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PACKAGING – FROM NEOLITHIC TO PACKAGING INDUSTRY

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Abstract: The article presents the history of packaging from ancient times to the present day. Its application in particular periods of time and the significance of technical progress in the development of the packaging industry are described. The second part of the articles presents definitions of modern packaging and its functions. Next, the basic statistical data on packaging introduced into the economic terminology in 2012-2015 are presented, and on their basis an analysis of the Polish packaging industry has been made and an attempt is made to predict future trends in the packaging industry.

Keywords: packaging, marketing, logistics

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Introduction

The author's motivation for taking up the subject matter related to the broadly understood area of packaging is the lack of scientific studies in the subject literature, which would contain the description of packaging as well as auxiliary packaging materials in the logistic and marketing concepts. An important issue is also the evolution of packaging from the times of its manufacture in antiquity to modern times, when the marketing and logistic (Skowron-Grabowska 2014, p. 39) concepts present them with numerous challenges.

It is also important that the current economy is described as a networked economy (Nowakowska-Grunt 2016, p. 66) and the importance of a proactive environmental strategy for companies is growing (Seroka-Stolka 2014, p. 10).

The author is, of course, aware that it is impossible to present in this paper all issues concerning packaging and its related problems. It should be added that further work on this topic will continue and the results will be published in the future papers.

Genesis of packaging and packaging industry

At the very beginning, the need to protect precious things and goods was satisfied with what men had in their vicinity and what was associated with the place of their existence. As far as possible, ancient people used the leaves of trees or plants to fold objects into them and then place them in skins or shells (Pelc 2015). As time passed, people gained more and more experience and sought to produce better packaging that would make it possible to protect the value of the

products in use or food kept in them, and/or to cover a longer distance with goods, e. g. which were meant to be exchanged for other products. It should be added here that a breakthrough occurred during the discovery of clay pottery in the Neolithic period.

The Neolithic Age is determined by the time frame depending on the area of its occurrence. In the Middle East it begins at about 8300 BC and in Europe at the end of the 7th and the beginning of the 6th millennium BC. This term was introduced in 1865 by J. Lubbock and originates from the name of a new technique of using stone, which consisted in its use in grinding processes, i. e. smoothing and drilling of holes. Hence this period was also called the age of the polished stone. This period was a stage in the development of culture, in which the man for the first time abandoned the use of natural resources as part of the assimilation economy, such as hunting, hunting, fishing, harvesting for the production economy, which was based on domestication of wild cereals and domestication of animals, as well as firing clay vessels and diversified decoration of those vessels. Weaving with the use of floating looms was invented and there was a development of flint quarrying, far-reaching exchange of various raw materials, river and sea routes were developed (https://encyklopedia.pwn.pl/…). All these factors contributed to the development of products and packaging, which also became a transport-related product. This is evidenced by clay products such as vases, jars, bowls and pots dug out during archaeological works in Mediterranean areas. Every single civilisation tries to develop methods of packing and covering increasingly long distances with products so as to deliver them to their recipients in the best possible condition, which has always been part of the trading process.

Another very important period for the production of packaging was the Bronze Age, thanks to which special tools used in production processes, including packaging, were produced. Decorative elements started to be applied, giving objects their unique distinctive features. The packaging began to be increasingly sophisticated when it received closing solutions or handles[1].

Armed conflicts in Europe in the 18th and 19th centuries were a breakthrough in the perception of the importance of packaging. In 1795, Napoleon Bonaparte promised the prize to a person who would come up with a way of preserving food so that it could be transported along with moving troops over long distances over longer periods of time (Chrzanowska 2017). At the turn of 1809 and 1810, Nicolas Appert invented a groundbreaking method of packaging food by sterilizing foods in a glass jar (https://www.britannica.com/…). Shortly after this discovery there was another breakthrough in packaging when Peter Durand produced a tin can.

The time of the Great Industrial Revolution was a particularly advantageous period for the development of packaging. At that time, comprehensive research began on packaging and its functions related to the storage time of food products and long-distance transport.

[1] The above statements of the Author are the result of an analysis of a number of exhibitions of objects from archaeological excavations.

