and the minimal cleanup required.
- Institutional Settings: Used in hospitals, schools, airlines, and other large-scale food service environments for efficient meal distribution

MERITS	DEMERITS
Convenient and time-saving	Significant environmental impact
Hygienic i.e. reduces cross-contamination	Potential for chemical leaching
Cost effective for businesses	Limited recyclability, landfill accumulation
Durable for Single Use	Relies on fossil fuels, resource intensive
Versatile in Size and Application	May break or leak, limited insulation

MARKET SIZE OF DISPOSABLE PLASTIC TRAYS

The global disposable food containers market (which includes plastic trays) is projected to reach USD 19.36 billion in 2025 and grow to USD 29.77 billion by 2035 at a CAGR of 4.4%. The plastic trays market alone was valued at USD 8.5 billion in 2024 and is expected to reach USD 12.5 billion by 2033, with the food and beverage sector accounting for about 40% of this demand. The plastic ready meal trays segment was valued at USD 1.41 billion in 2023 and is forecast to reach USD 2.12 billion by 2032.

WHAT TYPE OF PLASTIC TRAYS ARE PRESENT IN THE MARKET?

Primary Research – Visit to various Supermarkets, Bakeries and Stores





MOST COMMON PLASTIC TRAYS STUDIED

CPET (Crystallized Polyethylene Terephthalate) Plastic Trays

CPET trays are food packaging containers made from crystallized polyethylene terephthalate, a material engineered for high heat resistance and durability. They are widely used for ready meals, frozen foods, and applications requiring both freezing and oven/microwave heating.

Properties & Materials

- Temperature Range: Withstand -40°C to $+220^{\circ}\text{C}$, suitable for freezing, microwaving, and conventional oven use.
- Barrier Performance: Excellent barrier against oxygen, water vapor, carbon dioxide, and nitrogen, preserving food freshness and extending shelf life.
- Strength & Safety: High impact resistance even at low temperatures, leak-proof seals, and BPA-free.
- Design: Available in multiple colors, compartment options, and can be customized for branding.
- Sealing: Compatible with various sealing films for airtight, aroma-tight packaging



CPET trays are ideal for applications requiring high heat resistance, excellent barrier properties, and true recyclability, especially in ready meal and frozen food sectors. Their sustainability is enhanced by high recycled content and compatibility with closed-loop recycling, though infrastructure gaps remain in some regions

MERITS	DEMERITS
Dual ovenable—safe for both microwaves and conventional ovens	Not all regions have facilities capable of efficiently recycling CPET, leading to confusion and potential waste
Excellent barrier properties protect against contamination and spoilage	May lose original color if exposed to air over time
Maintains shape and integrity under extreme temperatures	Slightly higher cost compared to some other plastics, though offset by performance and recyclability
Attractive, glossy finish and customizable appearance	Not biodegradable; relies on recycling for sustainability
Meals can be prepared, sealed, frozen, and reheated in the same tray	
Increasingly made from recycled PET (rPET), with some trays containing up to 85% recycled content. Fully recyclable in PET recycling streams, supporting circular economy initiatives	

PP (Polypropylene) Trays

PP trays are thermoformed containers made from polypropylene, a widely used food-safe plastic. They are common for fresh produce, deli items, microwaveable meals, and hot/cold food storage

Properties & Materials

- **Temperature Range:** Can withstand temperatures up to 130°C, making them suitable for microwave use and hot food storage, but become brittle at very low temperatures.
- **Barrier Performance:** Good moisture resistance; can be enhanced with EVOH layers for improved gas barrier.
- **Strength & Safety:** Durable, impact-resistant, lightweight, and do not absorb flavors or odors.
- **Design:** Available in various sizes, shapes, and colors; customizable for branding and compartmentalization.
- **Transparency:** Typically more opaque than PET/CPET, though clear options exist

MERITS	DEMERITS
Generally cheaper than CPET and other specialty plastics	Becomes brittle at very low temperatures, limiting use for deep freezing
Lightweightness reduces shipping costs and environmental footprint	Can degrade under prolonged UV exposure unless stabilized
Suitable for microwaving and hot filling	Lower gas and oxygen barrier compared to CPET unless modified with barrier layers
100% recyclable (resin code #5), with growing infrastructure for PP recycling	While recyclable, actual recycling rates for PP are often lower than for PET/CPET due to collection and sorting challenges
Resistant to breaking, shattering, and chemical degradation	Less transparent than PET/CPET, which may be a drawback for product display
Easily molded into a variety of forms for different applications	

IS THERE NEED TO REPLACE PLASTIC FOOD TRAYS ?

Yes, there is a growing need to replace disposable plastic trays, driven by several factors

Many countries are implementing or tightening regulations on single-use plastics, pushing businesses toward alternatives like paper, bamboo, bagasse, and bioplastics

Brands and governments are setting ambitious sustainability targets, aiming to reduce plastic waste and increase the use of recyclable or compostable packaging

Awareness of plastic pollution and health risks has led to increased consumer preference for eco-friendly packaging

Major food chains and manufacturers are pledging to reduce or eliminate single-use plastics to align with environmental and social responsibility goals

Concerns about chemical leaching from plastics, especially when heated, are prompting a shift to safer alternatives



RETHINKING PLASTIC PACKAGING WASTE MANAGEMENT

As global demand for packaged food rises, so does the environmental burden of plastic packaging waste. One effective strategy for source reduction is to lower the consumption of virgin raw materials by reusing packaging materials that would otherwise be discarded. **However, the reuse of plastic packaging, especially for food, poses significant challenges. Used plastic packaging may be contaminated, and to prevent the migration of contaminants into food during reuse, thorough washing is required. This makes reuse less practical for primary food packaging, where consumer safety is paramount.**

Landfilling remains the most undesirable waste management strategy for plastics. Although it is often considered indispensable for nonrecyclable and noncombustible waste, most plastics disposed of in landfills persist for centuries due to their poor biodegradability. They also generate greenhouse gases, such as methane, contributing to climate change. Moreover, landfill space is becoming increasingly scarce and expensive. In response, many governments have enacted legislation to reduce the volume of waste sent to landfills, aiming for a future where nothing is simply thrown away.

The issue is particularly pressing in developing regions like Africa, where rapid population growth is driving increased food consumption and, consequently, higher demand for plastic packaging. This trend is expected to result in a surge of single-use plastic waste. Addressing this challenge requires significant investment in waste management infrastructure, which can be resource- and time-intensive. Additionally, the lack of affordable alternatives to conventional plastics needs urgent attention.

A promising path forward lies in the adoption of eco-friendly packaging solutions, such as biodegradable biopolymers for single-use food packaging. These materials offer the potential for long-lasting, sustainable solutions that minimize environmental impact. Some countries, notably France and Germany, are leading the way. Producers in these nations are collaborating across the value chain and investing heavily in research and development to create new, sustainable plastic packaging options.

Promoting the use of biopolymers and other green alternatives in packaging is essential for a more sustainable future. By reducing reliance on virgin plastics, improving waste management, and embracing innovative materials, the global community can move closer to a circular economy and a healthier planet.

SUSTAINABILITY RELATED CONCEPTS THAT WERE OFTEN MISUNDERSTOOD

- **Sustainable:** Sustainable refers to practices or products that meet present needs without compromising the ability of future generations to meet theirs, minimizing environmental impact and promoting long-term ecological balance and resource conservation.
- **Eco-friendly:** Eco-friendly describes products, actions, or practices that cause minimal harm to the environment, supporting the health of ecosystems by reducing pollution, conserving resources, and promoting overall environmental well-being.
- **Renewable:** Renewable refers to resources or materials that can be naturally replenished or regenerated over time, such as solar energy, wind, or plants, ensuring a continuous, sustainable supply without depletion.
- **Recyclable:** Recyclable materials can be collected, processed, and re-manufactured into new products after their initial use, reducing waste, conserving resources, and minimizing environmental impact through repeated material cycles.
- **Biodegradable:** Biodegradable substances can be broken down naturally by microorganisms, such as bacteria or fungi, into harmless components, returning safely to the environment without leaving persistent pollution or toxic residues.
- **Compostable:** Compostable materials decompose under controlled composting conditions into nutrient-rich compost, leaving no toxic residue, and supporting soil health by providing organic matter and nutrients for plant growth.
- **Non-toxic:** Non-toxic means a substance or product is free from harmful chemicals or compounds, ensuring it does not cause adverse health effects to humans, animals, or the environment during use or disposal.

WHAT ARE FROZEN FOODS?

Frozen foods are food items that have been subjected to a freezing process to preserve them for longer durations. Freezing reduces the temperature of food below its freezing point (typically around -18°C or 0°F), halting the growth of bacteria, yeasts, and molds, and significantly slowing down spoilage and enzymatic activity. This method retains the food's texture, flavor, and nutritional value better than many other preservation techniques

TYPES OF FROZEN FOODS

- Vegetables: Peas, corn, spinach, broccoli, and mixed vegetable packs.
- Fruits: Berries, mango, pineapple, and other fruits frozen at peak ripeness.
- Meats and Seafood: Chicken, beef, pork, fish fillets, shrimp, and other seafood.
- Prepared Meals: Frozen pizzas, ready-to-eat dinners, entrees, and wraps.
- Bakery Items: Breads, pastries, waffles, and cakes.
- Dairy and Alternatives: Ice cream, frozen yogurt, sorbet, and cheese.
- Snacks and Appetizers: Frozen fries, nuggets, samosas, and spring rolls



PACKAGING NEEDS FOR FROZEN FOODS?

Frozen food packaging must meet strict criteria to ensure product safety, quality, and convenience:

- **Temperature Resistance:** Packaging must withstand extremely low temperatures without becoming brittle, cracking, or losing integrity.
- **Moisture and Oxygen Barrier:** Effective barriers against moisture and oxygen are essential to prevent freezer burn, dehydration, and oxidation, which can degrade food quality.
- **Durability and Strength:** Packaging should be strong enough to protect food during transport, handling, and storage, resisting punctures and leaks.
- **Sealing Ability:** Airtight seals are crucial to prevent contamination, maintain freshness, and extend shelf life.
- **Food Safety Compliance:** Materials must be food-grade, non-toxic, and not interact chemically with the food.
- **Convenience:** Packaging should be easy to fill, store, and use, sometimes offering features like resealable zippers or microwave/oven compatibility.
- **Sustainability:** Increasingly, there is demand for recyclable, biodegradable, or compostable packaging options to reduce environmental impact.

