

INTELLIGENT PACKAGING AS A MARKETING TOOL. ARE DIGITAL TECHNOLOGIES RE-SHAPING PACKAGING?

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Abstract. *Rapid technological advancements, digitalization trends, changes in consumer behavior, and call to achieve sustainable development goals induce transformations in the packaging industry. Digital technologies are enabling the packaging to move from its core passive functions to more enhanced features such as prolonged preservation, traceability, communication, sustainable supply chain, life-cycle evaluation, and extended shelf-life of a product. Intelligent packaging can provide information about the conditions inside and outside of the packaging preventing contamination of the product. Monitoring of food products allows consumers, producers, and retailers to avert potential spoilage and unnecessary waste. Consumer behavior determines the success of intelligent packaging. Their acceptance of new technologies, environmental concerns, attitude towards sustainability issues, as well as safety and quality preferences define customers' buying behavior. The innovative features of packaging have not yet attracted much attention from academics and practitioners. In addition, the design and development of such packaging are associated with high prices, which encourages manufacturers to avoid it. Therefore, a comprehensive understanding of current packaging trends can shed light on the benefits and potential barriers to its use. This paper provides a literature review of intelligent packaging and explains its functions. It defines the role of packaging in marketing in the current digital era. The paper discusses the definitions of smart, active, and intelligent packaging and suggests how intelligent packaging can serve as a marketing tool while achieving marketing strategies.*

Keywords: *packaging, intelligent packaging, marketing, digital technologies, communication, sustainability*

INTRODUCTION

The unprecedented advancements in digital technologies in the past few years have empowered companies to reshape marketing tools and strategies. The emergence of Artificial Intelligence, Virtual Reality, Big Data Analytics, Mobile Internet, Internet of Things, Blockchains, Automation, and Robotization enabled marketers to respond to consumers' needs in an effective and efficient way. The advent of the digital economy along with the New Normal caused by the recent pandemic has altered social systems and business models toward innovative solutions (Skala, 2019; Gigauri, 2021). Technological progress and accelerated digitalization influenced packaging and created new opportunities for the packaging industry.

Consumer requirements towards packaging are changing in line with digitalization trends. Changed lifestyles and the current digital age imply consumers' decisions on more convenient packaging, especially for food and drink products (Jinkarn & Suwannaporn, 2015).

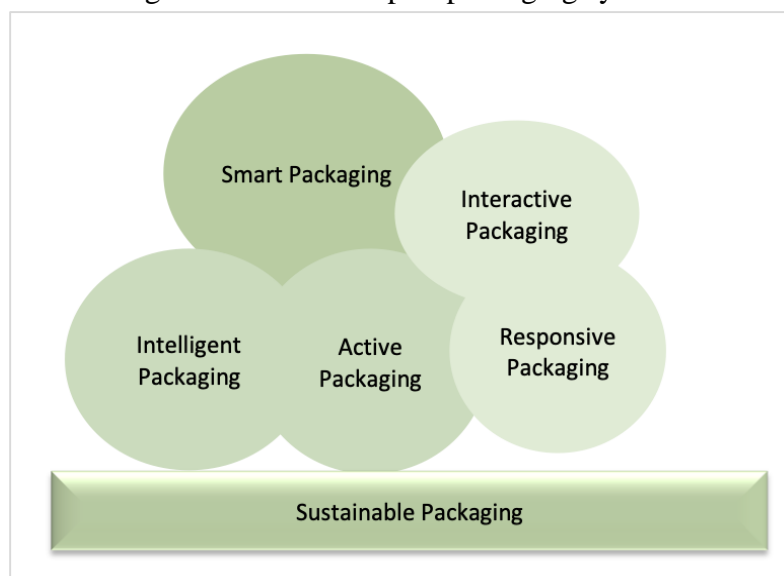
Packaging makes impression on buyers as they first come into contact with the packaging before the product. Therefore, the visual effects of packaging including shape, size, and color are significant marketing elements. The positive feelings and emotions evoked by the packaging can lead to a purchase decision. For this reason, packaging as a marketing tool has become attractive for researchers and marketers, who have more and more improved packaging systems. As a result, intelligent packaging emerged combining digital, innovation, and marketing tools. The importance of packaging is not only represented for supply chain management but also for improving packaging sustainability. Demand for traceability features is growing and the need for the safety and quality of products is increasing. Intelligent packaging provides information about the conditions inside and outside of the packaging enabling timely decision-making. Its potential to prevent waste aligns with Sustainable Development Goals. In this vein, packaging has become essential not only from the marketing perspective but also for the implementation of sustainable business strategies.

