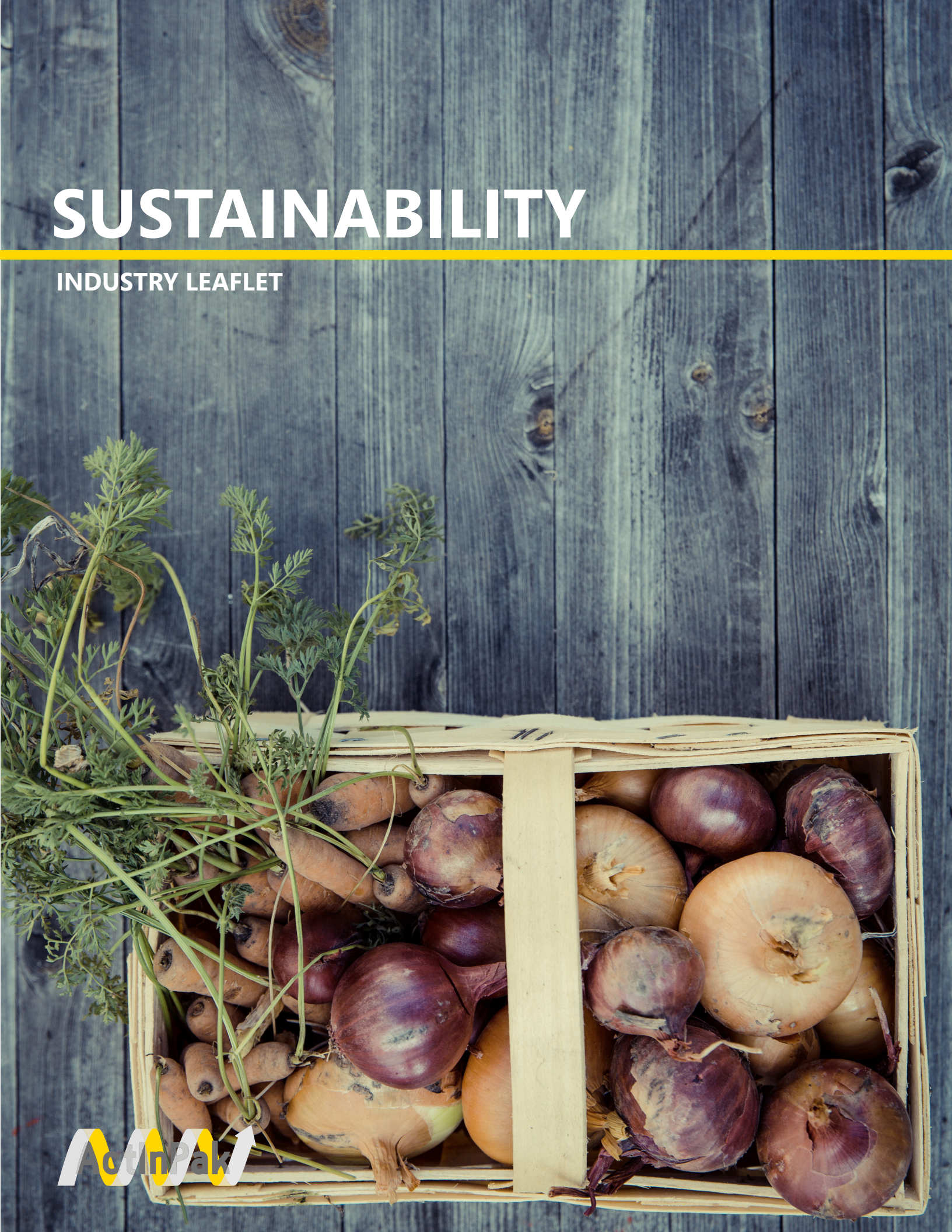
SUSTAINABILITY

INDUSTRY LEAFLET



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INTRODUCTION

Traditional definition of sustainable development was developed by the Brundtland Commission in 1987. It states that sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development comprises three elements - economic, social and environmental - which have to be considered in equal measure in a whole life cycle of given product, service or economic process.

Active and Intelligent packaging solutions tackle sustainability in a variety of interesting ways, depending on where the interaction takes place in full packaging value chain.

This leaflet explains various sustainability aspects and benefits and challenges related to active and intelligent packaging.

ACTIVE AND INTELLIGENT PACKAGING AND SUSTAINABLE DEVELOPMENT

WHAT IS ACTIVE AND INTELLIGENT PACKAGING?