WHAT ARE READY TO EAT MEALS ?

Ready-to-eat (RTE) frozen or microwave meals are fully cooked, pre-packaged food products that are preserved by freezing and require only reheating—typically in a microwave—before consumption. These meals offer maximum convenience, allowing consumers to enjoy a wide variety of dishes with minimal preparation time. They are popular among busy individuals, families, and anyone seeking quick, nutritious, and tasty meal solutions.

TYPES OF READY-TO-EAT FROZEN/MICROWAVE MEALS

- Traditional Entrees: Dishes like cottage pie, curries, biryani, lasagna, pasta, and casseroles.
- Rice and Grain Bowls: Microwaveable rice dishes (e.g., korma rice, vegetable biryani, steamed basmati rice).
- Plant-Based and Vegan Meals: Meat-free options such as vegetable lasagna, lentil soup, plant-based bowls, and vegan entrees.
- Snacks and Appetizers: Samosas, wraps, parathas, and spring rolls.
- Breakfast Items: Waffles, pancakes, and breakfast bowls.
- International Cuisine: Chinese fried rice, tikka masala rice, and global-inspired bowls.
- Diet-Specific Options: Organic, low-fat, low-calorie, or gluten-free meals



PACKAGING NEEDS FOR READY TO EAT MEALS?

RTE frozen and microwave meals require specialized packaging to ensure safety, convenience, and product quality:

- **Microwave Compatibility:** Packaging must withstand microwave heating without melting, warping, or leaching harmful substances. Materials like crystallized polyester (CPET), polypropylene (PP), and specially engineered microwaveable pouches are commonly used.
- **Barrier Properties:** Packaging should provide excellent barriers to moisture, oxygen, and microorganisms to prevent freezer burn, dehydration, and spoilage.
- **Physical Strength:** Trays, pouches, or cartons must be durable enough to protect the food during freezing, transport, and handling.
- **Sealing and Leak-Proofing:** Airtight seals are essential to maintain freshness and prevent leaks, especially for saucy or liquid-rich meals.
- **Convenience Features:** Easy-open notches, resealable closures, and steam-release valves (such as VSTEAM) enhance user experience and safety during reheating.
- **Sustainability:** There is a growing trend toward recyclable and mono-material packaging solutions that are both microwave-safe and environmentally friendly.
- **Product Visibility:** Transparent or semi-transparent packaging can showcase the meal, increasing shelf appeal

Major Indian brands like Haldiram's, ITC, MTR, McCain, Godrej Yummiez, Pal Fresh, Amul, Sumeru, Bikano, and ShimlaRed are leading the market in frozen foods and ready-to-eat meals, offering a diverse range of products to suit modern consumer needs. More and more brands are entering this market.



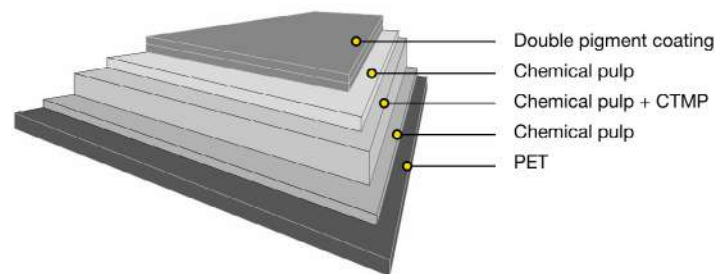
WHAT IS TRAYFORMA ?

Trayforma by Stora Enso is a pioneering line of sustainable, fiber-based packaging materials designed to replace conventional plastic and aluminum in food packaging. Developed by the Finnish pulp and paper giant Stora Enso, Trayforma leverages renewable wood fibers to create eco-friendly solutions for frozen, ready-to-eat (RTE), and fresh food applications.



KEY FEATURES –

- Primarily made from 90–95% wood fibers, sourced sustainably from FSC/PEFC-certified forests. It reduces reliance on fossil-based plastics, lowering the carbon footprint by up to 75% compared to traditional plastic trays.
- It is compatible with fiber-based recycling streams, enabling circularity. Some variants (e.g., Trayforma PET34) use <10% PET plastic, enhancing recyclability in regions with paper recycling infrastructure.
- Withstands temperatures from -40°C to 220°C, suitable for freezers, microwave, oven, and conventional heating.
- The PET layer protects food contents against moisture, oxygen, and grease, extending shelf life while maintaining food safety.
- The material has a rigid structure which is ideal for stacking, transport, and freezer storage. Available in multiple grammages (e.g., 210–400 g/m²) and formats (pressed trays, folded lids, vacuum skins).
- Enables customisation as the material is compatible with flexographic and offset printing for branding



SUSTAINABILITY IMPACT –

- The material aligns with the latest EU recycling targets by replacing multi-material plastics with fiber based solutions.
- Extends shelf life through superior barrier properties, reducing spoilage.
- Lower lifecycle carbon emissions due to renewable sourcing and minimized plastic content

APPLICATIONS

- Frozen Meals: Ideal for microwaveable entrees, rice bowls, and frozen vegetables due to freezer-safe properties.
- Ready-to-Eat Meals: Compartmentalized trays for curries, grains, and snacks, often with heat-sealed lids.
- Fresh Food: Vacuum-packed trays for meats, fish, and cheeses (Trayforma BarrPeel).
- Conventional Oven Trays: High-temperature resistance for baked goods and prepared meals
-

MANUFACTURING PROCESS

Tray manufacturing with Trayforma starts by feeding pre-conditioned fiber-based Trayforma sheets into a thermoforming machine. The sheets are heated to become pliable, then shaped over molds using vacuum or pressure, forming the tray's structure. After forming, the trays are rapidly cooled to lock in their shape and prevent warping. Excess material is trimmed off, and trays are inspected for cracks or defects. If needed, a heat-sealable lid or barrier film is applied for food protection. Throughout, correct moisture content, proper mold design, and precise temperature control are critical for achieving durable, high-quality trays suitable for frozen and ready-to-eat meals

Now, Lipi has developed a tray for frozen foods and ready to eat meals from the material but faced a few issues :

- They faced sealing issues the the rounded corners.
- The product was cracking at the bottom side of corners.



The issues stem from a combination of design, material properties, and processing parameters that need to be addressed systematically. For a significant amount of time, I was not able to find scientific studies related to this material on how to solve these issues but by the third month, I found research papers from Finland Institutes which were able to address these issues.

ADDRESSING THE CORNER SEALING ISSUES -

How are the trays sealed?

Once food is filled in the trays, they are heat sealed with sealing lids with a countertop tray sealing machine. To understand this better, we tried sealing the tray in-house.



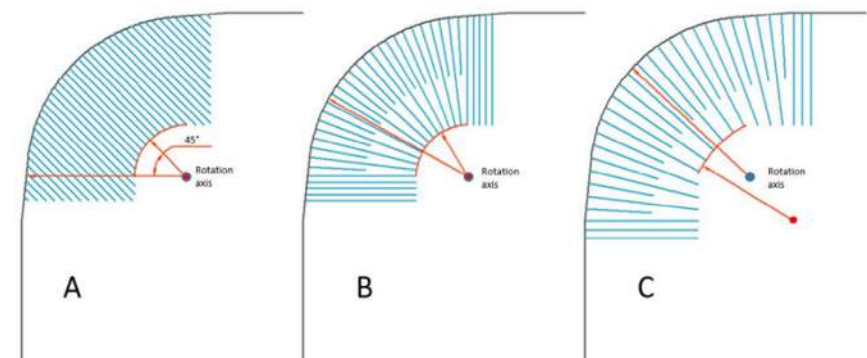
Observations

- Aligning the lid with the tray had cognitive load. It opened opportunity areas for improvement in the machine design or accessory design
- While filling, if food lands on the rims of the tray, it will be difficult to achieve leakproofness at that location
- The corners had uneven heights due to wrinkles which prevented the PET layer of Tray from melting properly and sealing

What are these wrinkles ?

Plastic excels in creating 3D packages with robust barrier properties, while fiber-based materials like Trayforma offer sustainability and printing advantages. Composite structures (e.g., fiberboard with PET/PE coatings) aim to balance these benefits but face challenges in forming and sealing due to the inherent complexity of converting flat sheets into 3D trays. Creasing is a process of imprinting fold lines on the blank. It is critical for shaping fiberboard but introduces risks like wrinkles, uneven folds, and sealing defects.

Blank preparation is an essential part of paperboard tray pressing. The basic principle of the manufacturing method is to place a pre-cut and creased, possibly plastic-coated, paperboard blank between molds that are pressed together to form a tray of a desired shape. Researchers collected various paperboard trays from Europe and analyzed their crease patterns to understand industry practices. They identified three different creasing methods (A, B, and C) based on the tray corners' radii. They tested these methods and found that **method B was the best for folding the paperboard smoothly**. Good quality trays had smooth sealing areas and evenly folded creases. Methods A and C had more partially folded creases, especially at the ends.



In those research papers, I could find a few formulas that would allow one to achieve better creasings

The ideal width of the creasing tool was advised to be 0.71 mm. Creases made with rule widths of 0.40 mm and 0.71 mm folded the best. Using wider rules resulted in more unacceptable creases.

