

## Digitalization in Packaging

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### Abstract

*Digitization is an invariable process of the packaging life cycle. Its clarification, prerequisites, conditions and manifestation in and through packaging is part of the understanding and characterization of **digital packaging**. Faced with the opportunity to respond to new consumer demands directly reflected through customization and connected packaging, packaging professionals are applying all the tools of the digital transformation process to their work. **The aim** of this research is to present the role and the place of digitalization in packaging. In the study have been used the **descriptive - analytical approach, the methods of comparison, analysis and synthesis**)*

*Keywords: digitalization, packaging, technology, innovation, printing*

*JEL Code: O30, L70, L81*

### Introduction

Digitalization, defined as the use of digital technologies to change a business model and provide new value-producing opportunities, is transforming entire industries with varying speed and scope. The packaging industry is also undergoing a profound transformation, with brand owners shaking its value chain. They are under pressure from competition, market expectation and new local brands to reduce new product cycle times, from packaging design to arrival on the shelves. The reduction of lot sizes, the continual growth of digital printing and the need for color consistency between physical and online product displays, calls for more efficient workflow tools. Competition from traditional and emerging players is also intensifying within packaging plants around digital products and services (Pauchard, 2020).

Packaging industry has grown from just “packaging” to an experience today. According to ET Spotlight (Changing world of packaging, 2020) today, consumption is happening on-the-go. Consumers, retailers and food producers are looking for fresher, more convenient packaging solutions that have minimum impact on the environment. Companies are constantly trying to connect with the consumer to analyse consumption behaviour and enhance his buying experience.

Modern packaging is developing under the influence of a number of factors, the most important of which are the **personalization of products** for end customers and **digitation on manufacturing processes**. In addition, the packaging sector must consider **design trends, environmental requirements and opportunities for greater consumer awareness**.

Leading place in the packaging industry are solutions related to: process automation, reduction of materials used, reuse of the same, naturally oriented design and construction, the ability to easily manipulate packaging throughout the logistics of packaging to the end user. Sustainability as a basic principle of action in every field, including the packaging sector, requires the use of environmentally friendly and smart packaging. Packaging is getting “smarter”, with a minimalist and simple design, produced with the capabilities and quality that digital printing provides. Augmented reality (AR) connects the packaging sector with new thinking and new lifestyles, showing that the industry is following the future trends and continuing to move in the right direction. Digitization is an invariable process of the packaging life cycle. Its clarification, prerequisites, conditions and manifestation in and through packaging is part of the understanding and characterization of **digital packaging**.

**The aim** of this research is to present the role and the place of digitalization in packaging. In the study have been used the **descriptive - analytical approach, the methods of comparison, analysis and synthesis**.

### 1. What is digital packaging

Digital transformation is the process of using digital technologies to create new — or modify existing — business processes, culture, and customer experiences to meet changing business and market requirements. This reimagining of business in the digital age is digital transformation. (Lewis, 2022) (fig. 1).

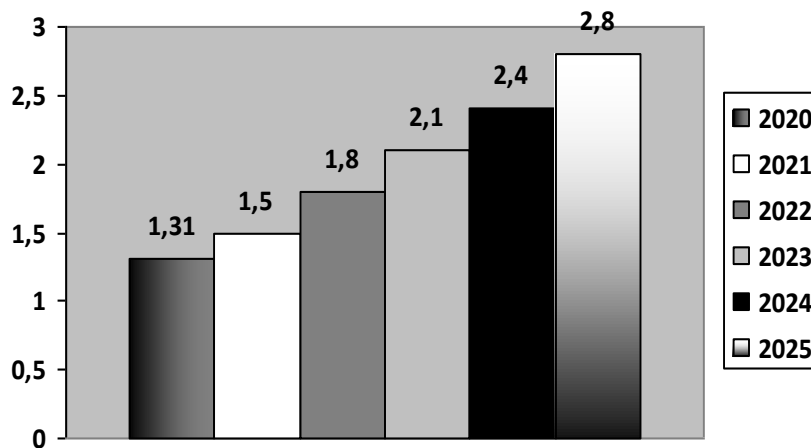


Figure 1. Spending on digital transformation technologies and services worldwide from 2020 to 2025 (in trillion U.S. dollars)

