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CONSUMER EXPECTATIONS TOWARDS INNOVATIVE FOOD PACKAGING

Due to increasing consumer demands for safe and high-quality food, modern technology in food packaging needs to be provided by manufacturers. This poses a challenge to the food packaging industry and acts as a driving force in the development of new and improved technological packaging concepts. In addition to its function of protecting the product from the reaction of external factors, innovative food packaging in the form of intelligent and active packaging is intended to communicate the condition and quality of the product to the potential purchaser and to interact with the packaged food product. The article presents the essence, role, functions and division of packaging as a factor influencing the choice made by the consumer. Moreover, it focuses on determining the knowledge and attitude of consumers to this type of packaging used in the food products market.

Key words: innovations, packaging, active packaging, inteligent packaging, products.

Через зростаючий попит на споживання свіжих продуктів із збільшеною тривалістю зберігання виробники мають використовувати сучасне та безпечне паковання. Це є викликом для харчової тари та діє як рушійна сила у розробці нових та вдосконалених концепцій технології паковання. У статті розглянуто сутність, типи та класифікацію паковання як фактора, що впливає на вибір, зроблений споживачем. Крім того, основна увага приділена визначенню знань та ставлення споживачів до такого виду тари, що використовується на харчовому ринку і в харчовій промисловості.

З точки зору споживачів харчових продуктів, найважливіша роль паковання полягає в забезпеченні безпеки харчових продуктів на всьому логістичному ланцюжку, від виробника до споживача. Розумне паковання – це паковання, оснащене функціями, що дозволяють відстежувати товар через логістичний ланцюг або контролювати внутрішнє та зовнішнє середовище тари, а також спілкуватися зі споживачем. Таке паковання може не тільки контролювати якість та безпеку товару, але й повідомляти про його стан потенційному споживачеві чи виробнику. Поява інтелектуальних пакувальних систем сприяла черговій важливій зміні існуючого сприй-

няття паковання, оскільки вона перетворює традиційну комунікаційну функцію тари на інтелектуальну комунікаційну функцію. Іншим рішенням для інноваційного паковання харчових продуктів є активне паковання. Активне паковання – це системи, які завдяки хімічним, фізичним та біологічним діям активно змінюють умови всередині тари з метою подовження терміну зберігання і збереження початкової якості та сенсорних властивостей їжі. В активному пакованні продукт, навколишнє середовище і тара взаємодіють, збільшуючи тим самим якість продукції, термін придатності та довговічність. Розумне та активне паковання, крім функції захисту продукту від реакції зовнішніх факторів та привернення уваги замовника, спрямоване на інформування потенційного покупця про стан та якість товару і взаємодію з упакованими харчовими продуктами.

Ключові слова: інновації, споживач, активне паковання, інтелектуальне паковання, їжа.

Introduction. Today's conscious consumer has precise expectations with regard to the quality of food products and their packaging. Expectations result mainly from market trends and an increase in demand for food products and their packaging, which are adapted to consumer requirements. This situation forces packaging manufacturers to adapt to the changing requirements of the market environment. Due to the growing consumer awareness of food quality and risks, ensuring the safety of packaged food is a priority for all food chain actors (Kawecka and Cholewa-Wojcik, 2017).

Packaging is one of the most important product attributes influencing consumer purchase preferences. When developing marketing strategies related to the design and marketing of new products knowledge of consumer attitudes towards the new generation of packaging is a valuable source of information for producers (Brągiel et al., 2017). Packaging is an essential element in modern commodity trade, conditioning the preservation of food product quality, and is also a means of market advertising. It plays an important role, protecting the packaged product from external conditions affecting the quality and health safety of food, facilitates transport and storage (Barska and Wyrwa, 2016). The dynamic growth of the role of packaging contributes to the continuous improvement of production methods and ways of producing them. Packaging for food should be safe, which should be achieved by complying with the numerous legal regulations applicable in this area. It has been assumed that safe packaging should feature minimised risk of harm to the user and consumer due to factors present in it and on it (physical, chemical, biological), as well as due to the condition of the packaging (guarantee of integrity of the packaging and originality of the packaged product) and the absence of packaging defects of critical importance for safety and customer requirements (Lisińska-Kusmierz, 2010).

