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Standardisation in reusable food packaging

A research exploring the potential of standardisation in primary reusable food packaging to enable and stimulate the widespread transition to reusable packaging systems in the food industry.

Netherlands Institute for Sustainable Packaging

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Management summary

In the Netherlands, packaging reuse schemes have been and are increasingly being adopted in secondary and tertiary packaging use in a business-to-business context such as pallet pooling or the reuse of supermarket crates. These processes have been standardised over the years to reduce operational costs. With the rise of reusable primary packaging, it is important to find standardisations to not only prevent high implementation and operational costs, but also to increase the environmental benefits of reuse.

The purpose of this article is to provide practical insights for the Community of Practice (CoP) on Reusable Packaging by the Netherlands Institute for Sustainable Packaging (KIDV) into if and how standardisation of reusable packaging for Open and Closed Systems could be introduced.

This small scale research consisted of desk research and semi-structured interviews with some of the largest Dutch food vendors, packaging distributors, packaging producers, washing installation producers and logistics companies. The aim of this research is to gather insight into the requirements of primary reusable food packaging used by different actors, for the most efficient and effective cleaning and reverse logistics. This article aims to answer the question:

What are the requirements for the most suitable solution for primary reusable food packaging taking into account reverse logistics, cleaning and multiple reuse by different actors?

First it is important to look at the criteria of reusable packaging for their most optimal functioning in an Open or Closed System. Through the interviews, desk research and practical experience in the field, a selection of functional and non-functional requirements were identified such as: PolyPropylene as preferred material, heat resistance for cleaning (85℃), separable and universal lid, nestable and the use of light colours.

Secondly, efficient reverse logistics are required for a well functioning reuse system. Multiple interviews with packaging distributors have been conducted to identify the most suitable shape and dimensions of the packaging for transportation. Although the current trend is to use round shaped food packaging, for transportation a more square or rectangular shape is preferred. Also, many packaging and logistics companies offer secondary packaging which conform to Euronorm, but comply to Gastronorm sizing on the inside. It could be useful to produce reusable primary food packaging according to Gastronorm sizes that fit in collomodular Euronorm crates[1].

Euronorm is an international standard used for a variety of commercial activities, commonly used for transportation. The standard is derived from the Europallet. Gastronorm is a common standard used in the preparation, storage and transport of food.

Management summary

It could be useful to produce reusable primary food packaging according to Gastronorm sizes that fit in collomodular Euronorm crates.

After the reverse logistics it is important to gather insight into the requirements of primary reusable food packaging for an efficient and effective cleaning process. Interviews were conducted with industrial cleaning machine suppliers in the Netherlands. Cleaning plastics is a complex operation, because plastics do not absorb heat and therefore stay wet at the end of the cleaning process. Avoiding deep edges, grooves or narrow holes is recommended as these can become blind spots for the cleaning machine and will be difficult to dry. Square and rectangular shapes are preferred for cleaning because they are easier to transport through the machines and would therefore need less support and contact points.

Regarding dimensions for cleaning it is important to focus on Euronorm (EN), since most industrial cleaning machine designs are based on these standardised measurements. The most suitable dimensions for cleaning are derived from Euronorm, so the maximum dimensions for packaging are: 600mm * 600mm * 200mm. When using baskets, there are no minimum dimensions, but baskets will lead to more contact points and are more difficult to dry. The minimum dimensions of food packaging that do not require the use of baskets are: 35mm * 35mm * 30mm.

Finally, three options are explored in this article that could minimise the damages that occur during transportation, cleaning and consumption. The goal is to apply certain design techniques so the perception of different actors that the packaging is clean and of quality after frequent reuse is maintained. This could in turn increase the amount of times a packaging can be reused by different actors.
Patterns & imprints: These are used to disguise small damages in- and outside the packaging and will prevent the perception of “used” by the end-user.
Colour use: Food pigments appear to attach more to transparent plastics and would eventually be perceived as end-of-life sooner than darker- or more cardboard-like colours.
Guided impact: It’s possible to protect important elements of the food packaging (e.g. labels or QR/Barcodes) by adding subtle edges around these elements. This way it is possible to guide the damages that occur during transportation and cleaning.

With this research we hope to contribute to the acceleration and the adoption of primary reusable food packaging schemes and to initiate further research into standardisation of reusable food packaging systems.

Table of contents

Introduction

The recent worldwide spread of COVID-19 has impacted the demand for single-use packaging, mainly driven by restaurants' concerns regarding hygiene. For example, in the early stages of the recent virus, Starbucks published a statement denouncing their use of a Bring Your Own (BYO) cup policy in their restaurants (Williams, 2020). This concept entailed that consumers were allowed to bring their own mug to Starbucks stores to have their coffee filled in that own mug in exchange for a discount on their purchase. The required physical contact between Starbucks employees and consumers, was the main driver behind the decision to terminate this BYO policy. In addition, the Plastic Industry Association issued a letter to the US Department of Health and Human Services advocating for more single-use packaging in restaurants and retailers by referencing research articles on the spread of viruses and bacteria through certain surfaces (Plastics Industry Association, 2020). However, these articles are far from conclusive with the Centers for Disease Control and Prevention merely advising restaurants and consumers to wash reusable crates and bags more frequently (Centers for Disease Control and Prevention, 2020). In addition, the objectivity of the often cited 2011 article in the letter could be challenged as it was funded by the American Chemistry Council, a trade group that advocates on behalf of disposable plastic bag manufacturers (Gerba et al., 2011, p. 513).

