



Case study report - Keter

Good practice of circular economy business models

Case study report - Keter

Good practice of circular economy business models

As part of the TRANSFORM-CE project, several case studies are done to benchmark existing circular economy business models. This document covers the results of the case study conducted at Keter, based in the Netherlands. A total of 20 case studies will be done, with five cases per country (The Netherlands, Germany, Belgium and the United Kingdom).

Date May 2021

Authors Malou van der Vegt, Evert-Jan Velzing

Deliverable WPT3 D2.1 Benchmarking existing circular economy (CE) business models



This research has been conducted as part of the TRANSFORM-CE project. More information about the project can be found on: www.nweurope.eu/transform-ce. TRANSFORM-CE is supported by the Interreg North West Europe programme as part of the European Regional Development Fund (ERDF).

Table of contents

1. Introduction and method	4
1.1 Goal of case study	4
1.2 Company background	4
1.3 Case study process	5
2. Circularity of business model	7
2.1 Circular business model canvas	7
3. Circularity in the value chain	14
3.1 Material and value flow map	14
3.2 Circular strategies	15
4. Circularity of operational activities	18
4.1 Operational process map	18
4.2 Circular sourcing and design	18
4.3 Production process	20
4.4 Quality assurance and packaging	21
5. Conclusion and recommendations	21
5.1 Strengths for circularity	22
5.2 Barriers and enablers for circularity	23
5.3 Opportunities for circularity	24
References	26

1. Introduction and method

1.1 Goal of case study

TRANSFORM-CE is an international research project which researches amongst others (successful applications of) circular business models, barriers, enablers and needs for circularity, and offers in-depth support for the uptake of recycled feedstock by businesses. A core part of the project is to provide advice to businesses on their way to transition towards a circular economy (CE).

In order to help businesses with developing circular business models (CBM's), it is first important to benchmark existing CBM's of companies. This is done by conducting case study projects with 20 selected businesses throughout North-West Europe. The aim is to provide participating businesses with an in-depth analysis of their current situation and business model, to identify opportunities and provide recommendations for facilitating the transition towards a CBM for these and other companies. The case studies also present an unique opportunity to study barriers, enablers and needs for circularity (and recycling) in more detail.

1.2 Company background

Keter group is a manufacturer of durable plastic consumer products sold to retailers and consumers in 108 countries, with 19 plants worldwide. The group now has several brands under its name, including Keter, Curver, Allibert and Jardin. Products include everything in and around the house made of plastic, such as outdoor storage and furniture, planters, home organisation and tools storage. For many years recycled materials have been applied in Keter's products, with an average of 41% recycled content in 2019¹.

Although the Keter group covers many different brands and plastic products, the scope of this case study is placed on its two key brands: Keter (outdoor furniture and storage) and Curver (home organisation). A short overview of Keter group is given in table 1.

Table 1: Overview of company

Topic	Information
Company name	Keter Group B.V.
Website	https://www.keter.com/bnl_nl/ & https://uk.curver.com/
Country	The Netherlands and operating globally in Israel, Europe, Canada and the United States
Size of company (0-10, 10-200, 200-500, 500+ employees)	500+
Mission/vision	"Inspiring people to create amazing spaces in their homes and gardens, with innovative, high-quality products."

¹ See for more information Keter's sustainability report of 2019:

https://www.keter-pim.com/images/Fittings/keterpim/website_general_docs/KeterSustainabilityReport2019.pdf

	"Deliver innovative and affordable lifestyle solutions for different people and places and advance a circular economy through use of recycled content and recyclable design."
Product category	Outdoor furniture and storage, planters, home organisation and tools storage
Production/operational process	Injection moulding (and extrusion)
Used materials	PP

1.3 Case study process

The case studies are being carried out between September 2020 and December 2021. The case study process is structured in four steps², with an iterative approach at the end of each step. The first step (circularity of the business model) aims at creating a general overview of the company, the context and its (circular) business model, to capture how the company creates and delivers value. The second step (circularity in the value chain) involves a circularity assessment of the company and its activities in the value chain. The third step (circularity of operational activities) is focussed on the circularity of the company's operational activities. The last step involves a wrap-up of the results and concludes with the case company's strengths in regards to circularity, an overview of the barriers and enablers for circularity, and opportunities for further enabling circularity. The final result is a case study description, covering the previously established information.

An overview of the case study analysis process is shown in figure 1 on the next page. In order to obtain the results, each of the three steps is divided into four sub steps: 1) desk research and preparation; 2) interview; 3) reporting results; 4) iteration of results. More information about the process and the steps needed for receiving the results can be found in a separate document ('case study methodology') explaining the case study process in more detail. Three interviews are conducted for this case study, with one interview per step and the interviewed persons each having a different function and responsibility within the company.

Table 2 gives an overview of the interviewed persons for Keter.

Table 2: Overview of interviewed people

	Interviewed person	Function
Interview 1: Circularity of business model	Natasja Groeneweg	CFO
Interview 2: Circularity in the value chain	Daniel Rasenberg	Marketing director
Interview 3: Circularity of operational activities	Marloes Verbruggen	Material expert

² We make grateful use of insights and methods derived from previous research, in particular the case study method of R2π (2017, 2019), the work of Circulab (2020) and the Ellen MacArthur Foundation (2017, 2019).

