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# Ecodesign in Food packaging

## Unit 5: The packaging logistics for food systems marketing

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After learning this unit, the student will be able to:

- To know the logistics materials and packaging systems
- To be informed about the possibilities of Ecodesign of logistics packaging



## 5.1. The packaging Logistics, overview

Logistics is defined by the integrated planning, organization, taxation and control of all commodities and materials classes together with the information classes related to them, starting from suppliers through the stages of values creation (ex. production and/or distribution stages) until the products delivery to customers, including waste disposal and recycling.

A possible definition of the logistics concept is the application of the 6 P: right amount of the right product, at the right time, of right quality, at right costs, at right place. Often and 7th P appears with the right informations to all participants. In particular in the production "just in time" the information processing plays a very important role<sup>1</sup>.

Logistics networks are delivering food through complex distribution channels. Supply chains vary from the manual delivery of garden vegetables of a neighbor to the importation of exotic and rare foods, processed, using trans-global distribution systems of specialized products. Agricultural markets, grocery stores, restaurants, fast-foods, institutions of food service and direct marketing, are faced with a multitude of operational variables. Also, they are supplied with a wide range of packaging types, sizes and shapes.

Logistics packaging are also named as: distribution packaging, transit packaging, industrial packaging, intermediate packaging, transport packaging and containers.

Logistics packaging represent the science, art and technology to close or protect products for distribution, storage, sale and use. Also, they refer to the process of packages design, evaluation and production.

Logistics functions: distribution facilitating; the protection of both the product and the environment; they provide informations about conditions and locations; marketing functions; graphic design; formulation of legislative and marketing requirements; customer requirements / consumer convenience, for the final use; distribution; environmental issues; recovery / recycling, dematerialisation versus toxicity of the reusable packaging.

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<sup>1</sup> <https://ro.wikipedia.org/wiki/Logistics>



Costs for packaging must be considered throughout the entire value chain. The purchase costs for a pack represent one third of the total costs generated by a pack. The other two thirds are the process and logistics costs. Even if the prices on the packaging supplier are reduced, this has not an effect on the other two price categories.

## 5.2 Materials and packaging systems

Common materials and systems used in logistics packaging of food include containers or corrugated cardboard boxes, shrink-film bundles, reusable bags, packaging units (pallets and shrink film).

### 5.2.1 Containers and boxes made of corrugated cardboard

Containerboard, (CCM or corrugated paperboard material for containers) is a type of thick paper specially manufactured for the production of corrugated cardboard. It is formed from one or two plates of linear cardboard and a sheet of corrugated cardboard. Because the containerboard plate is mainly made of wood natural fibers, it is generally brown and its nuances can vary depending on the type of wood, the process of cellulose obtaining, the recycling rate and the impurities content. For certain boxes that require a good presentation, the bleached cellulose is used on the top layer of the protective board which is located in the box outside<sup>2</sup>.

Corrugated cardboard types<sup>3</sup> :

Depending on the number of paper layers, several corrugated cardboard types are distinguished: type II, III, V, VII, also called CO2, CO3, CO5, CO7.

- type II – is composed of a lid and a paper core, united by bonding lines between the folds tips and lid;
- type III – is composed of a corrugated layer, caught between two smooth layers;
- type V – is composed of two corrugated layers and three smooth layers;
- type VII is composed of three corrugated layers and four smooth layers.

Type II is used as protective packaging paper, support for lamination (billboards, presentation packaging printed offset) and stored in scrolls, while types III, V and VII are

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<sup>2</sup> <https://en.wikipedia.org/wiki/Containerboard>

<sup>3</sup> <http://www.cutii.info>



obtained in the plates form, which can be used in the form of separators or are processed for packaging obtaining from corrugated cardboard.

Another classification criterion is the corrugation size, defined by the corrugation height(h) and step(p) of the paper core.