Social changes, present in consumer awareness, the development of packaging materials and packaging and the dynamic growth of industry have had a cumulative effect on the way in which the essence of packaging and the requirements placed on it are perceived. The process of creating and assigning ever newer functions to packaging has begun. This has resulted in innovative solutions in the field of packaging and packaging systems, e.g. in the form of innovative food product packaging. These packages fulfill mainly a monitoring and informational role, as they inform the consumer about the quality and safety of the product.

The ***aim of the study*** is to present the essence, role, functions and applications of innovative product packaging occurring in the food market in the food industry.

The importance and function of packaging as a factor influencing consumer choice

The term packaging, which has its origins in the Latin word paceus, has entered the Polish language probably through German at the turn of the 19th and 20th centuries. The German etymologist F. Kluge-Mitzka traces the origin of the term to the words Pack,

Packen, used during the Flanders wool trade to denote the weight of variable volumes of wool. According to the dictionary of Polish language, packaging is "what given thing is wrapped in, sometimes also with contents". The vast majority of products intended for the market must be packaged and labeled. According to the definition included in the Polish Standard PN-88/0-79000, packaging is a product designed to protect other products from damage, as well as to protect the environment from the harmful effects of the packaged goods. In addition, it defines it as a product ensuring the maintenance of a certain quality of packaged products, adaptation to transport and storage, and presentation, as well as protecting the environment from the harmful effects of certain products. ISO TC-122 WG 5 standard defines packaging otherwise i.e., as "a designed article for protection, preparation of a product for distribution, logistical operations and an ambiguous term for consumer, storage, bulk, transport, reusable and other packaging".

According to Düssel (2009), packaging is the ready-to-sell form of a product in terms of quantity, type and external appearance. Packaging is all products, made of any materials of any origin, used for storage, protection, transportation, delivery and presentation of goods on the way from the manufacturer to the user or consumer (Korzeniowska, 2001), (Lisinska-Kusnierz and Ucherek, 2006), (Lisinska-Kusnierz, 2005). Therefore, packaging is a material with an appropriate structure, whose purpose is to protect the product from damage, as well as to protect the environment from the harmful effects of the packaged product. The essence of packaging is a finished product that allows the movement of products during transport, storage, sale and use, informing about the content, affecting the buyer through aesthetic and economic values (Stewart, 2009). Packaging draws the potential buyer's attention to the content, thus inducing him to purchase the product (Kramer, 2004).

From a consumer perspective, packaging should be seen as a set of specific values for the customer, i.e:

– the use value, which manifests itself in the packaging's ability to satisfy the need for convenience, safety, time saving,

– prestige value, suggesting an exclusive purchase that may have been

– made only by a specific consumer (personification of packaging),

– the competitive value of making the packaging more attractive than others,

– innovative value, characteristic of packaging

– modern, containing new structural and technical solutions (manifestation of personification of packaging) (Pilarczyk and Mruk, 2007):

The primary function of packaging is to create a boundary between the product and the surrounding environment, thereby reducing the impact of environmental factors on the products inside the packaging.

The consumer's first contact with a product is most often through the packaging. The qualities of the packaging often determine the interest in the product. Companies are inclined to extend the classic set of marketing instruments with the element of product packaging, because the proper design of product packaging is an integral part of the marketing strategy, it can also contribute to the increase of product competitiveness and buyers' interest in it. Packaging as an element of marketing can fulfill many diverse functions. They do not result only from the essence of packaging itself, but also from its connections with other phenomena and other marketing instruments, accompanying the processes of offering products.

