WHITE PAPER

europages

Smart Packaging:

From a simple packaging solution to digital versatility!

01

Foreword

It was long ago that packaging served only for the primary purpose of protecting goods for transport or giving food products a longer shelf life. Digitalisation and innovative technologies have now also made their way into the packaging sector. In „smart packaging solutions“, packaging is additionally equipped with features that go beyond pure protection, containment, and product information. Thanks to the use of sensors, they monitor the condition of the packaging, ensure traceability throughout the supply chain, or remind patients to order a new prescription. In this white paper you will find out more about smart packaging, the technologies behind it as well as the many exciting possibilities for the future. Take a look at the future of packaging with us: enjoy the read!

Content

02

Types of packaging

The European Parliament‘s 1994 Directive 94/62/EU on packaging and waste distinguishes three types of packaging:

The purpose of primary packaging is to contain, store and protect a product. It is in direct contact with the product and must keep it in perfect condition. Primary packaging must ensure that a product can be stored in a stable state and identified according to the regulations in force.

Secondary packaging is a combination of primary packaging. In the case of milk, the individual Tetrapak is the primary packaging and the carton of 6 milk cartons is the secondary packaging. Secondary packaging must be easy to stack and transport resistant so that the goods are not damaged.

Tertiary packaging combines primary and secondary packaging into one large loading unit. It must be strong and allow for the grouping of products. Tertiary packaging must also make optimal use of the storage capacity of the facility and the transport vehicle and be made of robust materials.

03

Smart Packaging: What is it?

In theory, the term „smart packaging“ describes packaging that has one or several extended functions. In general, one differentiates between two types of smart packaging: active packaging and intelligent packaging.

Active packaging refers to packaging that interacts with the container.

They can, for example, extend the shelf life and maintain the quality of the product during storage by releasing certain substances, or absorb a certain substance from the product or its environment. This is possible, for example, through light-filtering materials, the addition of oxygen or ethylene absorbers, antimicrobial surface films or moisture-regulating materials. For example, plastic beer bottles are often fitted with a screw cap containing an oxygen absorber. This absorber removes oxygen from the bottle and thus extends the shelf life of the beer by about three to six months. Packaging films with ethylene absorbers have a similar positive effect: they absorb the ripening hormone ethylene produced by foodstuffs during storage and thus considerably extend their shelf life.

Intelligent packaging is an even more interesting form of smart packaging. Their ‚intelligence‘ is essentially reflected in the fact that the packaging is able to communicate with the outside world. Using sensors and indicators, smart packaging can, for example, monitor the condition of a product and indicate whether threshold values have been exceeded. The retailer or consumer can then see at a glance - for example by the change in colour of the label - whether the cold chain has been interrupted.