This review paper addresses the role of intelligent packaging from a marketing perspective. To achieve its aims, the paper provides definitions of active, intelligent, smart, and sustainable packaging and discusses the functions and benefits of intelligent packaging for marketing strategies.

I. About the Definition of Intelligent Packaging and Related Terms

The advancements in the intelligent packaging system resulted from the current technological progress, changes in consumer preferences, and sustainability trends (Palazzo et al., 2023). The term is related to smart, active, interactive, responsive, intelligent, and sustainable packages (Figure 1).

Figure 1. Relationship of packaging systems



Source: Authors' elaboration based on the discussion of definitions.

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Smart packaging offers improved functions utilizing new technologies (Kerry & Butler, 2008). Incorporated sensor technology enables smart packaging systems to monitor products such as food and pharmaceuticals aiming to transmit information about their quality, safety, and freshness (Schaefer & Cheung, 2018). Smart packaging contains characteristics of intelligent packaging and active packaging (Vanderroost et al., 2014). In this regard, Schaefer and Cheung (2018, p. 1023) summarize the smart packaging notion in the following way: “Smart packaging allows to track and trace a product throughout its lifecycle and to analyze and control the environment inside or outside the package to inform its manufacturer, retailer or consumer on the product’s condition at any given time”.

Active packaging includes additives to maintain the quality and shelf life of a food product (Biji et al., 2015). It is mainly used for rapidly perishable products to reduce the number of active materials causing food damage and avoid bacteria from entering the product (Schaefer & Cheung, 2018). Usually, active packaging systems contain oxygen scavengers, ethylene scavengers, flavor and odor absorbers/releasers, antimicrobial and antioxidant packaging technologies (Prasad & Kochhar, 2014).

European Food Safety Authority defines intelligent packaging as “materials and articles which monitor the condition of packaged food or the environment surrounding the food (Regulation (EC) No 1935/2004 Article 2.2.b and Regulation (EC) No 450/2009 Article 3.b)” (EFSA, 2009, 4). Intelligent packaging systems inspect food condition and transmit information about its quality during storage or transportation (Biji et al., 2015). The system contains various indicators such as time-temperature, gas detectors, and freshness or ripening indicators (Prasad & Kochhar, 2014). Intelligent packaging is a complex system embedded with intelligent functions to detect, record, track, and communicate information about the quality of a packaged product (Yam et al., 2005). These functions are achieved through hardware components such as different indicators and sensor devices as well as radio frequency identification (RFID) systems (Kerry, O’grady & Hogan, 2006), which trace, record, and provide information about discovered alterations in a product and its environment inside packaging (Realini & Marcos, 2014). Thereby, for example, changing oxygen or pH levels, the freshness of food, or temperature can be detected (Yam et al., 2005).

Responsive packaging responds to specific stimuli in the food or surrounding environment, such as microorganisms, with the purpose of monitoring and enhancing food quality (Brockgreitens & Abbas, 2016).

