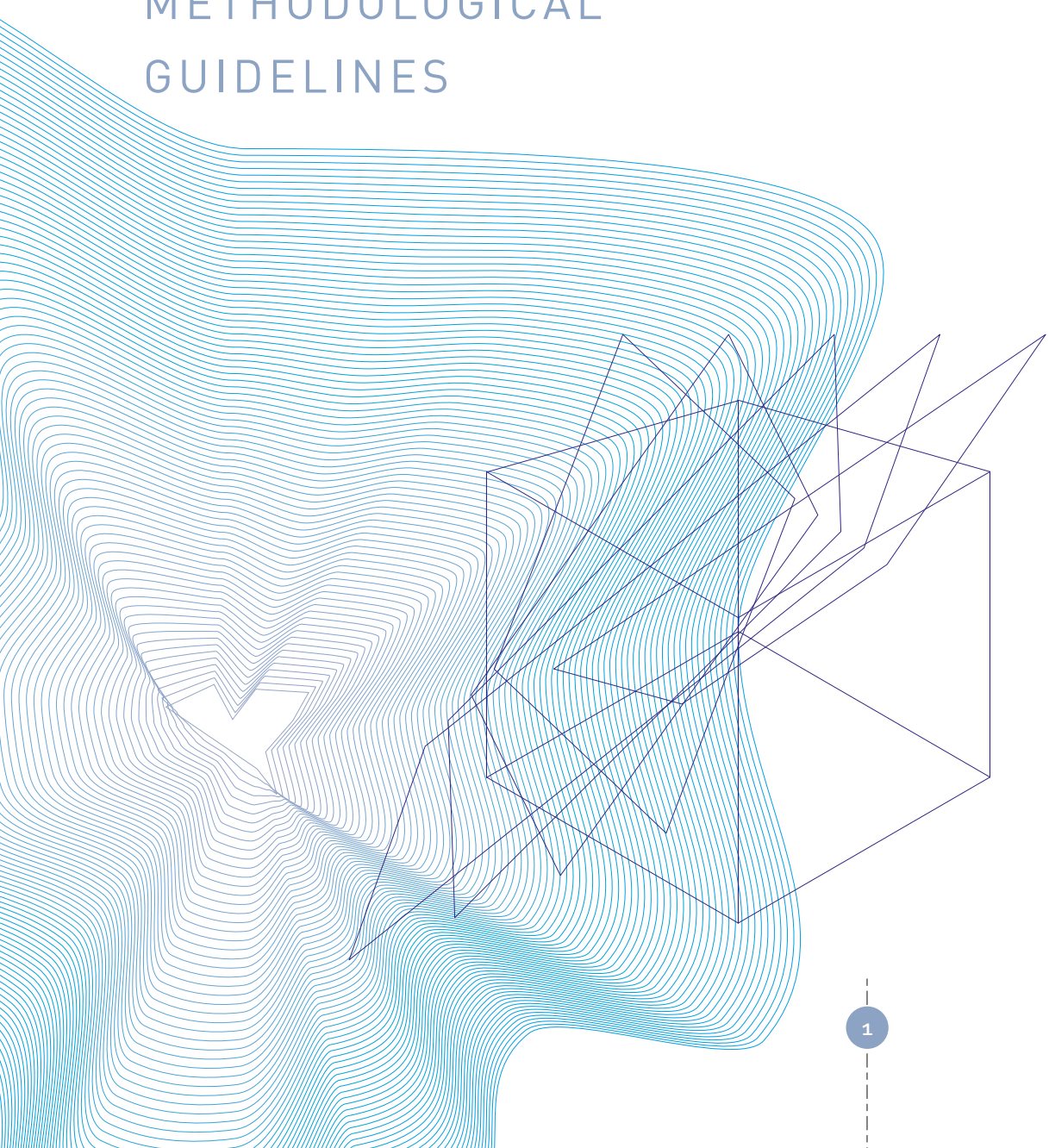
RMT
RÉSEAU MIXTE TECHNOLOGIQUE
PROPACK FOOD

FITNESS

PACKAGING DESIGN

METHODOLOGICAL GUIDELINES



SUMMARY

The design and development of a packaging consists in following a multi-stage project management method that enables a better understanding of the input data and information, possible constraints and obstacles, and eventually helps to find a solution that is the best compromise between technical and economic criteria.

This process runs through several phases, from the very beginning, which consists in analysing the demand, to the final feedback that allows the evaluation – and if necessary the optimisation – of the solution, without forgetting scaling up to industrial production.

