

DT 1.1.4 Analysis of paper-plastic value chain

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Croatian plastic packaging manufacturers are gathered in the *Association of Plastics and Rubber Industry (UIPG)* of the Croatian Chamber of Economy (HGK). RERA S.D. established cooperation with HGK Split Dalmatia County in implementation of the BIOCOMPACT CE project due to the fact that HGK Split has recognized the significance and importance of the circular economy for its members in a timely manner and is involved in a number of EU funded projects related to this topic.

Plastic industry is one of the few domestic economic activities that is continuously growing in the Republic of Croatia. Manufacturing of semi-finished and finished plastic and rubber products in 2014 amounted to 158,577 tons, while in 2006 it amounted to 96,790 tons, which is a 39 percent increase. In 2016, the plastics industry recorded a production of 198,000 tons.

Since the Croatian market is small, companies in this industry earn the highest revenue by exporting their products to foreign markets, and in 2017 the export of this sector was worth EUR 707 million.

The plastic and rubber sector in the Croatian industry today does not have a large share in domestic gross domestic product and exports, but it shows very high vitality. About 700 companies with more than 8500 workers are registered in plastic and rubber

processing industries in Croatia. Plastic production is performed by 615 companies, accounting for about 5.6% of total registered companies in the manufacturing industry.

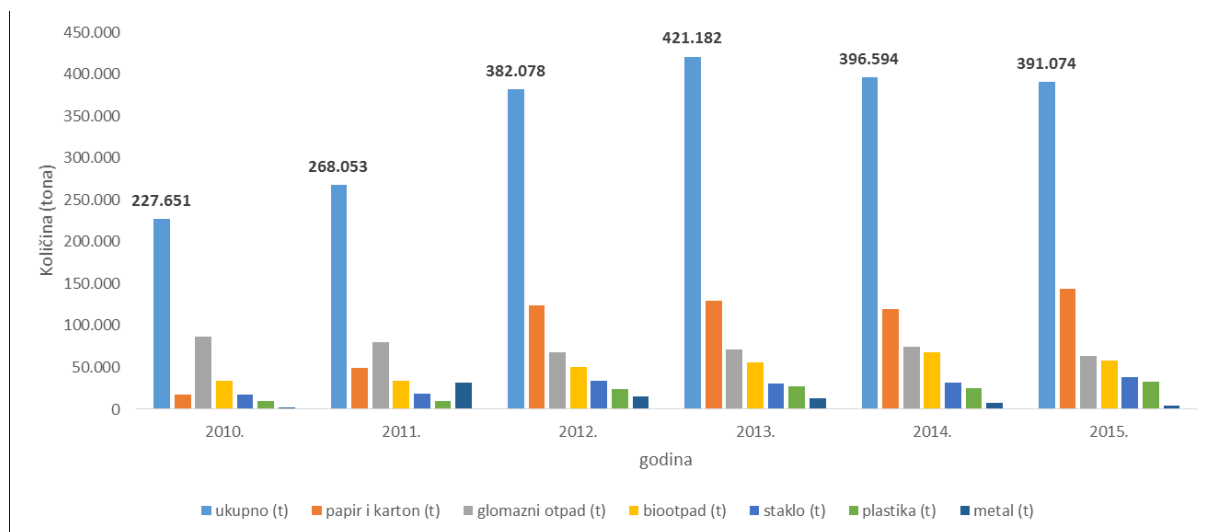
Technological modernization of production process.

Reasons for increased capacity utilization in the Croatian plastics and rubber industry sector in recent years depend largely on the growth of demand in the Central European countries. The market is in any case potent and therefore technological restructuring takes place relatively quickly having as a result a relative business success. However, the need for technological modernization of the production process is continuous and proper timing would be the main driver of the whole sector development. In this sense, certain state incentives have played their part, such as the favorable development credit line of the Croatian Bank for Reconstruction and Development (HBOR).

Waste management.

However, the problem exists in separate collection and quality sorting, which would make possible to obtain secondary raw materials for the production of new products. The most desirable option is recycling, composting and energy recovery of discarded plastics.

Therefore, for the more intense use of plastic and eventually bioplastics in production in Croatia, it is necessary to create the preconditions in separate collection and quality sorting – where mainly the responsibility lies among local self-government units. The problem that Croatia needs to solve to restore raw material to plants is the establishment of a separate collection of plastic waste at home place to get quality raw material that will have market demand. There is a need for cooperation between all stakeholders throughout the value chain, especially between utilities and users of secondary raw materials, which can be recyclers but also the manufacturing industry actors.



Quantities of separately collected municipal waste by category: 2010. to 2015. (HAOP, 2016)

Legislation in Croatia

The analysis of paper-plastic value chain brings us to different types of products (packaging in food industry, packaging in textile industry etc.) as well as different types of actors active within the value chain (waste management companies, product designers etc.).