CREASE WIDTH CALCULATION

To ensure smooth and controlled folding in press-formed paperboard trays, the creasing groove width (WCG) is determined using the formula:

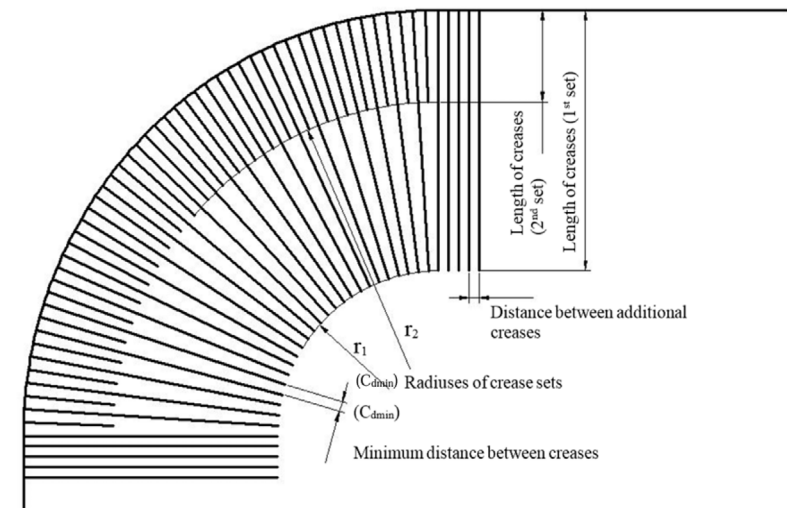
$$WCG = \mu \times (TPB + WCR)$$

Where:

$\mu = 1.4$ (Optimal creasing coefficient)

TPB = 0.46 mm (350 gsm Paperboard thickness, converted from 460 μm)

WCR = 0.71 mm (Creasing rule width)



CALCULATION OF MINIMUM DISTANCE BETWEEN EACH CREASE

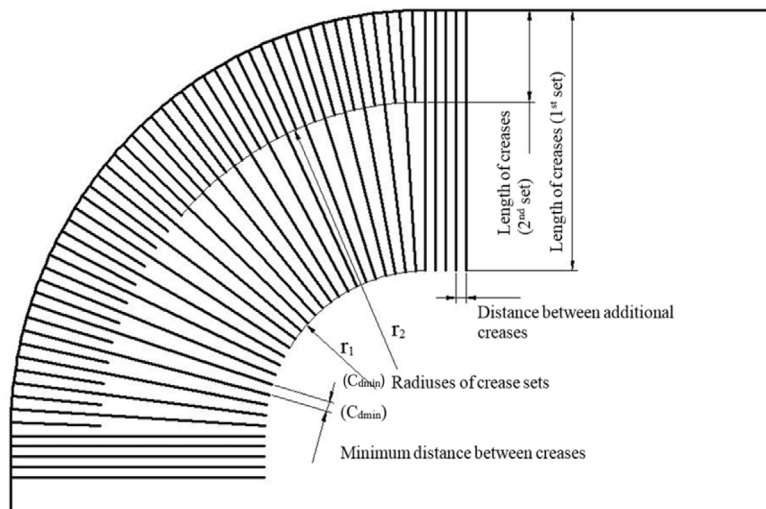
The minimum distance between adjacent creases (from the center line of one rule to another) was defined as,

$$C_{min} = W_{CG} + W_{ML} \quad (2)$$

where W_{ML} is width of the land between adjacent creasing grooves. W_{ML} is 1 mm when the radius of the blank corner is below 80 mm. W_{ML} is 2 mm when the radius of the blank corner is 80 to 110 mm. Further testing with different mold sets should be performed to make the recommended values more accurate. Also testing of other types of paperboard in further studies is advisable.

Limitations observed - Suggests minimum distance but not maximum. Still, trial and error is required for desirable qualities. Findings - Measurement comes accurate when formula is applied with exact dimensions

QUANTITIES OF CREASES IN FIRST SET (LONGER CREASES)



$$Q_{c1} = \frac{(2\pi \cdot r_1)/4}{C_{dmin}} = \frac{\pi \cdot r_1}{2C_{dmin}}$$

This formula helps in determining how many creases are needed in the curved corner of a tray to allow proper folding. It ensures that creases are placed at the right intervals to avoid material stress or improper folds.

This formula calculates the number of creases in the first set (for a 90° tray corner).

- r_1 is the radius where the first set of creases is placed.
- C_{dmin} is the minimum crease distance
- $2\pi r_1$ represents the circumference of a full circle, but since we are working with a 90° corner (one-fourth of a full circle), we divide by 4.
- If Q_{c1} is high → More creases → Easier bending
If Q_{c1} is low → Fewer creases → Stiffer bending

ANGLE BETWEEN CREASES IN THE FIRST SET

A_{c1} = The angle between consecutive creases.

Q_{c1} = Number of creases in the first set.

Since these creases are evenly distributed over 90° , we divide 90° by the total number of creases.

$$A_{c1} = \frac{90^\circ}{Q_{c1}}$$

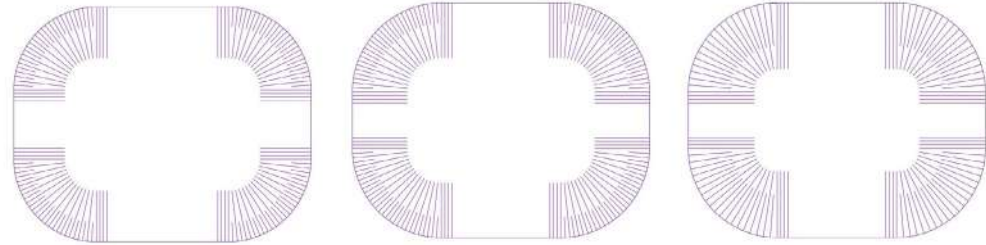
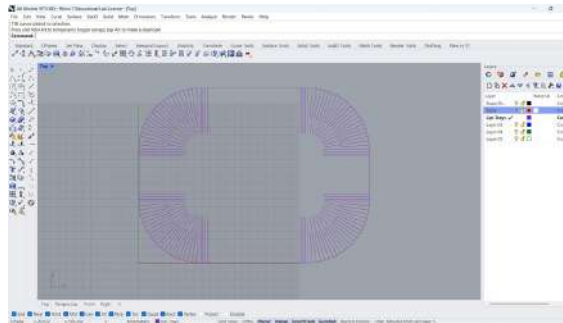
- Smaller A_{c1} → More creases → Smoother bending
- Larger A_{c1} → Fewer creases → Stiffer bending

Morphological charts were developed as a tool for designers to determine the relationships between the functional and structural aspects of in multi-dimensional, non-quantifiable design problem tasks. Morphology provides a structure for an overview of the considered functions and aspects and their alternative solutions.

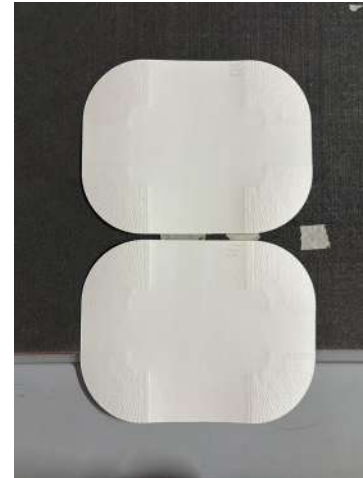
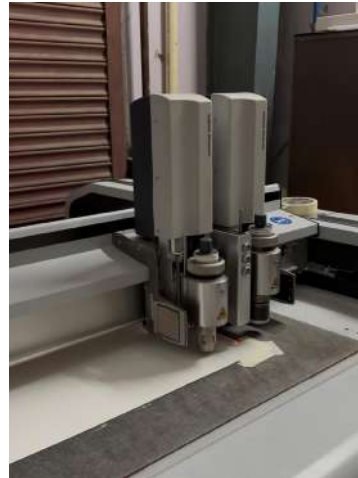
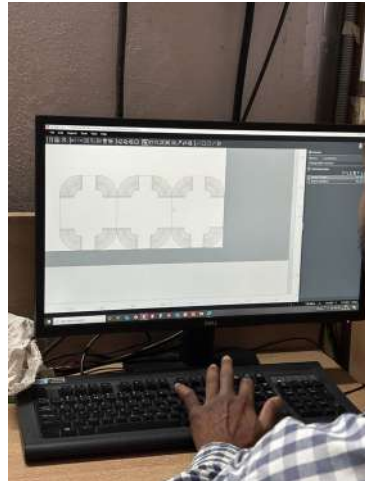
There has been no data about radii of bottom corner or steepness of wall. Needs to be collaborated with die-maker based on new designs.

		1 st Crease Set	2 nd (and 3 rd , etc.) Crease Set	Additional and Assisting Creases	Formability in Tray Forming Process
Outer Dimensions of the Tray	Length			Larger length provides room for additional creases	Small influence
	Width			Larger width provides room for additional creases	Small influence
	Height	Affects length of creases	Affects length of creases. If height is small, 2 nd set aren't required		Very large influence. Deeper the tray, harder to form.
Features of the Tray	Steepness of the Tray Wall (Eq 5)	Affects length and number of creases	Affects length and number of creases	Affects length of creases	Very large influence. Steeper the tray wall, harder to form.
	Main Radius of the Tray Corner (Eq 3-5)	Affects number of creases	Affects number of creases		Very large influence. Larger the corner radius, easier to form.
	Radii of the Bottom Corner of the Tray (Eq 3-5)	Affects number of creases	Affects length and number of creases		Average influence. Small radiuses demand more from material properties.
	Thickness of the Paperboard (Eq 1-5)	Affects number of creases and distance between creases	Affects number of creases and distance between creases	Affects distance between creases	Average influence. Thicker paperboard has usually better strength properties in forming.
	Shape of the Tray (Eq 3-5)	Affects positioning of creases	Affects positioning of creases	Affects positioning of creases	Very large influence. Round and oval shaped trays easiest to form. Complex shapes can be impossible to form.

USING THESE FORMULAS I WAS ABLE TO MAKE SAMPLE BLANK DESIGNS



Several line drawings with variations were made on Rhino.



A high-quality paperboard tray must have precise dimensions uniformly folded creases, and a smooth, planar sealing flange.

Defects like fractures, wrinkles, or uneven creases compromise appearance, functionality, and sealing integrity.