This guide was intended to be educational, providing simple tools such as flowcharts and supporting example forms.

It is tailored for food industry/agribusiness companies that use packaging, and are willing to adopt design and optimisation approaches in the development of a new product or ecodesign.

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INTRODUCTION

It is difficult to talk about ecodesign without first introducing the concept of design and the general approaches used in the packaging sector, especially because the methods are clearly described in European regulations (Directive 94-62/EC) and thus transposed into the French law (Decree 98-638).

This methodological guide to packaging design is a tool that should be used prior to any ecodesign process and complements several guides that already exist in this field.

In order to successfully develop a packaging, it is necessary to follow a method where as much information as possible is gathered, to channel creativity without blocking it, to justify and rank the options, and approve the chosen solution.

Using a method ensures a better packaging design, better organisation, avoids wasting time, and facilitates the resolution of any issues that may be encountered.

The objective of this guide is to make projects more reliable by gathering all the information, facilitating their progress with a simple and universal method, and accelerating processes by indicating the optimum path to follow.

The applied methodology for a successful packaging development consists of five essential steps. These steps are explained in detail below with example forms to clarify the explanations.

METHOD

The method described in this guide consists of 5 steps:

- **Gestation phase:** Evaluation of the point of the project
- **Research phase:** Creation and selection of a solution and evaluation of the inherent risks of this solution
- **Characterisation phase:** Development of a and futureproofing
- **Industrial phase:** Full-sale production
- **Feedback phase:** Evaluation of the solution implemented

The diagram below briefly describes every step of the method, including the stakeholders, and the duration, which may of course depend on the project itself and the type of company.

PHASE	GESTATION	RESEARCH	CHARACTERISATION	INDUSTRIALISATION	FEEDBACK
DESCRIPTION	Ascertain the demand and gather external elements Identify and analyse the needs	Search for solutions Choose the most relevant solution	Make the solution operational and future-proof	Develop the means of production Pilot scale & demonstration	Confront the product with its market / Launch the product Monitor the product's life on the market
DELIVERABLE	Orientation file	Packaging advice	Achievement file	Manufacturing & control program	Optimisation plan
STAKEHOLDERS	Marketing Product R&D Quality department Packaging	Marketing Product R&D Consulting Packaging Purchasing Suppliers	Purchasing Suppliers Marketing Logistics Quality department Packaging	Purchasing Suppliers Packaging Sequencing Production Process/Maintenance	Commercial Quality department Packaging Production
DURATION	4 WEEKS	8 WEEKS	6 WEEKS	17 to 30 WEEKS	

Each phase will now be explained in detail and illustrated with a diagram displaying the input data, tools and methods, and the output data. Example forms will be introduced right after each diagram.

I. GESTATION

The objective of this phase consists in identifying the actual demand, evaluating the opportunities, and confirming its relevance with regard to the available skills and means of production.

This is the first stage of packaging development, during which it is possible to consider elements that are not part of the development itself (market, target, consumers, retailers, etc.)

The input data is the result of a Marketing Brief. This can also be called the "background", and it contains all the essential elements of the product-packaging couple:

- the definition of the product and its positioning
- the consumer target
- the retail target
- expected sources of profit
- identified limits and constraints

Based on the Marketing Brief or "background", the orientation file should be built and approved by a project manager in collaboration with top management, which officialises the launch of the study. The orientation file defines: the topic, the objectives, the duration, the costs, and the available resources.

The orientation file is one of the reference documents that should be available throughout the study to find solutions that may satisfy the requirements of the brief. It features the main elements of the demand, explains the motivations that gave rise to the project, defines the constraints and expected benefits, as well as listing the people who initiated it.

Orientation file

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		ORIENTATION FILE	P 1/1

PROJECT NAME
Packaging for high-quality strawberries

PROJECT REFERENCE
FRAISE UP

SUBMITTED BY
Xavier Durand Date: 20/11/2018
Function: "Small fruits" product manager

OBJECTIVES
To develop a range of high-quality strawberries and help reinforce its market positioning by creating a packaging that clearly displays their superior quality.

CONSTRAINTS
Technical: Inter- and intra-varietal heterogeneity of the fruit (shape, size)
Economic: The packaging must not exceed a certain percentage of the total cost price

DURATION
5 months
Planned launch: April 2019

SIGNATURES	
Signed by: Date:	Approved by: Date:

II. SEARCH FOR SOLUTIONS

The objective of this phase is to find several solutions, evaluate them, and select the most relevant one.
This starts with a creative phase, followed by an analytical selection, and a proposed solution.