Smart packaging

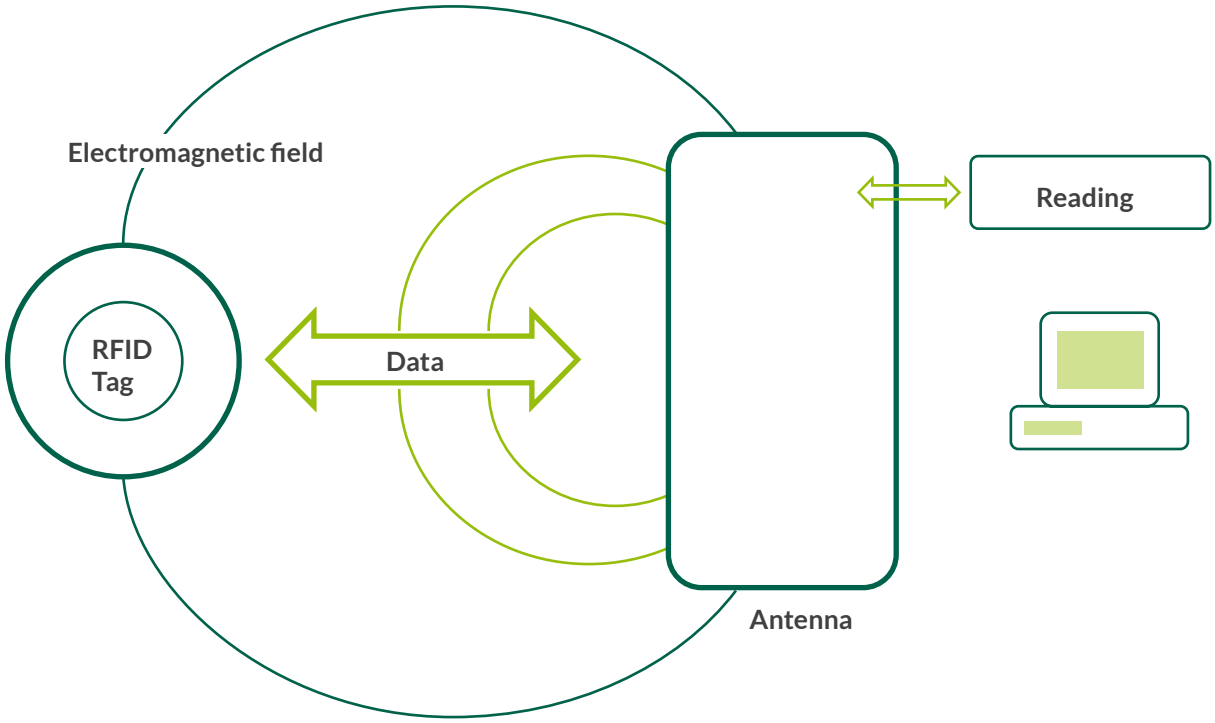
Intelligent packaging can do much more. For instance, RFID chips, close field communications or QR codes are able to provide important information, automation, marketing or protective functions. For example, these technologies allow medicine packaging to record the removal of tablets and to set off an alarm in the event of incorrect dosage or they can even notify the patient‘s doctor. (You can find concrete examples of the use of intelligent packaging in Chapter 7 of this white paper.)

Another exciting part of smart packaging is **extended packaging**, which will increasingly be the driving force behind customer-oriented digitalisation. After the spread of the ‚cheap is smart‘ mentality, more and more customers now want more transparency and information. Today‘s customers want to know exactly where and how their product is produced and whether their various health, ethical or moral requirements are taken into account. This is where Extended Packaging fits in perfectly: barcodes or RFID chips on or in smart packaging allow them to obtain additional product information quickly and easily using their smartphone.
However, with the spread of digital packaging, it is not only information (which may influence purchases) that can be placed directly on the product. Service and support functions or direct order renewal options can also be integrated. This makes Extended Packaging the perfect lever in times when ‚hybrid shoppers‘ first inform themselves online and then buy in a fixed retail outlet - or vice versa.