From this point of view differ folds with the following sizes:

- large: type C (h between 3,5-3,7 mm)  
type A (h between 4.5-4.8 mm);
- average: type B (h between 2.3-3.2 mm);
- fine: type E (h between 1.1-1.2 mm);
- micro-folds: type-N (average h =0.46 mm)  
type F (average h =0.76 mm).

The CO2 plates have nodules type B and C, the CO3 plates present corrugations of the B, C and E type and CO5 presents corrugations of B+C and E+C type.

The most common box style is the classic corrugated cardboard box (Regular Slotted Container, RSC). All lids have the same width. Typically, longer lids meet in the middle, and smaller lids do not meet. The box closing can be done by adhesive tape, staples, bindings, etc. The size of a box can be given by its internal dimensions (for filling capacity) or by its outer dimensions (for handling or palletizing).

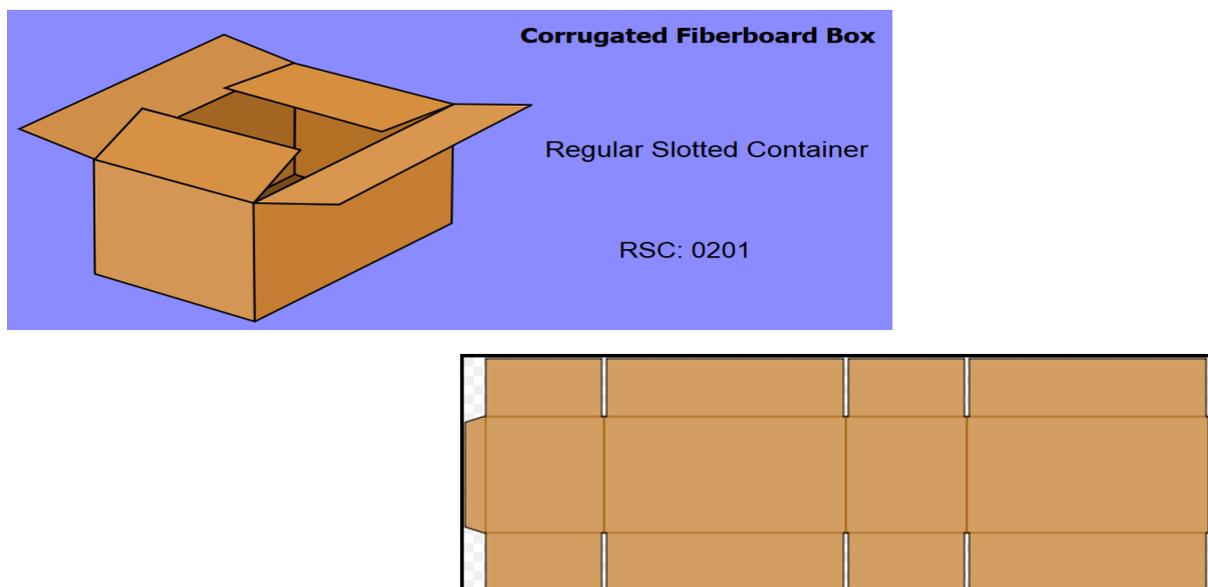


Fig. 1 The classic box (RSC) [https://en.wikipedia.org/wiki/Corrugated\\_fiberboard](https://en.wikipedia.org/wiki/Corrugated_fiberboard)



In a well designed container, the load-bearing panels have folds parallel to the direction of loading; for the resistance to stacking should be used vertical folds. When the lateral resistance is more important (e.g. at the fund with shrink film), it is better the folds should be horizontal.

Corrugated cardboard is easy to recycle, both from a technical and logistics point of view. The used containers are generally sent to the recycler, in large piles, homogeneous from the factories, warehouses and retail stores - businesses which have as an incentive the costs reduction by recycling. As a result, the corrugated cardboard has a very high rate of recycling.