Source: Statista, 2022

Sava (Sava, 2022) reports that in 2022, spending on digital transformation (DX) is projected to reach 1.8 trillion U.S. dollars. By 2025, global digital transformation spending is forecast to reach 2.8 trillion U.S. dollars. Digital transformation refers to the adoption of digital technology to transform business processes and services from non-digital to digital. This encompasses, among others, moving data to the cloud, using technological devices and tools for communication and collaboration, as well as automating processes. Digital transformation growth is due to several contributing factors. Among these is the recent COVID-19 pandemic, which has increased the digital transformation tempo in organizations around the globe in 2020 considerably. Other contributing causes include customer demand and the need to be on par with competitors. Overall, utilizing technologies for digital transformation render organizations more agile in responding to changing markets and enhance innovation, thereby making them more resilient.

**Digital packaging** explains Dube, (Dube, 2020) is packaging that is made using digital technology, three-dimensional software, printed electronics and digitally controlled manufacturing protocols. It is any packaging that features connected technology including QR codes, augmented reality, smartphone scanning and so on. Digital packaging is smart packaging that is an important dynamic within the ecosystem of the digital marketing realm. It promotes interaction with consumers and may collect data about its journey from production to disposal. Digital packaging attempts to enhance the relationship between companies and consumers and works through processes of engagement with buyers including but not limited to gamification, education, entertainment and other interactive activities.

Digital packaging can be defined as the incorporation of digital technology into the packaging of products. Digital technology incorporated into packaging includes near field communication (NFC), radio frequency identification (RFID), Bluetooth, Wi-Fi, QR codes, Barcodes, etc. The implementation of digital packaging therefore encompasses broad range of packaging systems such as labels, tags, closures, flexible packaging, rigid packaging, etc. (Digital Packaging Market - Global Industry, 2022).

As the name suggests, digital packaging is packaging that's created using digital technologies. Sometimes known as "**connected packaging**", it may include three-dimensional

software, printed electronics, and digitally controlled manufacturing protocols. It can include connected technology such as augmented reality, smartphone scanning, and QR codes to create a more immersive and engaging experience for the consumer. It incorporates gamification elements whereby aspects of the gaming experience are used to facilitate marketing goals. It not only promotes interaction with consumers, but it can also collect data about the journey the packaging takes, from production through to disposal.

Digital packaging is becoming increasingly common. It promotes a more rounded and immersive creative experience between consumers and products, companies, and brands. Digital packaging gives the products “the wow factor”, conveying a sense of discovery and excitement. It is novel and intriguing, and it can increase the chances purchasing the product. Digital packaging can offer a vast range of opportunities to businesses of all kinds. It can provide better tracking through the supply chain, providing a greater depth of information beyond what can be written on a label. It also improves the quantity and quality of data collection. This ability to connect directly with the customers gives marketers another means by which to foster engagement and brand loyalty.

Digital packaging can help the products stand out from the competition. There is a range of different techniques and components that can be included:

- **Image recognition:** is increasingly being used as part of digital packaging. This is where a digital device can recognize a certain shape and then respond to it. One means by which this is being used is via *augmented reality (AR)*. This is where real-world objects or places are enhanced using computer-generated images. It could be, for instance, used to scan products to gain information about how and where they were made. AR is part of the “connected packaging” trend, which allows people to unite the digital and real worlds. In this way, the impossible becomes possible. Augmented reality can be used to make practical things easier to use by keeping users of their smartphones over groceries, for example, to read nutritional information. Technology really comes to life when it allows people to enter the world of the brand. Gamification is one such approach, using AR to superimpose digital games on the real world. When done well, AR adds a whole new dimension to the customer experience and can provide a channel to illustrate the brand's promises. With the help of connected packaging, designers can send a much wider range of messages without restriction to the surface of the packaging. It takes people to a new dimension, which can be a website, microsite or AR and allows much more to be expressed. These can be functional messages, such as “first steps” lessons, rational brand messages that present additional reasons for buying, or emotional messages that help build a brand community or that reflect people's needs and aspirations.

- **QR Codes:** are frequently used in digital packaging and are becoming a common part of everyday life. This is a system of machine-readable code that's made up of a collection of black and white squares. Typically, this can be used to store links to websites. Some marketing professionals have raised doubts about the usefulness of QR codes. This criticism has its roots in the early days of QR technology when it was used widely, often with the attached content being of poor or superfluous quality. Increasingly, brands are paying greater attention to what's delivered by a QR code.