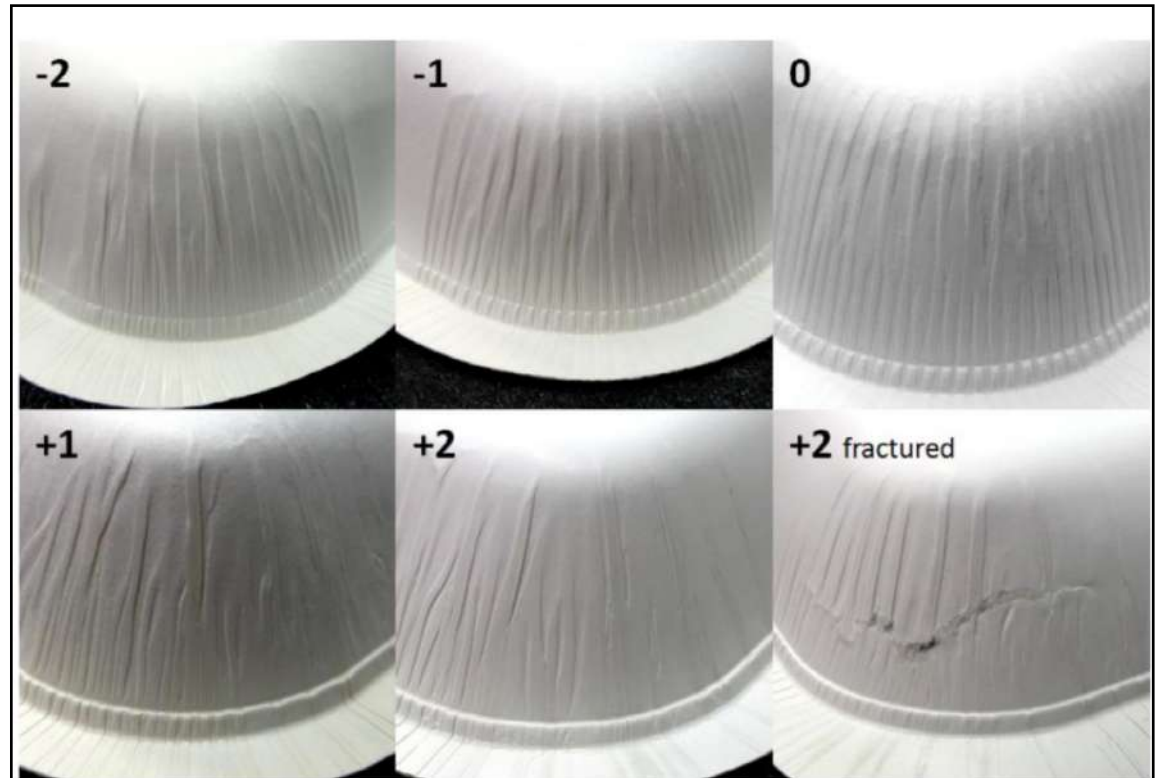


Figure 11: An example of grades of corner quality at observation point D (presented in Figure 10) on the basis of Table 3. Grade 0 is the most desirable one.

Grade	Description
-2	Mould clearance too large, creases fold irregularly
-1	Mould clearance a bit too large, unaccomplished crease smoothening
0	Mould clearance ideal, creases perfectly smoothed
+1	Mould clearance a bit too small, tray wall starts to polish too much
+2	Mould clearance too small, compaction of material causes fractures

MATERIAL STORAGE CONDITIONS

- Paperboard should remain wrapped until it reaches the press room temperature to prevent moisture imbalance.
- The recommended storage conditions are 50–55% relative humidity and a temperature of 20–23°C.
- Acclimatization time varies based on pallet weight and temperature difference:
800 kg pallets require 3–4 days to stabilize when moved to a 20–30°C press room.
- Product properties are guaranteed for 12 months if stored properly indoors, protected from rain, snow, and extreme conditions.

For optimal printing results, the moisture proof wrapping should not be removed until the board has reached the temperature of the press room.

Pallet/Reel Weight (kg)	Difference in temperature between board and press room (press room temp. approx. 20°C)		
	10°C	20°C	30°C
400 kg	2 days	2 days	3 days
800 kg	2 days	3 days	4 days
1200 kg	2 days	4 days	5 days

The product properties, according to the specifications, are guaranteed for 12 months after the production date. In order to ensure product safety, the product must be well wrapped and stored indoors, sheltered from rain and snow. The recommended storage conditions are 50–55% relative humidity and 20–23°C.

CHALLENGES IN NAGPUR CLIMATE

1. Summer Risks (March – June)

- Low humidity (below 30%) -> Excessive drying -> Cracking and brittleness.
- High temperature accelerates moisture loss & warping.
- Direct heat exposure can cause uneven expansion.

2. Monsoon Risks (July – September)

- High humidity (above 70%) -> Moisture absorption -> Softening, warping, mold growth.
- Condensation risk when warm air meets stored pallets in a cooler room.
- Poor ventilation can lead to mold, fungal growth, and weakened material.

Nagpur-Specific Storage Strategies

A. Summer (Preventing Excessive Drying & Cracking)

1. Measurement

- Use of Industrial Hygrometers in Storage Areas



2. Maintaining Relative Humidity (~50%)

- Use of **industrial humidifiers** or **water trays in storage** to prevent excess drying.
- Pallets must be stacked with gaps for air circulation to prevent uneven moisture loss.
- Place **water trays or wet sacks** strategically in the storage area to increase humidity passively.



Model Type: AIHUG015Z
Ultrasonic Industrial
Humidifier, Mild Steel
₹ 24,000/Piece



3. Temperature Control

- Away from sunlight and walls
- Ventilation fans to prevent heat buildup.
- Airconditioning

4. A separate storage area for pre-conditioning

- Since the paper requires acclimatization with press room, they must be stored in a separate storage area in the press room before consumption

Nagpur-Specific Storage Strategies

B. Monsoon (Preventing Moisture Absorption & Mold Growth)

1. Control Humidity (~50-55%)

- Using dehumidifiers to absorb excess moisture.
- Place silica gel packs or desiccants near stored pallets.
- Ensure the storage area is well-sealed & moisture-proof.



2. Prevent Condensation & Mold Growth

- Elevate pallets on wooden blocks to prevent moisture absorption from the floor.
- Maintain airflow with exhaust fans to reduce stagnant humid air.
- Avoid keeping pallets against walls where condensation can form.

These strategies also point towards process flow mapping and implementation of CCP and OPRPs according to FSMS and HACCP for Trays

In this way, I was able to contribute to the current tray problem.

This helped me understand the criticalities of manufacturing and the material. Further, now I had to design packaging for frozen foods and RTE meals. Here, I was introduced with the feasibility constraints –

- Developing trays for various volumes was a cost-heavy process due to die and mould-making cost, so it was decided that the mould makers can do that work once they receive demand from market.
- Testing the samples made earlier also required dies to be made, but it was experimental testing so the idea was dropped.
- The company had pasting machines which could be used to make custom packaging using the material given it is able to achieve manufacturing through gluing process.

SO NOW THE BRIEF WAS NARROWED DOWN TO DEVELOP PACKAGING SOLUTIONS FOR FROZEN FOODS, READY-TO-EAT (RTE) MEALS, QSRS, OR RETAIL PRODUCTS THAT CAN BE EFFICIENTLY PRODUCED USING PASTING MACHINES.

- I went back to reviewing my images and interview data from the initial primary research.
- Since, the Frozen Foods and RTE Meals had already become a convenience in the global markets, I reviewed many food reviews to understand the packaging and user needs.
- I also viewed several vlogs and reviews, along with comments to come up with opportunity areas that could be solved within our scope.
- The retail markets in Nagpur didn't have many options. The majority of them were out of scope. So, the opportunity areas were narrowed down based on online data.
- I was able to find the food item for one of the opportunity areas, so moved forward with the design process for that.

PRODUCT DEVELOPMENT – 1
New Product Development for Brownies

(A) PRIMARY RESEARCH

Brownies are commonly sold in black plastic containers that are microwaved before consumption. Replacing these with fiber-based Trayforma packaging offers a sustainable, microwave-safe alternative, directly addressing consumer and regulatory demand for eco-friendly solutions.



The brownie packaging market represents a significant opportunity within the broader baked goods sector, with the global packaged brownies market projected to reach \$5.96 billion by 2031, growing at a CAGR of 6.2% from 2024 to 2031. Currently, the market is dominated by black plastic containers that, while functional for microwave use, present significant sustainability challenges.

Traditional brownie packaging relies heavily on polypropylene (PP) and other plastic materials, creating environmental concerns as consumers increasingly demand sustainable alternatives. Major bakery brands like Theobroma have begun experimenting with bagasse plates, but these solutions face critical limitations particularly the inability to achieve high-quality printing for branding purposes. This printing limitation creates a **significant market gap for eco-friendly brownie packaging that can maintain both functionality and brand identity**

Leverage Areas with Trayforma were -

- Reduction in the plastic content of packaging by 80%
- Microwaveability
- No additional plates/packaging required during usage
- Printability allows premium customisation



(A) DESIGN PROCESS AND STAKEHOLDER CONSIDERATION

After two months of company experience, the design approach evolved to consider multiple perspectives: **end consumers, bakery operators, food packaging needs and manufacturing requirements**. This holistic perspective proved crucial for developing commercially viable solutions that address real-world usage scenarios.