Nonetheless, the interest for adoption of circular reuse system for food packaging is growing. Packaging reuse has been widely adopted across industries for the past decades in order to decrease the financial as well as the environmental burden of the constant extraction of raw materials and their production. 'Reuse' is sometimes interchangeably used with 'recycling', however the definition used in this article is the reuse of end-packaging without the need for (mechanical) recycling.

In the Netherlands, packaging reuse schemes have been and are increasingly being adopted in secondary and tertiary packaging use in a business-to-business context such as pallet pooling or the reuse of supermarket crates. The adoption of reusable packaging in primary food packaging is however less common, especially in the food industry. The most well known adoption in the Netherlands is probably the reuse of glass beer bottles, incentivised by a consumer deposit system. After collection of the beer bottles in supermarkets, the bottles are cleaned and redistributed among beer producers. However, several use-cases have operationalized reusable packaging systems, even during COVID-19, for primary food packaging such as Loop, Go Box, Ozarka, CupClub, PackBack and Pieter Pot.

Introduction

The purpose of this article is to provide practical insights for the Community of Practice (CoP) on Reusable Packaging by the Netherlands Institute for Sustainable Packaging (KIDV) into if and how standardisation of reusable packaging for Open and Closed Systems could be introduced.

This small scale research consisted of desk research and semi-structured interviews with some of the largest Dutch food vendors, packaging distributors, packaging producers, washing installation producers and logistics companies. The aim of this research is to gather insight into the requirements of primary reusable food packaging used by different users, for the most efficient and effective cleaning and reverse logistics. This article aims to answer the question:

What are the requirements for the most suitable solution for primary reusable food packaging taking into account reverse logistics, cleaning and multiple reuse by different actors?

As one of the respondents stated: "*Our products have a short lifespan before it becomes waste.*" (Sustainability Manager - Bunzl).

Informing and advising the CoP members on how standardisation could be realised could potentially result in more widespread, efficient and thus more environmentally friendly adoption of primary reusable food packaging. It is the purpose of this research to inspire the implementation of these standardisations into their individual packaging design by the members of this community. This could in turn decrease the millions of kilos of single-use packaging waste that are generated each year by the food industry all while enabling an affordable reusable packaging service.

Methodology

The Community of Practice on Reusable Packaging strives to conduct extended research into reusable packaging. It is the ambition of the group to find a common denominator between members to accelerate the implementation of reusable packaging. It is therefore interesting to explore the design of a set of standardised measurements, shapes and use of materials to optimise (reverse) logistics and cleaning.

In order to provide these insights, the main research question has been defined as the following: What are the requirements for the most suitable solution for primary reusable food packaging taking into account reverse logistics, cleaning and multiple reuse by different actors?

In order to answer this research question, several sub questions have been defined.

1. What are the criteria for a reusable primary packaging for food?
2. What is the most suitable material for reusable packaging taking into account the criteria of the packaging?
3. What is the most suitable shape of reusable food packaging for transportation, based on the current reverse logistics providers?
4. What are the most suitable dimensions of reusable food packaging for transportation, based on the current reverse logistics providers?
5. What is the most suitable shape of reusable food packaging for cleaning?
6. What are the most suitable dimensions of reusable food packaging for cleaning?
7. Which design choices can be made to minimise traces of reuse occuring during the consumption or transportation of reusable food packaging?

The research methods adopted are desk research, field observations and semi-structured interviews. In total, 10 respondents have been interviewed. These respondents have been sampled based on knowledge and experience in the practical use, distribution or production of primary food packaging. Other respondents have been selected based on their knowledge and experience in the manufacturing of professional machines for food-safe cleaning or on (reverse) logistics. The respondents were approached by the project facilitator of the CoP Reusable Packaging after which the authors contacted them for 15-30 minute interviews. The interviews were conducted by phone or video chat. The interviews have been conducted and transcribed in Dutch. However, the quotes from the interviews used in this research have been translated into English. These translated quotes have been verified with the respondents to ensure the accurate translation of the meaning of their statements.

Methodology

The interviews were analysed by means of edited transcription, meaning that sentences and phrases that were deemed unnecessary, excessive or grammatically incorrect have been edited or deducted. The edited transcripts have been verified with the respondents.

Reliability and validity

Because of the size of this research and its research design, the intended outcome does not produce generalisable results. This article rather aims to provide insight into the perspectives of the respondents and based on that, contribute to the discussion and provide suggestions as to how the CoP Reusable Packaging could adopt standardisation in primary reusable food packaging. Triangulation of the data collection methods has been applied: desk-research, field observations and semi-structured interviews were conducted. The research data can corroborate the findings of the interview data and vice versa.

The first way in which the reliability of this article is addressed is by discussing the role of the authors and the limits of the subjectivity based within that role. The authors are members of the CoP Reusable Packaging and founders of PackBack, a startup company designing a reusable food packaging system in The Netherlands. Therefore, it is important to be aware of the authors' subjective reality which is at the background of the interpretation of perspectives and knowledge gathering. Further, there is full transparency about the data collection methods and the data analysis. Full transcriptions of all data have been provided in a supporting document to the project manager of the CoP Reusable Packaging.

Structure

This article is structured by means of chapters and subchapters. The article starts by discussing the different models and criteria of primary reusable food packaging in the first chapter. What follows is an elaboration of the most suitable material. The article continues by discussing the most suitable shapes and dimensions for reverse logistics and cleaning. Sequentially, possibilities for the reduction of traces of use are discussed. The article is concluded with an overview of the most important findings as well as recommendations on how to implement standardisation in primary reusable food packaging.