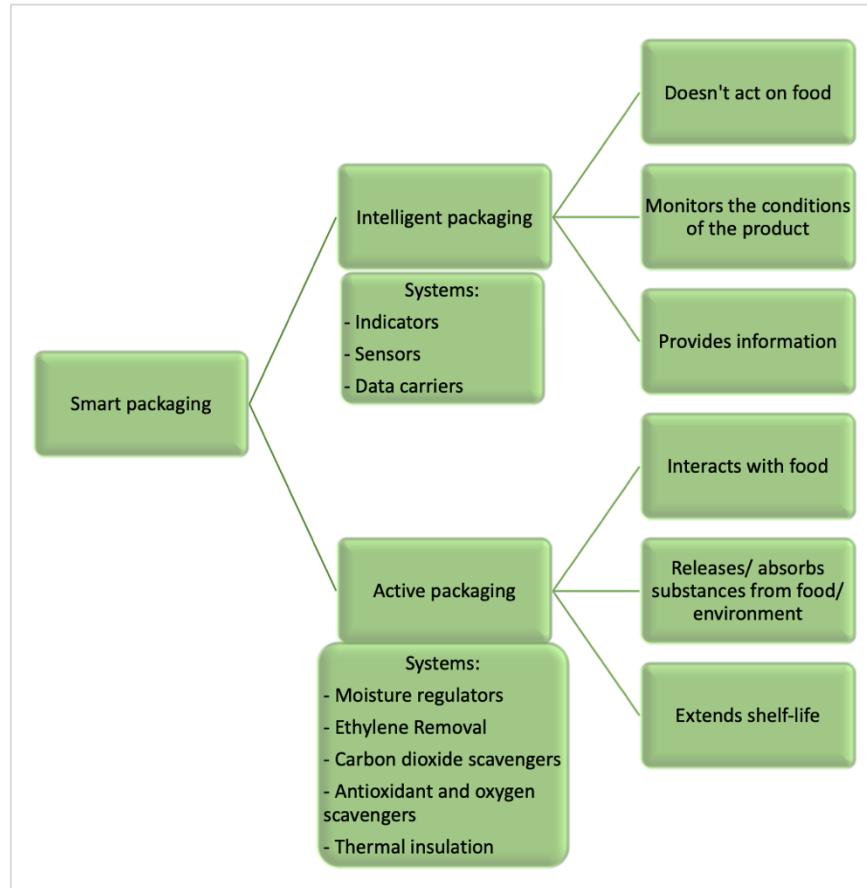
Interactive packaging enables two-way communication between consumers and packaged goods through the incorporated technological systems (Butler, 2013). The research conducted by Lydekaityte and Tambo (2020) found that smart interactive packaging improves the effectiveness of a product and increases consumers’ experiences as they can engage with it.

Active packaging systems react to the food environment to enhance the quality, safety, and shelf-life, while intelligent packaging aims to monitor the conditions of the product (Drago et al., 2020). Accordingly, intelligent packaging detects and shares information, whereas active and responsive packaging takes actions to improve the quality of food and environment (Vanderroost et al., 2014). As a result, both types of packaging can cooperate under the concept of Smart Packaging (Müller & Schmid, 2019) to enhance product quality (Figure 2).

Sustainable packaging refers to eco-friendly packaging that also considers social and

economic aspects (Boz, Korhonen & Koelsch Sand, 2020). Sustainable packaging is sourced from renewable and sustainable materials, it can reduce waste as well as resource and energy use. Sustainable packaging is recyclable and reusable.

Figure 2. Systems and Properties of Active and Intelligent Packaging



Source: Authors' elaboration based on Drago et al., 2020.

II. Functions and Benefits of Intelligent Packaging for Marketing strategies

In general, packaging plays a significant role in the consumer market being an essential marketing element of marketing communication strategy (Rundh, 2009). Moreover, packaging design must suit to the working lifestyle of consumers taking into account urbanization.

Since customers' expectations are constantly changing and their demands are never fully satisfied, companies are motivated to create consumer-oriented offers attracting purchasers to participate in the process (Baruk & Iwanicka, 2015).

Packaging functions involve not only the protection of a product but also represent marketing tools (Robertson, 2013) as a communication trait is an integral part of packages. The communication strategy of marketing incorporates brand concept and product quality for influencing consumer decisions. Customers first encounter packages when touching a product and get their first impression of a brand and product through packages. Successful marketing communication through packaging covers not only information about the product but also packaging design, fonts and colors used as well as logos, illustrations, and symbols on it (Koutsimanis et al., 2012; Renn, 2007; van den Berg-Weitzel & van de Laar, 2001). Therefore,

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packaging involves an important task to promote and sell commodities by providing information about a product (Rundh, 2005).