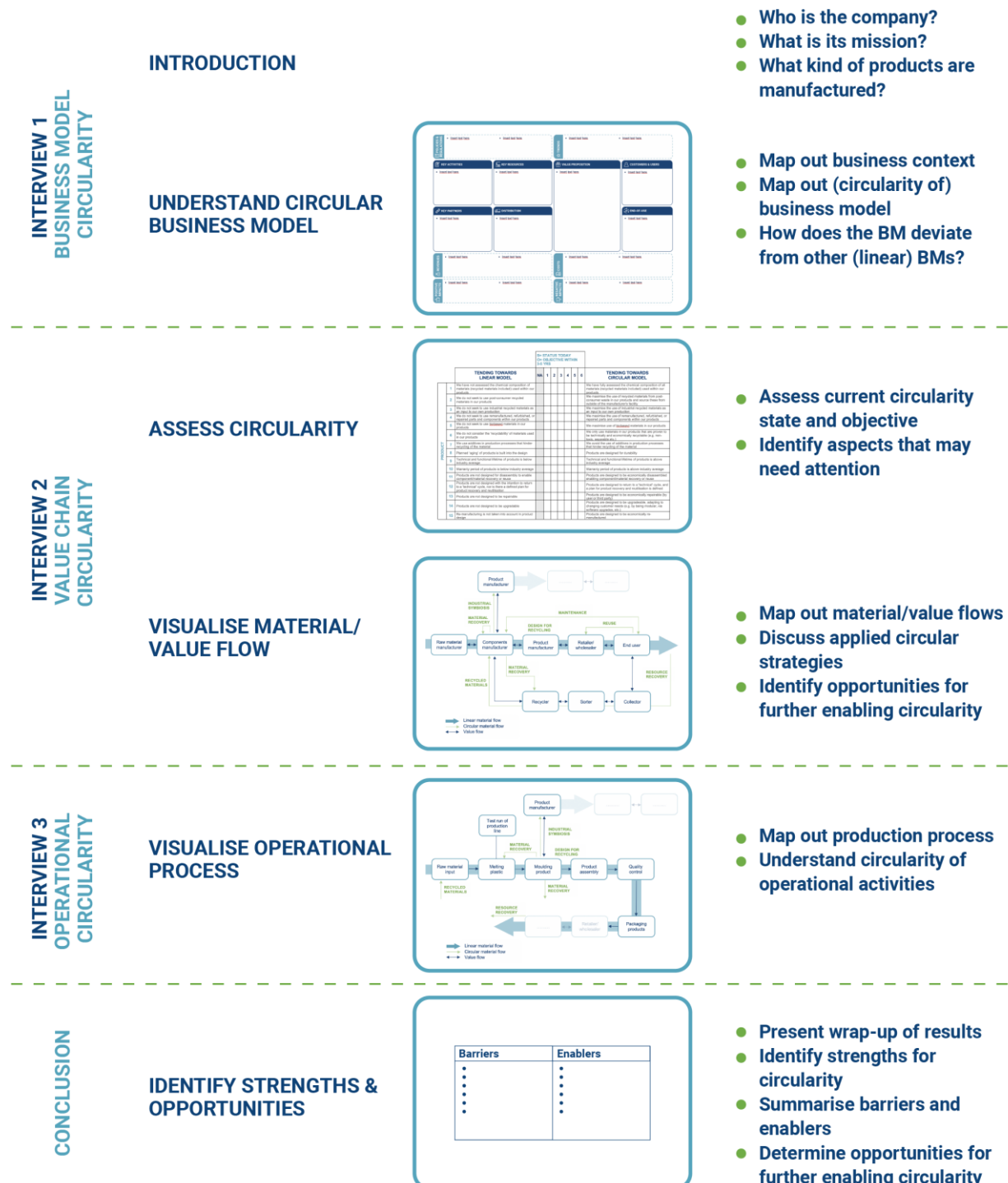


Figure 1: Overview of case study process

2. Circularity of business model

The first step aims at creating an overview of the company's business model and the context in which it operates, to capture how the company creates and delivers value (for circularity).

2.1 Circular business model canvas

The circularity of the business model is investigated by using a circular business model canvas (CBMC). This model is created for the purpose of this study and shows how the company creates, delivers and captures value, highlighting circularity aspects of the business. The CBMC of Keter is visible in figure 2 and a description of each element is given below.



Figure 2: CBMC of Keter

Value proposition

Keter group manufactures all kinds of plastic consumer products in and around the house. They sell durable home and garden products under various brand names, which include their two key brands: Keter and Curver. With the Keter brand they “create amazing spaces” by means of outdoor furniture and storage. Under the Curver brand they sell products for organising home with the goal of creating a “welcome home”. Products are positioned as good quality products in the middle to high price segment for plastics products for both retail and e-commerce.

Sustainability is high on the company’s agenda and for many years Keter has used recycled materials in its products. The company already uses an average of 41% recycled content in their products, with the aim to double this percentage in the next ten years. They produce sustainable plastic consumer products that are durable (not intended for single-use) and suitable for recycling at end-of-life. The importance of sustainability communication to customers and consumers, and in more particular the use of recycled materials, has grown over the years and has now become an effective marketing tool.

For years, customers have chosen Keter’s products because of good quality for affordable prices, product innovation and new designs (new textures etc.), which now also includes the use of recycled materials.

Customers & users

Keter’s products are marketed worldwide in 108 countries, including Israel, Europe, Canada and the United States, and sold to both businesses and consumers. Their home and garden products can be found in over 25,000 retail stores and multiple online web shops. Customer segments consist of:

- DIY (e.g. Hornbach, Gamma, Praxis)
- Garden Centres Intratuin, Groenrijk)
- E-commerce (e.g. Wehkamp, Bol.com, Amazon, Fonq)
- Discounters and grocery stores (e.g. Action)
- Home furnishing stores (e.g. Leenbakker, Kwantum)
- Mass Market (e.g. Blokker)

Keter’s products include outdoor furniture and storage, planters, home organisation and tools storage. Examples of products sold under the Keter brand are lounge sets, garden storage boxes, garden chairs and planters, see figure 3 on the next page.



Figure 3: Examples of products of Keter brand (lounge set, garden storage box, garden chair, planter)
 Source: Keter

For the Curver brand, product examples include waste bins, home storage boxes, baskets and food containers, see figure 4.



Figure 4: Examples of products of the Curver brand (waste bin, storage box, basket and food container)
 Source: Keter

The use of injection moulding as a production process allows for producing high volumes in a short period of time, hence, products are aimed at the masses. Focus is placed on more traditional retailers rather than specialists (with expensive brands and tailored customer needs), to allow for a large number of product sales from the same (expensive) mould. Moreover, customers of the Keter brand are often large retailers, with enough space on the shop floor for (large) show models. It is often the case that a store displays only one show model, and other variants may be purchased on order.

Key activities

Keter's manufactures, sells and distributes plastic consumer products. Manufacturing of products for the Dutch market includes injection moulding of outdoor furniture (Keter brand) and home organisation products (Curver brand). While injection moulding is Keter's main manufacturing process, the company also has factories where panels are extruded.

