**Innovative Secondary Packaging Redesign and Automated Packaging Machinery Implementation for Enhanced Packaging Efficiency**

[ Balazs Barcza ]

[ TU Dublin Ireland ]

[ Diploma In Packaging Technology ]

[ 05/12/2023]

Packaging is essential 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. Packaging is essential to the modern world, without it could not exist. 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. We can still remember the impact of COVID-19 on our economy just a few months ago. “ Demand is likely to shift drastically 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.” **1**

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. **2**

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.” **3** 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.(The Brainy Insights ) **4**  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.

One of the most important requirements for ready meal packaging is that it must be able to protect the food from spoilage during transportation, storage, and heating. This means that the packaging must be strong enough to withstand 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. This means that 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.

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,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 self-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.

Design:

If you're a packaging designer looking for standard styles, it's common to refer to industry standards and specifications. Fefco (European Federation of Corrugated Board Manufacturers) **5** and ECMA (European Carton Makers Association) **6** are indeed 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. Witnessing firsthand the changing weather and its impact on our lives, we recognize the importance of environmental stewardship. Packaging, while essential for product protection and transportation, can burden the environment if not managed responsibly. Sustainable packaging choices can significantly reduce our ecological footprint and safeguard the planet for generations to come. When constructing corrugated cardboard boxes, we have the option to choose different types of fluting medium, such as B-flute or EB-flute, for the wavy structure of the board. 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 the recycled paper production. ” **7** Packaging technology encompasses a wide range of knowledge and expertise due to its significant impact on the environment.

Why do the packing technology 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. The packaging decision process is essential for businesses to select the most suitable packaging materials and designs that meet their specific requirements and objectives. **8** 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. **9**

Machine:

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. **10** It also contributes to waste reduction and a more sustainable approach to packaging. As we delve into the realm of food packaging machinery, a multitude of machines awaits. 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” **11** 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.

In today's competitive marketplace, optimizing packaging lines is crucial for businesses to enhance efficiency, reduce costs, and maximize profits. 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 example, switching from bulky plastic packaging to lightweight corrugated cardboard boxes can significantly reduce packaging weight and transportation costs. Embracing sustainable packaging practices not only benefits the environment but also positively impacts a company's brand image and marketing efforts.

Reference:

1. www.mckinsey.com. (n.d.). *The packaging industry and the coronavirus pandemic | McKinsey*. [online] Available at: <https://www.mckinsey.com/industries/packaging-and-paper/our-insights/how-the-packaging-industry-can-navigate-the-coronavirus-pandemic.>
2. www.jchs.harvard.edu. (n.d.). *The Rise of the Single-Person Household | Joint Center for Housing Studies*. [online] Available at: <https://www.jchs.harvard.edu/blog/the-rise-of-the-single-person-household.>
3. www.thebrainyinsights.com. (n.d.). *Ready Meals Market by Type & End-User 2032 | The Brainy Insights*. [online] Available at: <https://www.thebrainyinsights.com/report/ready-meals-market-13755#:~:text=The%20global%20ready%20meals%20market> [Accessed 3 Dec. 2023].
4. Yahoo Finance. (2023). *Ready Meals Market Size to Surpass USD 219.90 Billion Growth by 2032 | Growing Need for Quick Solutions for Nutritious Meals*. [online] Available at: <https://finance.yahoo.com/news/ready-meals-market-size-surpass-140000443.html#:~:text=Europe%20emerged%20as%20the%20market> [Accessed 3 Dec. 2023].
5. www.fefco.org. (n.d.). *FEFCO - European Federation of Corrugated Board Manufacturers*. [online] Available at: <https://www.fefco.org/.>
6. Ecma International. (n.d.). *Home*. [online] Available at: <https://ecma-international.org/.>
7. Sunthonpaobvong, M. and Kumar Magudapathy, S. (n.d.). *DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS DIVISON OF SUPPLY AND OPERATIONS MANAGEMENT Commercial Packaging and Sustainability A Framework to Measure Environmental Impacts of Commercial Packaging Solutions*. [online] Available at: <https://odr.chalmers.se/server/api/core/bitstreams/bfd8320a-5465-43de-860a-bcfc9bc1caaf/content> [Accessed 3 Dec. 2023].
8. ‌Cortina-Mercado, M. (2017). *Effect of Packaging Design in the Purchase Decision Process: A Comparison of Generations*. [online] papers.ssrn.com. Available at: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3041635.>
9. ‌Khaja Mannanuddin, Dr. Purnendu Bikash Acharjee, BAG, A. and Jaiswal, Dr.Sushma. (2023). *MACHINE LEARNING APPROACHES FOR BETTER BUSINESS MANAGEMENT IN COMPETITIVE ENVIRONMENT*. Blue Rose Publishers.
10. Deskera Blog. (2023). *The Benefits of Investing in Automation for Food Manufacturers*. [online] Available at: <https://www.deskera.com/blog/the-benefits-of-investing-in-automation-for-food-manufacturers>/ [Accessed 3 Dec. 2023].
11. Lightstead, A. (2022). *Food Packaging Guide – Different Types & Machines Used - PWR Pack*. [online] Available at: <https://www.pwrpack.com/food-packaging/#:~:text=the%20flow%20wrapper.>- [Accessed 3 Dec. 2023].