Analyzing the source literature on the type and functions of packaging, it is possible to notice their diverse division, taking into account various criteria. According to Zamkowska and Zagozdzon (2011) the most important functions of packaging are: production, marketing, application and logistics functions. Each of the mentioned functions plays an important role. Namely production functions consist in proper selection of packaging (taking into consideration preparation of proper amount of goods for production and taking proper amount of goods out of production).

In turn, marketing functions focus on packaging as part of the marketing strategy of the product, enabling it to be differentiated from competitors' offerings (mainly through slogans promoting the product, encouraging its purchase), and most often refer to unit packaging. The application functions refer mainly to the issue of reuse of packaging by the consumer. Logistic functions, in turn, consist in an appropriate selection of packaging that enables and facilitates the performance of logistic processes (e.g. transport, loading and other). Among the logistic functions of packaging one can distinguish: protective function, storage-transport-manipulation function, information function and disposal function.

Korzeniowski et al. (2011) point out the following functions of packaging: protective, promotional and sales, and informational. The protective function is the basic function of any packaging, its task is to protect a given product at each stage of its life cycle, starting from the production line and ending with the consumption process. The purpose of packaging is to ensure that the quality characteristics of the product are fully preserved. The most important task of the promotional and sales function is to arouse the interest of the potential customer, make it possible to identify the product, evoke the desire to possess it and lead to its purchase. The product packaging should be designed in such a way that it effectively influences the customer's psyche so that he or she makes a conscious or subconscious decision to buy the product; this function combines three elements of psychological influence on the consumer: it increases the value and willingness to buy the product, advertises the product together with the manufacturer and influences the increase in sales volume. The last-mentioned information function is related to the fact that a lot of information is placed on packaging for customers, distributors and sellers.

Packaging must ensure the high quality of the product from the moment of packaging, through storage, transport, sale and up to consumption by the consumer. It must also prevent the product from drying out, becoming dirty, losing freshness, changing colour and consistency. Packaging guarantees the so-called “first opening” and makes it difficult to steal the goods inside. It is often an integral part of the product, associated with it throughout its life cycle (Latka, 2008).

Companies are increasingly influenced by environmental issues and therefore by the production of Eco-friendly packaging. Some consumers do not purchase foodstuffs whose packaging poses a threat to the environment. This is why manufacturers take care to ensure that used packaging does not harm the nature. After use, they are used as secondary raw material, they are biodegraded (natural decomposition) or burned in specially designed furnaces. The environmental function is largely dependent on the purchasers of packaging and selective waste collection (difficult in the case of multi-layer materials and combined packaging). There are also materials that cannot be reused (Chuchlowa et al., 2005).

Innovative food packaging

Contemporary enterprises operating in the conditions of a globalized economy and knowledge-based society should demonstrate an intensive innovation policy. Introducing innovations on the market allows to reduce operating costs by improving operational efficiency or to increase revenues by, among other things, greater market coverage (Webster, 2004).

Most consumer products on the market require packaging in order to be marketed. Progress in the field of packaging is aimed at better and better protection of the quality of products contained therein and, at the same time, at increasing the usefulness, ergonomics and promotional aspect of packaging. It enables the implementation of modern packaging production technologies, the use of innovative packaging materials, which provides protection for the health and nutritional values of the products contained in them. This encourages companies to better adapt their market offer to the changing needs and requirements of consumers by introducing

product innovations of both the product itself and the packaging (Korzeniowski et al., 2011).

The packaging sector is one of the fast-growing sectors and shows great diversity in terms of product innovation. This mainly concerns the increase in functionality, ergonomics, ecological or economic value of the offer, as well as changes in the graphic design of packaging. Development in the packaging industry is taking place in three main directions: technological, material and design. The largest segment in the packaging sector is food packaging. In the structure of packaging in Poland in 2016, 64.8% was food and beverage packaging. According to estimates, in 2015 the value of the market amounted to EUR 8.62 billion, which means a nearly 40% increase compared to 2009. Assuming a 4-5% economic growth rate in 2016-2020, the value of the market will approach the level of developed countries of Western Europe (about EUR 300 *per capita*). Currently, the packaging market in Poland constitutes about 1.4% of the global packaging market, which was valued at EUR 535.7 billion in 2013 (Wasiak, 2016).