Models reusable primary food packagng

Within and outside of The Netherlands, there is a growing amount of startups and food vendors designing reusable primary food packaging models. By analysing these use cases, a distinction of four categories can be made (Coelho et al., 2020; Ellen MacArthur Foundation, 2019):

1. BYO bowl: Consumers bring their own bowls to food vendors to be filled. This is often incentivised by food vendors by offering a discount. The consumer owns the packaging. Example: NS train station food vendors, Starbucks.
2. Purchase bowl: Consumers are able to purchase a reusable bowl with their order which they can have re-filled at the food vendor. This is often incentivised by food vendors by offering a discount. The consumer owns the packaging. Example: Pokébowl, Just Salad.
3. Closed System: Food vendors offer the use of reusable bowls for consumption at the site, often with a deposit scheme, which can then be returned by the consumer at the site. The food vendor cleans the packaging and offers it for reuse again. The food vendor owns the packaging. Example: Wageningen university, Ozzi.
4. Open System: Packaging producers or distributors offer food vendors the use of reusable bowls which is then offered to their customers (consumers or businesses) on a use basis. Packaging producers/distributors could also offer it directly to consumers. The packaging producer/distributor cleans the packaging and re-distributes it among food vendors or consumers. The packaging producer or distributor owns the packaging. Example: Pieter Pot, GoBox, Packback, Ozarka.

An interesting observation when analysing the use-cases for reusable primary food packaging systems, is that a variety of packaging shapes and materials are adopted within and between solutions. In addition, it appears as if, contrary to reusable secondary or transit packaging systems, all Open System solutions have designed their own cleaning solution as well as their own logistics. Even though reusable packaging systems are easily classified as economies of scale, there is, outside of the reuse of beer bottles, a lack of standardisation in reusable packaging used as primary food packaging. This lack of standardisation results in high investments needed by the packaging owners in proper cleaning facilities, storage and logistics to facilitate the reusable packaging service. This also results in higher operational costs and higher CO2 emissions as opposed to the scenario where multiple Open Systems solutions would make use of the same (reverse)logistics as is the case with the beer bottles industry.

Models reusable primary food packagng

The Open and Closed System appear to be the most suitable for standardisation. These models enables the use of the same primary food packaging by multiple users, whether it be consumers or businesses, which requires professional cleaning and logistics. The reason for this is the potential of these system to increase the adoption rate of reusables by a variety of business-to-business and business-to-consumer food vendors by their lower entry barriers. These entry barriers are lower due to the lack of investments needed by food vendors and consumers in more expensive reusable packaging as well as avoiding physical contact between the food vendor employee and the bowl (in BYO bowl and Purchase bowl). The Open System, contrary to the Closed System, does not require access to proper cleaning facilities and storage by the food vendors. Nonetheless, within an Open System, several Closed Systems could exist, with packaging only circulating on one site at a period of time while avoiding the investment of purchasing reusable packaging. In addition, food vendors initially adopting a Closed System at one site, could expand their reusable packaging systems to other sites, transforming it into an Open System.

Criteria reusable primary food packagng

After understanding the different reuse models adopted for primary food packaging, it is important to look at the criteria of these packaging for their most optimal functioning in an Open System. Through the interviews, desk research and practical experience in the field, a selection of functional and non-functional requirements have been identified:

Functional	Non-functional
Food safe	Universality
Heat resistant 85°C	Visibility food
Chemical resistant	Light colors
Hassle-free use	No “over”-packaging
Separate lid	
Universal lid	
Nestable	
Firm (max 6mm wall thickness)	
Anti-leakage	
Recyclable	

Functional requirements

In exploring possibilities for standardisation in primary food packaging for widespread adoption, using the same type of packaging for different food types is preferred. The main common denominator between all food types and vendors are food safety requirements. The only packaging material that can be used are the ones indicated as food-grade by regulatory agencies, such as the U.S. Food and Drug Administration (FDA) or the European Food Safety Authority.

Criteria reusable primary food packagng

For the requirement 'heat resistant', a distinction needs to be made between heatable or warm ready-made foods and cold ready-made foods or non-ready-made foods. Heatable ready-made foods are often found in retail stores such as supermarkets. Warm ready-made meals are also increasingly found in supermarkets but are most commonly offered in take away or food delivery by restaurants. For those food types, an important requirement is the ability to microwave the packaging as well as its ability to withstand short amount of exposure to temperatures up to 100℃. Cold ready-made foods could be salads or sandwiches. Non-ready-made foods could be vegetables, fruit or non-perishable grocery items. These do not necessarily require a heat resistant packaging during filling of the packaging. However, in order to properly disinfect the packaging during dishwashing, the material needs to withstand temperatures up to 85℃ (Account manager - Hobart). The material should also be able to resist chemicals used during the cleaning process.

Another functional requirement is the easy use of the packaging by food vendors, users and cleaners. High traffic locations require the easiest handling of the packaging as possible, so avoidance of additional straps or difficult click-mechanisms are desired. Packaging with the lid tied to the bowl appears to be the easiest in use, if a lid is necessary at all. However, due to the extra space such a design creates in cleaning, storage and during shipment, another functional requirement is the separation of the lid from the bowl as well as the bowl being nestable. In addition, it is advised to use one lid for different bowls to avoid having to match lids with bowls after retrieval: "*Attaching the lid to the bowl seems to be the easiest in use, but what we've seen is that it creates much less room for those packaging in storage. A lot of our clients have that problem [limited storing capacity]. You can only fit 500 in one box versus 1500 with seperate lids for example. Also try to work with one lid system. That way you can easily mix and match lids.*" (Sustainability manager - Bunzl).