Internal (top down) communication of sustainability is also part of Keter's main activities, which pushes the entire organisation to take steps in the field of sustainability and circularity. Employees

all have sustainability targets and have to report each month whether they have achieved goals. Communication to consumers is done by online communication and slogans on packaging. Moreover, customer service is offered to consumers to replace broken parts or pieces (free of charge within warranty period). The company is also exploring other options for circularity such as implementing product end-of-life programs and selling second hand outdoor furniture.

"The biggest challenge is to keep working on sustainability continuously, in addition to all other activities"
- Natasja Groeneweg, CFO of Keter

Besides Keter's key activities, the company is also engaged in other areas. This includes research into new material options in Keter's innovation centre in Israel. For instance, they have done material tests with plastic waste derived from diapers or ocean waste plastic. They also have multiple small initiatives going on, such as sponsoring Waste Free Oceans.

Key resources

The primary raw material used in the production of products under the Keter and Curver brand is polypropylene (PP). This could be virgin material, sourced from post-consumer resin (PCR) or post-industrial resin (PIR). An average of 41% recycled material content is currently used within production of Keter (combination of PCR and PIR), with the goal to reach 55% by 2025. Some product families under the Curver brand are made from 100% recycled plastic, derived from post-industrial sources. Products of the Keter brand contain a larger part of PCR, because of easier application due to the use of darker colours.

Keter has been using recycled materials for many years and has developed valuable expertise over time. Their years of experience results in limited problems with the production of recycled materials. To avoid production problems with recycled materials, it is important to take the use of recycled materials into account at the beginning of the product development process. Hence, moulds are tailored to the use of recycled materials, taking into account, for example, wall thicknesses, sharp edges etc.

Most products of the Keter brand are made of different parts and have to be assembled by consumers. All parts are made of PP with the exception of for example metal table legs. Some parts are made of 100% recycled plastic, some of only virgin materials, while others are a mix of recycled and virgin content. As an example, the seat of a lounge set is more crucial in terms of quality, so this part largely consists of virgin material.

Keter has 19 manufacturing sites worldwide. Outdoor furniture is produced in the Netherlands (Rijen and Enschede), while home organisation products are manufactured in Luxembourg or Poland. The production factory in Rijen (NL) has 46 injection moulding machines, multiple robots and some hand equipment, which will be further expanded with machines coming from the factory in Enschede. All production sites also have a shredder for reusing materials from Keter's own production process..

Another key resource of Keter is the company's commitment and communication on sustainability, both internally and externally. Sustainability is implemented throughout the organisation by top down communication and commitment from the CEO, and by setting sustainability goals and

targets for employees. Externally this is done by active communication of recycling on packaging and online media. While the communication of recycled materials is largely stimulated by customers and consumers, the incentive for the use of recycled materials comes from within the company (top down from CEO). Communication to consumers is largely focussed on the use of recycled materials, and distinction between PCR or PIR is not explained to keep the message short and simple.

Key partners

In order to manufacture products with such a high content of recycled materials, collaboration with recycled material suppliers is very important. They are able to supply recycled granulate of sufficient quality with a consistent colour. Other suppliers include virgin material suppliers, packaging suppliers and mould suppliers. Keter's end products are sold to businesses (retailers and e-tailers) and sometimes directly to consumers.

"For sustainability it is important to look for partners who can make the transition, because it will not be possible on your own."

- Natasja Groeneweg, CFO of Keter

Distribution

Distribution of products mostly happens through warehouses of retailers and e-tailers. Little is directly supplied to consumers. Packaging is used for distribution and sale of products. Current packaging consists of expandable polystyrene (EPS), which is being replaced with cardboard as a more sustainable alternative.

End-of-use

Keter's products are designed to last for several years and are not intended for single-use. The recyclability of all products allows for the possibility to recycle products at end-of-life. However, waste separation is arranged differently in each country. For example in the Netherlands consumers are offered the opportunity to separate plastic packaging waste. Nonetheless, larger products such as outdoor furniture (bulky waste) must be separately collected and taken to a municipal waste station. At the municipal waste station the waste is collected separately as well. Moreover, Keter is exploring options for implementing end-of-life programs, which will help to ensure that products are actually recycled in practice. On the other hand, products that break at warehouses of customers can be returned to Keter and are used for manufacturing new products.

Costs & revenues

Keter is a healthy and sustainable business, with a revenue of over 1 billion euro worldwide. Recycled materials were previously used due to cost considerations, but the difference between virgin and recycled material costs has become smaller. If recycled materials are a bit more expensive, it will be acceptable, however the difference should not become too big. Keter still needs to make profit.

Policies & regulations

In terms of laws and regulations, it is important for Keter to be able to demonstrate and communicate the right percentage of recycled materials used in products. For this reason, they often communicate a lower percentage to ensure that the burden of proof is met. Recyclers are supplying certificates to prove the percentages of PCR in products.

Few products under the Curver brand also have to deal with approvals for food contact materials. This limits possibilities for the use of PCR in products. As of this moment, PP from post-consumer streams is not allowed to be used for food purposes. This is because it cannot be demonstrated that a minimum of 95% has previously been used for food purpose. For now this is only possible for Polyethylene terephthalate (PET) waste coming from the bottle return system. In contrast, PP from post-industrial sources may be used for food applications.

Trends

Keter has been using recycled materials for several years, however consumers had little interest in it at the time. Since the past few years, attention for sustainability and plastic recycling has increased. Where in the past recycled materials were used but the use of it was not communicated (due to reluctance of consumers), it has now become an effective marketing tool and an added value for the company. Hence, the use of recycled materials and recyclability of products is now actively communicated to customers and consumers.

Keter's customers belong to various retail groups such as Kingfisher and Adeo where sustainability has become more and more important. The high sustainability targets of these retail groups highlighted the urgency for communicating the use of recycled materials in Keter's products. Businesses have to prove that products contain a certain part of post-consumer resin (PCR) and have to be able to demonstrate percentages of recycled materials in the parts lists. In contrast, Dutch retailers are not asking for such prove yet.

"Where in the past we preferred not to communicate about our use of recycled materials, it has now become part of our communication to the retailer and the consumer."