The existing law and regulations cover the topics separately and this paper provides list of laws and regulations related to above-mentioned types of products and actors within the paper plastic value chain.

List of currently applicable regulations in Croatia concerning traceability (related to food packaging):

Law on General Product Safety (Official Gazette 30/09, 139/10, 14/14) / Zakon o općoj sigurnosti proizvoda (Narodne novine 30/09, 139/10, 14/14)

Food Act (Official Gazette 81/13, 14/14, 30/15) / Zakon o hrani (Narodne novine 81/13, 14/14, 30/15)

Ordinance on the Material Safety of Materials and Objects Contaminated with Food (Official Gazette 125/06, 31/11) / Pravilnik o zdravstvenoj ispravnosti materijala i predmeta koji dolaze u dodir s hranom (Narodne novine 125/06, 31/11)

Law on General Use Items (Official Gazette 39/13, 47/14) / Zakon o predmetima opće uporabe (Narodne novine 39/13, 47/14) / Pravilnik o zdravstvenoj ispravnosti predmeta široke potrošnje te zdravstvenoj ispravnosti i sigurnosti igračaka (Narodne novine 47/08)

Ordinance on the Health and Safety of Consumer Goods and Health and Safety of Toys (Official Gazette 47/08)

List of currently applicable regulations in Croatia concerning packaging and packaging waste:

Regulations on packaging and waste packaging / pravilnik o ambalaži i otpadnoj ambalaži (Official Gazette 88/2015)

Ordinance on Amendments to the Packaging Ordinance and Waste Packaging / Pravilnik o izmjenama i dopunama Pravilnika o ambalaži i otpadnoj ambalaži (Official **Gazette** 116/2017)

Most important companies in the plastics sector in the Republic of Croatia.

Muraplast – one of the leading producer of polyethylene blown film in Croatia. They operate with an annual production capacity of 20.000 tons and employ more than 230 people.

Their main product is extruded polyethylene tubular blown film, mainly been used for the packaging of beverages and food. They also produce industrial bags, pallet covers and sacks, shopping bags with different carrying handles and others products of similar use. Since 2013 their production program has been upgraded with multilayer flexible packaging, and in 2015 they have invested in production of paper packaging and paper bags.

Weltplast – producer of wide range of products, including pressure HDPE pipes, PP pipes for home installation and dressed packaging, industrial films and foils. Weltplast also offers a range of environmentally friendly products, under the EcoWelt brand. EcoWelt® products are completely biodegradable and compostable. Obtained by extrusion process of BASF raw materials. EcoWelt® packaging products fully comply with the requirements of EN 13 432, which establishes criteria for biodegradation and composting, as well as compost quality, and all harmonized with the European Directive 94/62/EC on packaging and packaging waste. Company also has recycling line installed.

EcoCortec – specializes in manufacturing of biodegradable and compostable films. Company offers wide range of products; from collection and retail bages, to high tech barrier and tensioning films under the commercial brand Eco Film, Eco Works and Eco Wrap. Main product line are polyethylene films based on Cortec Corporation's innovative Vapor phase Corrosion Inhibitor (VpCI®) technology used primarily by the automotive industry. Company has a complete technology for recycling of their waste.

Drava International - even in European context, the company is quite large actor in processing the PET packaging. The total amount of plastic collected in Croatia is about 15 thousand tons, but Drava International annually processes about 25 thousand tons. The difference is imported from Serbia, from Kosovo and Bosnia and Herzegovina, and smaller quantities even from Germany. Company's main activity is recycling of PE and PET packaging. Company also extrudes PE films, producing different LDPE, LLDPE and HDPE packaging.

Aluflex - producer of flexible packaging foils and films. Company manufactures mono-layer structures and multi-layer laminations by rotogravure and flexographic printing on aluminium foil and variety of films and papers. Main industries served with flexible packaging either PE or Paper/ PE combination are pharmaceutical industry, human food packaging and confectionary.

Rotoplast - In the area of flexible packaging, they offer the complete product – from design to printing, laminating, slitting, pressing and confectioning, i.e. manufacturing of various types of bags. Serving different industries and covering various packaging applications: coffee and coffee substitutes, confectionary industry, packaging of snacks, sliced and frozen products, meat and dairy.

MEC – flexible packaging converter: manufacturer of films and bags.

Paper Statistics

The European paper industry is a strategic sector, playing an active part in Europe's sustainable re-industrialization. Our natural, renewable bio-based resources and our knowledge of wood and fibre chemistry give us a key role in adding value and creating jobs within a long value chain. The many European sectors that use paper-based products or supply goods and services to the paper industry benefit considerably as a result. At least 82% of our raw materials are sourced in Europe from responsibly managed forests which are more abundant and healthier now than they were 40 years ago .