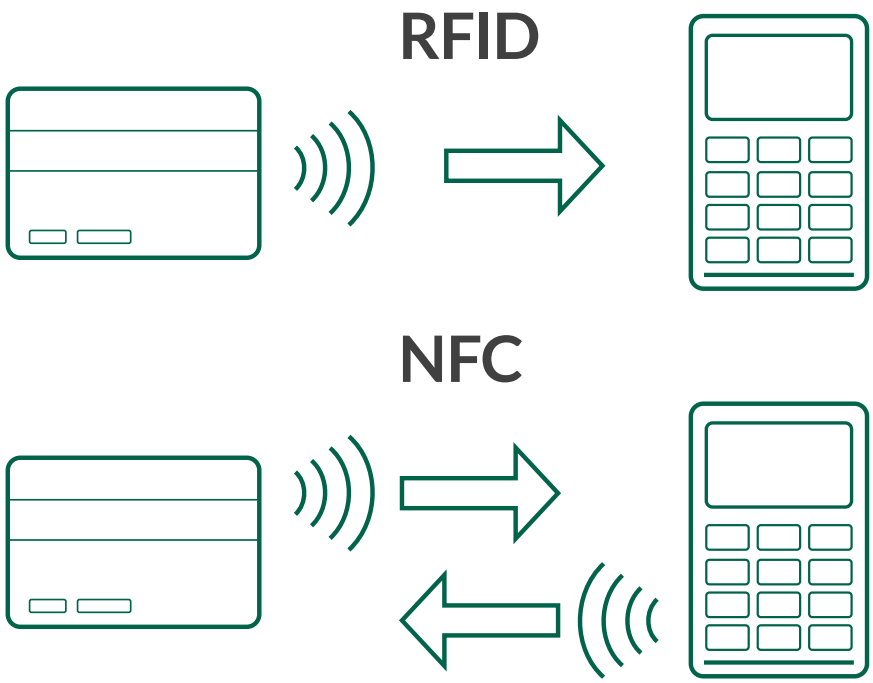
04

Technologies

RFID (radio frequency idenfication) is a technology for reading and recording data without contact. For this purpose, the data does not need to be seen or touched. The data is transmitted solely by radio signal. In order to use RFID, as a rule two elements are needed: a transponder (also called RFID tag or radio tag) and an RFID reader. There are two kinds of transponders: active and passive. Active RFID tags contain an energy source, allowing them to emit a signal up to 100 metres away. Passive RFID tags operate without their own power source. Instead, they are activated by an electromagnetic signal emitted by the RFID reader. The signal is not emitted as far as active RFIDs. This is why passive RFID tags are used more for short reading areas.



NFC (Near-Field Communication) is a standardised specialisation of RFID technology which was developed especially for short distances (max. 10 cm) and secure data transfer. Hence, NFC may be based on the same standards and standardized protocols and also serve the purpose of linking two units (transponder and reading device) for data exchange. However, this interconnection is only possible at close range, on a standardised frequency range (frequency: 13.56 MHz). This makes NFC technology particularly suitable for secure applications, such as contact-free payment. Another important difference to conventional RFID is that NFC technology is also able to write information. This usually requires the interaction of two active terminals, whereas RFID chips are usually only the passive equivalent of an active reader.



QR codes (quick response codes) are black and white cube patterns into which any type of information can be embedded. QR codes can then be read using the camera of a smartphone or tablet. As soon as the code is recognised, the smartphone or tablet displays the hidden information, for example the address of a website or an invitation to a promotional campaign.

Looking for a suitable supplier?
On europages, you can find providers of **RFID labels**, **NFC- technology** and **augmented reality systems**.

05

Advantages

Smart packaging protects against counterfeiting.

Product pirating is a constant threat, especially for manufacturers of brand-name and luxury goods. The financial damage caused by imitation products is only one aspect of the problem. Fraudulent products can also pose serious health threats, for instance if they are imitation medications or the use of harmful chemicals. This problem can be solved by using RFID technology: RFID codes are either printed on the packaging or integrated directly into the packaging. The RFID system then sends an identification signal to an RFID reader, enabling automatic, contact-free communication with the packaging. In this way, retailers can check the current status of their goods within seconds.

Smart packaging protects against theft.

Products with an RFID transponder embedded in their packaging can be accurately tracked at all times. This not only helps to prevent theft in the shops, but also helps manufacturers in supply management, transport and logistics. After all, products can be tracked perfectly throughout the entire supply chain: from the factory to the warehouse and on to delivery to the shops or to the consumer.

Smart packaging ensures transparency.

It is particularly important that perishable goods, sensitive pharmaceutical products or even luxury goods are packed at the right temperature, remain dry and are stored correctly. In these cases, intelligent packaging with its sensors contributes to the protection of the product by continuously monitoring its condition and providing accurate data. In this context, paper and packaging manufacturers are working to further improve these sensors, so that producers and retailers can obtain the data at any time, when they need it - even without a reader on site.

Smart packaging opens up new communication channels.

As already mentioned at the beginning of this white paper, smart packaging is a simple way to make information available to customers (eg. via their smartphone). This is particularly convenient when the packaging itself offers little space for text. NFC technology, which can be discreetly integrated into labels, is often used so that existing packaging does not have to be redesigned. From explanatory videos to digital notifications and advertising actions, the possibilities are vast.

