



DELIVERABLE D.T1.2.3 "FIRST VERSION OF STRATEGY DOCUMENT_REV2"

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BACKGROUND CONTEXT

The development of sustainable packaging solutions is one of the most important challenge for the European society. Packaging needs to meet new consumers' demand with respect to functionalities, new life styles and at the same time reduce its impact on environment.

The new recent revision of EU directive 94/62/CE enhanced the recycling target for most of the packaging materials giving even more relevance to proper end-of-life options. Furthermore, **environmental, social and economic challenges focus the needs for a sustainability transition towards a circular bio-based economy**. In this context, **paper and bioplastic packaging products may play a strategic role**.

As a matter of fact, paper and bioplastics raw materials share some important features:

- They are produced from renewable bio-based resources
- They are recyclable (material recycling or organic recycling)
- They are biodegradable and compostable

Presently, conventional plastic represents a large share of the total materials used in packaging applications with a low recycling rate. Consequently, a gradual replacement of this material with paper and bioplastic will help (i) decreasing the amount of not-renewable fossil-based products in the market (ii) enhancing recycling options (iii) reducing the release of not biodegradable microplastics into the environment.

The best ecological solution in paper/plastics composites is represented by the use of renewable raw materials (bio-based) – paper/biodegradable plastics is taken as fully biodegradable and compostable material whereas paper/not-biodegradable bioplastic may be recycled in specialised paper recycling mills.

Recently, biodegradable compostable packaging has quickly become an essential part of the global packaging market. The demand is increasing and will continue to increase as the companies utilize packaging like a mean to protect and promote the safety of the environment along with their products. **In the context of current waste management applicable solutions**, compostable packaging products with a short life cycle, such as food contaminated packaging (e.g. wrapped foils and bags) and articles intended for a single use (plastic cutlery, trays, cups, jars, food thermo-boxes, etc.) may be organic recycled in composting plants, particularly, in the framework of "a closed loop", in communities (e.g. schools), or in organizations, where it is easily manageable handling paper/bioplastics products avoiding contamination with conventional plastic.

BASIC CHALLENGES

Faster development of innovative paper, bioplastics and paper/bioplastic multi-materials to replace plastic packaging:

- Eco-design of paper/bioplastics multi-materials products shall aim to keep industrial recyclability
- Paper is inherently biodegradable in compost and marine environment. Biocomposites made of paper/bioplastics shall aim to maintain these properties.

Acceleration of all bio-based plastics development is necessary to reduce costs of sustainable products:

- Non-biodegradable (presently BioPP, BioPE already exist while BioPET is partially bio-based)
- Biodegradable (presently PLA, TPS and PHA)

Conventional plastics have to be separated from bio-based biodegradable plastic waste with high efficiency to lower the impact during organic recycling

- Labelling system have to be improved
- Legislation and policies have to be modified (created)
- Composting of biodegradable bioplastics must be readily available

Bio-based paper/bioplactic multi-materials shall be recycled in paper mills as much as possible to recover fibres

- Promote development of suitable infrastructures (collection and recycling mills)
- Promote recyclability standardization for multi-materials to limit recycling constrains

CURRENT CRITICAL ISSUES IN THE VALUE CHAIN

PERFORMANCES/PROPERTIES/FUNCTIONALITIES MATERIALS

Properties of biodegradable bioplactic and biopolymers are not yet fully comparable to oil based material, mechanical and/or functional properties of the bio-based packaging products shall be further developed against the current state-of-the-art in the field.

AVAILABILITY OF RAW MATERIAL AND TECHNOLOGY OF CONVERSION PROCESSES

Bio-based Not-biodegradable bioplastics are available at higher costs. Few biodegradable biopolymers are already available at commercial scale (TPS, PLA, PHA), their processability is relatively good for their conversion into bioplastics, on the contrary there are still not many companies processing paper and bioplastics in composites.

COSTS/MARKET

Cost of biopolymers and bioplastics are still much higher than conventional plastics. Furthermore, the use of bioplastics in combination with paper to achieve greater functionalities (barrier, transparency) leads to increase costs in comparison to mono-materials. Often, the present small niche market does not allow sufficient returns.

WASTE COLLECTION SYSTEMS AND PRODUCTS END OF LIFE

Currently, waste collection systems are not optimised for multi-material packaging. The presence of specialised paper recycling mills capable of treating these materials is scattered or not present at all in some CE countries. Composting infrastructures are not yet widely spread in several countries. Organic waste collection is still highly contaminated with conventional plastic even in countries adopting strict legislations (e.g. Italy). Compostable packaging is not easily distinguishable from conventional plastics leading to high contamination.

The fast development of integrated anaerobic and aerobic digestion industrial plant in some countries poses additional constrains to the acceptance of biodegradable compostable packaging in composting plants due to the fact that bioplastics are often recalcitrant to anaerobic digestion.