- Daniel Rasenberg, Marketing Director of Keter

Another market trend that Keter sees is the increasing awareness of consumers for problems with plastic waste and for example the plastic soup. However, consumers are also becoming aware of the fact that such problems are related to disposable and single-use plastics, rather than Keter's durable products.

Trends amongst competitors also include the use of recycled materials, although Keter is confident to be ahead of competition in this field. Moreover, the volume of recycled materials used by Keter is much higher than that of competition, due to their large product portfolio. Thus, the use of recycled materials by Keter is used to distinguish the company from competition. Other market initiatives such as product take-back at end-of-life options are closely followed by Keter.

On an economic level is seen that prices of recycled materials are still cheaper, but also that differences in prices seem to become smaller. The company expects the prices of recycled materials to increase due to increasing demand.

Positive and negative impacts

Key positive impacts of Keter relate to the sustainability of their products. They produce durable products, which are not intended for single-use, but designed to last several years. Besides, products are made of recycled materials and are suited for being recycled again after use. Positive impacts of the company will increase with the implementation of end-of-life programs, which will help to ensure that products are actually recycled in practice. Negative impacts are mostly related to the production process and Keter is working on reducing these impacts to a minimum (e.g. reducing energy usage, reducing CO₂-emissions, making use of solar panels, etc.). Another negative impact related to materials is the use of fossil fuels by Keter. However, the company is extensively looking to reduce these impacts by the use of high percentages of PIR and PCR in products.

Moreover, the company views sustainability from a wider perspective than solely the environmental impacts of its activities. They are for example also working on social equity, improving health, etc. All these aspects are regarded to be important, but circularity of materials comes first.

3. Circularity in the value chain

After analysing the company's current (circular) business model, a more detailed circularity assessment of the company and its activities in the value chain is made. The material and value flow map is presented, together with its adopted circular strategies.

3.1 Material and value flow map

The ultimate goal of a CE is for resources to flow in circles, with limited leakage out of the system. To evaluate this, it is important to map and visualise the current flow of materials and value within the company's value chain. The material and value flow map of Keter is presented in figure 5. The value flows (blue) indicate that value is being exchanged between actors, and enables an analysis of the relationships amongst key partners. The circular material flows (green) show where the material comes from, where it goes and how it may return into the cycle.

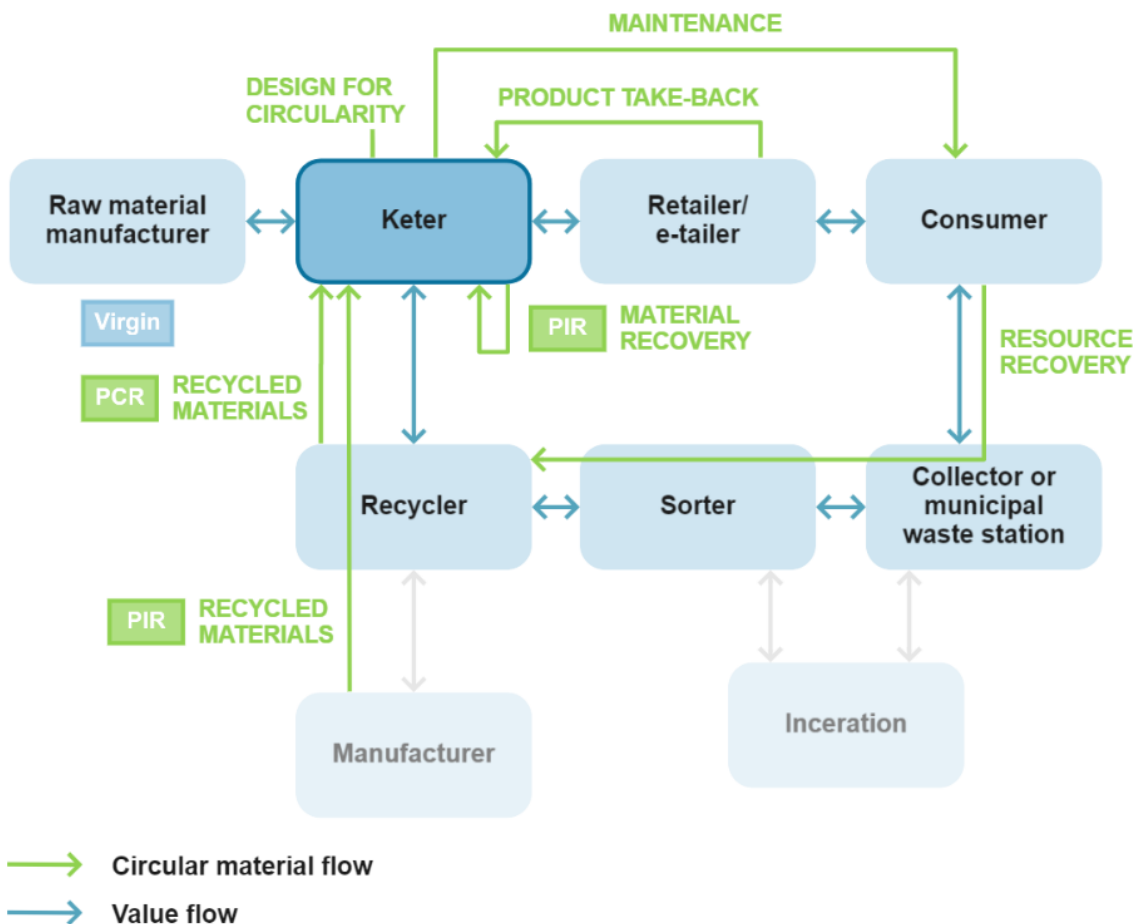


Figure 5: Material/value flow map of Keter
(with PCR: post-consumer resin and PIR: post-industrial resin)

3.2 Circular strategies

As shown in figure 3, Keter applies multiple circular strategies: the use of *recycled materials* in their products, *material recovery* of production waste, *resource recovery* at end-of-life, *maintenance* by replacing broken parts, and *design for circularity*. Each of the strategies is further explained below.