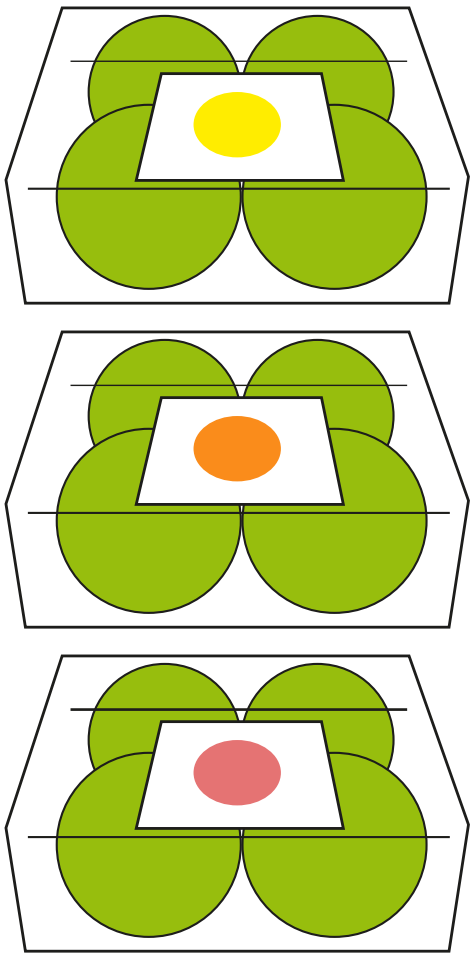
06

Sustainability

“ The environmental problems we face can be solved through advances in technology and changes in the packaging sector. I am absolutely convinced that active and intelligent packaging will bring about significant changes in these areas. Eef de Ferrante, the Director of the World Congress on Active & Intelligent Packaging on Smart Packaging under sustainability aspects.

Sustainability and the integration of intelligent technologies in packaging do not have to be mutually exclusive - on the contrary. Let‘s take a look at the food industry: in the industrial countries of the West, there is an overabundance of foodstuffs; fruit, vegetables and meat are available at any time and at a low price. If the expiry date has passed or its appearance has changed slightly, the goods are often discarded - even though they are still consumable. But with goods, it is also the resources that were used for their production that end up in the bin.

Here, too, active and intelligent packaging can help to control the problem of food and resource waste, for example by showing the actual quality of the product in a concrete way. Smart packaging can also provide the customer with additional and detailed information on how to recycle the packaging and even provide directions to the nearest recycling facility.



Indicators on apple packaging: a color code indicates the quality of the content.

07

Success stories

For the great majority of the packaging industry, the use of smart technologies in the supply chain is not new. Many companies have been using QR codes, RFID tags and microchips for decades to track products during transport from producer to retailer. But in other areas too, smart packaging is starting to be used.

A concrete case was developed in the automotive industry by the German company Knüppen Verpackung: to protect newly manufactured gears and shafts from corrosion damage during transport and storage, anti-corrosion capsules are added to the packages. These capsules release an active substance which is distributed throughout the package, settles on the metal and thus protects it from corrosion.

With the development of new, more economical technologies, intelligent packaging is gradually making its way to the end consumer, as the following examples illustrate:

- **August Faller** a German manufacturer and solution provider for the secondary pharmaceutical packaging sector, had a problem: many instructions were simply ignored. The company developed an intelligent folding box with a small electronic paper display and electronic elements. The folding box automatically counts the number of tablets taken, reminds patients of the correct time to take them and signals when it is time to refill a prescription. An application developed by the company itself allows the doctor or pharmacist to transfer an individual prescription directly to the folding box via Bluetooth.

- Similarly, the wine and spirits sector, which is generally highly regulated, is increasingly opting for smart packaging. In the UK, for example, the coconut liqueur manufacturer **Malibu Rum** has placed bottles of Malibu Rum equipped with NFC tags in several Tesco supermarkets. These allow customers to use their mobile phones to display a nearby bar where they can enjoy other Malibu Rum specialities. In addition, the smart packaging even uses up-to-date weather data and, depending on the weather conditions, offers the customer an indoor or outdoor bar.

