

Project praxpack

ECONOMIC ASSESSMENT OF REUSABLE SYSTEMS

Evaluation of three example cases

Praxpack - Workshop Paper
September 2021



GEFÖRDERT VOM




Bundesministerium
für Bildung
und Forschung


Imprint:

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1 Economic assessment of reusable shipping systems

The environmental assessment shows clear advantages of reusable packaging compared to single-use packaging for shipping (Zimmermann and Bliklen 2020a; Zimmermann and Rödiger 2021; Zimmermann and Bliklen 2020b), however, the economic comparison between single-use and reusable packaging in shipping, and especially from the perspective of the online retailer, shows a different picture.

The economics of reusable packaging systems in shipping are characterised by a number of differences compared to single-use packaging systems:

- Reusable packaging is usually more expensive to purchase.
- The introduction of reusable packaging
 - usually requires adjustments to existing order picking and packaging processes, which initially entail additional costs, and
 - requires additional communication measures aimed at customers.
- An automated order picking and packaging process is still clearly limited by the current availability of reusable shipping packaging.
- The necessary return of the empty reusable packaging by the end customer is associated with costs that are not necessary in the case of single-use shipping packaging.
- Furthermore, the cleaning, inspection and reprocessing of the reusable packaging for a further cycle of use are associated with additional costs.

Licensing fees, such as those paid to the dual systems for the collection, sorting and recycling of single-use shipping packaging, do not apply to reusable packaging. The prerequisite for this, however, is recognition as a reusable system (including the existence of return logistics for the packaging and an incentive system for the return of reusable packaging by consumers).

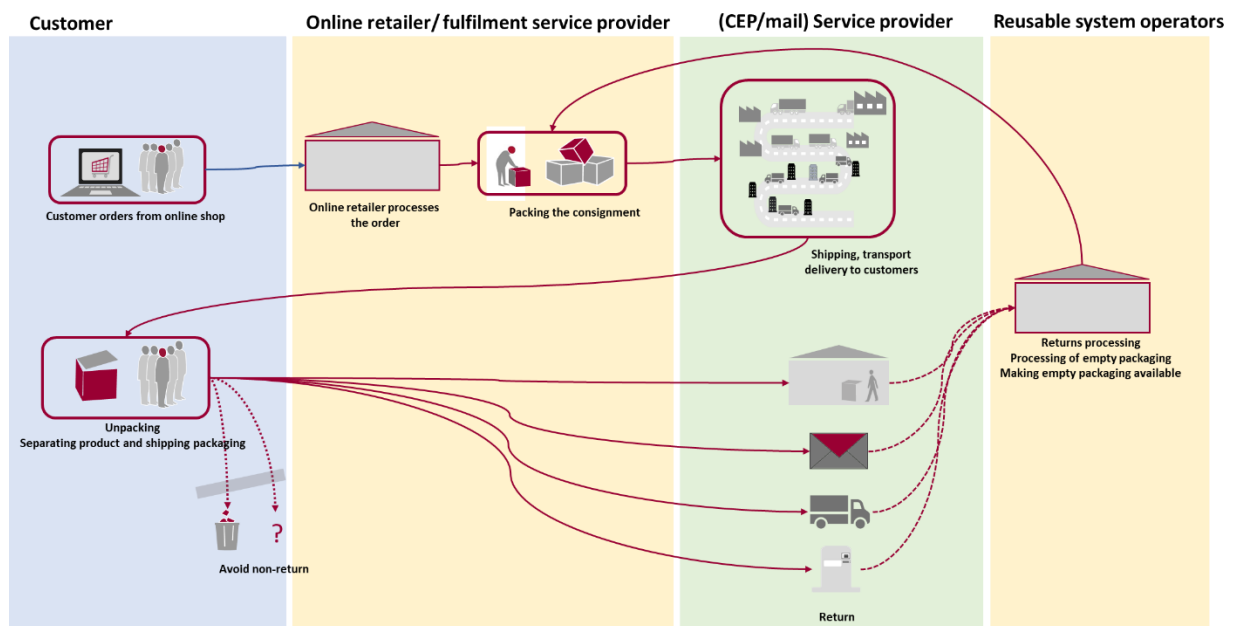
For the closer economic consideration of reusable packaging systems in the following, three system variants are distinguished

Table 1: Description of the three system variants considered

#	Variant	Description
1	The online retailer is the owner of the packaging and is responsible for return and reprocessing.	The complete operation of the returnable system is carried out by the online retailer. The online retailer buys the packaging and organises the return shipment independently (usually via CEP service providers).
2	Pay per Cycle - The online retailer as user of a reusable packaging system	Reusable packaging is purchased by the online retailer for one usage cycles via a supplier.
3	A hybrid of both systems	The online retailer buys the packaging from a reusable system provider. A further fee for return and reprocessing is paid to the provider per usage cycle.