- **Near-Field Communication Technology (NFC):** is a short-range wireless technology that's commonly found in all kinds of devices including phones and smartwatches. It's most commonly encountered in payment cards; the technology that allows for contactless payment for example. It's the technology that allows devices to create wireless connections by which to communicate with one another. This means it can be used for wireless payment or in key cards. All of these technologies offer creative marketers the chance to develop exciting ways to create engagement and foster brand loyalty.

- **An immersive consumer experience:** the potential of digital packaging is still being explored and developed. It's clear, at this relatively early stage, that it offers real potential for creating a much more immersive consumer experience. The key to its future development and

relevance will lie in developing content that adds value to the consumer experience (What is digital packaging, 2022 and Strategii za opakovkite - Rakovodstvo 2021, 2021).

*Industrial Automation* (Emergence of IoT and Global Digital Packaging Market, 2021) writes that digital packaging is incorporating a sensor or a digital tool that helps in identifying a package and tracking its status. It also involves placing printed material on the package that can be used for detection. Widespread technological developments are primarily augmenting growth of the global digital packaging market. The factors propelling the global digital packaging market are:

- *Penetration of internet* to the remotest corner has enabled logistics management organizations to provide access to consumers about the status of their packages. It has also facilitated easy detection of items, and segregate them at a faster rate. This has helped speed up delivery of products. These factors are considered favorable for the global digital packaging market.
- Digital packaging products are extremely useful where *large volumes of packages are transported*. It facilitates maintenance of data of the packages, helping manufacturers track them in case of theft or loss. This makes it ideal for courier and parcel services, mailing services, and other logistic companies to process deliveries faster, another positive for the global digital packaging market.
- *Food industry* has benefited from digital packaging, too. With food delivery applications promising delivery in short time, it's easier now for customers to track their order. Food outlets place an RFID code for the same. Such extensive use of RFID tech also propels growth in the global digital packaging market.
- Another promising application of digital processes is in the electronics industry. Most electronics manufacturers provide a *QR code on the product box*, which upon scanning with a mobile phone displays all necessary product information. The sky-rocketing sales of electronics is a big bonus for the global digital packaging market.
- Further, it has provided a fresh dimension to marketing. Big brands are placing digital sensors or QR codes on packages, and are engaging customers with attractive *marketing and advertising strategies*. It has helped improve customer engagement. With customer experience gaining impetus, the global digital packaging market will also grow in the coming years.
- Digital packaging also finds interesting applications in the *pharmaceutical market*. Consumers are able to set medication reminders, track hydration levels, temperature, and other parameters. Such medicines are packed in smart bottles. The growth in pharmaceutical industry in the past few years is a positive trend for the global digital packaging market.
- *Printing on multiple types* of packaging materials can be a constraint. There is one format of printing that suits multiple applications. However, technological advancements are likely to resolve this issue soon.
- *Regionally*, the North America and Europe are expected to hold the largest share of the global digital packaging market. Rapid technological advancements, awareness levels among people, and penetration of internet, are favoring growth of the market in this region. Asia Pacific will emerge in the coming years as developing economies like India and China show massive progress in digitisation.

The aspects of digitization in packaging cover *production technology, innovations in process automation, digital printing, application of the tools of the technological revolution*.

## **2. Digitalization in packaging technology and innovations**

For organizations providing logistics services, dynamic changes in the external environment impact process performance risk and threaten effective integration of resources, coordinated management of operations and consequently, negatively impact customer satisfaction and loyalty (Stefanova, 2022). The author (Stefanova, 2022) concluded that the main reasons for the decline in

customer satisfaction are poorly managed logistics processes. Moreover, non-conformities in logistics activities management systems involve events caused by omissions in the planning, execution and control processes caused by a human error in the logistics services (Stefanova, 2021).

For Gardner (Gardner, 2019), as the manufacturing sector moves towards Industry 4.0, so too must the supply chain supporting it, particularly packaging, without which no goods can move. Defined by McKinsey as the “digitisation of the manufacturing sector”, Industry 4.0 is about the pursuit of operational effectiveness, Overall Equipment Effectiveness (OEE) and the ability to achieve mass customization at mass manufacturing prices. It is also about approaching things differently, introducing higher levels of automation and connectivity and making better use of big data. Done well, Industry 4.0 improves the industrial processes involved in manufacturing, engineering, material usage, asset performance and management. However, it also makes significant new demands of the supply chain, including packaging.