- The Franco-German start-up **Living Packets** has developed a smart packaging under the name „The Box“, which should be launched this year. „The Box“ is intended for e-commerce companies and has an integrated camera, a capacity of up to 32 litres, new sensors, a new cushioning mechanism, an electronic locking mechanism and is expected to be reusable up to 1000 times. In addition, „The Box“ has a microphone and speaker so that the sender can send a voice message to the recipient. Online retailers can, for example, also wish their customers a happy birthday with the delivery of their parcel. One can also imagine messages from the sender or the recipient to the delivery person.

- Confectionery manufacturer **Cadbury** is using image recognition technology to turn its chocolate bars into video games. To do this, a code, similar to a QR code, is applied to the packaging of the chocolate bar. The customer then scans this code with their smartphone and embarks directly into an augmented reality game. In addition, players can immediately take part in competitions and other promotional activities on their smartphone screen.

- The security aspects of the connected parcel are the main reasons why the **US Postal Service** is actively drawing the attention of its customers to the advantages of intelligent packaging. For example, the company explicitly promotes the use of NFC technology on its cardboard boxes and shipping envelopes. The US Postal Service tells its customers that NFC technology gives them the ability to confirm the authenticity of a product upon delivery. All the recipient has to do is hold his or her NFC-enabled smartphone near the package. Via NFC, a website opens up on his smartphone where he can immediately register the product. The NFC tag can also be attached to the package so that the customer is immediately informed if someone else tries to open the package.

- For his new album, the American DJ star **DJ QBERT** came up with something special: he decided to apply conductive ink to the cover of his new record. The user can run his or her hand over the surface to produce a sound. The whole thing works like an electronic battery which, as soon as an area is touched, reproduces the sound assigned to that area thanks to the connected audio system. Almost like a printed sound machine.

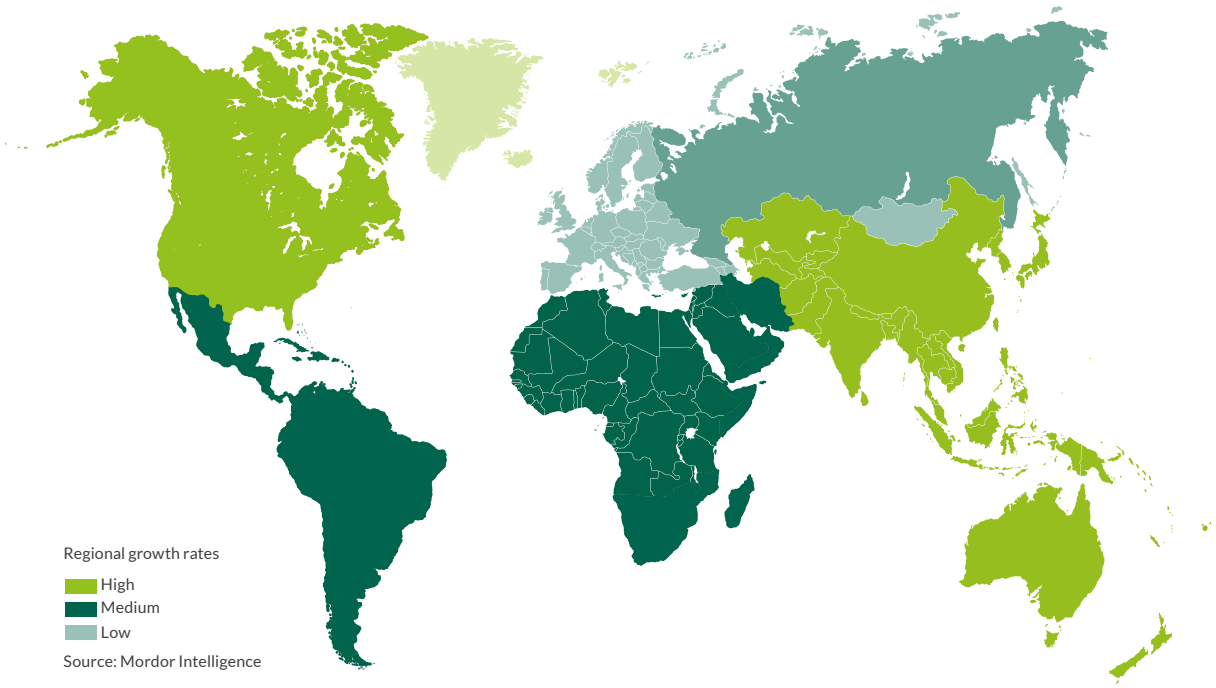
- Already in 2015, **Apple** applied for a patent for a smart packaging technology, which should make it possible in the future to configure devices, while they are still packed in the shop. The technology should work for all devices (laptops, smartphones, tablets, etc.) and make it possible, thanks to a button on the packaging, to start the activation process of the product even before unpacking it.

