Innovative Secondary Packaging Redesign and Automated Packaging Machinery Implementation for EnhancedPackaging Efficiency

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1. Introduction

Packaging is important for preserving the quality and safety of food and beverage products throughout storage, transportation, and consumption. Packaging is an important element of the marketing mix, as it can influence consumer purchasing behavior, product protection, and information communication. It has become an integral part of the modern world and it is hard to imagine living without it. Why am I saying this? Because packaging has a significant impact on our daily lives. Packaging helps protect and preserve products. We cannot transport products long distances without proper protection. Products like food and electronic devices can be damaged during transportation if they are not properly protected from the outside world. We use packaging to identify products and obtain information about them (e.g., expiration dates, manufacturer information). Packaging also helps to improve storage efficiency by managing factors such as temperature and humidity. Additionally, it contributes to brand recognition and sustainability. It is an important part of our fast-paced world because products need to be transported from one place to another, known as the global supply chain. The lingering effects of COVID-19 on the economy are still apparent, even after several months. “Demand is likely to shift noticeable in the food area as the pandemic shuts down restaurants and food-service outlets. Consumers will thus continue to move to grocery purchases, for which packaging demand will rise” (www.mckinsey.com April 16, 2020).

2. Importance of Ready Meal Packaging

Ready meals are becoming increasingly popular in shops because our fast-paced world demands quick and convenient food, which is readily available at shops. Moreover, the surge in single-person households has played a role in this phenomenon. Defined as a dwelling occupied by just one individual, these single-person households have become increasingly prevalent. They are the most common type of household in many developed countries. In the United States, for example, single-person households accounted for 37.89 million households in 2022, or 28.7% of all households (www.jchs.harvard.edu 2015). Ready meals, available in stores, are fully prepared and only require heating before consumption. Packaged in microwave-safe containers or trays, these meals can be quickly heated in minutes. Popular among busy individuals, ready meals provide a convenient and cost-effective solution for enjoying a nutritious meal. They are also a suitable choice for those with limited time or cooking skills. “The global ready meals market was valued at USD 135 billion in 2022 and grew at a CAGR of 5% from 2023 to 2032. The market is expected to reach USD 219.90 billion by 2032” (The Brainy Insights 2023). This data is about global growth, but how is the European market performing, especially in economically developed countries? Europe leads the global ready meals market with 37% share, driven by rising incomes, busy lifestyles, and more single students and working women (Yahoo Finance 2023). Ready meals have had a significant impact on packaging technology. In order to meet the unique needs of ready meals, packaging manufacturers have developed a variety of new technologies and materials. Ready meals are available in eye-catching packaging and have a long shelf life, with the market segmented into frozen, chilled, freeze-dried, and canned varieties.

3. Primary Packaging for Ready Meals

The ready meal packaging is considered primary packaging. It is in direct contact with the product and must be able to protect the food from spoilage during transportation, storage, and heating. This means that the packaging must be strong enough to resist impact and vibration, and it must also be able to maintain a barrier against bacteria, oxygen and other gasses that can cause food to spoil.
Another important requirement is that ready meal packaging must be convenient for consumers to use. The packaging should be easy to open and close, and it should also be microwaveable so that consumers can heat up their meals quickly and easily.
In order to meet these requirements, packaging manufacturers have developed a variety of new technologies and materials. For example, many ready meals are now packaged in flexible pouches made of materials such as laminated plastic and foil. These pouches are strong, lightweight, and easy to open and close. They are also microwaveable and can provide a good barrier against oxygen and other gasses.