II.1 - Creative phase

Certain methods may be used to design or optimise packaging. The best-known ones are:

- Brainstorming
- Value analysis
- Theory of the resolution of invention-related tasks (TRIZ, BioTRIZ)
- Advanced Systematic Inventive Thinking (ASIT, EcoASIT)

The results of this creative phase will be the input data for the following phase.

II.2 - Analytical phase

The Functional requirements specification form (FRSF) is an essential tool during this phase, allowing the sorting and analysis of technical, logistic, marketing, safety, environmental and economic functions and constraints that the packaging must meet.

For food packaging, it is traditionally common to distinguish:

- 4 technical functions: contain, preserve, protect and distribute
- 5 marketing functions: inform, alert, positioning, association with a given product type/segment/position, provide the user with a service
- 2 legislative constraints: food safety and environmental safety
- 2 constraints internal to the company: industrialisation, cost price

These functions should be divided into sub-functions and analysed in terms of objectives and expectations for the consumer or end user, on the basis of measurable criteria, target levels, flexibility (permissible deviation), and constraints linked to the function.

This inventory may take the form of several tables such as the one presented below:

FIELD	FUNCTION	CRITERIA	LEVEL	FLEXIBILITY	K IMPORTANCE COEFFICIENT	OBJECTIVES/ PROMISES
MECHANICAL	Protect	Pressure	10 Pa	+3 Pa - 0 Pa	1	Resist to strength under pressure of the distribution channel
PRESERVATION	Fulfill	Shelf life	100 days	+ 20 days	1	Maintain quality all along shelf life
SERVICE	Open	Time	$1/10^{th}$ s	$+-1/5^{th}$ s	2	Facilitate product use
MARKETING	Alert	Rate of citation	80%	-10%	1	Identify the product in a competitive market

This inventory step is followed by a **function hierarchy** phase, which is necessary to define the priorities of the future packaging. This hierarchy must be justified objectively and must be shared between all departments involved in the project.

The functional requirements specifications form (FRSF) is the reference document of the design approach. Approved by the project manager, it will be the tool used during internal and external consultations and allows the analysis and comparison of the proposed packaging solutions.

Functional requirements specifications form (FRSF)

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	FUNCTIONAL REQUIREMENTS SPECIFICATIONS	p 1/1

CONSERVATION	CRITERIA	LEVEL	FLEXIBILITY	TESTS
CONSERVATION				
Microbiological	Mould	Nil	0	Visual and microbiological
Sensory	Appearance	Category A	Category B	Visual
Protection				
Crushing	Mechanical pressure	10 Pa	+3 Pa	Compression under a load (standards, etc.)
Retail				
Position on the shelves	Dimensional (LxlxE)	10 cmx6cmx4cm	+- 0.5 cm	Trials on shelves
Information				
On the product	Transparency	100%	-10%	Visual
Attribution				
Origin France	Acknowledgement	100%	0%	Consumers
Positioning				
Superior quality	Match	100%	5%	Consumer
Information				
On variety	Understandability	100%	5%	Consumers
Service				
Opening	Time	1/10th second	1/5th second	Practicality tests

II.3- Proposal phase

Combined with the functional requirements specifications form (FRSF), the results of the creativity phase will enable design professionals (graphic design agencies, designers, consultants) to make the first sample proposals based on the identified functions.
These solutions may then be analysed within the scope of the functional requirements specifications form (FRSF) in order to select a final solution that will be submitted to the suppliers who in turn will propose prototypes.

Only realistic prototypes will be able to meet technical criteria such as preservation or protection.

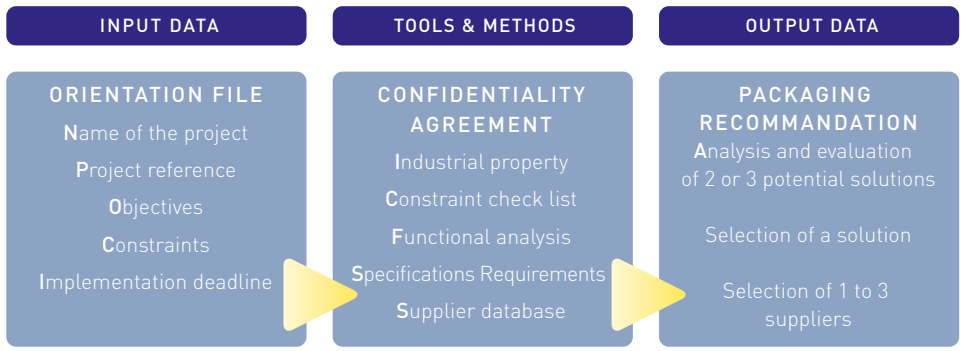
In order to produce packaging models, software such as CAO 2D or 3D may be used (Rhinocéros, Solidworks, Illustrator).

