

How do you see print products (graphics and packaging) in the circular economy?

Introduction

The world is facing a complex but feasible task – to become greener. This is the needed evolution which has to become our reality in the name of ourselves and the planet we live in and use. Changing our view, we protect the future of the human race from a scenario like in an apocalyptic film. To build a society which puts more effort into the environmental protection, means that we have to be more careful how produce and utilize our energy, how we develop new technologies, how we heat and cool our buildings as well as the transportation we use.

We live in times when the technology is at its peak and it is a part of each aspect of our lives. The century of inexhaustibility, innovation. Robotics, Internet, huge data bases, artificial intelligence, virtual reality, augmented reality, 3D printing are some conceptions which are and will be the center of our fast – changing and progressive world. But with the growing of our world, our responsibility for the environment grows as well.

Young generations are born with “screen in their hands”. They choose the modern technology over the analog ones. The main sectors in the industry, advertising and publishing, are also aiming at digital screens because they offer a wider range of greater possibilities which the paper can’t provide. Although all of the above, the printing industry has a great potential and an answer for this fast improvement – ink jet printed electronics. They are innovative packaging with increased barrier properties, made of environmentally friendly and recyclable materials. The printing industry now has a leading role in the circular economy – a transition driven by the desire for a greater economic and environmental sustainability. This is the best point of view – the industry has to consider the technology as an advantage, not the opposite, in order to change effectively.

I often encounter articles or different opinions of people who think that the end the printing industry has come to an end but me, as a reader connoisseur of physical copies, I don’t share this point of view. In fact, though an increasingly large percentage of our everyday experiences may start out or somehow exist in digital form, none of our interactions with these experiences actually occur in the digital domain. Instead — though it’s very easy to forget — every one of these experiences happen in an extraordinarily high-resolution analog domain (otherwise known as the real world). It’s fascinating to see that more and

more people want to enjoy the analog physical experience that reading a paper book provides them. With the progress of the strategy, the European commission made in March, a new plan for promoting the circular economy has occurred in order to propose sustainable product design and waste reduction. In my opinion, this allows the human – beings and the words “REFUSE, REDUCE, REUSE, RECYCLE” to coexist in a complete harmony.

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1. Print products (graphics) in the circular economy? From Linear to Circular

By entering the Fourth industrial revolution, the new technologies bring a great range of possibilities to transform our ways of making business. They lead to new paths of creating a value in the circular economy both for start – ups and established businesses. To predict trends or anticipate changes on a topic as huge as the printing and packaging industry, the topic needs to be segmented. Here, I will focus further, discussing the state of packaging and printing industry because of its complexity due to the fact that it is directly related to two thirds of the waste generated worldwide. The circular economy, which is regenerating and rebuilding by nature, helps organizations to create more value while reducing their dependence on the scarce resources. Circular business models are well established throughout the product life cycle - including supply chains, recovery and recycling, extending product life and moving from product-based to service-based models. Meanwhile, digital innovations, which are increasingly using the cloud, and 3D printing promise to stimulate additionally the adoption of circular business models in the printing industry. The shift from plastic to polyfoil/polywrap, as well as for the packaging, to paper and cardboard respectively, has significantly increased the demand for sustainable cellulose.

- Print electronics

In times of pandemic and crisis, it is difficult to speak with clear and certain facts about the future of the graphic industry, but we must certainly aim to provide added value to products. This will become reality with the help of the printed electronics and the possibilities they offer:

- **Increased demand for printed electronic products in automotive and transportation (printed sensors)**

Touch control technology and smart surfaces have become a standard in car interior interfacing and here come in handy the printed electronics products. They are widely used in the automotive industry due to their characteristics, including thinness, strength and flexibility. For example, the Belgian company “Quad Industries” has

designed and manufactured a versatile and robust capacitive touch sensor to enhance innovation in the car's interior and exterior surfaces. The sensor is composed of functional inks that are conductive. The distinctive advantage of printed electronics in the automotive industry is that it enables the development of high-quality displays, lighting, and capacitive touch sensors to be embedded in the curved surfaces inside cars, collectively known as in-mold electronics. The increase in demand for EVs and HVs is expected to spur the growth of the printed electronics market.