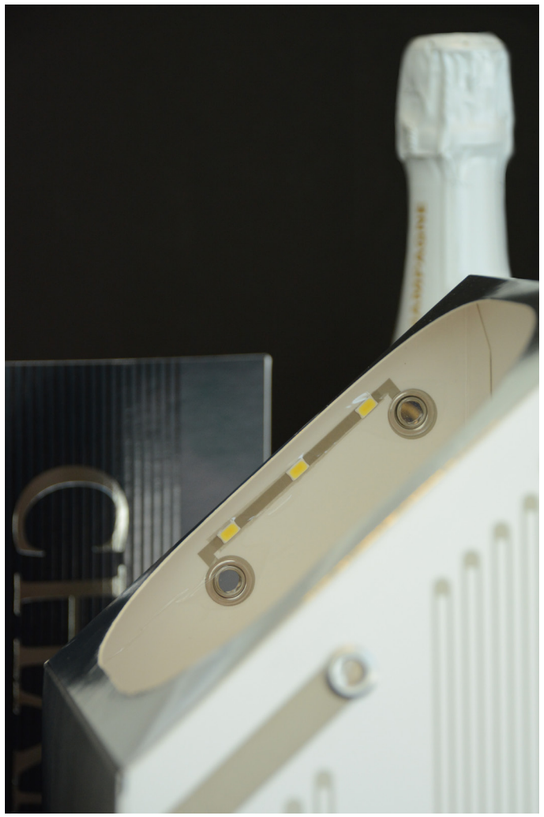
Active packaging is intended to extend the shelf life or to maintain or improve the condition of packaged food. It is designed to deliberately incorporate components that would release or absorb substances into or from the packaged food or the environment surrounding the food.

Examples of active packaging:
- Oxygen, moisture or ethylene scavengers
- CO_2/antioxidant emitters
- Adaptors

Intelligent packaging refers to packaging systems that can inform and/or interact with the consumer about the quality, nature or production history of the packed product.

Examples of intelligent packaging:
- Oxygen sensors
- Temperature and time-temperature indicators
- Freshness indicators
- Interactive packaging

See our leaflets on active and intelligent packaging for more information.



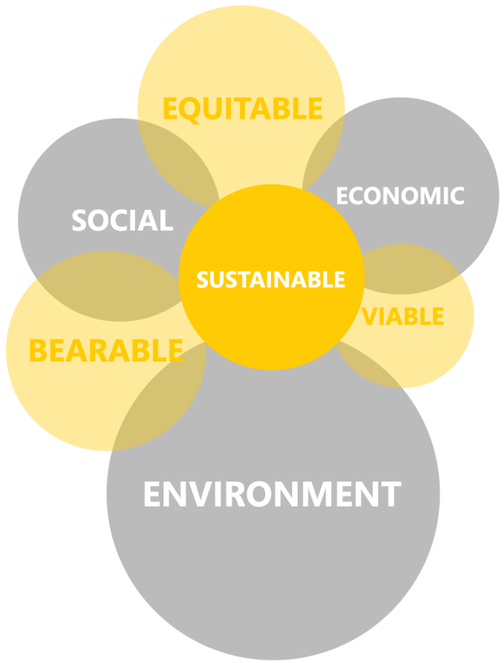
ACTIVE AND INTELLIGENT PACKAGING AND SUSTAINABLE DEVELOPMENT

SUSTAINABLE DEVELOPMENT?

Traditional definition of sustainable development was developed by the Brundtland Commission in 1987 in a report 'Our Common Future'. It is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development thus comprises three elements - economic, social and environmental - which have to be considered in equal measure at the political level.

For business concept this definition consists of taking into consideration widely understood economic, environmental and social issues in the daily and long term operations of a company. In packaging industrial practice that means being responsible for the introduction of new packaging on the market from the perspective of those three issues. This means that packaging should be evaluated with regards to environmental, social and economic impacts it generates. This evaluation, which gives equal rank to all three elements, should be performed in whole product life cycle stages (designing, manufacturing, using, recycling).

This fulfilment has to be present in all product life cycle stages, starting from production process, delivery chain, demand for sources, processing methods, packaging, distribution, usage and waste management including transport. At the same time companies should try to match up or exceed their competition by offering better functional and quality properties of their products, fulfil environmental protection standards and also better contribute to waste management system.



SUSTAINABLE PACKAGING?

Widespread use of fast moving consumer goods and its packaging causes a noticeable increase in environmental burdens - the consumption of natural resources, emissions during production, as well as the need for management of increased waste. Increasing public awareness, more stringent legal regulations and the development of knowledge about the environmental impact of products, makes the protection of the natural environment and sustainable development a significant trend in the current climate.