The multiplicity of innovations introduced in the packaging sector each year requires that the terms "innovation" and "innovation in packaging" be systematized. In order to clarify, it is assumed that packaging is understood as a product, i.e. an object of commodity circulation intended to satisfy consumer needs. The concept of innovation, which is the basis for the development of subsequent interpretations and classifications, was introduced into economic science at the beginning of the 20th century by J.A. Schumpeter (1912). He treated innovation as a factor of economic development, and his approach is considered classic. He distinguished three types of innovation: inventions, innovations and imitations. Schumpeter's definition has a very broad object scope, covering product, process, marketing and organisational changes. In contrast, the time scope given to innovation by Schumpeter is very narrow.

In economic literature, there is no uniform, universally accepted definition of innovation. Both theoreticians and practitioners use the term in many different meanings. Innovation is one of the most complex and ambiguously defined concepts in economic theory. The difficulty lies in the different ways of perceiving innovation. According to Janasz and Koziol (2007), the term 'innovation' is understood broadly and refers to all areas of life, from new solutions concerning economic or social life to new currents of thought or culture. In the Schumpeterian perspective, innovation in packaging is understood as a commercialised result of the process of development of an invention in the field of, for example, packaging material or implementation of a new process in packaging production. When analysing the essence of innovation in packaging, both the consumer and the producer should be taken into account. Considering the consumer point of view, it is assumed that innovation in packaging is an effective entrepreneurial tool. According to Kotler (2000), "any packaging, idea, or packaging concept that is perceived as new by the consumer is an innovation". From the consumer's point of view, innovation in packaging should provide new functional, utilitarian, environmental, economic or aesthetic benefits. On the other hand, from the producer's point of view, an innovation in packaging is a modified package, e.g. with an improved construction, changed material, graphics or form or a completely new package with new technical and technological solutions introduced to the market (Sudol et al., 2000).

According to Switalski (2005), packaging innovations are completely new, original or modified packaging that is new from the point of view of the entity introducing it to the market and recognized by the consumer as new. Innovations in packaging are most often product innovations. Product innovations can be defined as intentional replacement of hitherto manufactured products with their new versions and creation of completely new products, which are assessed as capable of uniquely satisfying the needs and preferences of specific buyers and thus improving the competitive position of the enterprise on the market (Schumpeter, 1960).

Active packaging and intelligent packaging make a highly significant contribution to the quality of food products. Recently, there has been a growing interest in them. Nowadays we can see on the market the presence, although still not on a very large scale, of a group of such innovative packaging. Both in Poland and in most European Union countries the use of such packaging is still not very popular. Among others, similar situation is in Australia and New Zealand. However, intensive research is being conducted on this type of packaging. It is very likely that in the near future they will be registered in the European Union and will become commonly used. This will contribute to extending the shelf life of food products and increasing their attractiveness (Drzewinska 2010).

According to the European Community Commission Regulation of 2009, intelligent packaging, also called smart packaging, are materials and products that monitor the condition of packaged food or its environment. According to Yama et al. (2005), smart packaging is packaging that is equipped with functions enabling it to track the product through the logistics chain or to monitor the internal and external environment of the packaging, as well as to communicate with the consumer. Smart packaging can therefore not only monitor the quality and safety of the product, but also communicate its condition to the potential consumer or manufacturer. The emergence of smart packaging systems has contributed to another important change in the existing perception of packaging, as it transforms the traditional communication function of packaging into an intelligent communication function (Han, 2005).