CONSUMER NEEDS –

- Microwave-safe containers that allow direct heating without transferring food to other dishes
- Safe grip features for removing heated containers from microwave (addresses the ergonomic need)
- Attractive packaging that showcases product quality and creates positive first impressions
- Confidence that packaging is food-grade and won't leach harmful chemicals when heated
- Packaging that maintains brownie texture, moisture, and flavor during storage

CONSUMER EXPECTATIONS FOR PREMIUM PRODUCTS –

- Sophisticated packaging design that reflects product quality
- Memorable opening experience that creates emotional connection
- Clear display of brand identity and product information
- Eco-friendly packaging materials that align with environmental consciousness
- Containers that withstand temperatures from freezing (-40°C) to oven heating (220°C)

BROWNIE PACKAGING NEEDS

- Prevent crushing of delicate toppings (frosting, cream, fruits)
- Maintain product freshness (moisture barrier, grease resistance)
- Leak and odor containment, especially for refrigerated or glazed items

MANUFACTURING NEEDS – PASTING MACHINE FRIENDLY

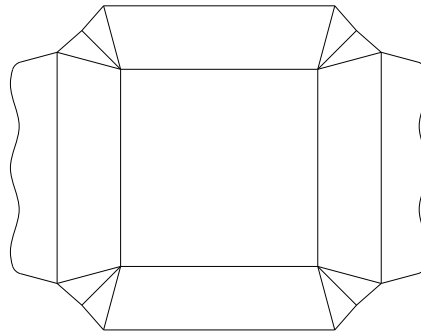
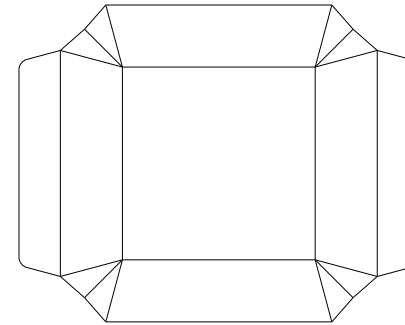
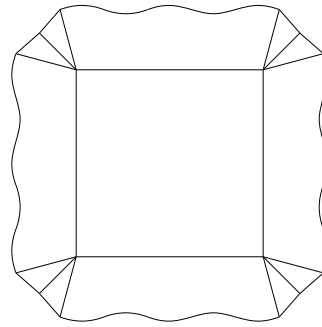
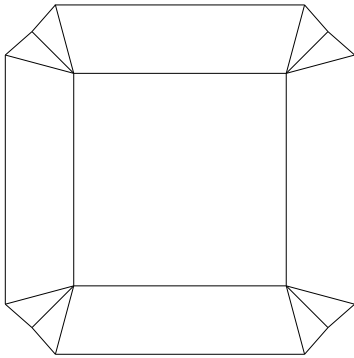
A carton erecting machine is an automated device used in the packaging industry to form flat-packed cardboard blanks into fully erected cartons or boxes, ready for filling. These machines significantly improve packaging efficiency and consistency in industries such as food, pharmaceuticals, electronics, and consumer goods.

The process begins with a stack of flat carton blanks loaded into the machine. The machine uses vacuum suction cups or mechanical arms to pick up each blank and open it into a box shape. Once erected, the machine folds the bottom flaps into place and secures them using tape, hot melt glue, or other sealing methods. Some machines can also insert liners or dividers, depending on the packaging requirements.



IDEATIONS

The packaging design should communicate softness and indulgence that are key attributes associated with quality brownies through subtle visual cues and tactile elements. Designing the line drawing (or dieline) for a tray layout is a critical step in packaging design it turns your concept into something that can be cut, creased, folded, and manufactured. A standard size of 90 X 90 X 30 mm was selected with a 15 degree draft angle.



SAMPLES



CONCLUSION

The designs though simple are functional. These helped in understanding the foundations of packaging design from the lens of DFM.

PRODUCT DEVELOPMENT – 2

New Product Development for Frozen Food Wraps

(B) OPPORTUNITY AREA RESEARCH – YOUTUBE



This is a frozen dosa wrap. The primary packaging was a paperboard sleeve in a plastic flow pack and the secondary packaging was a food box with branding. This food box was shrink wrapped with another plastic layer..

Q. What is the science behind this packaging?

Primary Packaging

- Paperboard Sleeve: Structural support to the wrap
- Plastic Flowpack Pouch: Primary moisture/oxygen barrier (likely LDPE or multi-layer laminate).

Secondary Packaging

- Paperboard Box: Secondary protection and branding.
- Shrink Wrap: Tamper evidence, bulk stability, and moisture ingress prevention.

SCIENTIFIC RATIONALE

- Moisture Control: Plastic pouch + shrink wrap create dual barrier against moisture.
- Oxygen Barrier: Primary plastic pouch acts as the main oxygen barrier.
- Structural Integrity: Paperboard layers prevent crushing.

PROBLEMS WITH CURRENT PACKAGING

- Over-Engineering: Shrink wrap + plastic pouch are redundant.
- Cost: Multiple layers increase material and production costs.

HOW DID THE USER USE THE PACKAGING?

The user removed the roll from plastic pouch, put it in a plate, microwaved it and then ate.

INITIAL OPPORTUNITY IDENTIFICATION

- Trayforma is material that offers convenience. Flow packed frozen foods require users to transfer foods in microwaveable utensils and the number of tasks increase. These also include washing the utensils. These steps are non-essential and can be easily eliminated by integrating ovenable packaging in the trays itself.
- The multiple packaging layers can be reduced with since Trayforma can offer multiple features in a single layer.

Initial opportunity identification was limited to online mode as frozen wraps were not available in vicinity. So I gathered more content online. A deeper information collection revealed a series of interesting opportunity areas.



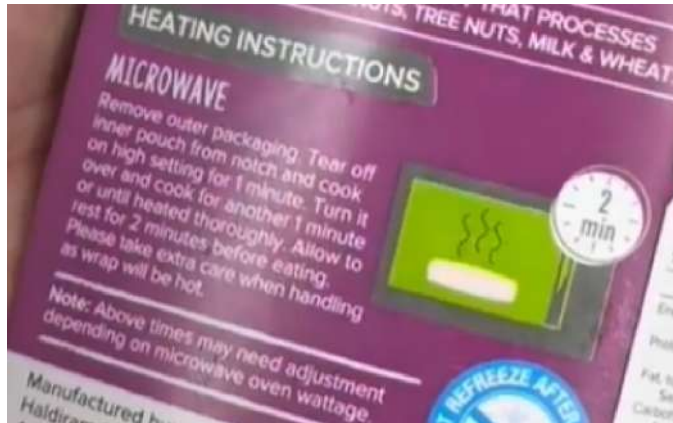
Haldiram's also made frozen food wraps. The primary packaging involved a paperboard sleeve and a sealed plastic pouch.

But why this type of packaging? Do we need the plastic pouch?

These wraps are frozen ones. Moisture retention and oxygen transmission are essential factors to consider in packaging. The plastic pouch completely separates the outside environment with the food environment. This blocks the oxygen and moisture from coming in contact with the food and prevents decay. When kept frozen, the shelf life of the inner contents increases.

Thus, the pouch is required in packaging.

ANOTHER INTERESTING OBSERVATION WAS...



COOKING INSTRUCTIONS

The instructions seem unclear. It asks the user to remove outer packaging. Then it asks the user to tear off the inner pouch from notch and cook.

Here, it clearly mentioned to remove the outer packaging. But failed to provide clear instructions regarding the inner pouch.

AS A RESULT...



People microwaved the wrap with the pouch.
The pouch did not have clear signage if it's microwaveable.

INSIGHTS -

- (A) Unclear cooking instructions
- (B) People are confused and unaware regarding the microwave-ability of these plastic
- (C) Potential risk of microplastics migrations in food wraps.
- (D) Food reviews are watched by many. Such type of usage also prompts the viewers to cook this way.

In one case, the user cut the pouch from top and put it in the microwave. On cooking, they saw that the wrap came out of the pouch on it's own.

What may have caused this?

When the frozen wrap was heated in the microwave, the moisture in the food converted to steam, creating pressure inside the sealed pouch. The user made a small hole. This led to pressure buildup and the wrap came out on it's own in order to avoid the pouch from bursting.



HOW DO PEOPLE EAT AFTER HEATING THE WRAP ?



Although the sleeve design is intended for the user to hold it vertically and eat. It's isn't intuitive. A few other users were observed removing the wrap from the packaging entirely and putting on the plate.

INSIGHTS -

- (A) Packaging Design of the inner sleeve can be intuitive
- (B) The users are using another utensil. This adds inconvenience of locating a plate and washing it later

WHAT IFs...

- **What if I remove the packaging and heat the wrap in sleeve?**
The sleeve only covers half of the wrap i.e. the other half will come in contact with the bottom plate.
- **What if I do not have any utensils?**
As a first time user, I'll avoid taking frozen food with me during travel. The application will remain confined to kitchen spaces.

PRIMARY RESEARCH



Product Discovery

The wraps are kept upright in the freezer section of a supermarket, enabled by their tall hexagonal box shape. The tall hexagonal structure allows it to stand upright.

The packaging uses bold colors and clear product images, making it easy to spot and differentiate between variants (e.g., Schezwan Paneer, Chilli Paneer)

The branding is also printed in upright manner acc. to the structure

PACKAGING REVIEW

The packaging represented a vertical hexagonal structure. This is essential for structural stability, food protection and transportation.

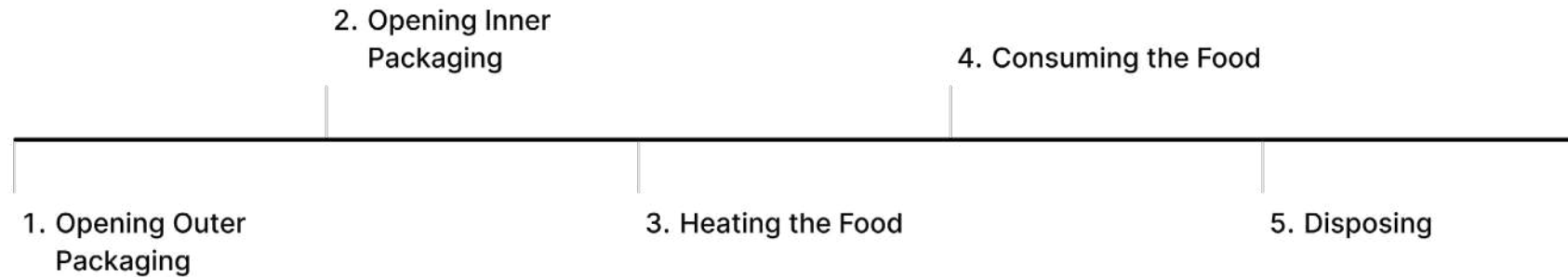
This packaging came with four layers as well. Starting from outermost -

- Transparent plastic shrink wrap - This shrink wrap protects the inner paperboard sleeve from frozen conditions as well as acts as a moisture and oxygen barrier.
- The hexagonal paperboard sleeve - It serves the purpose of food protection, structural integrity, safe transportation and branding
- Plastic flow-pack pouch - The plastic pouch adds another layer of environmental protection.
- Paperboard sleeve - It holds the food wrap during all activity cycles.