The packaging should also be firm enough to withstand the logistics process. A maximum firmness of 6mm of the walls of the packaging is desired. A thicker wall could negatively influence the cleaning process: "*Extremely thick walls could influence the speed of drying the packaging through the machine. This would mean that the speed of cleaning would be delayed and more energy per product needs to be used.*" (Sales manager - Meiko)

Criteria reusable primary food packaging

Image 1 (The Harvest)

Image 2 (Efteling)

Image 3 (Cafeteria TU Delft)

Image 4 (McDonald's)

Furthermore, the packaging should preferably be anti-leakage to also suit to-go as well as delivery food vendors. In addition, ideally the packaging would also be recyclable to ensure an environmentally friendly end-of-life once the packaging cannot be reused anymore. Recyclability of packaging is incorporated in Albert Heijn's sustainable goals and HEMA reports on the recyclability of their packaging and the use of recycled plastic.

Non-functional requirements

The first non-functional requirement discussed is universality. There are several ways in which food vendors customise their packaging. This article looked at customisation through branding, labelling, type of packaging and colors. Branding on packaging is an important strategy for many food vendors. However, in order to rotate as much packaging between vendors and consumers, any permanent personalisation could minimise its reusability among vendors. CHEP, as part of Brambles, is global market leader in the pooling of reusable logistics packaging such as pallets, containers and plastic crates.

The Marketing lead for their Zero Waste World (ZWW) Packaging programme explained that one of the key enablers of a reuse system for secondary and tertiary packaging is to work with cross industrial standard design". Our strength lays in the 'share and reapply' strategy; the 'share' part is very important in this. Customised designs are perhaps logical from a marketing point of view, but they limit options to share/exchange with other users of the same packaging format. Rather we advise to make a reusable packaging design as universal as possible. Alternatives, especially for reusable primary packaging, are to work in a closed reuse loop (reuse from home) or explore creative solutions on decoupling the branding. That way both financial and environmental benefits can achieve maximum potential."

The ways in which vendors express their brand on primary food packaging does appear to differ. In the images below, it is seen that ready-made meal vendors appear to often add stickers onto the packaging (image 1-2) and some do not use any branding at all (Image 3). However, there are also cases in which the brand is printed on the packaging itself (image 4).

With retailers, we observed detailed brand expression on the packaging more often. They often use the branded labels also to explain relevant product information: "*We are dealing with etiquettes. On ready-made meal packaging we include information such as how the meal should be heated, allergens and other important information. This is also for products that are in the stores. The labels include information such as the nutrients and a barcode.*" (Packaging specialist - Albert Heijn).

Criteria reusable primary food packaging

Image 5 (SLA)

The packaging specialist at HEMA echoed that:"At HEMA we really want our brand to express through the packaging. How do you do that with standardisation?" In acknowledging the trade-off between branding and universality, other options were explored. Image 5 showcases an example of what a personalised label could look like without customising the packaging itself. This example is from the Dutch restaurant chain SLA. In order to avoid creating additional material waste, this band could be replaced by a material that could be reused by the food vendor. On this band, vendors could display their brand as well as include other relevant information such as the product name, expiry date, allergens, ingredients and other nutrient information.

Also visible in most of the primary packaging is the clear lid which results in immediate visibility of the meal. It has been expressed by multiple food vendors that this improves their customers' experience, especially in retail, as the consumer has a good idea of what they are purchasing. Another common denominator appears to be the light look of the packaging. Research suggests that lighter colored packaging is often used to highlight a product's healthiness as well as trigger important taste functions. However, with often reuse, complete transparency or clear white is not recommended by Meiko. Meiko is a German producer of professional washing installations, with 50 years of experience in the manufacturing of washing machines for the food and beverages industry. Last year, they have manufactured a washing installation, specifically designed for the efficient washing of reusable cups for a Dutch company called Cupstack. The sales manager stated: "*We do not advise any specific color in reuse, but food pigment does appear to attach more to transparent plastic. We would therefore advise the use of light brown, cardboard looking colors or off-white. Black is also an option by the way.*" (Sales manager - Meiko)

Therefore, for primary reusable packaging, it is recommended to design a transparent lid with an off-white or light brown bowl for the most attractive packaging that is the most suitable for often reuse by different users. A more detailed elaboration on how user traces could be camouflaged can be found in chapter "Appearance and lifespan".

Criteria reusable primary food packaging

Choice of material

The most suitable materials to match the criteria of reusable primary food packaging appear to be polypropylene (PP) or polyethylene terephthalate (PET). PP is used often by existing reusable food packaging systems. GoBox and GreenGo for example both use PP boxes. The same boxes have been used in experiments of Bunzl with reusable food packaging. PP matches all functional criteria: a common material, affordable, heat resistant and recyclable. The downside however is the difficulty of recycling PP into certified food-grade material. This means that it is difficult to recycle reusable PP food packaging into new reusable food packaging. This would require a minimum of 95% food approved use of the packaging which would be complex to prove. A consultant from DW Reusables explained:

"You can test whether it's [recycled polypropylene packaging] food safe. You do that by testing migration, and that would probably be very small if you reuse food packaging in a monostream. The problem occurs with certification according to international food safe regulations. That will be very challenging and complex." (Consultant - DW Reusables)

rPET is a food grade material due to achieving the 95% threshold. In addition, Technical Director of PET Power, a packaging designer and producer for PET products, explained that a purification process called post-condensation is applied which cleans the polymers from contamination. He also continued to explain that rPET does have the disadvantage of not being heat resistant for longer periods of time, preventing the material to be used within the microwave or to be cleaned in a professional dishwasher. He continued: *"Standard PET can be used for filling temperatures up to 55-60°C. In addition, there is so called heat set PET that can be a bit more heat resistant if it is combined with a more firm design. Even though this makes the material more heat resistant for filling, the high temperature and duration a dishwasher requires is often not suitable for this material."* (Technical director - PET Power)

The consultant from DW Reusables also mentioned recent patented developments in the recycling of PP into food grade rPP. For example, the decontamination of rPP has been researched and tested in 2016 by The Waste and Resources Action Programme (WRAP), a non-profit organisation. After applying a patented decontamination technology, their research suggested that the resins tested were compliant for food use according to EU and US regulations (Waste and Resources Action Programme, 2013).

