Checklist Design for **Optimised Ressource Use**

Project name	**Example "Yoghurt Pot"**
Project number	040 – 39 1002 – 0
Project manager	Schweig / Zimmermann
Date	01.02.2018

Initial situation:

- Yoghurt Pot 500ml, K3-system
- Lid: Aluminiumfoil, 30µm printed, weight 0,85g
- Sealing lacquer: 2g/m²
- Pot: PS-thermoformed, 6,4g unprinted
- Paper sleeve: White lined chipboard ~240g/m². Weight 9,65 g

Question	Explanation	Instructions	Documentation of results
Approach 1: Re-use Solutions			
Is it possible in principle to establish a functioning multi-use system in light of the existing marketing requirements or to use an existing one?	The question of whether a re-use system can be established for a specific packaging option depends on a number of basic factors primarily concerning aspects such as the structure of the distribution area, the channels of distribution and other basic aspects of distribution logistics. Those are to be evaluated by relevant experts in the particular design project.	If **YES**: continue If **NO**: document the reasons and continue with approach 2	*No, packaging is designed and intended as a single-use packaging.*
How many re-use cycles can be achieved under realistic assumptions?	A crucial factor for the number of re-use cycles achievable under realistic assumptions is the opportunity and willingness of end consumers to actually introduce the packaging into such a reuse system; as a rule, this is much more important than the system's technical factors. Numerous aspects play important roles here, for instance, the number and accessibility of places to return packaging, knowledge about the environmental advantages and potentially existing (financial) incentives for returning packaging. The specific effectiveness of such factors is to be assessed by the relevant experts in each packaging project to arrive at realistic assumptions about the expected average number of packaging re-use cycles. Whether the overall resource savings on the basis of this number of packaging re-use cycles are greater than the additional resources needed for the return system (especially for transport and cleaning) is to be evaluated using life cycle analyses (LCA). The level of detail of such an assessment may be properly varied depending on the anticipated number of reuse cycles. Important indicators can be transport distance, weight and cleaning effort..	If **= 10:** the multi-use solution may be assumed to be more advantageous. A simple review will suffice. If **< 10 ≥ 3:** a more detailed LCA is to be performed on the basis of specific designs of the packaging and the multi-use system. If **≤ 3:** the single-use solution may be assumed to be more advantageous. A simple review will suffice.	*Not relevant, designed for single-use.*
Can a re-use solution be expected to be ecologically advantageous?	In order to limit the effort for the LCA comparison of single-use and re-use solutions, only those processes are to be considered that actually differ in the two solutions.	If **YES**: continue developing the Eco Design for re-use packaging. If **potentially**: if the results of the evaluations are similar, both packaging alternatives (single-use/re-	*Not relevant.*

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	In addition, a limitation on the parameters (CED / CO2 equiv.) can be achieved while maintaining sufficient informative value.	use) should be developed and then further evaluated in approaches 2-4. If **NO**: continue developing the Eco Design for re-use packaging.	
Result: If a re-use version is desired, the option "Investment in new bottling plant" must be possible (excluded here in the determination of the leeway).			

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Approach 2: Material Reductions			
Can modifications of the logistics system reduce the functional requirements of the packaging?	It is imaginable in principle that logistics solutions placing lower demands on packaging (in terms of transport and transfer processes as well as storage conditions) could reduce the functional requirements of packaging (e.g. in terms of stackability, stiffness etc.). This may result in packaging solutions requiring smaller amounts of materials.	If **YES**: document the result and continue. If **NO**: conduct potentially possible optimisations and document them.	*The transport tray / pot system has already been optimized within certain limits (space requirement / stacking). As the corrugated paper tray and pot are not a fixed system and the pots vary in their construction and their composition, a possible optimization would need to be re-examined, but it is not feasible within the given design scope*
Has the entire system consisting of primary, secondary and (as appropriate) tertiary packaging been reviewed and optimised in terms of total materials use?	The next question is about optimising the combined effects of primary, secondary and potentially tertiary packaging. The core functionalities of a packaging system are generally provided for by combining various types of packaging in a targeted fashion. From an environmental perspective, the effectiveness of this combination is to be examined with a view to potentially reducing the total amount of materials. Refill solutions, for example, are one possible result of such a holistic optimisation effort.. It is important to review both the total weight (mass) of the materials as well as relevant LCA values such as CED and/or CO2 equivalents.	If **YES**: document the result and continue. If **NO**: conduct any necessary optimisations and document them.	
Can the thickness of the packaging material be reduced?	Such optimisation should include review of whether the packaging precisely fulfils the necessary requirements of the protective function as previously defined. From an environmental perspective, both overfulfilment and underfulfilment of these requirements are problematic and should be avoided.	If **YES**: document the result and continue. If **NO**: make any necessary adjustments and document them.	*Due to using recycled fibers as supporting cardboard sleeve in a "humidity environment", the inner pot was increased in weight / wall thickness. This can lead to over-packaging. Without the use of recycled fibers, a thinner inner pot would be possible.* ***Another option may be an all plastic pot; this will be examined hereafter.***
Can the geometry of the packaging be changed to save materials?	Optimisation of geometry can also result in material reductions. For example by eliminating unnecessary large headspace.	If **YES**: document the result and continue. If **NO**: make any necessary adjustments and document them.	*The dimensions of the pots are more or less standardized.* *Upper pot opening: diameter 95mm* *However, the larger the pot is supposed to appear, the more conical it is designed. Conicity runs against an optimized space*