The creation of a “**digital twin**” allows extensive simulation and virtual development to take place even before any metal is cut. Consequently, whole new operating platforms have been developed which have low energy consumption, low materials usage, the flexibility to manage a wide variety of packs, super-fast changeover times and enhanced production speeds, as standard. This same digital twin then lives in the IOT where it constantly monitors the physical twin to ensure each element is operating as it should. In the event of any issues, preventative maintenance is quickly identified and undertaken, and the problem of costly downtime is eliminated.

Industry 4.0, the automation of manufacturing and industrial processes with smart technology, featuring machine-to-machine communication and the internet of things, is omnipresent in the packaging industry (Packaging Europe, 2022). The digitalisation of production promises benefits like more efficiency, a higher transparency and – in the end – happier customers. The Industry 4.0 has a wealth of advantages in store for the packaging industry. Required are easy to use end-to-end solutions that offer them clear added value. It could be called Packaging 4.0. Three different aspects of Industry 4.0 solutions help the packaging companies: ***machines become more efficient; small print runs and even unique packaging become realistic and packaging gets smart*** (Alt, 2017).

The packaging industry as a whole is experiencing a large shift towards more digital processes. This could take the form of a number of different aspects such as sensory elements, personalization, product packaging mockups, e-commerce, social media presence and smart packaging (Lewis, 2022).

The report of *Understanding eCommerce* (How Digital Transformation is Changing the Packaging Industry, 2022) analyze how digital transformation is changing the packaging industry. Technology and digitalization are the future of the packaging industry and many others across the globe. According to experts in the packaging industry the trends that are currently being observed related with technological changes in packaging industry could be summarized to:

- Changing and evolving consumer behaviour with the rising e-commerce buying trends
- Increased demand for customized and personalized packaging materials from enterprises for branding purposes
- Increasing need for agile production with the rising trends of the Print-on-demand business model
- Increasing demand for integrated technology solutions such as order management systems, online platforms, packaging design software, and others for business process digitalization
- Need for cognitive technologies to break silos and establish effective and real-time data exchange
- Increasing need for manufacturing and sourcing processes for sustainable packaging products

Impact of digitalization and technological advancements in the packaging industry include: ***Enterprise Applications for process automation and efficiency; Process digitalization for better customer services; Sustainability and waste management in production.***

***Enterprise Applications for process automation and efficiency*** understood as: Automated order management system and Agile and collaborative industry value chain.

Although the packaging industry is a B2B business, having orders managed online and automation of order management can help the packaging industry increase its efficiency and transparency amongst its customers and personnel. The customers can effectively track their orders; the personnel can also be well aware of their roles and the timeline. One of the biggest problems of the packaging industry currently is the lack of integrated systems. There are technology solutions for each department, but these technology solutions act as silos without cognitive and cyber-physical solutions. With the help of IoT and Artificial Intelligence (AI), one can easily break these silos and create an integrated digital ecosystem for effective data exchange and information flow.

***Process digitalization for better customer services*** brings to the fore the importance of Packaging design software for customization and faster go to market and AI for personalized product offering. With the increasing branding significance because of the intensely competitive market, branding managers also include packaging as one of the branding collaterals. In addition, customers and social media trends have made packaging an important aspect of the brand. As a result, there is an ongoing trend of unboxing and thus the need for attractive packaging. Apart from that, marketers are also using packaging materials to communicate their brand message with the customers and integrate QR codes and other such things to connect with the customers.

Because of such varied trends, the need for customized packaging has increased exponentially, and because of that, the packaging industry is observing high demand for packaging design software. The package design tool not only digitizes the product designing process but also empowers the end customers of the packaging industry to design their packaging and send a bulk printing order with a ready-to-print file. Such box design software provides an opportunity to optimize the design process. It solves the problem of inventory creation as designers can create their packaging designs and virtually upload them to their online platforms. With the help of the print-on-demand model, the packaging business can reduce the entire designing cycle and ensure a faster go-to-market with the least possible resources.