LONG TERM VISION TARGETS

Industrial leadership in bio-based products

Innovative production technologies and increased market share will reduce overall cost of the products and the gap in comparison to conventional plastics.

Paper and bioplactic producers will develop a full range of materials acceptable for different end-of life options (material recycling, industrial composting, home composting, anaerobic treatment)

The entire bio-based industry supply chain, from material producers to converters, will engage greater alliance to develop sustainable packaging solutions to fulfilling new consumer needs.

Circular bio-based economy

Separate collection as well as low costs infrastructures such as aerobic composting plants will grow in all CE countries.

Anaerobic digestion plants will develop technological solutions to efficiency process biodegradable bioplastics and paper based biodegradable multi-materials.

Material sorting will take advantage of automation both in advanced collection platforms and recycling mills.

The capacity and technologies of specialized paper recycling mills treating multi-materials will increase leading to better environmental performances (reuse and refining of side streams).

The development of bio-additives and bio-coatings will further enhance the sustainability of bio-based materials by increasing the performance of mono-materials thus reducing recycling constrains.

Policy regulation development

Greater environmental awareness of younger generations will improve the acceptance of the higher costs and drive stricter regulation on packaging waste management.

Calculation of social costs and Corporate Social Responsibility will be an important driver.

GPP will play a central role for some years to come promoting the market of bio-based recyclable packaging

MID TERM ACTIONS AND SUPPORTING MEASURES

In the mid-term the main priorities are seen in the following areas:

- Further development of the Innovation system (R&D funds at local level for SMEs)
- Greater alliance of paper and bioplastic actors in the context of the EU bioeconomy strategy
- Improve technical Communication among stakeholders of paper-bioplastics value chain
- Increase the level of education and communication up to final consumers
- Create new market opportunities based on social responsibility (e.g. replacement of single-use plastic products in closed communities such as schools, public buildings etc.)
- Promote GPP regulation to facilitate the creation of buyers' groups thus increasing opportunities at local level
- Develop local infrastructures for collection, recycling and composting thus creating job opportunities

The above mentioned priorities can be further detailed as following:

INNOVATION SYSTEM

- Improve production processes of raw materials and additives decreasing costs and enhancing the amount of bio-based content in final products.
- Innovation in transformation technologies (i.e. plastic extruders, thermoformed products, biobased coatings) to guarantee proper performances according to consumers' need.
- Supporting innovation in SMEs intended to create new services and products across Central Europe.
- Set-up of co-innovation partnerships alongside existing and new value chains

VALUE CHAIN AND COMMUNICATION

- Spread awareness about sustainable production of bio-based products among associations, industries, Public bodies, entrepreneurs and stakeholders from the civil society.

- Enhance the reliability of sustainability certifications and standards through further development of fit-for-purpose sustainability scheme, including standards, labels and certifications for bio-based products.
- Expanding the adoption of life-cycle methodologies (LCA, LCC, S-LCA) bio-based products among decision makers in public bodies and private companies
- Finding suitable application system/case studies capable to emphasise ecological benefits of bioplastics and paper/bioplastic bio-composites.
- Encourage market pull for bio-based products through the assessment of consumers' preferences and acceptance.

POLICY REGULATION FRAMEWORK & MARKET

- **Integrate scientific and engineering approaches with social sciences and humanities-based approaches** in order to formulate guidelines for a common framework promoting the development of regulations and standards to support the adoption of business innovation models in the bio-based products sector.
- **Perform scenario analysis at regional level** in order to support the development of a common framework to achieve harmonized policy regulation.
- **Public procurements regulations** shall be used to exploit the potential of public procurement to foster innovation, developing tools for purchasers thus facilitating the creation of buyers' groups. The increase awareness and incentives may lower the barriers to purchasing thus leading to the opening of **new markets** of bio-based products in Central Europe.
- **Create a new cross-sectorial interconnection** in bio-based economy clusters linking to the complete value chain, from bio-based raw material to end-users with the aim to create new services and products.
- **Promote current applications of paper/bioplastics systems in closed communities** (hotels, hospitals, schools, administrative buildings etc.) –according to smart cities concept - taking into account and developing local recycling infrastructures.
- **Open new markets for new applications** for biobased/biodegradable packaging calculating **costs** of new materials on a life cycle basis compared to current materials.
- **Support creation of knowledge centres** gathering data from stakeholders and research community thus providing access to relevant information for markets and products innovations in the bio-based packaging supply chain.
- **Support new companies accompanying converters** to develop and integrate bioplastics/biomaterials into packaging products.

WASTE COLLECTION SYSTEMS

- Promote material recycling of paper/bioplastic products not contaminated with food in the paper industry based on standard recyclability assessment of multi-material products.
- Develop suitable locally based collection systems according to local infrastructures
- Develop low cost composting infrastructures in all countries to accept biodegradable/compostable food contaminated packaging products
- Avoid dragging effect of conventional plastic into composting plants through clear labelling and consumers' education.