Active and Intelligent packaging in all its forms and applications can be very beneficial from the perspective of sustainable development – especially when its functions improve, enhance or extend the shelf life of the packed product. There are however a number of challenges that have to be considered and addressed.

Although there is currently no standardised tool or method to assess whether a packaging is truly sustainable, there are many good practices of sustainable production.

According to the sustainable packaging coalition, a sustainable packaging:

- is beneficial, safe & healthy for individuals and communities throughout its life cycle
- meets market criteria for both performance and cost
- is sourced, manufactured, transported, and recycled using renewable energy
- is manufactured using clean production technologies and best practices
- is made from materials healthy in all probable end-of-life scenarios
- is physically designed to optimize materials and energy
- is effectively recovered and utilized in biological and/or industrial closed loop cycles

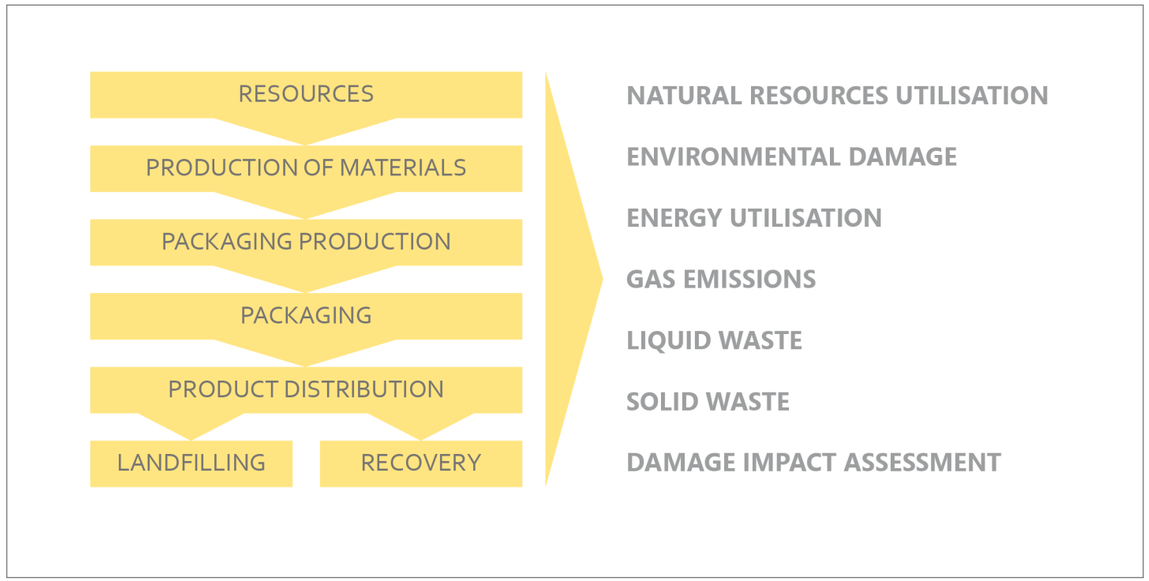
The following chapters of this industry leaflet provide a list of different assessment criteria and concepts that can be used to consider sustainability of active and intelligent packaging within its three main pillars – environment, sociology and economy. Each criteria and/or sets of criteria may be applicable to different packaging applications.
In order to evaluate sustainability as objective as possible it is important to choose as many fitting criteria as possible.

ENVIRONMENTAL ASPECT OF SUSTAINABILITY

LIFE CYCLE ASSESSMENT (LCA)

LCA is a method that can be used to rate and compare a product with another product of similar functionality, in terms of its environmental impact throughout its life cycle. LCA method consists of different criteria of evaluation in all life cycle stages of a selected product. LCA study can present full view on specific products influence on the environment starting from mining of resources, ending on recycling or waste treatment.

Potential environmental influence of every life cycle process of a chosen product is quantitatively recorded in categories such as: health, ecosystem quality and resources consumption. Potential impacts that a given product can have on an environment are: carcinogenic factors, organic and inorganic compounds emission, climate changes, radiation, ozone layer damage, ecotoxicity, acidifications/ eutrophication, terrain usage, natural resources and fossil fuel consumption.



Simplified process tree of a packaging, with examples of environmental threats that can occur throughout the life cycle. (Source: COBRO)

RESPONSIBLE RESOURCES USAGE IN MANUFACTURING

Current extensive exploitation of non-renewable resources (coal, oil, natural gas) will one day result in their final depletion. This in turn could have a catastrophic effect for future generations. That is why, according to the sustainable development policy it is recommended to try to utilise less materials in product applications and use renewable resources whenever possible.