In addition to the communication function, packaging has logistics, environmental, and marketing chain functions (Prendergast & Pitt, 1996; Rundh, 2005). Packages must protect products during shipment, distribution, storage, and transportation.

Furthermore, convenience features are the most demanded function of packages because of modern lifestyles. For consumers, packages of food, home care, or pharmaceutical products must be easy to open, re-close, unwrap, store, and carry, while for manufacturers, the packaging system should be convenient in order to pack and distribute goods (Jinkarn & Suwannaporn, 2015). Therefore, packaging design including such convenience functionality is a significant marketing tool (Silayoi & Speece, 2004).

Intelligent packaging detects and conveys information about the condition of the product. However, it does not have a function to address the problem it detects but stimulates active packaging function to tackle the changed environment or alterations in the product. Intelligent packaging aims to reveal the quality conditions of the product and therefore, improve its safety. For this reason, it includes several devices and detectors such as time-temperature indicators, freshness indicators, and tracking services to monitor the transportation and storage of perishable products. In addition to indicators, intelligent packaging contains data carriers to track product movement throughout the supply chain and chemical sensors to transform chemical information into a measurable signal (Azeredo & Correa, 2021). Consumers have access to the information intelligent packaging is gathering.

Prior studies conducted through 600 interviews with consumers revealed that the most essential feature of food and drink packaging was the opening characteristics, which impact purchasing decisions, and consumers even were ready to pay more for convenient packaging including tamper-evident design (Jinkarn & Suwannaporn, 2015). Moreover, Baruk and Iwanicka (2015) found that environmental aspects of dairy product packaging positively affect the consumer purchasing decision.

Blankenbach et al. (2018) developed smart packaging with Bluetooth and smartphone application for pharmaceutical products to provide information to patients about medicine intake. Through E-paper and sensors, it is possible to control the amount of liquid, number of tablets, and time to take tablets, equipped with alarm and reminder systems (Blankenbach et al., 2018). Logistically, it helps to monitor environment, temperature, and enables data transfer; it includes QR code and active tag for security, data exchange, and reordering purposes (Blankenbach et al., 2018).

The importance of packaging for marketing is increasing due to the following factors. First, consumer products require packages in order to bring them to market (Baruk & Iwanicka, 2015). Second, increased competition, a large number of available, and continuously more new products offered force companies to find innovative ways for differentiation (Wells et al., 2007). In this sense, packaging acts as an outstanding marketing tool to attract the attention of buyers. Third, changes in the marketing environment such as cultural, social, economic, and technological factors influence buying decisions, and hence, the packaging is expected to meet the expectations (Albino et al., 2009). Fourth, self-service facilities on the market are growing, where packaging serves as a “silent salesman” (Baruk & Iwanicka, 2015; Rettie & Brewer,

2000). In this regard, packaging can not only convey product information in a persuasive way but consumers also can feel and see the packaging before making a purchase decision.

Additionally, consumer awareness and demand for knowledge are growing. They want to know about the origin and composition of the product. Interestingly, studies revealed that consumers' age, gender, and education determine their expectations of packaging, which impacts their purchase decision (Baruk & Iwanicka, 2016).

Previous research performed through focus group interviews in Sweden and used thematic analysis demonstrated that consumers concern about the ethical and environmental impact of packaging material suggesting that manufacturers should communicate favorable characteristics of packaging (Fernqvist, Olsson & Spendrup, 2015). Food product perishability can be avoided by appropriate packaging to increase their shelf life and hence, decrease food waste, which is a main problem in the food supply chain (Li et al., 2020). Since products have an environmental impact throughout their life cycle (Williams & Wikström, 2011), companies need to decrease waste caused by damaged products using the intelligent packaging. The quality of a product can be communicated by transparent packaging (Fernqvist et al., 2015), which is made mainly of plastic. Intelligent packaging, conversely, provides through technological devices.