Criteria reusable primary food packagng

Similar testing is being done by Envision Plastics, St. Joseph Plastics and PureCycle Technologies LLC as reported on last year (Maile, 2019). Thus, these developments and technologies also appear to be nascent.

As for now, PP appears to be the most suitable material for a reusable primary food packaging bowl. For the potential required use of a lid, an additional, removable, flexible material could be needed to ensure anti-leakage of the packaging. A suitable material could be thermoplastic elastomer (TPE). Also, “TPE seems to dry quicker than PP for some reason” (Sales manager -Hobart). Future research and development of food grade recycled PP as well as heat resistant rPET could lead to other recommendations for suitable material for primary reusable food packaging in the future.

Logistics

After gathering the main functional and non-functional criteria as well as providing insight in suitable reusable packaging material, it is important to look at the logistics in an open reusable system. Within this reusable system, transportation and storage are critical. This next chapter discusses insights into the most suitable shapes and dimensions for reusable packaging transport and storage. standardisation of these packaging could enable more efficient transportation, thus minimising the costs and environmental impact.

A distinction needs to be made between logistics from packaging hubs to food vendors and reverse logistics from users back to the packaging hubs. As the logistics from packaging hubs to food vendors is already widely operationalised and optimised on a large scale, this chapter focuses on the shapes and dimension requirements taking into account storage at food vendors and the reverse logistics. In order to minimise operational costs of reverse logistics, packaging needs to be nestable and designed in a way that all space is utilised during transport and in storage. All while taking into account minimum storage capacity as explained by Bunzl, HEMA, HMSHost International and restaurants spoken to during our field observations.

Currently, no minimum or standardised sizes appear to be adopted in the design and creation in primary packaging: *"For logistics, the most ideal shape is square or rectangular. With round packaging we often see a lot of room wasted. But if I look at trends in the market I can see a lot of round packaging. Also, people also eat smaller meals, so we see an increasing demand for smaller packaging."* (Sustainability manager - Bunzl)

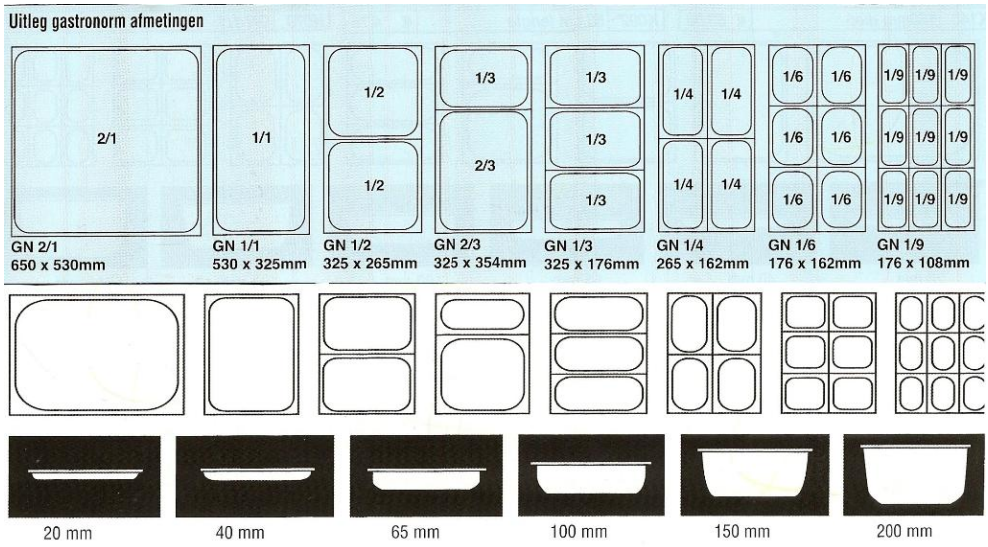
Apart from efficient transport, nestable packaging are needed due to the limited storage space of food vendors. Retailers, supermarkets and restaurants interviewed for this article all mentioned this as one of the concerns that would prevent them from using reusable food packaging: *"For packaging, I think refillable packaging in stores make the most sense. Logistics are already very tightly set up. The stores barely have any storage space so it will become very difficult to store and collect reusable packaging."* (Packaging specialist - HEMA)

"In high traffic locations, piles of crates take on all the space where you're standing. Especially with airports for example. Especially after customs, there is very little room for storage, so all packaging that we deliver needs to be nested very closely together. At Kiosk we tried reusable coffee cups but we couldn't store any. This is the case for almost all food vendors." (Sustainability manager - Bunzl)

Logistics

"As we become more sustainable as a business, we seek for products that meet cost, space and guest convenience factors. We want a solution that combines sustainable materials in a cost-effective and end-to-end sustainable model which also complements our operational process. For example, in our airports every inch of space is valuable, so a solution would need to optimize the usage of the storage space that we have available." (Buyer/Category Manager - HMSHost International)

A common standard used in the preparation, storage and transport of food is the Gastronorm (GN). This norm dictates the following standardised measurements:



(Standardised GN measurements - Gastronormbakken.com)

The standard GN sizing is 530 mm x 325 mm (1/1) (European Committee for Standardization, 1999). Other standardised GN sizes have been derived from one GN by either duplicating (2/1) or dividing the standard. The heights of the packaging has also been standardised: 20 mm, 40 mm, 65 mm, 100 mm, 150 mm, 200 mm. These sizing offer food vendors a variety of GN that could be used to optimise processes and transport within the food industry. GN packaging are nestable, which also allows for their efficient transport.