4. Secondary Packaging and Its Importance

We have already discussed primary packaging for ready meals, but our main topic is secondary packaging. Secondary packaging refers to the outer packaging that is used to group and protect individual units of a product within the primary packaging. But why is secondary packaging important, and why do we see more and more of it in stores?
Secondary packaging protects goods during transportation, and can make products easier to stack and store, both in the grocery store and at home. This can be helpful for both retailers and consumers. It can provide additional marketing opportunities. For example, retailers can use secondary packaging to promote their own brand or to advertise special offers. The secondary packaging can create a premium look for their products. So, by printing on the outer packaging, we can make products more visible on the shelf, thereby improving marketing and potentially boosting sales.
Another important aspect is that packaging can enhance the efficiency of the supply chain by making products easier to transport and store. Secondary packaging includes various types, such as shelf-ready packaging. Shelf-ready packaging (SRP) is a type of packaging that is designed to make it easy for retailers to stock and sell products. SRP is typically made of corrugated cardboard and is designed to fit on standard store shelves. It often has features such as easy-open flaps and tear-away perforations that make it easy for store employees to access products. SRP can help retailers to save time and money by reducing the amount of labor required to stock shelves.

5. Packaging Design Considerations

Looking for standard styles as a packaging designer, it's common to refer to industry standards and specifications (www.fefco.org 2021). and ECMA (www.ecma-international.org 2023) are In fact organizations that provide standards and guidelines for packaging.
Designing packaging isn't just about choosing a style; it involves understanding the entire product lifecycle, from production to distribution. A packaging designer needs to consider various factors, including the nature of the product, transportation methods, distribution channels, manufacturing processes, and the environmental impact of the packaging.
Noticing firsthand the changing weather and its impact on our lives, everybody recognizes

the importance of environmental stewardship. Packaging, while essential for product protection and transportation, can affect the environment if not managed responsibly. Sustainable packaging choices can reduce our ecological footprint and safeguard the planet for generations to come. Recycling cardboard reduces deforestation, conserves natural resources, and minimizes environmental impact. Approximately 55% of all cardboard is produced from trees, and recycling one metric ton of cardboard can save up to 17 trees, 1,440 liters of oil, 2.3 cubic meters of landfill space, 4,000 kilowatt hours of energy, and 26,500 liters of water (Save Monet Cut Carbon 2020).

When constructing corrugated cardboard boxes, we have the option to choose different types of fluting medium, such as B-flute or EB-flute. The fluting medium provides strength and rigidity to the box. Additionally, the designer can select the type of liner material for the inner and outer layers of the box, either kraft or test liner. The liner material provides a smooth, protective surface for the contents of the box. “Virgin based paper productions discharge more emissions than recycled paper production” (Sunthonpaobvong, Magudapathy 2020). Packaging technologists should possess a broad spectrum of knowledge and expertise in developing, designing, and implementing packaging solutions for a diverse range of products.

6. Packaging Decision Process

Why do the packing technologists have to be careful and have to have a Packaging Decision Process? The complexity of the global supply chain necessitates a well-structured packaging decision process. The diverse range of products, suppliers, distribution channels, and logistics providers demands a systematic approach to selecting the most suitable packaging solutions. Packaging plays a crucial role in protecting products during transportation and storage, enhancing product appeal to consumers, and communicating product information. Cortina-Mercado (2020) states that the packaging decision process is essential for businesses to select the most suitable packaging materials and designs that meet their specific requirements and objectives. As our world rapidly evolves and artificial intelligence becomes increasingly prevalent, businesses must adapt to leverage these advancements for optimal decision-making. In the packaging industry, we can anticipate a surge in automated packaging planning approaches powered by machine learning. This technology holds immense potential to revolutionize packaging processes, enhance efficiency, and optimize resource utilization (Mannanuddin, Acharjee, Sushma 2023).

7. Food Packaging Machinery

In recent years, the food industry has undergone significant changes with the advent of new technologies. To maintain and enhance productivity, companies must invest in specially designed machinery that can increase both speed and quality. The special food packaging machinery is crucial for optimizing production, ensuring food safety, complying with standards, preserving product quality, and staying adaptable to industry trends. It plays a pivotal role in the overall success of food packaging operations. There are several reasons why a modern food company should invest in packaging machinery: improved efficiency, enhanced product safety and hygiene, customization to meet specific requirements, keeping with industry standards, cost-effectiveness in the long run, automation for precision and consistency and adaptability to packaging trends (Deskera Blog 2023). It also contributes to