Recycled materials

Keter has been using recycled materials in its products for many years. They launched their first products made of 100% PCR in 2012. However, it turned out that consumers were not ready for it yet. Recently, attention for sustainability has increased and there is awareness for aspects such as the plastic soup. This led to a change in mindset of customers and consumers, who are now looking for sustainable options and products made of recycled materials. While in the past Keter did not communicate about their use of recycled materials (due to reluctance of consumers), they are now actively communicating this due to the change in mindset. Previously, Keter was using recycled materials mostly because of cost reasons, but it has now become an integral part of the company's strategy.

Because of Keter's large product portfolio and its global spread, the company is using a large amount of recycled materials. Per product, an average of 41% recycled materials is used, with the goal to reach 55% by 2025 and 80% by 2028. Recycled materials in Keter's communication includes waste from both post-consumer (PCR) and post-industrial (PIR) sources. Depending on the product, a choice is made to use one or the other. PCR is preferred over PIR, but has less application possibilities. With outdoor furniture, for example, it is easier to apply PCR due to the use of darker colours. In contrast, the Curver brand uses more brighter colours or sometimes even transparent materials, which are harder to achieve with PCR. Therefore, PIR is largely applied in Curver's products, but also due to restrictions of PCR food purposes (e.g. for food containers).

During the development of (new) products the use of (100%) recycled materials is already taken into account. This includes the design of the product, but also the design of moulds. For example, materials may have to be heated a bit more and higher injection forces may be used.

"If you do not take into account the use of recycled materials at the beginning of the product development process, you will run into problems with production later on."

- Natasja Groeneweg, CFO of Keter

Consumer waste is usually a challenge to recycle, which is why recyclers act as a partner that supplies material with a reliable quality in the form of granulate. The advantage of using recycled feedstock from a recycler is that the granulate is supplied in colour, whereas colour for virgin materials requires the need of a master batch. Both colour and quality are sufficient and consistent, which is also covered in agreements with recyclers. For chemically recycled materials the production capacity is still low and the larger brands (e.g. Unilever, P&G) are using all these resources.

Material recovery

Material remainders of the production process coming from for example colour changes are reused again for the manufacturing of new products. Keter's PP waste coming from the injection

moulding process is re-applied in their production processes. Waste of secondary packaging from raw materials supplied to Keter is collected and sent to a recycler, who melts the material and sells it to other companies. The production sites all have a shredder for reusing materials from Keter's own production process.

Maintenance

Keter's customer service offers consumers the possibility to repair products, for example by replacing broken parts. Keter sends the required parts free of charge if within the warranty period. Maintenance is communicated to the consumer as a warranty, whereas to the retailer it is communicated as consumer service (Keter takes care of it, not the responsibility of the retailer). At this moment, complete parts are replaced, but opportunities may present itself to repair parts in the future, rather than replacing them with new ones. The question is whether replacing or repairing parts is economically viable. For example, repairing a storage box may not make much sense, but replacing a side panel of a lounge set does.

Product take-back

Products that break at warehouses of customers may be returned to Keter to be used for manufacturing new products. This comes with the advantage of exactly knowing the used materials and additives. Shredded material from finished products differs from that of recyclers, but may be used in less critical products or components.

Next to product take-back from customers, Keter is exploring options for implementing product end-of-life programs (from consumers). This includes exploring options for product take-back at end-of-life, and arranging collaborations with recyclers for processing products to recycled granulate. This granulate may then be used again in Keter's manufacturing processes.

Resource recovery

Depending on the product (large/small, application type), products are either collected as household waste (plastic packaging waste or residual waste) or delivered to a municipal waste station as bulky waste (for larger products). Theoretically all products of Keter can be recycled, but whether they are recycled in practice has yet to be learned. Keter will be researching this in the near future.

Design for circularity

Design for circularity by Keter manifests itself in four ways: *design for recycling*, *design for durability and performance*, *less material usage* and *design for disassembly*.

Design for recycling

Most of Keter's products are all suited for recycling and are all made of mono materials. Whether products are recycled in practice depends on many factors and still has to be further researched. Recyclability of products at end-of-life is also taken into account during the design of products. For example, PP screws are used for garden furniture rather than metal screws. This way it is easier to process materials at end-of-life.

On the other hand, there may be issues with some products where other materials are used in combination with PP. As an example, lids for containers are manufactured by means of 2K-injection moulding, which may give problems with separating materials for recycling. (An alternative would be to use loose silicone rings, which can then be easily removed from the PP material.)

Design for durability and performance

Durability and performance are crucial for Keter's products. Hence, products are designed to last for several years and are very durable. For the Curver brand, durability of products is also part of the quality perspective.

Less material usage

Keter tries to use as few materials as possible in its products where possible. It is important to find the optimal balance between quality (including perceived quality) and the amount of materials used. For example, by not making products unnecessarily thick or heavy, or by using open designs. On the other hand, it may be the case that crucial parts of a product are made thicker, in order ensure that sufficient quality of the products can be guaranteed when using recycled materials.

"We try to find the optimal balance between quality perception and the amount of materials used."

- Daniel Rasenberg, Marketing Director of Keter

Design for disassembly

Since (larger) products are assembled by the consumer, they are also easy to disassemble again. Therefore, disassembly of products is already taken into account with the design of products. What is more, this increases the ease of maintenance, because broken parts can be replaced separately.

4. Circularity of operational activities

After assessing the circularity of the company's activities within its value chain, a more detailed assessment of the circularity of the company's operational activities is done. A visualisation of the operational process is presented, together with its adopted circular strategies.

4.1 Operational process map

To get a better understanding of how the company's operational activities are affected, an overview of the process is made, see figure 6. This includes circular sourcing of materials, the production process and quality assurance of products. Each of the steps will be further explained below.