Basically, all three variants follow the same pattern:

Figure 1: Stations/processes during shipping in reusable shipping packaging



In the first step, the customer places an order for products in the online shop. Depending on the product ordered, the order qualifies for the use of reusable packaging. Differences can exist in whether and how customers are involved in the decision whether reusable packaging is used.

The online retailer (in fulfilment) packs the product in the reusable packaging and sends it out.

The delivery to the consumer takes place as usual - with the product packed in reusable packaging. During unpacking, special features of the packaging must be taken into account (e.g. avoid using sharp objects to open the packaging in order to prevent damage to the packaging). The empty packaging must then be returned by the consumer.

The returned empty reusable packaging is then processed, inspected and made available again for re-dispatch.

Differences in the individual steps exist in the actor carrying them out and, depending on the type of implementation, in the costs arising, which will be discussed in more detail in the following subsections.

In all cases, as described above, the return of the reusable packaging results in additional costs. Whether and to what extent these costs are made transparent and passed on to customers can be a further distinguishing feature of reusable shipping systems.

In addition to the base case of “the consumer returns the reusable packaging empty after receiving the goods”, the case of “return of goods” must also be taken into account. In this case, there is usually no difference between reusable and single-use packaging in the costs for the return shipment. This means that the reusable packaging comes back to the sender cost-neutral (compared to the one-way system). The prerequisite here is that the return address is identical to the dispatch address or at least that a cost-effective onward dispatch from the return address to the dispatch location is possible. For the overall evaluation, an average case can be calculated if the return rate is known, which indicates the average (additional) costs when using reusable packaging.

1.1 Variant 1: The online retailer is the owner of the packaging and responsible for recycling and reprocessing.

For variant 1, in which the online retailer is responsible for the complete organisational handling of the reusable system, there are isolated real examples. For example, the online retailers Memo and Fairfox fall under this variant, which use reusable boxes for shipping. The authors are not currently aware of any examples of the use of flexible reusable shipping bags. One exception is Kiezbett, which uses a large-format shipping bag for shipping beds.

The online retailer purchases the reusable packaging. The product is sent to the customer in the reusable packaging. The return shipment takes place - as with a return - via a CEP service provider. Processing, cleaning, etc. are organised by the online retailer.

The following is a comparison of a case in which a plastic reusable box is used instead of a cardboard box.

Base Case

Taking into account data on real existing systems (Memo, Fairfox, Kiezbett), a high return rate of 99.5% is assumed for the following comparison. The assumptions on the individual cost items, which were discussed with actors from the practical field, as well as the costs per circulation that result on this basis are summarised in the following table.

Table 2: Variant 1 - Cost positions in the base case

Position	Reusable	Single-use
Acquisition cost per packaging	10,00 €	0,15 €
Licensing fee per cycle	0,00 €	0,02 €
Additional costs for order picking per cycle	0,10 €	0,00 €
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,03 €	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	3,31 €	0,00 €
Cleaning/inspection per cycle	0,10 €	0,00 €
Costs per cycle/consignment	6,95 €	3,46 €
Difference reusable/single-use	3,47 €	-3,47 €
Shipping costs	4,95 €	4,95 €
Gap to shipping costs	-2,00 €	1,47 €

The costs per cycle for reusable packaging exceed the costs for single-use packaging by € 3.47. When compared to the assumed shipping costs of € 4.95 (for both reusable and non-reusable packaging), there is still a gap of € 2.00 when using reusable packaging, while non-reusable packaging generates € 1.47 per shipment.

Case with return of goods

In addition to the base case, in which it is assumed that the packaging is returned empty, the return of reusable packaging must also be taken into account for a more practical consideration. For the case of a return of goods, the cost items are summarised in the following table.

Table 3: Variant 1 - Cost positions for the return of goods

Position	Reusable	Single-use
Acquisition cost per packaging	10,00 €	0,15 €
Licensing fee per cycle	0,00 €	0,02 €
Additional costs for order picking per cycle	0,10 €	0,00 €
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,03 €	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	3,31 €	3,31 €
Cleaning/inspection per cycle	0,10 €	0,00 €
Costs per cycle/consignment	6,95 €	6,79 €
Difference reusable/single-use	0,16 €	-0,16 €
Shipping costs	4,95 €	4,95 €
Gap to shipping costs	-2,00 €	-1,84 €

In the case of the return of goods, there are no changes to the cost positions of the reusable packaging, as the return of goods is sent back at the same price as the empty reusable packaging. In the case of single-use packaging, there are additional costs due to the return. The difference between reusable and single-use packaging is now significantly lower. The additional costs from the use of reusable packaging now amount to € 0.16.