With regards to the responsible usage of resources another important issue is the greenhouse effect and greenhouse gases emission from production. An indicator called "Carbon Footprint" shows total greenhouse gases emission produced directly and indirectly in all life cycle stages of a given product. Usually the indicator is given in tons or kilograms of carbon dioxide equivalent gases.

MEETING HIGHER REQUIREMENTS

…than set by current law, including non-obligatory environmental protection certification

There are many non-obligatory environmental reporting and certifications systems in existence in EU.

For example:

- Life Cycle Assessment (LCA) – standardised tool for evaluating environmental sustainability within whole life cycle of a given product (ISO 14040)
- Product Environmental Footprint (PEF) (http://ec.europa.eu/environment/eussd/index.htm)
- Tools for environmental management and certification (EMAS) (http://ec.europa.eu/environment/emas/index_en.htm)
- Tools for sustainable design (e.g. eco-design).
- Ecological footprinting (carbon footprint, water footprint)
- Other non-obligatory environmental certification systems

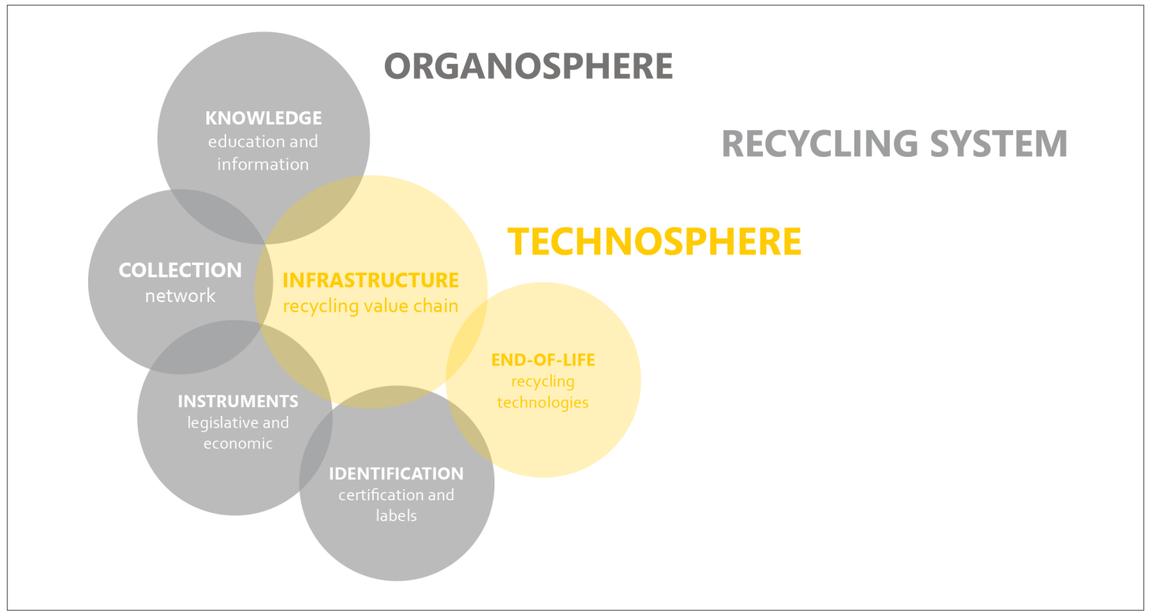
SOCIAL ASPECT OF SUSTAINABILITY

WASTE COLLECTION SYSTEM EXISTENCE AND RECYCLING AVAILABILITY

When introducing new products on a market we should consider waste collection systems and recycling methods availability in the region. A product can be sustainable from the point of view of environment, but when it turns into waste it can become a problem if end-of-life treatment is not supported in the region.

Active and intelligent components of packaging can for instance have in some cases negative social environmental impact when its recovery is not ascertained.

Figure below presents organisational and technological spheres that a working recycling system should have. When introducing a new product on a market it is worthwhile to study this model and identify how each circle is represented in a target market.



Recycling System model. (Source: COBRO)

CUSTOMERS KNOWLEDGE AND EDUCATION LEVEL

Approval of new technical and technological solutions by society requires high level of customers awareness which depends on capital and education expenditure.This factor depends on knowledge level and awareness of society and can be influenced by marketing/PR actions and educational schemes on different levels (school/university modules, seminars, conferences etc.)

FULFILLING CUSTOMERS' EXPECTATIONS

According to current marketing trends products and packaging should offer attractive look, high usage comfort, ergonomic shape, durability, etc. In other words the race for sustainability should not reduce aspects that are appealing from the point of view of end consumers. In order to support this step, various types of market research can be used.