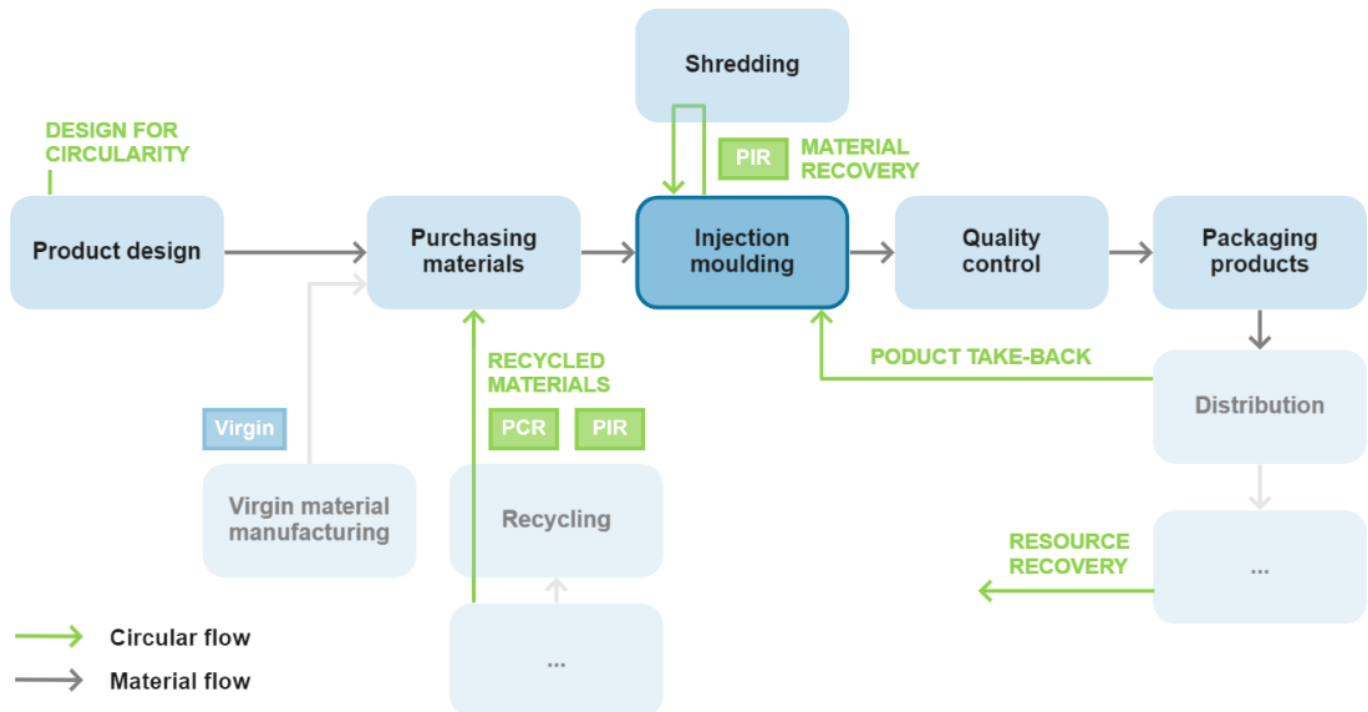


Figure 6: Operational process map of Keter
(with PCR: post-consumer resin and PIR: post-industrial resin)

4.2 Circular sourcing and design

The preliminary process of Keter consists of product design and purchasing materials.

Product design

The development of new products starts with a question or idea from marketing or sales, which is further developed by the design team. The engineers will then make sure that products can be manufactured on an industry scale. In the meantime, products and moulds are often tested so that the product can later on be directly applied in the manufacturing process. For example, lounge sets are tested to ensure that they should not sag easily, and laundry baskets are tested on its

brittleness (products should not become too brittle). Such tests are important for new product development, and form an important part of the design process.

The grey colour for garden furniture is easy to achieve with recycled materials and is therefore often used in Keter's garden furniture. But before the use of recycled materials, grey was already a 'trendy' colour, whereas the colours white and dark blue are used less nowadays. There is also a cappuccino-like colour for garden furniture. In contrast, Curver products are often a combination of transparent materials with bright colours.

An advantage is that most products of Keter have textures, which makes imperfections (e.g. 'dots' as a result of using recyclate) less noticeable. These imperfections becomes clearly visible if, for example, plates are made. Hence, the use of texture makes the application of recycled materials easier. On the other hand, these imperfections could also be used as a new style for products, for example with Curver's 'concrete-look' products. With new products, the choice is whether such aspects should be included in the design (e.g. with 'concrete-look', were 'dots' are desired) or should be hidden (with textures, which will blur the imperfections).

"You can include the influences of recycled material in your design, or try to make it less noticeable."

- Marloes Verbruggen, Material Expert of Keter

New products are designed based on the recycling streams available, but there are also many old products that have had to be converted into designs suitable for the use of recycled material. Some products therefore had to be adapted, which must be done step by step. For example, with garden chairs, extra ribs are used under the seats to strengthen the product. To allow for recycled materials, moulds must be adapted to ensure that moulds are filled properly with less material flow (because of using recycled materials).

"The moulds of products have to be adapted to use recycled materials."

- Marloes Verbruggen, Material Expert of Keter

Purchasing materials

Materials that are used by Keter consist of virgin materials, post-consumer recycled materials (PCR) and post-industrial recycled materials (PIR). Virgin materials are sourced from raw material manufacturers. PCR is delivered in the form of granulate, which are specifically formulated by recyclers. This material is often supplied in colour, because of the large batches used. PIR materials are either purchased from recyclers or come from Keter's own production. PIR waste from other companies first needs to be reprocessed into granulate by an external party, just like for PCR. For waste of Keter's own production processes, shredding the material is sufficient because this material already contains the required properties.

Materials from recyclers (both PCR and PIR) are delivered based on various specifications, which include for instance modulus, strength, flow, colours etc. UV-additives are used to prevent decolourisation of outdoor furniture.

Material requirements differ per product. For instance, a thin-walled laundry basket requires a higher material flow to make sure the mould is filled properly. Keter is working on standardising these requirements, to allow for easier adoption of recycled materials. However, these may differ per product group, depending on the desired properties. When purchasing large volumes (e.g. for garden furniture), it is easier to purchase material based on specific specifications.

For products under the Keter brand (garden furniture) large volumes of the same colour are used. This material (PCR) is therefore supplied in the final colour by recyclers, so Keter does not have to add any colour during production. In contrast, the Curver products (home organisation products) are available in a wide range of colours, with relatively small volumes per colour. Hence, this material (PIR) is supplied in a basic colour by recyclers, and Keter adds the desired colour itself.

Most of Keter's products consists of PP (about 90%), and some other materials are used when there is no other choice. As an example, thermoplastic elastomers (TPE) are used for the lids of containers. PS may be used for food storage boxes because PP cannot become completely transparent and because PS is more rigid.