Assuming an average return rate of 16 % (Zimmermann et al. 2020), this results in an average cost of € 6.95 per cycle for the use of reusable packaging compared to € 4.01 for the use of single-use packaging, which corresponds to additional costs of € 2.94.

Parameter variation

As described, the results depend on various parameters. The focus is particularly on the return rate and the costs of the return shipment.

Table 4: Parameter variation variant 1

Variation	Costs per cycle reusable packaging base case	Costs per cycle return of goods	Costs per cycle average case	Additional costs compared to single-use in the average case
Further increase in return rate to 99.8 %.	6,91 €	6,91 €	6,91 €	2,90 €
Reduction of return rate to 70 %.	10,28 €	9,83 €	10,21 €	6,20 €
Reduction of return shipping costs (empty) to € 2	5,64 €	6,94 €	5,85 €	1,84 €
Increase of the return rate to 30 %	6,95 €	6,93 €	6,95 €	2,48 €

1.2 Variant 2: Pay per Cycle - The online retailer as a user of the reusable packaging system

Under pay-per-cycle systems, the online retailer buys cycles of use for reusable packaging. The costs typically include arranging the availability of the reusable packaging, the return and reprocessing (cleaning, testing) for one usage cycle, and optionally the connection to an IT system (for tracking, incentive systems, etc.).

An example of a more established pay-per-cycle system is RePack.

In the following, a case is compared in which a flexible plastic shipping bag is used instead of a polyprop bag.

Base Case

Taking into account data on RePack users, a return rate of 75 % is assumed for the following comparison. The assumptions for the individual cost positions that were discussed with actors in the practical field, as well as the costs per cycle that result on this basis, are summarised in the following table.

Table 5: Variant 2 - Cost positions in the base case

Position	Reusable	Single-use
Acquisition cost per packaging	0,00 € ¹⁾	0,02 €
Licensing fee per cycle	0,00 €	0,00 € ²⁾
Additional costs for order picking per cycle	0,10 €	0,00 €

Position	Reusable	Single-use
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,00 € ¹⁾	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	2,75 € ¹⁾	0,00 €
Cleaning/inspection per cycle	0,00 € ¹⁾	0,00 €
Costs per cycle/consignment	6,19 €	3,33 €
Difference reusable/single-use	2,86 €	-2,86 €
Shipping costs	3,95 €	3,95 €
Gap to shipping costs	-2,24 €	0,62 €

¹⁾ Included in the pay-per-cycle fee.

²⁾ Included in the acquisition costs.

For reusable packaging, this results in costs of € 6.19 per cycle compared to € 3.33 for single-use packaging (additional costs for reusable packaging: € 2.86). With an assumed shipping cost of € 3.95, which is charged to the customer, there would be a gap of € 2.24 for the reusable packaging, while a surplus of € 0.62 would be achieved for the single-use packaging with shipping costs of the same amount.

Case with return of goods

As in variant 1, the case of returned goods is considered here. Instead of returning the empty reusable packaging to the pay-per-cycle system carrier, the goods are returned to the online retailer's returns centre. The packaging is then available to the online retailer (after inspection and cleaning) for reuse.

The cost positions for the return of goods are summarised in the following table.

Table 6: Variant 2 - Cost positions in the case of goods return

Position	Reusable	Single-use
Acquisition cost per packaging	0,00 € ¹⁾	0,02 €
Licensing fee per cycle	0,00 €	0,00 € ²⁾
Additional costs for order picking per cycle	0,10 €	0,00 €
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,00 € ¹⁾	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	3,31 €	3,31 €

Position	Reusable	Single-use
Cleaning/inspection per cycle	0,10 €	0,00 €
Costs per cycle/consignment	6,85 €	6,64 €
Difference reusable/single-use	0,21 €	-0,21 €
Shipping costs	3,95 €	3,95 €
Gap to shipping costs	-2,90 €	-2,69 €

¹⁾ Included in the pay-per-cycle fee.

²⁾ Included in the acquisition costs.

As with variant 1, the difference is significantly lower in the case of return. The difference between single-use and reusable is € 0.21.

Assuming an average return rate of 16 % (Zimmermann et al. 2020), this results in an average of € 6.30 per cycle when using reusable packaging compared to € 3.86 when using single-use packaging, which corresponds to additional costs of € 2.44.

Parameter variation

In analogy to variant 1, a parameter variation is carried out.