SOCIAL EFFECTS EVALUATION – HIDDEN COSTS OF END-OF-LIFE

Decisions made in microeconomic scale by producers and customers may cause an occurrence called "the external effect" or "the social effect". Depending if an action causes an advantage or a disadvantage we identify:

- positive social effect (social advantage)
- negative social effect (social cost)

Positive social effect happens when producers or customers actions cause advantages for society as a whole. For those advantages producers and customers are not directly recompensed for.

Negative social effect occurs when a producer or customer creates extra costs for the society as a result of their decisions, and at the same time they do not bear any cost himself. Those costs are called "social costs".

ECONOMIC ASPECT OF SUSTAINABILITY

DEMAND FOR AIP

Launching a new product on a market, and determining its price should be of course based on the total costs of manufacturing, including all material costs. This however should be based on the market analysis of potential consumers on specific output market.

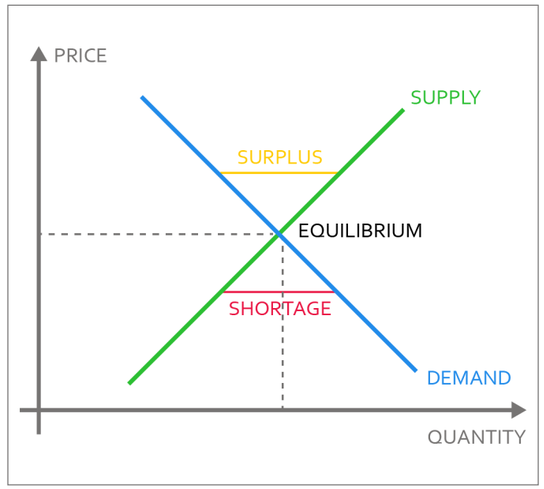
Graph shows a typical economic supply and demand curve which shows the areas of shortage and surplus – i.e. when more products are demanded that are supplied, and where more products are put on the market than demanded. When there is either a surplus or a shortage of supply and demand, the market is considered to be out of equilibrium and therefore unsustainable. In order to reach the equilibrium, the price of the product needs to increase or decrease. This simple concept is very important in determining the pricing strategy of products and packaging.

ECONOMICALLY SUPPORTED PACKAGING MATERIAL CHOICE

All sourcing choices should include:
- market analysis
- risk analysis (feasibility study)
- producers and suppliers portfolio analysis (competition analysis)

LIFE CYCLE COSTS EVALUATION (LCC)

Processes costs evaluation in all life cycle stages could be analysed by LCA method taking into consideration the costs of processes. This step would include a full environmental LCA study, with additional information about the cost of each particular process. With this approach to LCA separate processes contribution could be analysed and managerial decisions can be fashioned on the basis of costs.



Typical economic supply and demand curve with surplus and shortage areas highlighted.

SUSTAINABILITY ASPECTS

	OPPORTUNITIES	CHALLENGES
	• Extended shelf life of packed products (especially food) leads to less waste • Promotion of more responsible food consumption • Possibility of minimising health hazards (lower risk of food poisoning) • More attractive, engaging and interactive products	• Are consumers aware of active and intelligent packaging - do they know what it is, how it works and how to dispose it? • Will consumers accept active and intelligent packaging - are they willing to use it and perhaps pay more for it?
	• Reduced land required to produce food (because less food is wasted) • Reduced use of resources (water, energy, pesticides) to produce food (because less food is wasted) • Cleaner transport options in logistics due to longer shelf life	• What materials and processes are best for manufacture of A&I packaging? • What is the whole life cycle environmental impact of A&I packaging? Do benefits outweigh challenges? • What are the end-of-life options for A&I packaging? Is it easy to collect, sort and safe to recycle?
	• Marketability of "extended shelf life" • Increased sales from better looking products • Decreased logistics costs from longer product storage • Decreased peaks of availability may lead to increased financial gains during off-peak season	• Cost-benefit analysis needed for each opportunity • Are substances for production of A&I packaging readily available ? • Is infrastructure investment needed for production of A&I packaging?

SUSTAINABILITY LEAFLETS

A series of short-text leaflets on the topic of intellignet packaging has been published.

On the right, there are clickable links to web versions of the ActInPak's Intelligent packaging leaflets in various languages named after their country of origin.

English

Bulgaria

Croatia

Italy

Netherland

Slovakia

Slovenia

Spain

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COST FP1405 ActInPak aims to identify and overcome the key technical, social, economic and legislative barriers to a successful deployment of renewable fibre-based functional packaging solutions such as active and intelligent packaging. Currently, 43 countries are involved in the network, with participants representing 209 academic institutions, 35 technical centers, and 83 industrial partners.

For more information, please visit the ActInPak website:

www.actinpak.eu

COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

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