### 5.2.2 The shrink-film bundles (stretch films)

Containers linked together with plastic band are becoming more popular for products which are resistant to compression. Products, ex. cans or bottles, are placed in a tray made of corrugated cardboard (for stability) and the matrix is wrapped with a thin layer of film, ex. polyethylene film ((Low Low Density Polietylene -LLDPE) of linear low density. The film can be applied and manually or automatically stretched with a specialized equipment.



Fig 2 Manual (a) (<http://luckapack.ro>) and automatic (b) [www.antal.ro](http://www.antal.ro) stretch film

Characteristics:

- Width: 500 mm;
- Standard thickness: 20, 23  $\mu\text{m}$ , but it can also be 17  $\mu\text{m}$  or more thick of 23  $\mu\text{m}$ ;
- The mass of a manual roll is 2 kg;
- Elongation at break (length) : 600%;
- Elongation at break (width) : 780%;
- Strength at break (width) : 35  $\text{N}/\text{mm}^2$ ;
- Strength at break (length) : 20  $\text{N}/\text{mm}^2$ ;



- The roll mass of automatic foil is min. 17 kg.

The advantage of a contraction package compared with a corrugated board transport container is that it uses less material and is less expensive. A shrinkage package is less protective. But often appear less damages because people can see the contents and, therefore, they handle the package more carefully. The contractor film, LLDPE, can be easily recycled, like plastic bags.

### 5.2.3 Reusable packaging

As the cost of waste disposal increases because many countries have added incentives for waste reduction, the use of reusable packaging increased. The most common use is for the ingredients transport between companies, for storage and for the fresh products transport from the farm to the retailers. The most used are the plastic packaging, although some firms reuse corrugated boxes, wooden boxes and boxes arranged on pallets. Most of the reusable packaging applications have one thing in common: a short supply chain, well managed, with predictable stability. Primary participants are either integrated by the corporation, or finish partnership contracts or are administered under the control of a single firm.

The traders experience over 10 years in the UK, who have used reusable packaging for the products, shows that the major economies are accumulated by the retailer. The modular standardised nature of reusable packaging (standard footprint is 600mm × 400mm) allows these containers to be automatically sorted in a distribution center. Modularization facilitates the retail sale flow in stores, in which the product is presented in reusable packaging, which at drain may be replaced with one full.

### 5.2.4 Palletizing and containerization

The transport – handling – storage function of packaging manifests in the economic circuit that follows to the goods production. From this point of view, the packaging requirements are the following:



- packaging adaptation to the rules and transport means;
- the volume/ mass (weight) ratio optimization; for example, the packaging with standard volume benefit of a more advantageous price compared to packaging with non-standard or oversized volumes (very large), respectively the packaging with smaller own masses benefit of the lower transportation fees;
- the possibility of adapting the packaging dimensions to transport means (folding packaging or with variable volumes). In this sense, two new concepts have appeared – palletizing and containerization;
- palletizing - is the handling and transportation operation of goods stacked on pallets, move with the help of electro-forklifts. The name of the " palletizing " derives from the palette. This is a wood support or other material, with standardized dimensions, with the help of which is achieved through the bundling of multiple packages, a manipulation unit to the whole storage and transportation process, with a maximum charge weight of 1000 kg., used in the transport of goods packaged in the boxes, showing a sufficient stability. There are pallets of general use, pallets – crates and pallets for special use. The pallets have reduced height, are formed of two surfaces connected to each other by spacers, to allow the introduction of the machinery fork.



*Fig. 3. Euro wood pallets certified EPAL (UIC-leaflet 435-2), heat treated according to IPPC/ISPM 15, Size: 1200x800x145 mm - <http://www.europalbox.ro>*



*Fig. 4. Euro plastic pallets 1200x800x160 mm. Lifting height 110 mm, mass 20 kg, capacity 1000 kg*



-containerization- for goods transport, handling and storage uses unit called container. It is made of resistant materials, possibly flexible, allowing folding when it is not in use. The container provides the advantage of advanced keeping of quality and goods integrity, even in the elimination of individual packages and repeated handling.