These models make it possible to obtain a realistic visualisation of the potential solutions, to compare them, and to put them in a realistic environment (virtual reality or augmented reality[1])

The choice of solution will be made by comparing each solution with the requirements of the functional specifications. Each proposal is evaluated on a scale depending on its ability to fulfil the objectives related to each function or subfunction.

When making a choice, it is important to bear in mind every aspect of the packaging, particularly the secondary and tertiary packagings. A palletisation study may help to choose the packaging dimensions and to define the most economical palletisation plan, taking all constraints into account.

It may be necessary to conduct a priority search on existing models and patents, as well as file a patent in order to protect the solution found.



[1] *Virtual Reality is an immersive, visual, sound interactive computer simulation of real or imaginary environments. Augmented reality refers to computer systems that make it possible to superimpose a 2D or 3D virtual model to our natural perception of reality in real time.*

1-DESCRIPTION OF THE STUDIED SOLUTIONS

PRESERVATION			
	Solution 1	**Solution 2**	**Solution 3**
Name of the solution	Ball	Hexa	Round
Appearance			
Principle	PS tray, transparent bottom and lid Glued label	PS tray, coloured bottom and transparent lid Glued label	White cardboard bowl PS transparent lid Label printed on the cardboard
Technical characteristics	*See the supplier's specifications*	*See the supplier's specifications*	*See the supplier's specifications*

2-PERFORMANCES

	Solution 1	**Solution 2**	**Solution 3**
Result of the functional analysis (score for each solution on the functional requirements)	8/10	6/10	4/10
Main reasons	Total transparency Good mechanical resistance Good consumer perception	Partial transparency Good imagePerceived French origin	Not enough visibility Poor mechanical resistance Soils easily

3-ECONOMIC VALUE OF THE SOLUTIONS

	Solution 1	**Solution 2**	**Solution 3**
Reference quantity	See supplier invoice		
Cost of primary component			
Cost of secondary component			
Total direct cost			

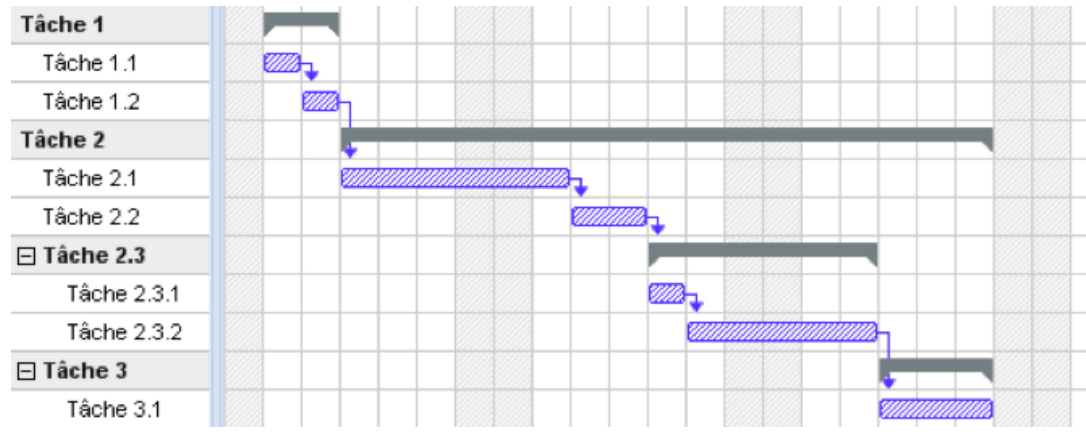
4-NECESSARY INVESTMENTS

	Solution 1	**Solution 2**	**Solution 3**
Printing consumables (plates…)	See supplier invoice		
Production consumables (thermo-forming moulds, injection…)			
Tools (machines…)			

5-DEVELOPMENT SCHEDULE

	Solution 1	**Solution 2**	**Solution 3**
Characterisation process	01/03/2019	*Solutions Not selected*	
Industrialisation process			
1st pre-production run	15/03/2019		
1st production run	31/03/2019		
1st commercial availability	30/04/2019		