Paper and board production in Croatia increased gradually until 2008 but suffered significantly from the economic crisis in 2008 and 2009, along with most industrial sectors. Croatian pulp and paper production in 2012 continued to be affected by the economic slowdown that began in mid-2011. Statistics show decrease in the number of enterprises in the manufacture of paper and paper products industry in Croatia from 2008 to 2016. In 2015, there were 301 enterprises manufacturing paper and paper products in Croatia. Statistical data for 2017, according to National Classification 1711 - Manufacture of Pulp show 38 911 metric tons produced in Croatia, 1712 – Manufacture of Paper and Paperboard 214 905 metric tons, 172 – Manufacture of Articles of Paper and Paperboard 369 542 metric tons. There is one large company in the industry (DS Smith Belisce Paper Mill), some fifty medium size paper and board converting plants with the rest being small or micro companies. In 2015, the paper manufacturing sector in Croatia employed a total number of 4,209 people showing almost constant decrease since 2009. The revenue of corrugated paper & paperboard manufacture in Croatia from 2009 (sharp drop following 2008 crisis) to 2014 have been growing and have reached 200 million EUR in 2015.

Croatia exports over 90% of its paper recyclables, Austria is the greater importer of Croatia's waste. The concept of recycling was implemented before the infrastructure to manage it properly. Pan Papier and DS Smith are one of the few companies who process paper in Croatia.

Main companies in the sector:

DS Smith Belisce Croatia –Corrugated case materials produced by DS Smith Belisce are supplied to the packaging industry for conversion into corrugated board and boxes. Corrugated packaging has one of the highest recycling rates of all materials – helping to make it a truly sustainable packaging

solution. DSM Smith Belisce produces speciality papers for many different industries including construction, tissues, food manufacturing, stationery and education. Belisce currently operates 2 paper machines, and has an annual production capacity of 225.000 tons.

Dunapack Valoviti Papir – member of Prinzhorn Holding is present on Croatian market from early 90's. Market leader in recycling, paper and packaging in the region. Factory is making business sales of 94 Mio m² corrugated products per year (data from 2014).

PAN, Tvornica Papira Zagreb – producer of all types of cardboard sheets and finished cardboard packaging. Paper is produced by recycling of waste paper. PAN is the only producer of white packaging papers in Croatia. They collect waste, packaging cardboard and paper in Zagreb, and use it in paper production. 30 % of produced packaging paper is processed into corrugated cardboard and 70% is exported as a finished product.

Flexible and/or corrugated packaging:

Model Pakiranja - Producer of transport packaging, displays and special packaging made of cardboard and corrugated board.

Biokalnik IPA – producer of cardboard boxes, serving primarily food industry.

Istragrafika – main product categories produced by Istragrafika are flexible packaging (45%) and cardboard packaging (40%). Main industries they serve: food industry, confectionary industry (Kras Zagreb), cosmetic industry, tobacco industry and crystal industry.

Jaškapack – company has BHS line for the production of corrugated board installed at the factory with the annual production capacity of 35 000 tonnes. They produce seven-layer corrugated boards and microflute board. In Croatia, they are the only producer of waterproof packaging. It is the so-called contact box for packing liquid industrial grease.

Grafičar - flexible packaging manufacturer for number of industries: food, pharmaceutical, cosmetic, tobacco and metal. They also produce labels for beverage industry, paper bags and office paper stationary.

Bioplastics in Croatia

Field of bioplastic materials in the Republic of Croatia is at a very early stage. Croatia's innovation performance over the last decade has fallen short of expectations. Based on information from HGK (Croatian Chamber of Commerce), there is no possibility at this moment to identify bioplastics manufacturers through existing official bases. Namely, producers and production of semi-finished

and finished products are monitored by the NKD¹ for all polymers. The production of the polymer is monitored according to the type of material but unfortunately the production of biopolymers in the Republic of Croatia for now does not exist according to official data and statistics. However, there is a production of biopolymer bags produced by companies Weltplast, EcoCortec and Mi-plast in Croatia.

The innovation system is operating below its potential, whether measured by the system's inputs, outputs or by the contribution of innovation to economic growth. Croatia is significantly below EU-average in innovation and belongs to a group of countries considered as moderate innovators. There are two major companies at the market that produce biodegradable films and foils, EcoCortec in Beli Manastir and Weltplast in Odra / Zagreb. In its production program, Eco Cortec offers products based on three types of biodegradable polymers – PLA, PHA and fossil-based biodegradable polymer, while Weltplast works with BASF biodegradable polymers. EcoCortec and University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture have been involved in the CIP Eco-innovation project, funded by the European Union – MarineClean (Marine debris removal and preventing further litter entry), with the scope of developing plastic packaging material, degradable in seawater.