Reverse logistics

Suitable transportation from drop-off points to reusable packaging producers and distributors requires efficient and sustainable transport in dense cities. The most suitable vehicles for reverse logistics appear to be (smaller) trucks and delivery vans as they already frequently move within dense cities (Topsector Logistiek, 2017). Drop off points should be easy to access by users, Interesting locations appear to be vendors using the packaging, other consumer businesses and other decentralised locations consumers frequent.

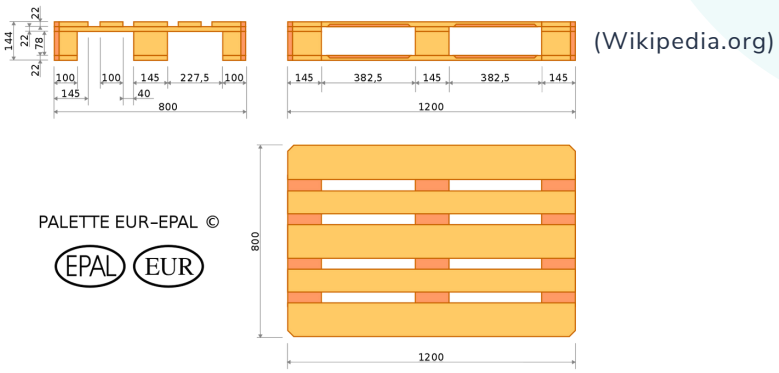
Logistics

CHEP's Marketing lead for their Zero Waste World (ZWW) Packaging programme highlights this with a cautionary tale: "Make sure you place sufficient drop-off points in order to succeed on the long run. For example, in Belgium we had a share & reuse set-up for cars some years ago. It was discontinued because the system could not track & trace where the cars were located and also participation was too limited geographically. If customers would take a car in Brussels and drive to Antwerp, there was no drop-off point. Therefore, it is essential to set up a large, connected network."Even though the business case is different, the need for decentralised drop-off locations also appears to be relevant for primary reusable food packaging.

Standardised dimensions transport

Different packaging norms are used for transportation. The most common and universal norms for European transport are: EPAL norm, ISO1 norm and Gastronorm for food (International Organization for Standardization, 2003). The EPAL norm and ISO1 norm are standardised pallet norms. The EPAL norm was initiated by the European Pallet Association (EPAL) and recognised by ISO as one of the six sanctioned pallet sizes in the ISO Standard 6780:2003 Flat pallets for intercontinental materials handling - Principal dimensions and tolerances. Standardisation in pallets enabled the more efficient and thus more environmentally friendly transportation and storage of goods. This is because it avoids packaging having to be unpacked and packed as well as ensuring the most efficient use of space in warehouses and storages (European Pallet Association, n.d).

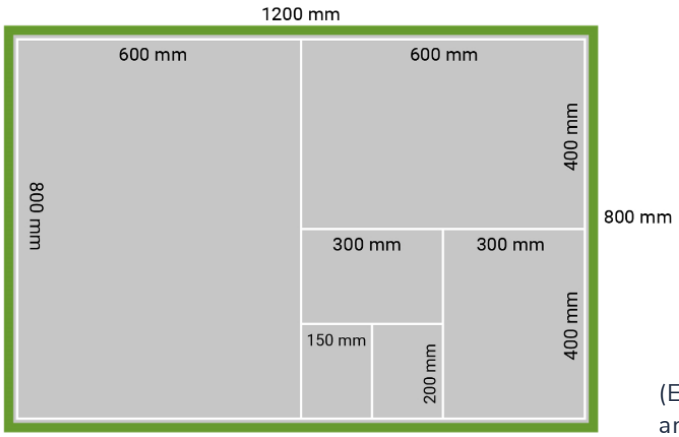
The ISO pallet (100x120 cm), also called block pallet, is the standard pallet used in France and the United Kingdom, but used in many European countries. The Europallet (80x120 cm) the standard pallet used in The Netherlands and Germany and the most common pallet used in Europe (European Pallet Association, 2019). A key benefit is that the Europallet fits in most normal doors, which eases storage and transport to and from residential and retail establishments located in dense cities. Most Dutch supermarkets accept either the Europallet or both block pallets and Europallets (CHEP, n.d., Jumbo Supermarkten B.V., 2019).



(Wikipedia.org)

Logistics

Derived from the Europallet, ISO pallet and roll container (60x80 cm) sizing, the standardised collomodular Euronorm sizing was created (Hulkenberg, 2017). Collo modularity in the Euronorm refers to the optimal sizing of boxes and crates for the most efficient stacking on pallets. The collomodular system is designed with the ground size 60x40 cm. The most commonly used crate in the food industry is the standard CBL crate (60x40cm) where different heights are adopted, Other commonly used Euronorm sizes are: 200 x 150 mm, 300 x 200 mm, 400 x 300 mm, 800 x 400 mm, 800 x 600 mm and 1000 x 400 mm (Hulkenberg, 2017).



(Example Euronorm crates and boxes - Palletplaza.nl)

Many packaging and logistics companies offer secondary packaging which conform to Euronorm, but comply to Gastronorm sizing on the inside. It could be useful to produce reusable primary food packaging according to Gastronorm sizes that fit in collomodular Euronorm crates. For the most optimal use of room available in transport and storage, a rectangular shape is recommended. This would allow the most efficient reverse logistics from drop-off points to cleaning facilities and storage hubs of different packaging producers.