waste reduction and a more sustainable approach to packaging. Food packaging machinery encompasses a wide range of equipment used to automate the packaging process for food products. These diverse types of food packaging machinery are tailored to meet the varied needs of the food industry, each skillfully designed to adeptly manage different facets of the packaging process. “Food packaging refers to how food items are packed” (Lightstead 2022). We can separate filling machinery, capping machinery, labeling, case sealing machinery, palletizing, strapping, shrink wrapping, bundling, flow wrapping, and form-fill-seal machinery. Choosing the right packaging machinery is essential for businesses that want to optimize their packaging processes, reduce costs, and improve product quality. Modern packaging systems not only optimize production and reduce costs but also integrate advanced technologies to promote data-driven decision-making, enhance supply chain transparency, and facilitate the use of eco-friendly packaging materials. With the advent of robotics, artificial intelligence, and smart packaging, the future of food packaging machinery holds immense promise for revolutionizing the industry. From ensuring food safety with time-temperature indicators to revolutionizing supply chain management with RFID-enabled packaging, smart packaging is transforming the way we interact with products. Active packaging extends shelf life and inhibits bacterial growth, while smart pillboxes improve medication adherence for individuals with complex medication regimens. Augmented reality packaging provides interactive product information and marketing experiences, enhancing the consumer experience and building brand engagement.

8. Automation and Sustainability

Implementing automation, redesigning packaging, and adopting sustainable practices can significantly improve packaging operations and contribute to overall business success. Automation plays a pivotal role in streamlining packaging processes and reducing labor expenses. Automated machinery can handle repetitive tasks such as labeling, filling, and sealing, freeing up human workers for more strategic roles and reducing the risk of errors. For instance, automated labeling machines can precisely apply labels at high speeds, significantly reducing labor costs and minimizing label waste. Packaging redesign can optimize production processes and minimize environmental impact. By choosing lightweight, recyclable materials and utilizing space-efficient designs, businesses can reduce material consumption, lower transportation costs, and contribute to a more sustainable packaging system. For instance, replacing bulky plastic packaging with lightweight corrugated cardboard boxes can effectively reduce packaging weight and transportation expenses. However, it's essential to consider the full life cycle impact of this decision. While plastic packaging can be reused, corrugated packaging may not be consistently recycled. Whenever selecting packaging, it's critical to thoroughly assess the packaging's entire life cycle. Embracing sustainable packaging practices not only benefits the environment but also positively impacts a company's brand image and marketing efforts.

9. Integration of Packaging Review Insights into My Project

If a company produces a product and aims to sell it on the market, whether it's food or electronic devices, the product must have adequate protection. This necessitates the use of packaging to safeguard, preserve, and maintain its quality. My project is based on Freshways, a company that manufactures and distributes fresh ready meals and sandwiches throughout Ireland, including shops, petrol stations, and airports. The focus of my project is

to enhance the company's operational efficiency and product quality. I will provide recommendations on why they should invest in a new case erector to streamline their packaging line, thereby speeding up their packaging processes. For the new automatic packaging line to function efficiently, it is crucial to modify their secondary packaging to align with the automatic case erector. In my project, I will outline the steps required to redesign the secondary packaging and implement the new automatic case erector, involving relevant stakeholders. The project's title is "Redesigning Secondary Packaging and Integrating Automated Machinery for Improved Packaging Efficiency." Additionally, I will address the labor shortage in Ireland and the associated challenges of retaining and hiring employees. Automation emerges as a critical strategy for companies to enhance cost-effectiveness and future-proof their operations. Furthermore, my project will delve into palletization techniques to optimize the packaging process.

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Overall comments

You have done a good literature review and have sourced a good range of references. The final paragraph should have had some references to support the points being made, however. To improve, I suggest you tidy up your writing as you make the same point in several ways, which is a bit repetitious. Also, your work would be improved if you formatted the review better, ie spacing between paragraphs, but less spacing in the reference list. Finally, I would have liked to have seen a link between this review and your project, as the purpose of the review is to inform your project and this link is not obvious from what you have written.