As an integral part of the product packaging moves along with it in the supply chain (wholesale and retail) and is subject to the same external factors. It is therefore the best carrier of information on the condition of the packaged product. The uniqueness of smart packaging comes from its ability and predisposition to communicate. In turn, the uniqueness of active packaging comes from its improved protective function. The basic types of smart packaging are two systems. One is based on measuring the conditions outside the package, the other directly measures the quality of the food products inside the package, whereby there may be direct contact between the indicator and the food, resulting in the need for additional monitoring of the safety and quality of the packaged food (Dainellia et al., 2008). Due to their ability to provide more precise and targeted information on quality parameters, the development trend in smart packaging is mainly towards direct indicators (Restuccia et al., 2010). The carriers of this information can be volatile organic compounds (microbial metabolites), carbon dioxide, nitrates (sodium or potassium) or bacteria.

There are many types of smart packaging available on the market. The principle of their operation is based on interactive indicators. These are most often colour indicators, allowing the packaged product to be evaluated. The change of colour can take place continuously or in steps. Continuous colour changes occur when there is a change in the amount of heat the product receives during transport and storage, while intermittent colour changes occur when there is a leak in the packaging. The use of an appropriate indicator in smart packaging is related to the specifics of the product and the factor to be controlled. Therefore, indicators of time and temperature, leakage, oxygen and carbon dioxide, shock or electronic labels and barcodes, among others, are distinguished (Dobrucka, 2014). Packaging equipped with temperature sensors is designed to easily identify changes in the quality of the packaged product due to abnormal storage conditions. Temperature indicators, using an irreversible colour change, can determine whether a product has been stored in the optimum temperature range, which is particularly important for frozen and refrigerated foods, such as fruits and vegetables (Han, 2005). They can also indicate the appropriate temperature for consumption of the product by means of a reversible colour change. Depending on their function, these indicators can be divided into three categories (Korzeniowski et al. 2011):

1. Critical Temperature Indicators (CTI), which provide information on operating temperatures above or below that indicated for a particular product;

2. Critical Temperature Time Indicators (CTTI), which reflect the cumulative exposure time of temperatures above and below the so-called critical temperature;

3. Time and temperature indicators (TTI), which show the entire temperature history of the stored product.

The second group of intelligent packaging are due date indicators. Their operation is based on detecting the presence of metabolites produced by microorganisms, i.e. carbon and sulphur dioxide, ammonia, hydrogen sulphide, amines, ethanol, enzymes, toxins or organic acids (Nowacki and Fijalkowska, 2011).

Examples of the use of innovative food packaging are given in Table 1. The most common indicators used in smart packaging are time and temperature indicators. Two types of such indicators can be distinguished, i.e. temperature indicators and time and temperature integrators.

Temperature indicators are used to continuously monitor the current product temperature. They are particularly important for frozen and refrigerated foods. They make it possible to record a temporary thawing of the product by a change in the colour of the label. Similarly, in the case of chilled food, if the product is subjected to a temperature above the optimum temperature or the product is stored outside the specified temperature range, there is irreversible discolouration of the label. This is particularly important information for the consumer about the inappropriate quality of such a product and the possibility of development of pathogenic microorganisms (Dainellia, 2008). Next, as popular as temperature and time indicators are oxygen indicators. They provide information on package leakage and oxygen content in products packaged in a modified atmosphere (Otles and Yalcin, 2008). A typical oxygen indicator rocks an erdox

Table 1

Use of innovative food packaging (smart and active)

Type	Form	Function	Application
Oxygen absorbents	Sachets, labels, bottle closures, films	Inhibition of lipid oxidation, mould growth, colour changes	Fats, oils, bakery products, roasted coffee, dried beef, cheese, dried fruit, drinks
Carbon dioxide absorbents	Sachets and films	Prevention of packaging swelling	Roasted coffee and cheese
Temperature regulators	Microwave sensors, self-heating and self-cooling cans	Allowing the product to be heated or cooled	Roasted corn, pizza, pastries, drinks and ready meals
Temperature sensors	Time - temperature indicators	Indication of change in ambient temperature	Frozen food, pizza, cakes, drinks and ready meals
Ethylene absorbents	Sachets and films	Control of ripening of fruit and vegetables	Natural and minimally processed fruit
Odour absorbents	Foils	Odour stabilisation	Absorption of unpleasant odours produced by the product
Moisture absorbents	Sachets and films	Moisture control	Dry products, meats and vegetables
Antimicrobial agents	Sachets and films	Inhibition of microbial growth	Bakery products, cheese and mixed meats
Antioxidants	Foils	Inhibition of oxidation	Ready-to-eat cereal products