Cleaning

Professional cleaning facilities and strict health and safety procedures are needed in order to be able to commercially reuse food packaging on a large scale. It is important to take the cleaning process into account when designing reusable food packaging. Cleaning and reusing a couple of dozen containers is not so complicated, but when operating on a large scale, there are some things to keep in mind.

Shape

Cleaning plastics is a complex operation, because plastics don't absorb much heat and therefore stay wet at the end of the cleaning process. This is probably recognisable when cleaning Tupperware containers. In that case it is possible to simply dry the food containers, but can become a problem when operating on a large scale and >10.000 items/hour need to be cleaned. When the packaging is not completely dry, moisture will lead to the growth of bacteria and the packaging is no longer food safe. According to the suppliers of industrial cleaning machines we spoke to (Meiko and Hobart) the most important thing to keep in mind with packaging design is avoiding deep edges, grooves or narrow holes. These can become blind spots for the cleaning machine and will hold water. This will slow down the drying process which will have a negative impact on the cleaning efficiency.

(Example industrial cleaning machine - Meiko M-IQ)

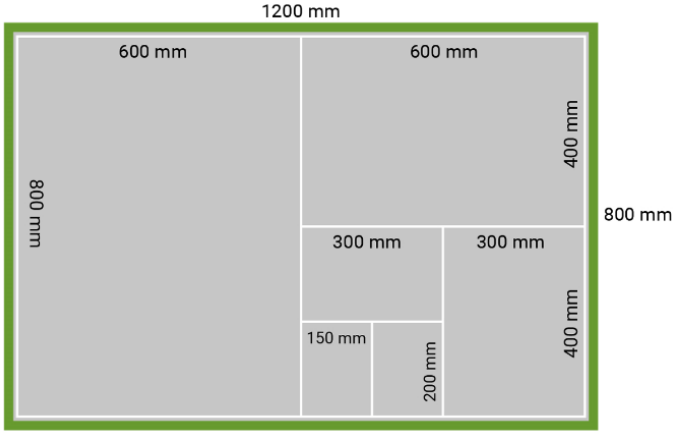
From a cleaning point of view Meiko prefers more a squared shaped packaging over round shaped. *“This is because squared shaped will be easier to transport through the machine and we need less contact points to keep the packaging in place, which are, again, more difficult to dry. This will eventually slow down the cleaning process and will increase the operational costs.”* Hobart has no preferred shape. *“The most important thing is that the water can run smoothly over the surface and that the machine can easily reach all parts of the packaging ”*, Hobart also confirms that contact points will slow down the drying process.

Cleaning

Finally, all machine builders state that there is no minimum or maximum weight to keep in mind. Water pressure can be adjusted to the packaging inside and baskets can hold everything in place if needed.

Dimensions

When it comes to finding standardisation in dimensions of reusable food packaging for cleaning, all industrial cleaning machine suppliers refer to Euronorm standards. Even though these standards are set for crates and outer cases, it is good to mention these dimensions first.



(Example Euronorm crates and boxes - Palletplaza.nl)

Most industrial cleaning machine designs are based on Euronorm standards (600*400 mm). Although it is always possible to custom-build machines specifically to your needs, but it will require an extra investment that will increase operational costs and could potentially become a problem when expanding the product range. So it is recommended to try to adhere as much as possible to these dimensions. Hobart advises to keep the ground dimensions as a constant and depth/height as a variable, like with Euronorm and Gastronorm.

Cleaning

Hobart uses a maximum height of 440 mm to 560 mm, whereas Meiko advises a maximum height of 200 mm to guarantee a optimal cleaning and drying result. Also, cleaning packaging that is longer than 600 mm requires adjustments to the standard washing and drying cabins. This brings the maximum advised dimensions to:

Length: 600 mm
Width: 400 mm
Height: 560 mm

When looking at the minimum dimensions of reusable food packaging for cleaning there is a trade-off to make. With the use of baskets there are no limitations to the minimum dimensions, but on the other hand, baskets will result in extra contact points which will require more drying capacity. According to Meiko, the minimum dimensions that don't require the use of baskets are:

Length: 35 mm
Width: 35 mm
Height: 30 mm

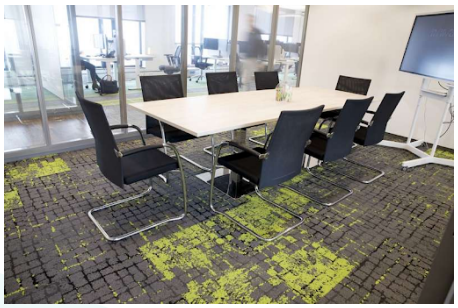
In conclusion, most industrial cleaning machine designs are also based on Euronorm, so it is important to keep these dimensions in mind. And secondly, drying is a very important aspect of efficient and effective cleaning. So it is recommended to avoid difficult to reach elements in- and outside of the packaging (e.g. holes, edges, difficult click-mechanisms) and to limit contact points between the packaging and cleaning machine as much as possible.

Appereance & Lifespan

The sustainable impact of reusing packaging is most effective when the packaging is actually reused as many times as possible. The perception on hygiene and quality by the user plays a big role in the reusability of the packaging. Therefore it is important to try to minimise the traces of reuse as much as possible. A few options will be highlighted in this chapter.

Patterns and imprints

The first recommended design choice by the CTO of Better Future Factory, a sustainable product design studio specialised in recycled plastic, is the use of patterns and imprints on the surface of the packaging. Small damages by (re)use and transportation can be disguised by adding a simple pattern in the design. A perfectly shiny coating will show the tiniest scratches on the outside after the first reuse cycle. This could give a “used” feel for the user and could negatively impact the reusability of the packaging. By adding these patterns, it is possible to reuse the same packaging multiple times extra before it is considered end-of-life. This would ultimately increase the sustainable impact of the reuse system.