Prior studies show that marketers can attract consumers through targeted packaging design and communication of product benefits based on consumers' opinions on packaging (Fernqvist et al., 2015). Likewise, the research results indicate that consumers demand that fruit and vegetable packaging communicate the origin of products, cooking recipes, as well as product name, brand, and expiration date (Fernqvist et al., 2015). Thus, packaging reflecting food quality and brand value creates consumer satisfaction (Coles, 2003) and helps achieve a competitive advantage.

In addition, packaging impacts the returns in online shopping (Wallenburg et al., 2021), as secondary and primary packages serve as a sensory experience for buyers (Heller et al., 2019). It communicates about the seller and purchased items. Especially, secondary packages are specifically designed by online retailers as a differentiation strategy to meet or even exceed customers' expectations. Packaging includes branding features to "create a premium esthetic appeal" (Wallenburg et al., 2021).

The recent study results by Palazzo, Vollero and Siano (2023) performed a systematic literature review of 130 articles published between 1991-2021 and confirmed the growing interest of scholars and practitioners toward intelligent packaging, especially, with respect to sustainability and innovation. Intelligent packaging can facilitate the transition to a circular economy and better waste management (Palazzo et al., 2023). Moreover, the research found that the food sector benefits more from advanced features of packaging due to the extended shelf-life and safety of food products (Palazzo et al., 2023; Vanderroost et al., 2014).

CONCLUSIONS

Marketing promotes the sale of products and is associated with the communication function of disseminating information about the brand and the quality or functionality of commodities to consumers. Packaging is recognized as a vital part of a product through which consumers contact the brand, and consequently, the concept of packaging is considered one of the key aspects of marketing strategy. The aim of packaging systems is not only to protect the

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product but also to ensure its safety and quality as well as preserve it during distribution. Additionally, packaging facilitates communication with customers by providing different types of information such as instructions, components, expiration dates, etc. It also sells a product through its attractiveness, as packaging functions and convenience for opening and storage are engaging marketing tools. In this context, intelligent packaging transmits information to stakeholders about the product and its surrounding environment remotely ensuring the satisfaction of consumers' demands. Technological progress and digitization have empowered packaging thanks to which advanced systems and properties are integrated into smart intelligent packaging.

Intelligent packaging can contribute to sustainability trends by reducing wastage and avoiding spoilage of products, especially, food, cosmetics, and pharmaceuticals. Since sustainable development goals aim to improve lives worldwide, consumers' behavior is altering adopting sustainable lifestyles, and demanding more responsibility from brands (Gigauri, 2022; Gigauri & Vasilev, 2022). Intelligent packaging responds to increasing demand for quality and safety and facilitates effective management of the supply chain. In addition, active and intelligent packaging has the potential to become transparent communication tool to consumers, retail and food industry for controlling the food production and supply chain.

This paper contributes to the literature and practice by exploring intelligent packaging as a marketing tool in the light of digital technologies. It adds value on the discussions of new trends and perspectives of smart packaging. The paper distinguishes between various types of packaging contributing to the knowledge of scholars and managers and demonstrates the relationship of the innovative packaging types. It also sheds light on some benefits and advantages of smart, intelligent and active packaging while engaging in debates about its usability for different product categories.

From the marketing perspective, consumer satisfaction through packaging can lead to shifting their behavior in favor of the company brand. Practitioners can recognize that packaging influence consumer purchase decisions. Furthermore, in the era of online shopping, packaging impacts consumer satisfaction and brand reputation. Consequently, marketers should address this issue by creating appropriate packaging design based on research.

Moreover, smart packaging can contribute to sustainability goals by decreasing waste. Consumers' concern about the environment and their willingness to purchase products with eco-friendly packaging is increasing. Thus, they are attracted by sustainable packaging. Accordingly, marketers can impress consumers with targeted packaging design, which communicates product benefits based on consumers' packaging demand.

Future studies should examine the features and characteristics of smart intelligent packaging for different products and survey consumers acceptance of various types of packaging. Since the concept is complex, it can contain many variables requiring more in-depth analysis, especially from different countries and culture contexts.

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