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			utilization; The same applies to strongly curved bottoms. *For a good surface / space utilization, the pot should only be slightly conical.*
Can total material usage be reduced by using different (polymer) materials?	It has to be assessed whether changing the selected materials, i.e. for example, using a different type or grade of polymer or changing a multi-layered structure (for instance, because of reduced thickness of walls or foils), can reduce the total amount of materials required. It is important to review both the total weight (mass) of the materials as well as relevant LCA values such as CED and/or CO2 equivalents. From an environmental view those parameters are decisive.	If **YES**: document the result and continue. If **NO**: conduct any possible optimisations and document them.	*For K3-Pot System:* *I) By using PP instead of PS weight can be reduced.* *II) By using PP and filling of the inner pot with at least 40 % CaCO3, wallthickness can be reduced by approx. 1/3 and therefore 50 % of fossile ressourcescan be spared.* *For All Plastic Pot Option:* *I) Utilization of a PS-All Plastic Pot* *II) Utilization of a PP-All Plastic Pot* *III) Utilization of a PP-Chalk Plastic Pot (Filling of at least 40 % CaCO3)*
	Note: In *this example* it is assumed that the various packaging variants can be filled/processed by the existing systems (without new investments) (*see definition of design leeway*). Possibly, in practice, a restriction of the leeway (no investments ...) can lead to the exclusion of certain packaging options.		

Result: New Packaging Options

K3-Pot

1. Pot made of PP
2. Pot made of Chalk-Plastic: PP and CaCO3

All Plastic Pot

3. PS-All Plastic Pot
4. PP-All Plastic Pot
5. Chalk-Plastic Pot: PP mit CaCO3

In any case:

- As cylindrical as possible, minimally arched bottom
- Sleeve made of wood pulp / virgin fiber

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Approach 3: Review of Options to Use Recycled Materials			
Can the functional requirements of the packaging also be fulfilled with recycled materials?	Recycled materials carry a significantly lower burden compared to primary materials. In addition, their use contributes to promoting the closing of material cycles. However, each packaging project should be reviewed to determine whether the specific functional requirements of packaging can be fulfilled precisely with the recycled materials in the qualities available on the market today or whether adjustments in packaging design, for example, are needed.	If **YES**: document the result and continue. If **NO**: potentially discontinue reviewing this approach.	*No. Recycling material would make multilayer construction necessary and therefore be much more expensive*
Are modifications of packaging design necessary?	In many cases, the recycling materials have e.g. due to residual contents of other polymers or impurities, deviating properties. In the case of packaging design, this must be checked in accordance with the respective requirements and taken into account accordingly.	If **YES**: make any necessary adjustments and document them. If **NO**: document the result and continue.	*Yes, multilayer-structure would be necessary.*
Are there any legal requirements that have to be observed when using recycled materials?	It should also be reviewed whether legal requirements are in force that must be observed when using recycled materials or that even prohibit their use for the packaging purpose in question. Such limitations exist, for example, in the area of food contact. Yet some of these usage limitations can be bypassed by design adjustments (e.g. using recycled materials behind a functional barrier).	If **YES**: document the result and continue. If **NO**: make any necessary adjustments and document them.	*Yes, direct food contact*
Can sufficient supply of recycled materials in the defined quality be guaranteed?	A further challenge today in the use of recycled materials lies in the fact that not all suppliers of such materials are capable of guaranteeing supply in sufficient amounts and consistent technical quality. For this reason, sourcing options are to be researched and evaluated. Another aspect concerning sourcing of recycled materials is the fact that the positive impacts of their use with respect to attempts to close materials cycles occur in particular when post-consumer material is used again (in this context, 'consumer' also includes commercial/industrial end consumers). Thus, precursor materials of this type are to be given priority in sourcing, and it makes sense to ask for evidence that the material actually comes from such sources	If **YES**: document the result and continue. If **NO**: as appropriate, agree on proof of relevant quality and origin, and document the results.	*No*
Result: no additional packaging options			

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Approach 4: Use of Bio-based Materials			
Can bio-based plastics be used in place of fossil-based plastics?	Bio-based plastics contribute only to a very small extent, if at all, to the substitution of non-renewable fossil resources.	If **YES**: document the result and continue. If **NO**: continue.	*No. PLA is basically an option; but would lead to weight increase compared to PP-, therefore excluded.*
Are modifications of packaging design necessary?	From a technical point of view, a distinction should be made between 'classic' polymers whose synthesis relies on bio-based precursor materials and biopolymers. The former, also called bio-based polymers, generally have the same technical characteristics as material produced entirely from fossil precursor materials. Biopolymers, in contrast, usually have characteristics of their own which differ from those of classic polymers. In addition, these (technical) characteristics may display greater variability, depending on the quality of the biologically produced precursor materials. In each case of packaging design, both of these aspects are to be reviewed and taken into account in comparison with the relevant requirements	If **YES**: conduct potentially necessary adjustments and document them. If **NO**: document the result and continue.	*(not considered here)*
Are there suppliers who can deliver sufficient amounts of the required precursor material (in the required quality)?	Also in the field of bio-based materials, the possibility of a permanent supply of defined material qualities or the presence of potential suppliers is (still) not always ensured.	If **YES**: document and continue. If **NO**: document the reason (result of the review) and discontinue reviewing this approach.	*(not considered here)*
Was the upstream chain of the production of bio-based polymers taken into account in terms of environmental aspects?	The production of bio-based plastics can be associated with very specific negative environmental impacts (land use, biodiversity impacts, ...). This should be considered.	If **YES**: document the result and continue. If **NO**: apply the checklist on the *strategy element 'sustainable sourcing'*.	*(---)*

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In any case

- As cylindrical as possible, minimally arched bottom
- Sleeve made of wood pulp / virgin fiber