Camouflage by patterns on carpets in office buildings

Camouflage by patterns on home accessories

Colour use

As mentioned earlier in chapter “Criteria reusable food packaging”, there is a trade-off to make with the packaging colour. Lighter colours are often used to highlight a product’s healthiness and trigger important taste functions. But from a camouflage standpoint it is recommended to avoid complete transparency or clear white as colours for a reusable packaging. Food pigment appears to attach more to transparent plastic and would eventually be perceived as end-of-life sooner than darker- or more cardboard-like colours.

Guided impact

In a system of reuse, damage by transportation is inevitable. But it is possible to strategically guide where this damage will occur. Some parts of the packaging are simply more important to stay in tact than others. For example, damages on parts for branding or tracking purposes are not favorable (e.g. Labels or Bar-/QR-codes). A great example of this guided impact is the glass beer bottle design.

Appereance & Lifespan

Camouflage by patterns on carpets in office buildings

Camouflage by patterns on home accessories

As seen on the left image, two small edges are added to the design. In between those two edges is the label of the beer brand (see right image). With this small adjustment to the bottle design the label is being protected during the transportation in the beer crate. The result of this guided impact is best seen on the beer bottle on the far right. The bottom of the bottle is damaged, but the label is in tact.

In conclusion, the ultimate goal is to extend the life-cycle of the reusable packaging by minimising the traces of (re)use that occur during consumption and transportation. Adding patterns to the packaging design can have a positive impact on the perception of “used” by the consumer and can therefore result in extra reuse cycles. And secondly, it is advised to examine the full logistical cycle and add strategic adjustments to the packaging design to better protect important parts of the packaging.

Findings & Recommendations

In this last chapter we summarise the most important findings and recommendations of this research by answering the (sub) research questions.

What are the requirements for the most suitable solution for primary reusable food packaging taking into account reverse logistics, cleaning and multiple reuse by different actors?

In order to answer this research question, several sub questions have been defined.

1. **What are the criteria for a reusable primary packaging for food?**

Functional	Non-functional
Food safe	Universality
Heat resistant 85°C	Visibility food
Chemical resistant	Light colors
Hassle-free use	No “over”-packaging
Separate lid	
Universal lid	
Nestable	
Firm (max 6mm wall thickness)	
Anti-leakage	
Recyclable	

2. **What is the most suitable material for reusable packaging taking into account the criteria of the packaging?**

As for now, PP appears to be the most suitable material for a reusable primary food packaging bowl. Future research and development of food grade recycled PP as well as heat resistant rPET could lead to other recommendations for suitable material for primary reusable food packaging in the future.

3. **What is the most suitable shape of reusable food packaging for transportation, based on the current reverse logistics providers?**

Looking at the market, the current trend is to use round shaped food packaging. But with round shaped packaging, room is wasted. So for efficient reverse logistics a more square or rectangular shape is preferred.

Findings & Recommendations

4. What are the most suitable dimensions of reusable food packaging for transportation, based on the current reverse logistics providers?

Many packaging and logistics companies offer secondary packaging which conform to Euronorm, but comply to Gastronorm sizing on the inside. It could be useful to produce reusable primary food packaging according to Gastronorm sizes that fit in collomodular Euronorm crates. This would allow the most efficient reverse logistics from drop-off points to cleaning facilities and storage hubs of different packaging producers.

5. What is the most suitable shape of reusable food packaging for cleaning?

The most important thing to keep in mind with packaging design is avoiding deep edges, grooves or narrow holes. These can become blind spots for the cleaning machine and will hold water. This will slow down the drying process which will have a negative impact on the cleaning efficiency. Square and rectangular shapes are preferred because they are easier to transport through the machines and would therefore need less support and contact points.

6. What are the most suitable dimensions of reusable food packaging for cleaning?

Also industrial cleaning machines designs are based on Euronorm (EN). The most suitable dimensions for cleaning are derived from Euronorm. Maximum dimensions for packaging are: 600 mm * 600 mm * 650 mm. When using baskets there are no minimum dimensions, but baskets will lead to more contact points and are more difficult to dry. The minimum dimensions of food packaging that don’t require the use of baskets are: 35mm * 35mm * 30mm

Findings & Recommendations

7. Which design choices can be made to minimise traces of reuse occuring during the consumption or transportation of reusable food packaging?

The goal of minimising traces of reuse is to extend the lifespan of the food packaging. There are three options explored in this research:

- **Patterns & imprints:** this can be used to disguise small damages in- and outside the packaging and will prevent the perception of “used” by the end-user.
- **Colour use:** Food pigment appears to attach more to transparent plastic and would eventually be perceived as end-of-life sooner than darker- or more cardboard-like colours.
- **Guided impact:** It is possible to protect important elements of the food packaging (e.g. labels or QR/Barcodes) by adding subtle edges around these elements. This way it is possible to guide the damages that occur during transportation and cleaning.

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Laura Klauss: CTO
Better Future Factory

Marcea van Doorn: Sustainability Manager
Bunzl

Raoul Gabriels: BD&T Director
PET Power

Marjolijn Kwint: Buyer/ Category Manager
HMSHost International

Consultant
DW Reusables

Johan de Bok: Sales Manager
Hans Nunnikhoven: Key Account Manager
Meiko

Leo Beijer: Accountmanager
Rob Riemsdijk: Hoofd Productgroep Vaatwas
Hobart

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