Personalization is not only a trend in packaging products but also in business processes. It was surveyed that people are willing to share their data with the businesses for personalized suggestions. Companies are incorporating AI and other cognitive technologies for effective customer services to deliver customized user experiences. With the help of AI, companies can offer better products and optimize sales and marketing with automated marketing emails and cross-selling and up-selling marketing techniques.

***Sustainability and waste management in production*** requires Sustainable production and sourcing approach and Remote monitoring and data analytics solutions for effective waste management.

The demand for sustainable packaging materials is high, so the packaging industry needs sustainable packaging production machinery. Still, they also need cognitive and IoT technologies to cut the waste in their production and pitch a minimal waste product to their customers. Another big problem that traditional packaging businesses face is the lack of data-driven decision-making capabilities. With the help of automated plant and job workflows, efficient quality control systems with remote monitoring, and optimized equipment performance, one can increase productivity and reduce unexpected downtime. Also, with the help of integrated systems, the data exchange between the stakeholders can become efficient, and it can help in effective strategizing and policy framing with data-driven decisions.

These days, 90% of companies are doing business in the cloud. Across industries, companies are reaping the benefits of digitalization by being able to modernize legacy processes, create and accelerate efficient workflows, strengthen security measures and so much more. It's important to not only migrate to the cloud, but to re-evaluate and optimize processes and systems as you go. Digitalization can be used to improve every part of an organization (Vlahos, 2022).

### 3. Digital printing packaging

According to the report of *Transparency Market Research* (Digital Printing Packaging Market, 2022) in the next decade, packaging industry will experience a significant revolution owing to the increasing applications of digital printing. Digital printing is one of the prominent printing technology for packaging and labels, that has been recognized among brand owners who prefer quick-turnaround capability which digital printing offers. Moreover, digitally printed packages improves workflow, enables innovative marketing, and helps in quicker marketing.

Recent advancements in the digital printing approaches for digital carton creasing, carton cutting and other finishing technologies has widened the application in corrugated packaging, flexible packaging and folding cartons. Digital printing is transforming packaging by providing custom variations that give products on-shelf distinctions. Packaging substrates such as cartons, labels and corrugated boxes have provided the eye-catching commercialization to draw positive impact on consumers. One of the ongoing trends in the digital printing packaging market are custom caps which opens up colorful choices for brand owners, which in turn making a positive impact with the consumers.

2022 is in the early stages of a decade dominated by the digital world. Digital printing utilizes computer generation as the principal mechanism behind designing physical product packaging and creating the images or graphics governing their appearance. It's fair to say digital printing influences every part of today's packaging. Digital printing allows packagers far more latitude in personalization and customizing options than mechanical processes like typesetting did. Most packaging companies switched from analog to digital within the past decade. However, it takes time to retool a factory completely. In 2022, there are only a handful of companies without making that progressive investment.

The packaging industry reached a tipping point in this decade. The use of digital presses grew, while conventional presses declined. In 2018, narrow-web digital presses exceeded the standard flexo presses for the first time. This digital printing technology allows all colors to be printed in a single pass, which has fostered a trend of "printing on-demand" in the industry. Studies say this demand will only grow. By 2024, it is estimated the global digital printing packaging market will reach \$28 billion. That's proof of a major trend changes in the packaging industry (2022 Packaging Industry Trends, 2022).

The Global Digital Printing Packaging Market is segmented based on Type, End User, and Geography (fig.2).