Bioplastics are on the rise and will continue to capture a larger share of the plastics industry year after year, and the same is forecasted for the Croatian market. [Grand View Research](#) stated bioplastics controlled less than a 2 percent share of the plastics industry in 2015. They predict bioplastics will control a 5 percent market share of the total plastics market by 2020 and a 40 percent share by 2030. The main drivers for these predictions are based on consumer demand, corporate vision, practicality of design and costs. Consumers are becoming more aware of the dangers petroleum-based plastics and the benefits of sustainable plastics.

For the period 2014-2020, Croatia has been allocated EUR 10.6 billion from the European Structural and Investment Funds. There are several programs targeting investment in the latest equipment for SMEs. Mi-Plast d.o.o., company based in Rijeka, Croatia is currently in the phase of significant investment of 1.5 million EUR in a new facility. Their product range will be wide and varied and will be entirely based on bioplastics. Company's main activity is the processing of LDPE and HDPE materials, bio polymers, packaging and production of these materials, as well as regeneration and recycling of these materials. The products obtained by processing of polyolefins and bio materials are mainly used in the construction sector, agriculture and in retail sector. These products are: agriculture mulch, shopping bags, garbage bags, construction film foils, laminated foils etc. The company is placing its products mainly to the countries in the South Eastern Europe, Slovenia and Italy. MI-PLAST provides agriculture products to public institutions in the field of agriculture and to private companies. The company markets its products through its retail stores (field sales) and by

¹ NKD-Nacionalna klasifikacija djelatnosti (eng. National Classification of Economic Activity)

direct contact with customers. Also we have to mention that Mi-Plast company is one of the founders of first Center of competence Rijeka for bio economy and biotechnology. Optiplast, family company from Odra, is another company that has received EU funds and invested in new equipment for production of biodegradable bags, mainly targeting western European markets.

Sustainable environment in Croatia has strengths in energy related areas while also being very strong in other environmental areas important for sustainable growth: tackling climate change (affects food production and bio-economy, quality of life, tourism, etc.); water resource management (drinking water, waste waters); clean air protection (health and quality of life); control of other environmental conditions (rivers, Adriatic sea, soil). Croatian Environment and nature Agency (CENA) as an independent public institution controls environment by monitoring water, sea, rivers, air, climate changes, soil, nature, sector impacts, waste and general issues. The Agency is a focal institution in charge for collecting, integrating, and processing all environmental data².

Important prerequisite for bio potential and part of the knowledge-based bio-economy (KBBE) will be to provide solutions and products for efficient collecting, compacting and discharge of municipal and selected **waste**.

Regarding the level of cluster development, CCCs that contribute to raising competitive value of this thematic area are: (1) Food processing CCC and (2) Wood processing CCC. Further development of relevant CCCs (Food, Wood and Chemical, Plastic and Rubber CCC) will contribute to raising competitiveness of this thematic area and to promoting cooperation between the public, private and science sector with the aim to create bioeconomy value chains, which produce goods, services and solutions sustainably, with more efficient use of resources and through clean technologies.

Conclusion

Industry in general.

The conclusion that arises from the above-mentioned data related to the plastic, bioplastic and paper industry in the Republic of Croatia is that the industry is still facing challenges related to the modernization of the existing technological processes and necessity to follow and anticipate the innovation challenges.

² CENA runs the database of documents on sustainable development and environmental protection.

Related to the value chain, the major problems/obstacles that were pointed out during the workshop carried out in May 2018 in Split (RERA S.D. together with HGK Croatian Chamber of Commerce) referred to the lack of sufficient quantities of raw material but also lack of good and active relationship with the academic community as well.

Additionally, the participants pointed out the need to communicate and cooperate among broader scope of included sectors (trade, waste management companies, product designers in packaging industry).

Packaging waste.

As far as the packaging waste management is concerned, the implementation of the rules laid down by the *Ordinance on packaging and packaging waste* in Croatia represents the first step in the concept of integrated waste management. However, it will greatly contribute to the reduction of waste collection at landfills and will generate large quantities of raw materials that can be used as quality secondary raw materials in another production process.

Entrepreneurship.

In the perspective of possible interest of local entrepreneurs for their entrance in bioplastic production and/or usage of bioplastic in their production, there is an interest shown during the workshop carried out for the territory of Split Dalmatia County together with HGK. The companies confirmed that the idea of inclusion within the pilot activities in BIOCMPACK CE projects is interesting and appealing although they need additional information. In order to assess the readiness and possibility to offer and adjusts the existing machinery and/or to join the pilots, all companies confirmed that they need additional information related to technical specification of the material and availability at the market together with accompanying parameters (price and possible implementation within the exiting technological processes).