08

Insights

Data Bridge Market Research recently published an in-depth **study** on the topic of Smart Packaging. According to the study, the global market for smart packaging in 2018 is estimated to be worth 35.33 billion USD. By 2024, the market for connected packaging is likely to reach 44.39 billion USD, according to the study. This corresponds to an annual growth rate of 4.19 percent.

In addition, the study identifies the main trends responsible for this growth. It shows that it is primarily the changing lifestyles of people, due to rapid global urbanisation, as well as the increasing use of individualised objects and services, that is accelerating the growth of the smart packaging market. Technological development in the printing industry is also a driving force for the market.



Smart packaging market: growth rates by region (2019—2024)

09

Challenges

In general, smart packaging is easy to use and offers many advantages. Due to their low cost, barcodes and QR codes are the most widely used today. Indicators and sensors on the other hand - especially in the B2C sector - are still rather rare.

“ The environmental problems we face can be solved through advances in technology and changes in the packaging sector. I am absolutely convinced that active and intelligent packaging will bring about significant changes in these areas.

Sven Saengerlaub, Business Unit Manager at the Fraunhofer Institute for Processing Technology and Packaging (IVV) in Freising.

Furthermore, there is a risk that the use of indicators and sensors, for example in the food industry, may negatively influence consumer behaviour. For example, they might put a product with a coloured freshness indicator back on the shelf and choose a product with an uncoloured freshness indicator. If the customer sees more and more colour-coded labels of a product range, this could even negatively influence his trust in the brand. At the same time, this behaviour could lead to an increase in unsold food products (source: DLG Expertenwissen 2019).

On the other hand, intelligent packaging could optimise the classic FIFO principle („First in - First out“): since the actual quality of the foodstuffs is known, the trader can sell the products with the shortest shelf life first. Food waste could thus be considerably reduced.

Disposal and recycling of smart packaging is also a challenge. Packaging with electronic components must be considered as electronic devices. Due to their autonomous electronic functions, they are subject to the Electrical and Electronic Equipment Act. Since this law takes precedence over the packaging regulation, disposal with household waste is problematic. The recycling potential of packaging can also be significantly reduced by the integration of intelligent and electronically printed components.

And finally, it should also be remembered that product manufacturers should never rely solely on intelligent packaging for quality assurance in the supply chain. Because abuses and failures can never be completely excluded. Environmental conditions, such as light, temperature or mechanical stress, can have a negative impact on sensor technology.

10

Conclusion

At the moment, intelligent packaging is mainly used in the food industry, but it is also making progress in many other areas. However, not all applications are relevant or necessary in all areas. Therefore, for each type of product, it should be carefully examined whether or not intelligent packaging is justified. Furthermore, producers should not be afraid of initial investments: it is not the acquisition costs that should determine the use of intelligent packaging, but the impact that may result.

Contact

Visable S.A.
157 rue Anatole France
92300 Levallois-Perret
France

Phone: +33 (0) 1 41 16 49 14
info@visable.com
www.europages.com

Trade name: Visable Nanterre Corporate
Trade register no B 338 631 930
Managing Director: Peter F. Schmid