The early 20th century saw an increase in the mobility of people between Europe and North America, Australia and Asia. More and more products started to have customized packaging that had to meet the handling and storage requirements. Packaging began to play an even greater role in the interwar period. It was then that the companies whose brands and products we know to this day actually began to develop. A summary of a few selected one is given in *Table 1*.

Table 1. List of selected product manufacturers contributing to the development of packaging

No.	Brand	Type of business activity
1.	Nestle	Foods
2.	DuPont	Chemical products
3.	Palmolive	Cosmetics
4.	Henkel	Chemical products
5.	Procter & Gamble	Personal hygiene products
6.	Coca Cola	Beverages
7.	Osram	Lighting

Source: Author's own study on the basis of websites of given brands (www.nestle.com; www.dupont.com; www.colgate.pl; www.henkel.pl; www.us.pg.com; www.coca-cola.pl; www.osram.pl)

These brands are well-known and recognized not only through their products but also through packaging, which is an element allowing the customer to find the right product.

After World War II, packaging gained an increasing importance. All the manufacturers started to compete with one another in winning the customer whom they wanted to become attached to their product and tried to do so through appropriate packaging. In this way, increasing amounts of money were being spent on research and development of packaging, which began to be a separate product, and became inextricably but also inseparably connected with the perception of the product which they were originally supposed to protect. In this way, the packaging industry was created, which introduced innovations and was open to new approaches such as merchandise, marketing, logistics or others (Brzóska, Jelonek 2015, p. 50). Today, packaging is in the area of interest of many sciences, for example technical, legal, and artistic, also including those closely related to environmental protection, which in turn reflect the binding of legal regulations.

Overview of selected definitions of packaging

Packaging is therefore today an object offering many more functions than it did hundreds of years ago. The following part of the paper will present the most important packaging terms, of which the most important is the definition of packaging. At present, there are many different definitions that are presented below in *Table 2*.

Table 2. Selected definitions of packaging

No.	Definition	Source
1.	An item (a set of objects) or material protecting a product against defect (caused by destruction, e.g. by insects, rodents, rain), theft, and changes in its quality during transport, storage, or display.	https://encyklopedia.pwn.pl/szukaj/opakowanie.html
2.	A product which ensures maintaining a certain quality of the packaged products, their adaptation for transport, storage and presentation, and protects the environment from harmful effects of certain products.	Polish Norm – Polska Norma PN-O-79000:97
3.	Article 3 Definitions For the purposes of this Directive: 1. 'packaging` shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable` items used for the same purposes shall also be considered to constitute packaging	European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste
4.	The packaging in the meaning of the Act is a product, including a non-returnable product, made of any material intended for storage, protection, transportation, delivery or presentation of products, from raw materials to processed goods.	Act of 13 June 2013 on Packaging Management and Packaging Waste Management, Journal of Laws of 2013 item 888 (Ustawa z dnia 13 czerwca 2013 r. o gospodarce opakowaniami i odpadami opakowaniowymi)

Source: Author's own study based on the sources presented in the table

The most comprehensive definition of packaging is presented by Andrzej Korzeniowski. It defines packaging as an object that has a set of the most important characteristics such as (Kisperska-Moroń, Krzyżaniak 2009, p. 187):
- protecting quality of goods during logistics processes and their use,
- protecting the environment against the product,
- simplification of production processes,
- information on the product and how to use it,
- economic aspects.

Development of packaging and packaging industry

Nowadays, the factors influencing the gradual increase in the importance of packaging include (Kisperska-Moroń, Krzyżaniak 2009, p. 187):
- growth of global production,
- advances in technical progress resulting in an increase in the range of products,
- automation of packaging process and packaging of finished products,

- striving to reduce costs of transport and storage processes,
- new sales techniques – self-service,
- aiming to reduce losses resulting from damaged products being returned,
- influencing demand for the product through the form of its packaging.

There is also a growing role of returnable packaging (both damaged and undamaged) (Starostka-Patyk 2016, p. 51; Mesjasz-Lech 2012, p. 42).