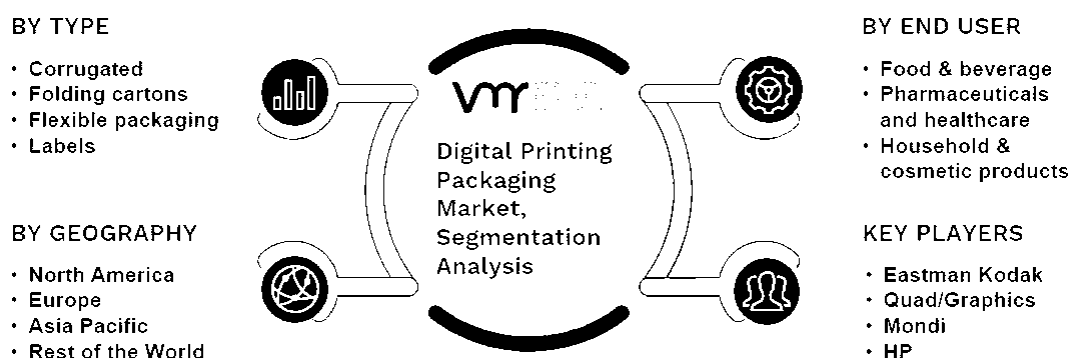


Figure 2. Digital printing packaging market size and forecast

Source: Verified Market Research, 2021

The report of *Verified Market Research* (Digital Printing Packaging Market Size and Forecast, 2021) shows that the transformation of the basic covering material for the product and leveraging it as a marketing and promotion tool is driving the demand in the global Digital Printing Packaging Market. The companies are using innovative packets or materials, or technology to devise new strategies to gain a maximum number of consumers in the global market. Digital

printing technology is used across materials substrates such as corrugated boxes, flexible packaging, folding cartons, and labels to rise the demand for the products in the market. Digital print is helping brands promote their products by imprinting the details, on the product, which the brand owners want to convey to their customers. Printing technologies such as inkjet and electrophotography help in improvising digital solutions for packing purposes.

The incorporation of these solutions enables manufacturers to initiate new print capabilities, the shorter process runs, label information as per consumer requirements, and offers brand protection in the global market. Digital technology allows companies to scan the image and convert it to digital data, and then transfers the data on to the surface for printing and provides higher consistency than analog printing in the market. The exponential growth of the food and beverage industry will drive the demand for advanced solutions. The developing economic powerhouses such as China and India are attracting new investments. The shift in vendors' behavior towards consumer products will encourage vendors to use these technologies to create product differentiation and boost revenues in the global market.

The augmentation of micro-brands across industrial applications will drive the requirement for advanced solutions in the global Digital Printing Packaging Market. The drastic shift in consumer behavior and purchasing patterns is encouraging the brands to offer a wide range of sub-brands to attract a maximum number of customers. These small brands entering the space are certain micro – brands prevalent across a specific geographic location. Such influx of companies will intensify the competition in the market and propel the need of digital technologies. The brands are focusing on rising their visibility by leveraging in-store displays and professional packing solutions. Digital technology allows the brands the opportunity to customize the wrapping as per the consumers' taste, highlight lucrative offers through products, and implement other marketing strategies to maximize their profits. The advent of several online retail stores and e-commerce websites will positively impact the development of the global Digital Printing Packaging Market.

Digital printing makes it far easier to customize packaging and add personalization to products. This trend has been building for a few years, and it has a major industry impact in 2022. Many of the top product brands have explored personalized packaging and found a significant return on this innovative marketing investment. One report cites that 70% of marketers believe personalization has a strong or extremely strong impact on their customers. There's no one-size-fits-all in personalized packaging. In fact, that's the core philosophy behind this trend. Personalization allows a company to promote their name and brand in a forceful way that stands out from competitors.

The **personalized packaging** trend is successful, as it allows individuals to identify with a brand's product. Personalized packaging also takes in a brand's story. When a company presents its package in a story-like way that connects to consumers on an individual level, the product becomes irresistible. Personalization is a top 2022 packaging trend, and it's sure to stay around for a while.

Presenting product information in a **clear and transparent way** is another strong packaging industry trend for 2022. This trend is all about trust and honesty. In today's world, where consumers have so much access to information, they can better educate themselves about product choices. At the top of smart consumers' interest list are what their product choices contain and the packaging methods they use. "Transparency" refers to manufacturers being completely open and honest about what the products contain. "Clean" means products are safe and don't contain harmful ingredients. When a manufacturer packages their product in a way that makes content information clear, concise and open, it promotes trust in the company's brand name.

**Individual store brands and private labels** are an interesting trend for the packaging industry. This move finds many stores offering product lines with a specific brand name unique to that store. It creates in-house brand awareness and local customer loyalty, as opposed to generic brands offered by every competitor. This trend also helps stores compete in the retail landscape, where consumers have a plethora of ways to buy the same products. In 2022, the trend of **bold designs and effects** on packaging remains strong. Many companies recognize how well strong colors, designs and dramatic effects stand out. They also see how well this trend results in increased



sales volume.