- **Promising newer applications of printed electronics in healthcare (Printed thin batteries, smart sensors and active clothing).**

Printed electronics have facilitated the development of easily available, low-performance, and cost-effective electronic products in flexible displays, smart labels, smart sensors, and active clothing. They have also facilitated the incorporation of additional functionalities in existing electronic products. For example, in recent years, a smart shirt has been developed to measure respiration and transmit measured data to the patient via a mobile application (remote monitoring). Stretchable conductive inks are spread on thin films using screen printing technology and transferred to a washable shirt. Printed thin batteries play a vital role in making electronic devices used in medical implants and smartcards - they are thin, lightweight, and compact to fit in device packages, made from silver inks. They can track the use of prescribed medications and remind the patient to take their pills, thus saving a lot of medical care costs. These innovations create lucrative opportunities for the growth of printed electronics in the healthcare industry.

- **The inks**

For a long time, the graphic industry has not only multiplied large circulations, but also color separation and formation. Inks have always been a major contaminant in polymers and paper, but research has shown that there are several models for making them more environmentally friendly and easier to recycle.

Inks are one of the key materials used in the fabrication of printed electronics. For instance, graphene ink is being developed to develop low-cost, flexible, water-repellent, and highly conductive electronic circuits.

Water-based inks are increasingly used in flexo and gravure printing. Inks that do not use petroleum-based ingredients play a major role here. Because water-based ink is water-based instead of plastic-based, it tends to fade faster on some types of fabrics. This is the sacrifice of having the best hand feel versus a plastisol print with a higher durability. Water-based ink is much more difficult to cure than plastisol. The printing houses, that are interested in printing water-based ink, must have the drying capacity to remove the water.

Fortunately, energy - efficient systems with UV and Led drying are becoming more and more popular and even cheaper.

The pursuit of bio-renewable inks based on renewable natural resources can also have a sustainable impact. But the more environmentally friendly the substances, the easier the recycling process will be and the more sustainable the process will become.

- **Digital and Hybrid printing**

The development of digital printing and in particular inkjet printing is undoubtedly the future. Digital printing facilitates economic production for smaller print volumes, and variable information options for packaging and label printing.

- ❖ Reduction of raw materials, paper, polymer and combined waste
- ❖ Elimination of plate production, water and waste
- ❖ Reduced power consumption
- ❖ Reduction of hazardous consumables
- ❖ Lower carbon footprint

Hybrid printing aims to combine the capabilities of analog and digital printing technology. From this synthesis, businesses get the high print quality and low cost of flexo printing with the flexibility and fast turnaround time of digital. This highly developed trend aims not to go through different printing sectors for each applied layer, namely through the digital printing sections.

The mass entrance of hybrid printed products as a result of PE production and the crisis that has engulfed the world in the last 2 years has significantly reduced the production of electronic components. It is a great idea for every printing house to have a sector in which to produce some of the consumables.

2. Packaging in the circular economy?

Sustainability matters now more than ever before. For every business, the challenge is to provide products and services that meet the sustainability standards that customers are coming to expect and demand. For this to happen, a lot of investment will be needed to improve infrastructure, to collect, sort and recycle. Much can be written about the trends and developments of the packaging industry. This is an industry that helps and reaches everyone in one way or another.

One of the leading solutions at the moment is to reduce the thickness and number of layers as well as their hardening. From my point of view, new barrier words and coatings should be created and implemented here to replace the old ones, which are quite expensive and not environmentally friendly. This will lead to thinner packaging, with better barrier performance. Currently, such coatings exist, but they are too expensive, difficult to apply in real conditions or interfere with the lamination (gluing) of the individual layers. The creation of multi-layer and combined packaging, which can be easily divided layer by layer during processing, is a direction that should be considered as a basic option and if possible, can be produced in any printing house with the available equipment. We can't downplay the importance of using the right

materials for packaging industry. When it comes to the most sustainable packaging materials.

Commercialization of high performing bio-based plastics (e.g. cellulose, fibre, resins, etc.) is an important trend. New technologies are constantly trying to improve features of bio-based plastics in packaging due to their high potential to replace oil-derived plastic packaging.

Consumers are becoming more aware and demanding when it comes to the sustainability implications of their purchases.

The sooner we manage to find a solution to the problem worldwide, the less time will be spent on the profitability of packaging companies.

What is your vision for print for a sustainable future?

Investing in research and applying it in order to save the planet we live in, must happen as soon as possible. The smooth and promising transition from a linear to a circular economy will be a difficult but cost-effective task by adding value and sustainability to the products that will be produced. The need for packaging will increase significantly over the next decade, driven by factors such as the growth of e-commerce, increased concerns about hygiene and safety from COVID-19. Just as our energy sources will have to switch to net-zero, so our packaging will have to adapt to a circular model.