Table 7: Parameter variation variant 2

Variation	Costs per cycle reusable packaging base case	Costs per cycle return of goods	Costs per cycle average case	Additional costs compared to single-use in the average case
Further increase in return rate to 99.8 %.	6,19 €	6,85 €	6,30 €	2,44 €
Reduction of return rate to 70 %.	6,19 €	6,85 €	6,30 €	2,44 €
Reduction of return shipping costs (empty) to € 2	5,44 €	6,85 €	5,67 €	1,81 €

Here, the difference between the pay-per-cycle system and the system handled by the online retailer itself becomes apparent (variant 1). An increase in the return rate is not accompanied by cost effects for the online retailer, as the retailer pays per use - regardless of the return of the packaging to the system operator.

The situation improves if the pay-per-cycle price is reduced.

1.3 Variant 3: Hybrid Model

In the hybrid model considered here, the online retailer buys the packaging, but the return and reprocessing are carried out by a system operator, to whom a fee is paid for this.

An example of this is Packoorang.

Base case

The assumptions for the individual cost positions that were discussed with actors in the field of practice, as well as the costs per cycle that result on this basis, are summarised in the following table. The packaging is purchased for € 6.99 by the online retailer; € 0.50 is paid to the system service provider per cycle of use. A return rate of 75 % is initially assumed, analogous to variant 2.

Table 8: Variant 2 - Cost positions in the base case

Position	Reusable	Single-use
Acquisition cost per packaging	6,99 €	0,02 €
Licensing fee per cycle	0,00 €	0,00 € ¹⁾
Additional costs for order picking per cycle	0,10 €	0,00 €
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,02 €	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	0,50 €	0,00 €
Cleaning/inspection per cycle	0,00 € ²⁾	0,00 €
Costs per cycle/consignment	6,12 €	3,33 €
Difference reusable/single-use	2,79 €	-2,79 €
Shipping costs	3,95 €	3,95 €
Gap to shipping costs	-2,17 €	0,62 €

¹⁾Included in the pay-per-cycle fee.

²⁾Included in the acquisition costs.

For reusable packaging, this results in costs of € 6.12 per cycle compared to € 3.33 for single-use packaging (additional costs for reusable packaging: € 2.79). Assuming shipping costs of € 3.95, which are charged to the customer, there would be a gap of € 2.17 for the reusable packaging, while a surplus of € 0.62 would be achieved for the single-use packaging with shipping costs of the same amount.

Case with return of goods

Analogous to variants 1 and 2, the case of a return of goods is considered here. For the case of a return of goods, the cost positions are summarised in the following table.

Table 9: Variant 2 - Cost positions in case of return of goods

Position	Reusable	Single-use
Acquisition cost per packaging	6,99 €	0,02 €
Licensing fee per cycle	0,00 €	0,00 €
Additional costs for order picking per cycle	0,10 €	0,00 €
Communication measures per cycle	0,03 €	0,00 €
Other additional costs per cycle	0,02 €	0,00 €
Postage - shipment to customer per cycle	3,31 €	3,31 €
Return shipment per cycle	3,31 €	3,31 €
Cleaning/inspection per cycle	0,10 €	0,00 €
Costs per cycle/consignment	8,39 €	6,64 €
Difference reusable/single-use	1,75 €	-1,75 €
Shipping costs	3,95 €	3,95 €
Gap to shipping costs	-3,44 €	-1,69 €

In contrast to variants 1 and 2, the difference between the two systems increases in the case of returned goods.

Assuming an average return rate of 16 % (Zimmermann et al. 2020), this results in an average of € 6.52 per cycle when using reusable packaging compared to € 3.86 when using single-use packaging.

Parameter variation

Analogous to variants 1 and 2, a parameter variation is carried out.

Table 10: Parameter variation variant 3

Variation	Costs per cycle reusable packaging base case	Costs per cycle return of goods	Costs per cycle average case	Additional costs compared to single-use in the average case
Further increase in return rate to 99.8 %.	4,09 €	6,90 €	4,45 €	0,68 €
Additionally: Reduction of costs for return shipment (system fee) to € 0.2	3,79 €	6,90 €	4,29 €	0,43 €

Here, the difference to the pay-per-cycle system becomes apparent: an increase in the return rate is directly associated with cost effects for the online retailer, as the costs of purchasing packaging are

distributed over more cycles. With high circulation numbers or return rates, the system fees become the relevant cost driver compared to single-use systems. A reduction of these fees would then further reduce the additional costs.

1.4 Conclusion

The economic considerations of reusable systems show that there are significant additional costs compared to single-use systems. In many cases, these costs range between 2 and 4 € per cycle. The most relevant cost driver here is the return shipment of the packaging for reprocessing. Depending on the system, packaging costs also play a role.

An increase in the return rate does not lead to cost savings for the online retailer in the case of the pay-per-cycle system. However, savings from a high return rate could possibly be passed on to the online retailer through a lower system price.

If high return rates are achieved, the price of purchasing the reusable packaging is of secondary importance. More relevant than are the costs for the return, which must be minimised.

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