Digital printing has virtually replaced stick-on shipping labels in many businesses. Label printing directly on packaging removes one step in the distribution process. **Digital label printing** lowers packaging and shipping charges, and sellers can then pass on those savings to the consumer (2022 Packaging Industry Trends, 2022). Digital packaging label market size is expected to grow at a compound annual growth rate of 13.00% for the forecast period of 2021 to 2028.

Data Bridge Market Research report on digital packaging label market provides analysis and insights regarding the various factors expected to be prevalent throughout the forecasted period while providing their impacts on the market’s growth. Packaging industry will witness an insurrection owing to the rising applications of digital packaging. The concept of digital printing for packaging is specially introduced to attract consumers. This method consists of printing of digital images or text on product packaging (Digital Packaging Label Market 2021-2028, 2021). Digitally produced labels can be applied directly to the product, rather than being applied to the primary packaging and then also to the secondary packaging. This results in cost savings and reduced waste.

According to Lloyd (Lloyd, 2022), digital packaging and labels have a great deal to offer – not only to brand owners, but also to the consumers on the receiving end. Digital print production for packaging and labels has seen exponential growth over the past two years, and it will continue to see a meteoric rise as influencing factors bring new advantages to this method of production. Digital offers the advantages of production flexibility, extremely short runs, improved inks that can even be used in food packaging, higher degrees of automation that save time and money, a reduction in process steps, as well as an ever-increasing range of substrates that are dedicated to digital print. This final benefit came about because it was more cost-effective for substrate manufacturers to make and improve substrates for digital production than for conventional printing.

Inflationary processes, together with the rising prices of electricity and materials and consumables for the industry, supply problems and the decreasing purchasing power of consumers - will have a negative impact on the printing markets in countries of Europe and the world. However, the effect of these unfavorable factors will not seriously affect the digital printing market, but will accelerate the process of digital transformation. Therefore, Smithers expects the volume of global digital printing to grow by 5.8% (CAGR) to 230.5 billion dollars (2032) compared to 136.7 billion dollars (2022) (Pazarite na tsifroviya pechat, 2022).

According to Statista (Coppola, 2022), by 2022, the European printed packaging market was expected to grow across different print processes, passing from 54.5 billion euros in 2017 to 59.9 billion euros. Digitally printed packaging accounted for 1.6 percent of the market in 2017 and was expected to reach five percent of the market by 2022. Nearly all other methods were expected to lose market share (fig.3).

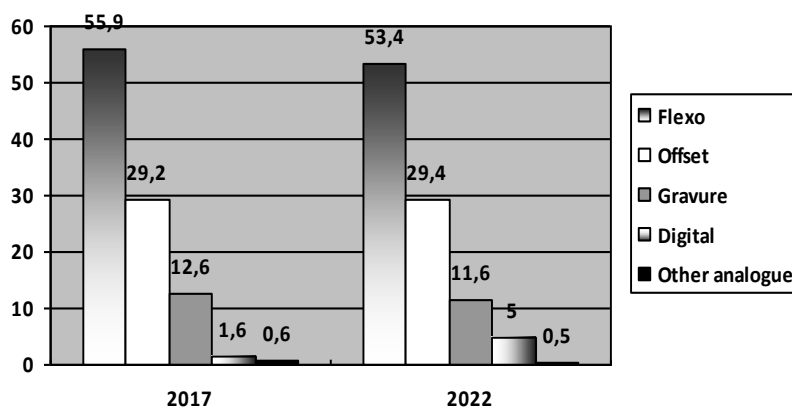


Figure 3. Breakdown of printed packaging market in Europe 2017-2022, by print process, %

Source: Statista, 2022

### Conclusion

Digitalization is already finding expression in all spheres of economic life. The modern packaging industry benefits from the rapid development of technology, innovation mediated by digitalization processes. Competitiveness in the packaging sector requires timely *automation of various technological and finishing processes*. Faced with the opportunity to respond to new consumer demands directly reflected through customization and connected packaging, packaging professionals are applying all the tools of the digital transformation process to their work.

The development of the *Internet of Things, augmented reality, RFID technology and the application of QR codes* and their embodiment in packaging is defining an expected trend in packaging - the production and demand for intelligent (smart) packaging, reflecting **current and future development trends in the packaging industry**.

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