TASK ANALYSIS

Task analysis is the process of breaking down a complex activity or task into smaller, manageable steps to understand how it is performed. It is used to study how users accomplish specific goals and to identify areas for improvement.



The task analysis of food wraps was broken down into two steps. First, I asked a layman to try using the product. Upon opening the packaging, he was not able to figure out how to use it. Why? Frozen foods require one to read the heating instructions and use microwave. Lack of literacy and familiarity restricted him to do so. So we moved forward with another person who was familiar with frozen foods and microwaves.



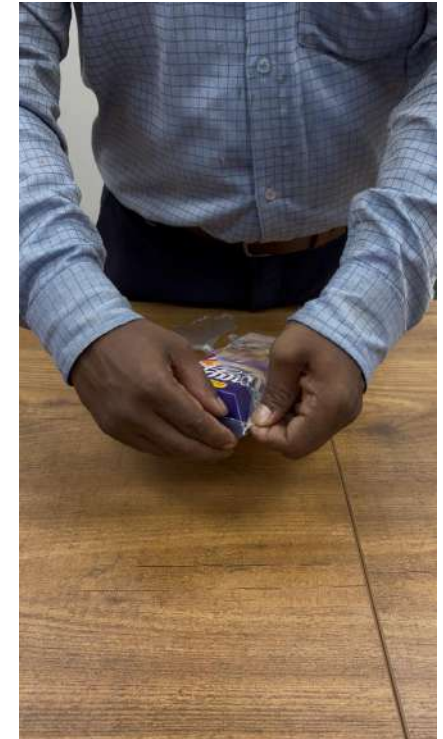
1. User picks up the product



2. User locates sealing line of plastic wrap since it is easier to open from there



3. After tearing apart the wrap enough to insert finger, he inserted his index finger and pulled apart the wrap.



4. Upon realising that the wrap was stuck on upraised corners of the box, he removes the wrap from both the corners one by one.



5. Then , removes the wrap from sides of the packaging.



6. User separates the outer packaging from the box and then keeps the plastic wrap aside.



7. While removing the plastic sheet, he already observed a tape which secured the box. He starts removing it then



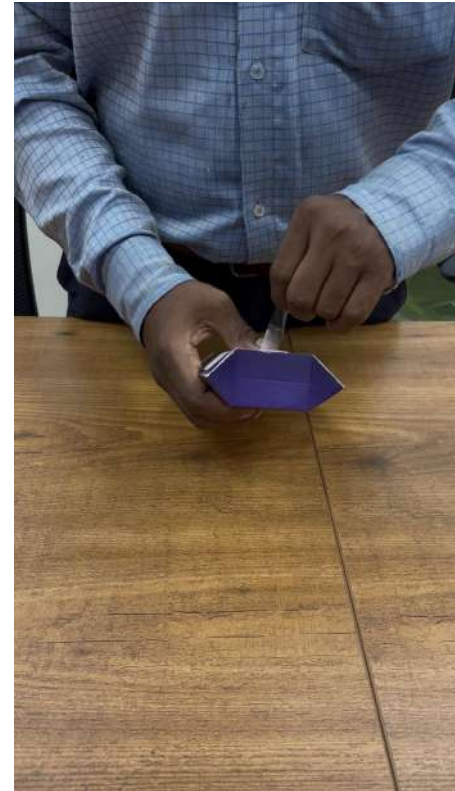
8. Realises that the tape is on the backside of the packaging, so he flips the box and starts removing it.



9. He scratches multiple locations on the tape with his fingers to get a grip on the tape



10. Get's a grip at the top portion and starts pulling it.



11. Pulls the tape apart



12. While pulling the tape got stuck on his fingers, so he tries to get rid of it.



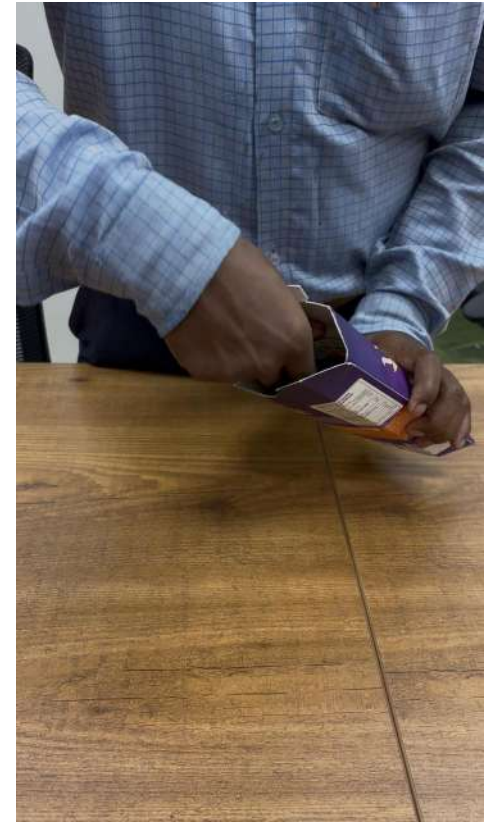
13. After getting rid of the tape, he open the first flap through the protrusion of tuck in



14. Saw that there is a hole on the second flap, so intuitively inserts his index finger in order to open the flap



15. On opening the second flap, he sees a blue pouch inside



16. Transfers the box from right to left hand, makes a pinching gesture from his fingers and puts hand inside the box to remove the pouch.



17. Pulls out the pouch



18. He scans the visual and observes the wrap in a sleeve inside



19. Lays it flat on the table.

OBSERVATIONS

- Outer plastic seals ask the user to pay significant attention, effort and strength to open.
- It also opens in any direction so the user has to tear it off from multiple directions in order to open the packaging
- The seal got stuck in the upraised corners. It became like a barrier in a task which is assumed to be of less importance.
- Removing the adhesive tape required precision as well as nails, increasing cognitive load and error likelihood
- Correcting the misclosed flap demanded real-time troubleshooting, suggesting the closure mechanism lacks self-explanatory design

DESIGN FOCUS AREAS

- Replace the full plastic seal with a pre-cut tear strip for one-pull opening, reducing effort
- Eliminate upraised corners to prevent snagging and simplify seal removal
- Use repositionable tape to minimize residue and finger sticking
- Replace non-recyclable cello tape with paper-based adhesive or compostable alternative
- Differentiate flap shapes/sizes to prevent misclosure (e.g., larger tab on the correct flap)

TASK ANALYSIS

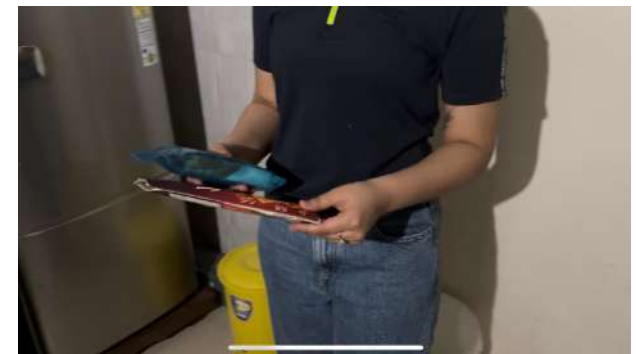
The next task analysis involved the testing of packaging while it's entire use-case. The user was familiar with how to use frozen foods



1. Opening the hexagonal packaging



2. Remove inner pouch containing wrap



3. Flattened and set aside outer packaging for later use. The user performed this action subconsciously.



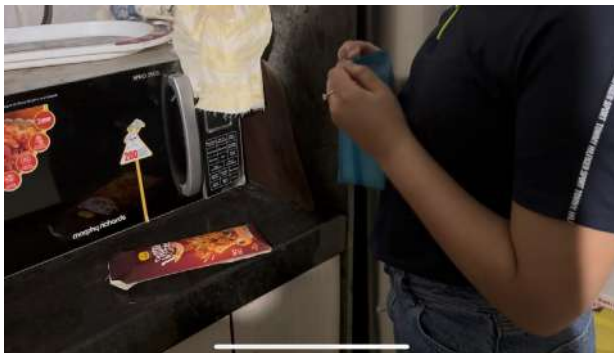
4. Examines the pouch on how to open



5. Tries opening from the corner side



6. Tries opening from the protrusion.



7. Uses teeth to open the pouch then tries opening again



8. Reads instructions on packaging to confirm if the packaging should be removed



9. Inserts finger inside the hole made from teeth to wide open the pouch.



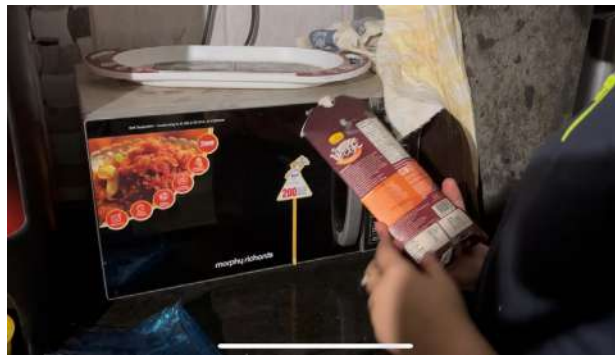
9. This required significant strength, this also results in the wrap falling out abruptly from the pouch.



10. She keeps the pouch aside, opens the microwave door and starts placing the wrap inside.



11. Closes the microwave door.



12. Reads the instruction again.



13. Sets the microwave to the particular setting



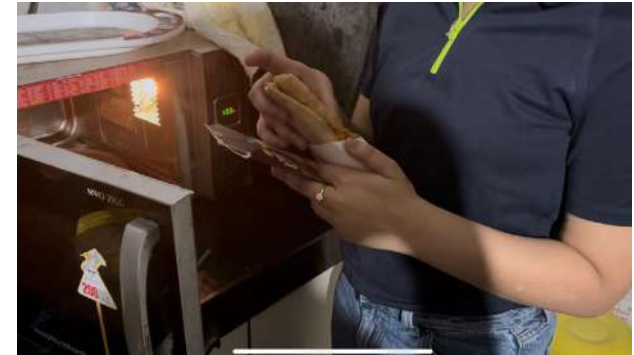
14. Waits for the wrap to be cooked.