6-SCHEDULE OF TASKS TO ACHIEVE (TÂCHE = TASK)



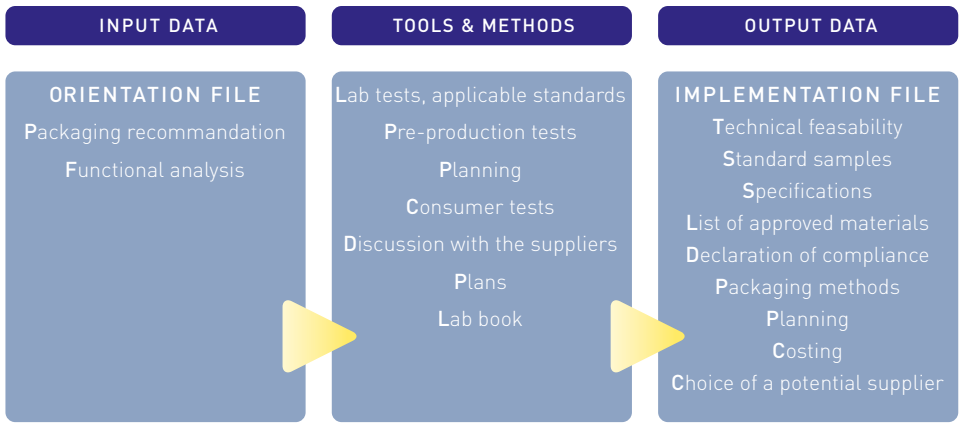
SIGNATURES

Signed by:
Date:

Approved by:
Date:

III. CHARACTERISATION

The objective of this phase is to develop the packaging and document it in order to prepare industrial-scale production. It is the bridge between creation and realisation. It consists in choosing the packaging system, its components, and the materials; and organising production and packaging trials.
The implementation file brings together all the documents below, which should be sent to all the departments involved.



The specifications define the technical characteristics of the packaging components upon delivery as well as the method for approving them. These requirements allow the supplier to conduct quality control on production and the client to approve deliveries. Specifications are divided into 3 categories:

- **General specifications**
  to define the company's needs for all packaging.
- **Group specifications** to define the characteristics required for a packaging group and define the quality control methods.
- **Individual specifications**
  to define the characteristics of a specific packaging.

The "testing method" form defines the modus operandi for several tests to ensure rigorous control of packaging quality.

The "packaging methods" form defines the requirements for the finished product and the evaluation criteria. Constituents of the complete packaging, assembly methods, the palletisation plan, and checks on the finished product must be defined.

The choice of suppliers is important because they will be partners during the packaging development and full-scale production. They must be able to take on this supporting role.

Technical feasibility form

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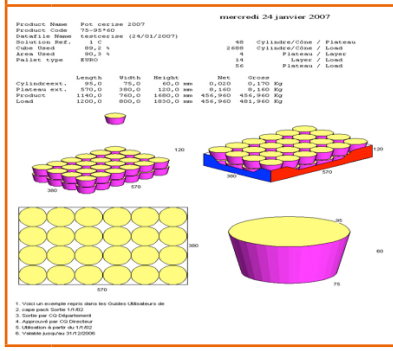
DETAILED DESCRIPTION OF THE PACKAGING (TAKE THE ELEMENTS FROM THE RECOMMENDATION SHEET)			
LIST OF PRELIMINARY SPECIFICATIONS			
Specifications		**Specification code**	**Certificates**
1	List the different specifications necessary for this packaging	Note the code for each specifications	Ex: certificate of compliance
2			
3			
4			
PACKAGING METHOD			
Attach the packaging method			
PALLETISATION			
Description of the logistic unit:			
Dimensions of secondary packaging (Lxlxh)			
Dimension of the pallet			
Number of primary packaging per secondary packaging			
Number of secondary packaging per pallet			
Number of primary packaging per pallet			
Height of the pallet			
Weight of the secondary packaging			
+ attach the palletisation plan			
			

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COSTS		
	Unit cost	**N°**
Sales unit (packaging, cap, label, etc.)		
TOTAL		
Logistics unit (RSC, adhesive, film, etc.)		
Transport (transport cost)		
TOTAL		
PACKAGING COST		

INVESTMENTS		
	Cost/Unit	**N°**
Printing consumables (plates, etc.)		
Production consumables (thermoforming moulds, injection, cut-out form, etc.)		
Equipment (machines, etc.)		
TOTAL		
SIGNATURES Signed by: Date:	Approved by: Date:	