There are certain requirements that are impossible to ask of recycled materials, such as a 'colourless' material. Moreover, high material flows are harder to achieve and PP recycled materials from consumer waste do not have a food approval. Such aspects should be taken into account during the design of products. In addition, there are safety requirements (such as REACH and no use of heavy metals) to which all materials must comply, whether these are virgin or recycled materials. For microwave applications even higher requirements apply, because no substances may be released when the material is heated.

"Recycled materials can be easily applied if everyone in the company has the incentive to use it.."

- Marloes Verbruggen, Material Expert of Keter

4.3 Production process

The production process consists of injection moulding various products and shredding production waste.

Injection moulding

When new moulds are used, the first run is always extra monitored. This is done to make sure that the material is easily and properly injected into the moulds and there are no visible colour changes. The biggest challenge for manufacturing new products is finding the right materials, with the right specifications. When the right materials are sourced, the production process can be easily adapted to the use of recycled materials. There are less margins during the production process when using recycled materials. For example, recycled materials must be processed at a lower temperature. Virgin material are easier to process because more requirements can be imposed on material specifications.

Shredding

Waste of the injection moulding process is collected and shredded. Each of Keter's factories has its own shredder. The shredded material may then be reused as input for new injection moulding

processes. Waste from products that have reached end-of-life have to be processed by recyclers into granulate, before being able to reuse in the production process.

4.4 Quality assurance and packaging

The quality assurance of products usually goes hand in hand with injection moulding.

Quality assurance

Next to testing products during product development, there are also the usual tests to ensure quality of products. During each shift, a few products are taken from the production line to check if quality still matches the criteria. Outdoor furniture are for example tested with pressure tests and drop tests are carried out for other products (e.g. laundry baskets). In addition, colour tests are also carried out to check whether the colour does not differ too much from the others. For garden chairs impact tests are done to test the quality of the seating, between 0°C and 40°C. This is done to guarantee quality and safety of products. Because quality of materials may slightly vary, margins are taken into account during the design phase.

“The biggest challenge you face as a producer is guaranteeing the quality of products made from plastic waste.”

- Natasja Groeneweg, CFO of Keter

A critical element of a garden lounge chair is the seat. For these products the use of PCR in products is already very high (about 90%), but the seats are often partly made of virgin materials, to guarantee safety and sufficient quality of products. It may also be the case that the seating is made thicker than other parts to guarantee quality with recycled materials, and to accommodate for variety in recycled materials. Other weak parts may for instance be the brittleness of products. Products may also become too brittle if temperature during production is too high. Where thin products are desired from a sustainability point of view, sometimes additional materials are required to guarantee quality with recycled materials. This is always a matter of finding the right balance.

All products have a standard warranty period of two years, but usually last for several years. To prevent colour changes of outdoor products, UV protectors are added.

Packaging products

For larger products, the different parts are produced separately, which are packaged together in one box. Smaller products are first stacked before they are packed in an outer box and transported to the customer.

5. Conclusion and recommendations

Based on the outputs derived from all three interviews with Keter, strengths of the business model and operational process in regards to circularity are identified, barriers and enablers for circularity are summarised, and opportunities for circularity are described.

5.1 Strengths for circularity

Business model

Keter manufactures durable plastic consumer products under the brands Keter, Curver and others. Products that they sell include everything in and around the house made of plastic, such as outdoor storage and furniture, planters, home organisation and tools storage. For many years, recycled materials have been applied in Keter's products, with currently over 40% of resources coming from recycled content. The aim is to double this percentage within the next ten years. The use of recycled content is not just a result of customer wishes or changing regulations, but is rather a result of internal incentives. Sustainability is implemented throughout the company by top down communication and commitment from the CEO, and by setting goals and targets for employees. Externally, the importance of sustainability communication has grown over the years. Where in the past recycled materials were used because of cost reasons, and the use of it was not communicated (due to reluctance of consumers), it has now become an integral part of the company's strategy.

In the end, it is a combination of product innovation (new designs, textures etc.), good quality durable products for affordable prices, and the use of recycled materials that allows Keter to distinguish itself from competitors.

Circular strategies in the value chain

Recycled materials used by Keter come from both post-consumer (PCR) and post-industrial (PIR) sources. Depending on the product, a choice is made to use one or the other. PCR is mostly used in outdoor furniture (Keter brand) because of darker colours. In contrast, home organisation products (Curver brand) largely contain PIR materials because of bright and transparent colours. Current legislation limits the use of post-consumer recycled PP for food contact. Recycled materials are supplied by a recycler, to guarantee sufficient quality and a consistent colours. In contrast, waste from Keter's production process is shredded by the company itself, and may then be reused in the production process.

Customer service is offered to replace broken parts or products within the warranty period. Products that break at warehouses return to Keter. Recyclers reprocess these materials into granulate, after which it is reused in Keter's production processes. Moreover, Keter is exploring possibilities for introducing product end-of-life programs, to collect (large) products and recycle them after usage.

The use of recycled content in products is already taken into account from the beginning of the product development process, for example by tailored moulds and product designs with less sharper edges. Theoretically, most of Keter's products are recyclable but whether they are recycled in practice had to be further researched. Products are designed to last for several years and are very durable. Material usage is limited where possible and a balance is found between quality (perception) and the amount of materials used. Larger products are assembled by consumers, hence, they are also easy to disassemble, which increases easy for maintenance and replacing broken parts.

Operational process

From the start of new product development, the use of recycled materials is taken into account. Products and moulds are often tested to guarantee quality of products. The imperfections due to use of recycled materials (e.g. 'dots') are either included in the design (with the 'concrete-look' products) or hidden (by using textures). For existing products, moulds are adapted to allow for the use of recycle.

Recycled materials used by Keter come from recyclers and are delivered based on various specifications, which can also be delivered in the desired colour. Because material requirements differ per product, a suitable (recycled) material has to be found for each product group.

Product tests are done to ensure quality. This may include: pressure tests, drop tests or colour tests. A critical element of a garden lounge chair is the seat. Seats may therefore be thicker, include extra ribs to provide additional support or be partly made of virgin materials. For other products the brittleness is usually the most crucial factor. While thin products are desired from a sustainability point of view, sometimes additional materials are required to guarantee quality with recycled materials. This is always a matter of finding the right balance.