12. Opens the microwave, and starts removing the wrap



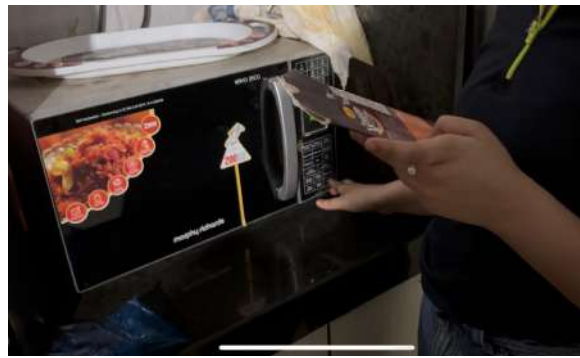
13. Realises it's very hot so quickly takes it out and puts it on the flattened packaging



14. Picks up after a while and touches the wrap to test whether it was cooked or not



15. She flipped the wrap and placed it inside the microwave again



16. Reads the instruction on the packaging again before starting



17. This time she set it for 30 seconds instead of 45. This was done because it was previously very hot and caused inconvenience



18. When she opened the microwave this time, it was hot again.



19. She hesitantly picked it up and placed on the flat base again for natural cooling. One can also observe that the food oil started transferring to the sleeve



20. While the wrap was cooling down, she picked up the waste and cleared the countertop



21. Once cooled, she observed that the sleeve was opening up.



22. Even the lower flap started opening on it own due to the weight of the wrap.



23. Even after the inconvenience, she put the packaging back in place, held on it with fingers and consumed.

OBSERVATIONS

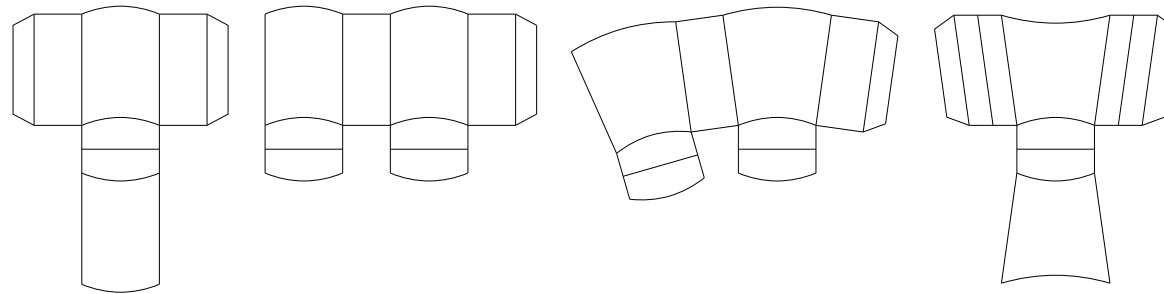
- The design plays in nuance. It isn't very strict upon how to use the product rather open to interpretation and experimentation. Why? Because of the intuitive flattening of outer packaging for later use
- She had to interrupt her tasks multiple times to read the instructions.
- Adaptation required (using teeth, scissors, etc. as tools) which means accessibility of tools is expected
- The product can fall off easily while opening. Coordination needed to prevent product from falling
- Cognitive load can be highlighted as high. User needs to be attentive at a lot of steps.
- Fine motor control with pain avoidance

DESIGN FOCUS AREAS

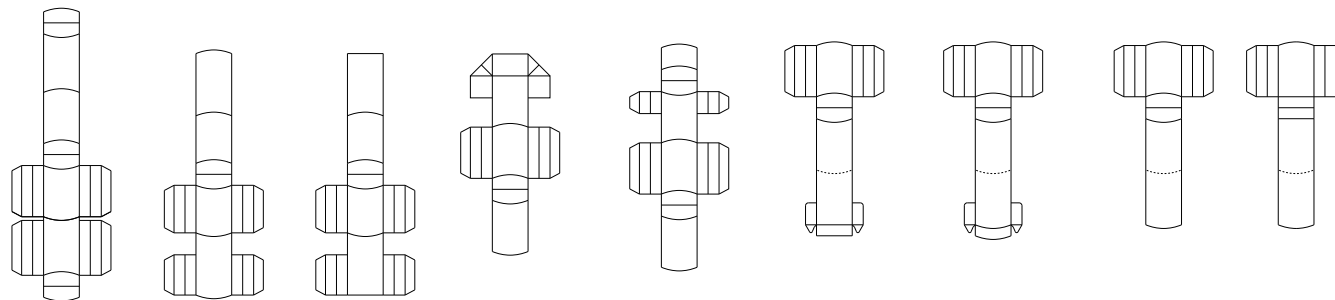
- Pouch can be designed with a user-friendly opening mechanism.
- Instructions can be clarified
- The pouch can have graphics with 'Do not Microwave' to avoid packaging fails.
- The redundant pouch packaging layers can also be minimised.
- Sleeve design had to be repurposed for a better microwaving experience.

IDEATIONS

The conceptualisation journey started from repurposing the sleeve design as it was within the scope of the design brief. The sleeve samples went through a design journey of sleeve to box where the focus of user experience, food needs, manufacturing capabilities and simplification.



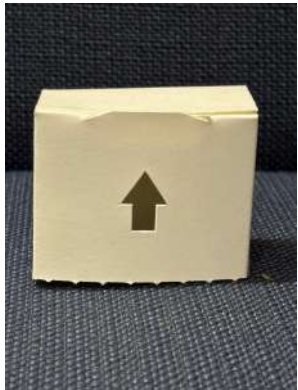
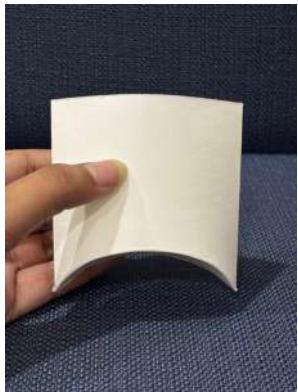
Sleeve design Key Line Drawings



Finalised sleeve design expanded Key Line Drawings – phase 2

SAMPLE MAKING

Ranging from multiple sleeve designs to food box, a range of KLDs along with samples were explored.



CONCLUSION

The developed designs are meant for the purpose to directly store the wraps and explores around user convenience and manufacturing capabilities.

ADDITIONAL PROJECTS WORKED ON

- Brochure Designs for more items
- Product Photography
- Shipping Label Design with Barcode integration
- Dispatch process revamping
- Print Designs for Trays

Each project required a strong learning curve. The internship required a multidisciplinary approach to work along with an open mind and curiousness to learn.

PRODUCT PHOTOGRAPHY



PRODUCT PHOTOGRAPHY



PRODUCT PHOTOGRAPHY





Explore our eco-friendly range of
PAPER BAGS AND POUCHES



 Sustainably Sourced  Made in India  Compostable  Customisable  Recyclable  Durable		POUCH		SEALABLE SOS PAPER BAG			PAPER BAG WITH FLAT HANDLE - BROWN			PAPER BAG WITH FLAT HANDLE - WHITE				
														
		7" 10"		S M L			S M L			S M L				
		LIPi ITEM CODE		KLD150	KLD151	KLD1021	KLD1019	KLD1020	KLD147	KLD148	KLD149	KLD147	KLD148	KLD149
		PRODUCT SPECIFICATION		7 in.	10 in.	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
		SIZE (mm)	L	177	254	125	180	210	179	216	248	179	216	248
B	192		269	80	110	135	92	108	148	92	108	148		
H	NA		NA	240	290	340	212	242	297	212	242	297		
UNIT WEIGHT (gm)		3.8	6.4	8.5	15	19	19.62	24.6	32.6	17.76	21.59	31.29		
NO. OF SKU		4	2	6	4	3	1	1	1	1	1	1		
NO. OF PIECES IN SKU		1000	1000	250	250	250	250	250	250	250	250	250		
NO. OF PIECES IN MASTER PACKAGING		4000	2000	1500	1000	750	250	250	250	250	250	250		
CFC (mm)	L	445	570	555	675	675	390	460	540	390	460	540		
	B	370	285	420	395	395	320	340	400	320	340	400		
	H	190	190	215	215	215	170	170	170	170	170	170		
CBM (m ³)		0.031	0.031	0.050	0.057	0.057	0.021	0.027	0.037	0.021	0.027	0.037		
OUTER BOX WEIGHT (kg)		0.800	0.477	0.7	0.65	0.6	0.425	0.480	0.629	0.410	0.488	0.629		
GROSS WEIGHT (kg)		16.0	13.3	13.5	15.7	14.9	5.3	6.6	8.8	4.9	5.9	8.5		
NET WEIGHT (kg)		15.2	12.8	12.8	15.0	14.3	4.9	6.2	8.2	4.4	5.4	7.8		
NO. OF MASTER CARTONS ON ONE EUROPEAN PALLET (1200 X 800 mm)		24	24	10	15	15	42	28	28	42	28	28		
NO. OF MASTER CARTONS ON ONE AMERICAN PALLET (1219 X 1016 mm)		36	36	20	15	15	63	42	28	63	42	28		



PRODUCT SPECIFICATION SHEET



PRODUCT PHOTOGRAPHY, PRINT DESIGN AND MOCKUP GENERATION

3.1 EVERYDAY SERIES

CONICAL TRAYS



SERVE BOLD. BRAND LOUD. BE CONSCIOUS.

The new-age serving tray is a greener alternative to plastic. Made for modern food service, they hold everything from snacks and salads to sandwiches and street food. Strong, easy to use, and made from better materials, they're perfect for food trucks, cafés, stadiums, and takeaways. These trays show your customers you care about quality and the planet.