Testing methods form

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NAME OF THE TEST Measure the thickness of trays at different points
OBJECTIVES OF THE TEST Check the characteristics of the delivered batch versus supplier specifications
TOOLS USED Caliper
PRINCIPLE OF THE TEST 10-point measurement of the tray
PREPARATION OF THE PACKAGING 10 packages / lot, test at room temperature 23 °C and 50% RH
MODUS OPERANDI According to ISO 5 034 standard
RECORDING THE RESULTS numeric values placed on the cut of the tray
INTERPRETATION OF THE RESULTS according to rules defined by quality control

SIGNATURES Signed by: Date:	 Approved by: Date:

PURPOSE

- Description of the packaging process on the packaging line
- Description of how the packaging must be packed in order to be in line with internal organisational requirements
- Description of the position of the products in the primary packaging
- Description of expected values for quality control points.

APPLICATION

Where should these packaging methods be used and on which packaging?

UPDATES

Version	Date	Modification	By

ENFORCEMENT DATES

Factory	Date	Comments

IMPLEMENTATION REQUIREMENTS

Key steps and their description	Photos or descriptive figures
Forming of the primary packaging - -	
Dosage and filling of the primary packaging - -	
Decoration/labelling of the primary packaging -	
Arrangement of primary packaging in the secondary packaging -	
Decoration/labelling of the secondary packaging -	
Palletisation -	

APPROVAL OF PACKAGING QUALITY

Inspection of the palettes, the primary packaging and the secondary packaging

Conformity of the delivered products

Identification symbol	Flaws	Actions
C	Critical	Production forbidden
M	Major	Production with dispensation
m	Minor	Corrective actions to be implemented

In order to improve legibility, flaw identification symbols will be inserted in the approval of the packaging quality.

Key steps and their description	Photos or descriptive figures
Palletisation - - - - M m	
Secondary packaging - - - - C	
Primary packaging - - - - C m	

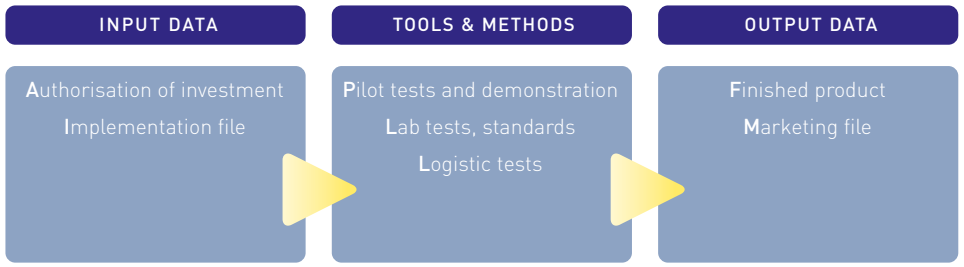
SIGNATURES

Signed by: Date:	Approved by: Date:

IV. FULL-SCALE PRODUCTION

The objective of this step is the implementation of the solution. It starts with a pilot phase to finalise the solution, which is followed by a first full-scale production run, which will be sold.

During this initial phase, quality control on the line must be strict in order to establish future production and performance indicators.



V. FEEDBACK

This phase is necessary to evaluate client and user satisfaction with the packaging and compare it with the initial requirements.

This phase uses traditional survey methods, non-compliance statements, and Pareto diagrams in order to qualify and measure the real performance of the packaging solution developed.

This information can be summarised in a check list, and compared with the FRSC in order to proceed to adjustments if necessary.

Check list example

Functions	Developed solution	Market standard	Competitor
Mechanical protection	++	+	+++
Visibility on the shelf	+++	-	+
Association with a given product type/segment/position	+	++	++
Information	++	-	++
Functionality	++	++	+
+ fulfills the function ++ performs the function +++ perfectly fulfills the function - Does not perform the function correctly			

CONCLUSION

All of these steps are important to the development of a good packaging.

Following this process allows a detailed analysis of every elements from design to full-scale production. It helps to avoid mistakes, eliminate poor choices, and improves communication and coordination between stakeholders.

All data produced is important for the following step. As with any process of this kind, the output data of one step becomes the input data of the following one. This is why communication between stakeholders (internal or external to the company) must be ensured by a specific project manager following all the reference documents cited in this guide (marketing brieff, FRSC, tool forms, etc.).

Every packaging development should be based on rational, evidence-based choices, and on established standardised methods that lead to solutions that guarantee packaging functionality, which must take into account sometimes contradictory requirements and constraints.

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