Folding box with lid

With these folding boxes, it can save storage capacity up to 82 % when boxes are empty. The integrated lid protects the goods from dust and prevents alteration. <http://magazin.orinev.ro>

Fig. 5 Containers and plastics crates  
<http://www.maseplastice.ro>

### 5.3 The Ecodesign of logistics packaging

Common materials and systems used for logistics packaging are relatively simple. These include corrugated boxes, stretch films, reusable bags and different materials, aggregated in a single loading unit, such as loaded pallets with cargo boxes related with stretch film. For the design of logistic food packaging, some free programs offered by PLMPack can be used, <http://www.treedim.com/en/products/15-plm-pack/121-plm-pack-en> , which is a components PLM (Product Lifecycle Management) platform for optimization systems and Ecodesign.

Each software component can be used independently, but their association in the platform framework allows the materials choice, packaging types (conditioning or transport) and pallets stacking (packing, palletizing, truck loading), thus achieving an optimized solution of packing system. Is automatically obtained a report of Ecodesign with all the technical documents (packaging drawings, packing, palletizing).



This platform ensures:

- the material choice with PackStress for the resistance calculation (this mode is not freely offered, it has been taken in the PLM, PICADOR software, their CAD (computer-aided design) software, which can be purchased for a fee, so the materials choice should be done separately);
- the choosing and resizing of the primary and secondary packaging with PackLib, the parametric library of standardized components of palletized packaging;
- the optimization of packaging and palletizing and the truck loading with StackBuilder.

The platform is developed in Open Source.

PackLib, <http://www.treedim.com/packlib/en/>

It is a program for the optimization of the packaging concept that groups numerous services intended for Ecodesign:

- Graphic navigation,
- Library of models (boxes made of corrugated ECMA, FEFCO, GAUL cardboard, presentation boxes, separators, components)
- The deployment of these objects, with the possibility of their resizing and bodies visualization in 3D, animated with the possibility of the animation saving in pdf format,
- The possibility of models download in formats like dxf (autocad), pdf, etc.

StackBuilder, <http://www.treedim.com/stackbuilder/en/> , is a free software for the package design and optimization (components / boxes), palletizing (box / pallet) and transport items (pallets / truck). StackBuilder has been developed in Open Source to allow a wider dissemination and to create a contributors community for software development or for the content enrichment. It is a simple software to learn, allowing a global vision of the supply chain of the designed packaging.

StackBuilder has many functions to meet the design needs:

- Boxes palletizing;
- Packaging / box optimization;
- Calculation of the optimum packaging system: component/ box / pallet;
- Searching for optimal packaging solutions in database;
- Cylinders palletizing;
- Groups palletizing;
- The addition of intermediate layers, corners, plastic strips (stretch films), the lid of the group of boxes on the pallet;
- Database of the boxes solutions;
- Truck loading;
- Analysis reports and their generation with conclusions.

The program comes with tutorials that make possible its use after a short period of exercises.

In addition PicView 8 can be used, it is created to view, study, annotate, convert and print the documents in the OFTEN, PDF, DXF, DWG, EPS, AI, CF2 (free software) formats, sizes in inch or mm <http://www.treedim.com/en/download> , .

Also, general design programs can be used, CAD, free for students or other programs CAD free online/desk.

Other software programs, specialized CAD on packages, which can be purchased for a fee, are ArtiosCAD (Esko), ArtPro + (ArtPro + comes with a set of editing features to prepare



illustrations for print. ArtPro + open the normalized PDF and import ArtPro files, saving the metadata such as information about barcodes or screening information) and Impact CAD (Arden Software). Can be build in 2D and 3D corrugated boxes, corrugated packaging, filler elements from foam, separators from the double tiles, bags of transparent materials, displays for PDV etc.