An important element influencing the development of packaging was the use of plastics in their manufacture. This trend continues and offers new possibilities for packaging production and applications. Polyester tapes are a good example of this trend since, having better properties, they replace steel tapes used earlier. Their advantage is based on their lower sensitivity to temperature fluctuations and elasticity, and, what is more, they are also resistant to corrosion manifesting itself in the change of colour (when corrosion gives a steel tape the golden-brown colour). *Table 3* below shows the most important groups of packaging materials.

Table 3. Key groups of packaging materials

No.	Type of material
1.	Plastics
2.	Aluminium
3.	Steel
4.	Paper and cardboard
5.	Glass
6.	Wood
7.	Natural materials – fabrics
8.	Ceramics

Source: Author's own work based on the (GUS 2016)

Packaging needs to fulfil various functions of which the most important include the following (Korzeniowski 2009, p. 188; Kisperska-Moroń, Krzyżaniak 2009, p. 187):

- protecting the product against mechanical, climatic and biological damage during transport, storage and handling,
- appropriate shock and corrosion protection of products,
- facilitating transport, storage and handling operations,
- maximum limitation of packaging dimensions and weight,
- rational and economical use of materials, especially materials which are scarce, and the use of environmentally-friendly materials,
- maintaining low costs of packaging,
- giving the packaging its final external appearance.

Properties of packaging result from many functions which they need to serve and they include:

- Production functions: the packaging enables preparation of the required quantity of goods at the beginning of the production process and the collection of the appropriate quantity of goods when leaving production.

– Marketing functions: packaging of a number of products is an important part of a product's marketing strategy that makes the product stand out from competing products. Also in the field of communication packaging - as an advertising medium – can fulfil important functions, e.g. sales promotion (Pfohl 2001, p. 140).
– Usage function: this includes reusing packaging by the purchaser or using it for other purposes. There is an important requirement concerning its manufacturing technology i.e. its manufacture needs to respect the requirements of environmental protection (Ustawa z dnia 13 czerwca 2013 r. …). This necessitates the need for disposal of waste in accordance with applicable legal regulations.
– Logistics functions: packaging makes it easier or even possible to carry out other logistics processes. Logistics functions include: protective function, storage function, transport function, manipulation function, information function (Pfohl 2001, p. 141).

Packaging is subject to a number of requirements that must be met. The most important of these are shown in *Figure 1*.

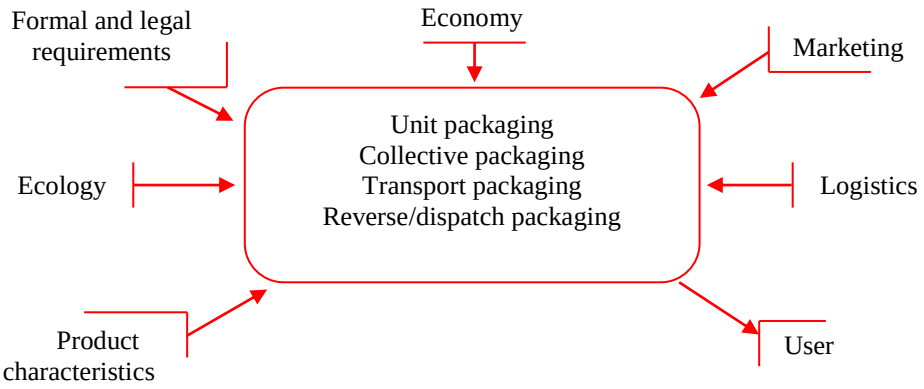

Figure 1. Factors influencing development of different types of packaging

Source: Author's own study based on (Korzeniowski, Skrzypek, Szyszka 2001. After: Pfohl 2001, p. 31)

Packaging is a key element in the logistic packaging process. The packaging process covers all the operations necessary for the containment of goods, from the delivery of empty packages and goods to be packaged to the packing station, through various stages of appropriate packaging, to the preparation of packaged units ready for collection from the packing station (Pfohl 2001, p. 145). Due to the variety of functions performed, packaging has significantly gained in importance, which is reflected in an intensive development of the packaging industry, including Poland. The packaging market in Poland totals approximately 1.4% of the global packaging market, which was estimated in 2013 to be worth EUR 535.7 billion (Wasiak 2015, p. 41).