Sources: Baran J., 2014; Han i in., 2005, Lisińska-Kuśnierz, i Ucherek, 2014.

dye such as methylene blue, an alkaline compound such as sodium hydroxide and reducing compounds such as reducing sugars (Nowacka and Fijalkowska, 2011).

A popular solution is also the use of smart colour indicators, i.e. indicators applied in the form of thermo chromium paint on the bottle. These inks are used to determine the correct drinking temperature for the beverage contained in the bottle. Once the correct temperature is reached, a message or stamp appears on the package indicating the best temperature to consume the product (Korzeniowski et al. 2003).

Another solution for innovative food packaging is active packaging. Active packaging are systems that, through chemical, physical and biological actions, actively change the conditions inside the packaging in order to extend the shelf life and maintain the initial quality and sensory properties of the food (Han 2005). In active packaging, the product, the environment and the packaging interact, thereby increasing product quality, shelf life and durability.

Consumers versus innovative food packaging

Consumers of the 21st century are increasingly aware and demanding. They expect fresh, high quality food, without added preservatives, with an attractive appearance and with the lowest possible degree of processing (Kosicka-Gebska et al. 2011, Kozak and Bieganska, 2012). Traditional packaging is designed to provide products with passive protection against damage and guarantee the longest possible shelf life. Active packaging allows to sustain freshness for as long as possible, maintain unchanged quality values, guarantee product safety and nutritional value (Ostrowska, 2013, Popowicz and Lesiow, 2014). Active packaging has been defined as "systems that (as a result of chemical, physical and biological actions) actively change the environmental conditions inside the package in order to extend the shelf life and maintain the initial quality and sensory properties of the food" (Jeznach et al., 2017). This type of packaging uses materials that, due to their specific composition, can absorb substances released by the food or emit compounds that allow to maintain unchanged freshness and extend the shelf life of the product. Active packaging is designed to prevent changes in a product. Active packaging can destroy or inhibit the growth of microorganisms that are present in a product. They can also improve food quality and safety, extend shelf life, by means of active interaction with the food or the atmosphere inside the packaging. It can be concluded that active packaging is a system that actively protects the products in such packaging, improves the safety and quality of the product and extends its shelf life.

The most common active packaging is the *oxygen scavenger*. This is due to the sensitivity of many food products to loss of quality caused by the presence of even a small amount of oxygen. The presence of oxygen in packaging leads to unfavourable reactions and processes such as: autooxidation of fat, oxidation of vitamins C and E, oxidation of some pigments and development of aerobic microflora. Oxygen absorbers occur in many different forms: sachets, stickers, special closures or polymers introduced into the structure of packaging (Kozak and Cierpiszewski, 2010). The most common form of oxygen scavengers are sachets containing a catalyst and various powders based on iron compounds. This system is based on an irreversible chemical reaction in which oxygen from the packaging reacts with the compounds in the sachet to form stable oxides (Baran, 2014).

Summary. Increasing consumer demands for safe food drive the food industry to introduce innovative food packaging in the form of smart and active packaging. In the food industry, the largest group of innovations introduced are product innovations. The introduction of these innovations by companies is associated, among other things, with the need to meet the constantly changing needs of consumers, for example in terms of packaging. From the point of view of food consumers, the most important role of packaging is to ensure the safety of food products throughout the entire logistic chain, from the producer to the consumer.

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