3.1 EVERYDAY SERIES - CONICAL TRAYS



EASY STACKABILITY TO SAVE SPACE



PRE-BUILT TO SAVE LABOUR COST



DESIGNED WITH UTMOST PRECISION



VERSATILE FOR VARIED APPLICATIONS

SKU	VARIANTS	PACK SIZE	WEIGHT (KG)
KLD1067	4 oz	3000	12.8
KLD1068	8 oz	2500	16.5
KLD1069	10 oz	2000	17.6
KLD1070	13 oz	2000	20.8
KLD1071	23 oz	1000	15.2
KLD1072	32 oz	500	18.5

Why settle for basic trays or generic bagasse when you can serve sustainably with style? ✦



BROCHURE DESIGN - INDESIGN



BROCHURE DESIGN - INDESIGN



BROCHURE DESIGN – INDESIGN



BROCHURE DESIGN - INDESIGN

SHIPPING LABEL DESIGNS

Previously, shipping labels were manually typed and printed on A4 sheets by the production supervisor. I was assigned to transition this process to thermal-printed sticker labels and implement a barcode system, working closely with the IT and ERP teams.

I began by understanding the purpose of shipping labels and identifying areas for improvement. Since different customers had different information needs, I created multiple label formats tailored to various packaging types.

For example, cartons sent to pharmaceutical companies required detailed labels, while seal-wrapped goods for restaurants needed only basic information. So, I designed adaptable label templates based on the type of packaging and customer requirements.

3 sizes of labels with 2 design variations were developed. Process –

1. Floor rounds and reviewing different types of packaging
2. Interacting with in-house teams to understand which internal departments use these labels
3. Understanding the different kinds of customers and packaging requirements
4. Studying the problems with current label design
5. Coordinating with IT and ERP teams.

SHIPPING LABEL DESIGNS

TO: CURE FOODS INDIA PVT. LTD.		ITEM: KRISPY KREME ONE DOZEN DOUGHNUT BOX [366 X 277 X 57]
CODE NO. - XXXXXXXX	LOT NO - XXXXXXXX	P.O.No. - XXXXXXXX
QTY. - 600 [50 X 12]	BARCODE HERE	COUNT - 51 / 100 / A
PKG. DT. - XX / XX / XXXX	1234567	Finished Goods Inside
PACKED BY - XXXXXXXXX	CHECKED BY - XXXXXXXX	APPROVED BY - XXXXXXX
FROM: LIPI INTERNATIONAL PVT. LTD. UNIT - I, WADODA, NAGPUR - 441104 (INDIA)		SCAN QR

TO: CURE FOODS INDIA PVT. LTD.		ITEM: KRISPY KREME ONE DOZEN DOUGHNUT BOX [366 X 277 X 57]
CODE NO. - XXXXXXXX	LOT NO - XXXXXXXX	P.O.No. - XXXXXXXX
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PKG. DT. - XX / XX / XXXX	1234567	Finished Goods Inside
FROM: LIPI INTERNATIONAL PVT. LTD. UNIT - I, WADODA, NAGPUR - 441104 (INDIA)		SCAN QR

TO: CURE FOODS INDIA PVT. LTD.		ITEM: KRISPY KREME ONE DOZEN DOUGHNUT BOX [366 X 277 X 57]
CODE NO. - XXXXXXXX	LOT NO - XXXXXXXX	P.O.No. - XXXXXXXX
QTY. - 600 [50 X 12]	BARCODE HERE	COUNT - 51 / 100 / A
PKG. DT. - XX / XX / XXXX	1234567	Finished Goods Inside
FROM: LIPI INTERNATIONAL PVT. LTD. UNIT - I, WADODA, NAGPUR - 441104 (INDIA)		SCAN QR

ITEM: FCO Chicken Box Generic Design [145 x 85 x 60]		ITEM: FCO Chicken Box Generic Design [145 x 85 x 60]	
QTY. - 300 [50 x 6]	LOT NO. XXXXXXXXXX	QTY. - 300 [50 x 6]	LOT NO. XXXXXXXXXX
PKG. DT. - XX / XX / XXXX	1234567	PKG. DT. - XX / XX / XXXX	1234567
COUNT - 21 / 30 / A		COUNT - 21 / 30 / A	

ITEM: FCO Chicken Box Generic Design [145 x 85 x 60]	
QTY. - 300 [50 x 6]	LOT NO. XXXXXXXXXX
PKG. DT. - XX / XX / XXXX	1234567
COUNT - 21 / 30 / A	

TEMPLATE SELECTOR MATRIX FOR LABELS			
LABEL SIZE	☐	Small	
	☐	Medium	
	☐	Large	
CHECKBOX	HEADING	OPTIONS	AUTOMATICALLY FILLED VIA LOT No.
☒	LOT No.	To be typed or drop down of active LOT Nos.	No
☒	ITEM NAME & SPECIFICATION	Automatic	Yes
		Automatic Code for Exports	
☒	DATE OF PKG.	☐ Date Selector	No
☒	QUANTITY	To be Typed	No
☒	P.O. NUMBER	Automatic	Yes
☒	LABEL COUNT	Automatic [Input given during FP Master]	Yes
☐	CLIENT NAME	Automatic Actual Name	Yes
		Automatic ERP Generated Customer Code for Exports	
☐	CODE NUMBER	Automatic	Yes
☐	CHECKED BY	To be typed	No
☐	PACKED BY	To be typed	No
☐	APPROVED BY	To be typed	No
☐	FIRM NAME AND DETAILS	Automatic	Yes
☐	TAG INSTRUCTION	☐ Finished Goods Inside	No
		☐ Loose Goods Inside	
		☐ Shade Card, Pull-up Sheet, COA, Cutter Separated Inside	

TO: CURE FOODS INDIA PVT. LTD. ITEM: KRISPY KREME ONE DOZEN DOUGHNUT BOX [366 X 277 X 57]

CODE NO. - XXXXXXXX LOT NO - XXXXXXXX P.O.No. - XXXXXXXX

QUANTITY - 600 [50 X 12] BARCODE HERE COUNT - 51 / 100 / A

PKG. DATE - XX / XX / XXXX 1234567 Finished Goods Inside

PACKED BY - XXXXXXXX CHECKED BY - XXXXXXXX APPROVED BY - XXXXXXXX

FROM: LIPI INTERNATIONAL PVT. LTD. UNIT - I, WADODA, NAGPUR - 441104 (INDIA)

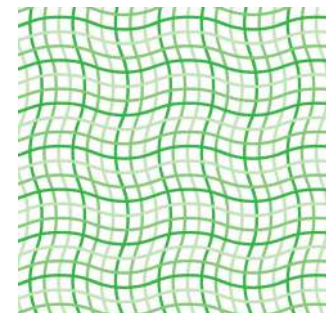
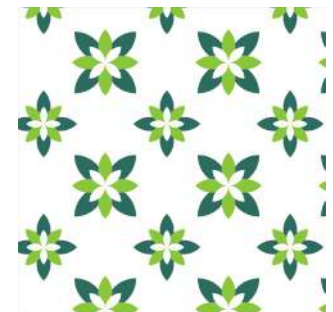
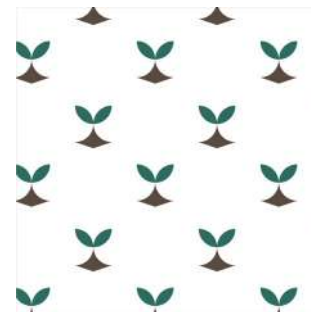
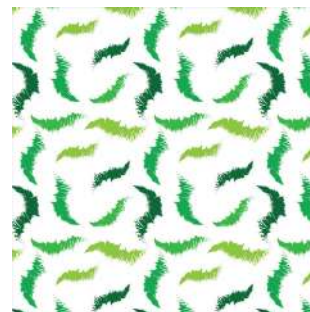
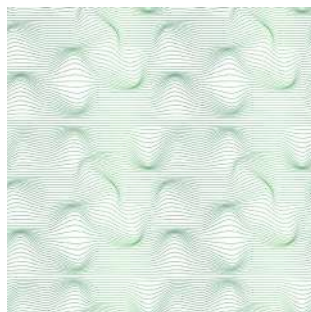
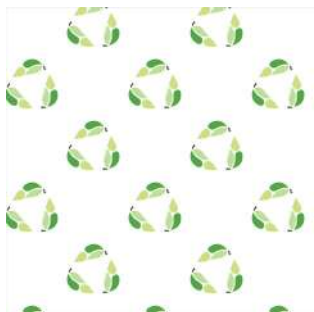
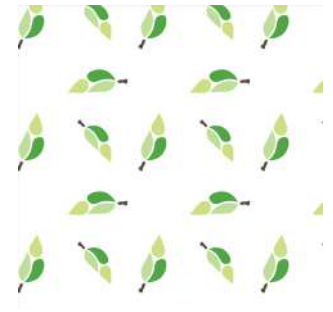
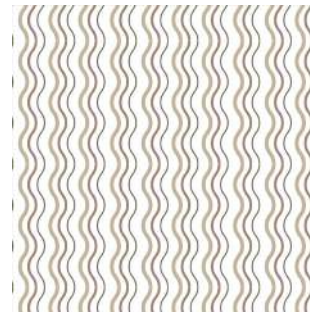
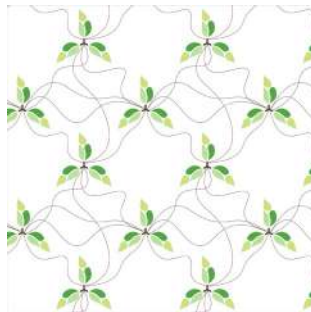
SCAN QR

1. LABEL SIZE SELECTION IS A PREREQUISITE OPTION.
2. THE CHECKBOXES ALREADY TICKED ARE COMPULSORY. REST OF THE OPTIONS HAVE TO BE THERE FOR CHOICE AND WILL BE SUBJECTIVE TO CLIENT NEEDS.

Multiple label designs were designed, samples created and tested on floor. Approved designs were forwarded to ERP technicians for generation through the ERP System.



PRINT DESIGNS



PRINT DESIGNS