Since the production and use of packaging is determined to the greatest extent by the material from which it is made, the packaging market is examined taking into account materials from which packaging is made. The market share of packaging made from particular materials in the years between 2011 and 2015 is presented below.

Table 4. Packaging on the market in 2011-2015

No.	Specification packaging	Size of packaging on the market in tonnes				
		2011	2012	2013	2014	2015
1.	Total packaging	4 611 055	4 669 891	4836 423	4 846 080	5 026 055
2.	Plastic	784 474	831 919	895 087	896 321	919 265
3.	Aluminium	86 174	91 670	86 927	87 692	86 587
4.	Steel, of which steel sweet	160 943	156 869	160 371	156 782	171 154
5.	Paper and cardboard	1 419 869	1 493 336	1 566 345	1 567 973	1 579 441
6.	Household glass packaging excluding ampoules	1 078 763	1 056 522	1 068 605	1 027 963	1 105 408
7.	Made of natural materials (wood and textiles)	1 080 832	1 038 029	1 059 088	1 108 601	1 164 199

Source: Author's own study based on (GUS 2016)

As can be seen from *Table 4*, the packaging market in Poland is growing steadily. According to the forecasts by the Polish Chamber of Packaging, at approx. 4-5% of the rate of economic development in the period 2014-2020, it will reach a comparable level to the markets of the well-developed Western European countries (approx. 300 EUR per capita). The packaging industry in Poland fully satisfies the demand of the domestic packaging market, and having overcapacity in the range of 20-25%, it is able to fulfil orders of foreign markets. Unfortunately, the Polish packaging industry is heavily dependent on import of raw materials and product materials, especially in the case of packaging made of plastics, paper and cardboard. Rising prices of those significantly reduce the profitability of packaging companies.

The Polish packaging industry is fully commercialized and privatised. The consolidation process is systematically progressing and it is also being bought out by foreign companies. This applies in particular to the glass packaging industry. Currently, approx. 75% of this industry is in the hands of foreign capital. This also applies to the metal packaging industry, in particular beverage cans and industrial chemicals (Wasiak 2015, p. 41).

Conclusions

Packaging has accompanied the man from the very beginning of his existence. Along with the development of civilization and technology, its importance has grown and increased. Its functions have also expanded from the original protective function to a number of present functions including product marketing and handling and customer information.

As far as the changes in the structure of the packaging market in the coming years are concerned, the development of the plastic packaging segment should be predicted, with flexible, paper and cardboard packaging in particular. Foods packaging will be dominant on the packaging market. The share of packaging for industrial products will slightly increase. Also a slight growth is expected in the pharmaceutical and cosmetics packaging segment. These changes will be related to the development of investments in the economy and changes in the supply system of pharmaceuticals. The packaging market will evolve along the demographic and lifestyle changes and consumption patterns. These changes concern both the type of packaging materials and kinds and ways of packaging. The share of smaller unitized packaging will increase as a result of demographic changes.

Assuming that Poland is developing at a moderate pace, it can be expected that the further development of our domestic packaging industry will follow in – at least – the next few years.

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OPAKOWANIA – OD NEOLITU DO PRZEMYSŁU OPAKOWANIOWEGO

Streszczenie: Artykuł przedstawia historię opakowań od czasów starożytnych do współczesności. Opisano ich zastosowanie w poszczególnych okresach oraz znaczenie postępu technicznego dla rozwoju przemysłu opakowaniowego. Zwrócono uwagę na rozwój funkcji opakowań: od najprostszej, najbardziej podstawowej, jaką była ochrona produktów, głównie żywności, po dzisiejsze, takie jak funkcja marketingowa czy logistyczna. Druga część artykułu przedstawia definicje nowoczesnych opakowań i ich funkcji. Następnie zaprezentowano podstawowe dane statystyczne dotyczące opakowań w latach 2012-2015 i na ich podstawie dokonano analizy polskiej branży opakowaniowej oraz podjęto próbę przewidzenia przyszłych trendów w tej branży.

Słowa kluczowe: opakowania, marketing, logistyka