5.2 Barriers and enablers for circularity

To ensure circularity for Keter and its value chain, several barriers and enablers can be pointed out. The biggest barrier for Keter is to be continuously working on sustainability, next to all other activities. Another significant barrier is to close the loop, to ensure product take-back from consumers when products reach end-of-life. Their biggest enabler is the implementation of sustainability top down from the CEO to ensure full integration within the company's strategy and active communication on the use of recycled materials. Other barriers and enablers have been mentioned and explained before and are summarised in table 3 below.

Table 3: Barriers and enablers for enabling circularity at Keter

Barriers	Enablers
<ul style="list-style-type: none"> Working on sustainability next to all other activities Different recycling systems (per country) Large products must be separately collected Little insights in recyclability in practice Difference in prices between virgin and recycled materials becomes smaller Chemically recycled materials are all used by larger brands Material requirements differ per product Less application possibilities for PCR (darker colours, food contact) No colourless recycled materials No food approved recycled PP Lower material flow for recycled materials 	<ul style="list-style-type: none"> Integration of sustainability within company and strategy Internal (top down) sustainability communication and commitment Setting sustainability goals and targets for employees Active communication on the use of recycled materials to customers and consumers High sustainability targets of larger retailers Increased attention for sustainability, recycling and problems with plastic waste Purchasing large volumes with the same material specifications Knowing material properties

<ul style="list-style-type: none"> • Reduced quality of PCR limits application for crucial parts • Closing the loop: organising return flows 	<ul style="list-style-type: none"> • Recycled materials from recyclers that deliver material based on specifications, have sufficient quality and consistent colour • Design products based on available recycling streams • Take into account the use of recycled materials from the start • Tailored moulds (wall thickness, sharp edges) • Increasing thickness for crucial parts • Use textures to hide imperfections • Use imperfections in design to create new style • Designing products fit for recycling • Easy disassembly of products • Implementing end-of-life programs
--	---

5.3 Opportunities for circularity

Although Keter has been using recycled materials for many years, there are still some opportunities to further enhance circularity of Keter's products. Keter also recognises this and has set several goals for the coming years.

Recycled materials

Keter already uses a large amount of recycled materials, but there is still room to increase this percentage in the coming years. The company's strategic goals include reaching an average of 55% recycled materials by 2025 and 80% by 2028. Furthermore, there are options to further increase the percentage of PCR in products.

Design for circularity and recycling

Although Keter's products can be recycled at end-of-life, there are still some challenges with some products. Opportunities present itself for certain lids of Curver's food containers since a combination of polymers is used in those products.

Repair service

At this moment, Keter offers *maintenance* within the product's warranty period. This often entails that complete parts are replaced. Opportunities may present itself to repair parts in the future, rather than replacing them with new ones. The question is whether replacing or repairing parts is economically viable. For example, repairing a storage box may not make much sense, but replacing a side panel of a lounge set does.

Product take-back

The large products of Keter have to be separately collected at end-of-life. At this moment, consumers have to bring products to a municipal waste station and it remains unsure if products are recycled. Hence, it will be useful for Keter to take these products back at end-of-life, which will also offer the possibility for Keter to use these materials (after recycling) in new their own

production process. In Keter's sustainability report³ objectives have been included to implement product end-of-life programs in all regions by 2025. This possibility is already offered in Israel. Options could be to offer the possibility to return products to Keter (on a few selected moments a year) or for Keter to collaborate with municipalities and pick up products at municipal waste stations. This also brings along another challenge of recycling these products. Hence, collaborations have to be sought with recyclers to ensure quality of the materials.

Repair, remanufacture or refurbish

Moreover, if products are taken back to Keter at end-of-life, there may also be options to repair, remanufacture or refurbish products rather than recycle them. Products may then be sold to consumers again as second hand or refurbished products.

³ See for more information Keter's sustainability report of 2019:
https://www.keter-pim.com/images/Fittings/keterpim/website_general_docs/KeterSustainabilityReport2019.pdf

References

- Circulab. (2020). *Circular Canvas: The tool to design regenerative business models*. Retrieved from: <https://circulab.com/toolbox-circular-economy/circular-canvas-regenerative-business-models/>
- Ellen MacArthur Foundation. (2017). *The circular economy in detail*. Retrieved from: <https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail>
- Ellen MacArthur Foundation. (2019). *Circulytics – measuring circularity*. Retrieved from: <https://www.ellenmacarthurfoundation.org/resources/apply/circulytics-measuring-circularity>
- Keter. (2019). *Keter sustainability report – 2019*. Retrieved from: https://www.keter-pim.com/images/Fittings/keterpim/website_general_docs/KeterSustainabillityReport2019.pdf
- R2π. (2017). *Circular Economy Business Model Case Studies: Introduction and Methodology*. Retrieved from http://www.r2piproject.eu/wp-content/uploads/2018/08/R2Pi-D3-35775-63432.2a-Case-Study-Methodology_v1.0.pdf
- R2π. (2019). *Methods and tools*. Retrieved from <http://r2piproject.eu/circularguidelines/methods-tools/>

About the project

The problems associated with plastic waste and in particular its adverse impacts on the environment are gaining importance and attention in politics, economics, science and the media. Although plastic is widely used and millions of plastic products are manufactured each year, only 30% of total plastic waste is collected for recycling. Since demand for plastic is expected to increase in the coming years, whilst resources are further depleted, it is important to utilise plastic waste in a resourceful way.

TRANSFORM-CE aims to convert single-use plastic waste into valuable new products. The project intends to divert an estimated 2,580 tonnes of plastic between 2020 and 2023. Two pilot plants will be set up, one in Almere (NL) and one in the UK. The plants will make use of two innovative technologies – intrusion-extrusion moulding (IEM) and additive manufacturing (AM) – to turn plastic waste into recycled feedstock and new products.

Moreover, the project will help to increase the adoption of technology and uptake of recycled feedstock by businesses. This will be promoted through research into the current and future supply of single-use plastic waste from municipal sources, technical information on the materials and recycling processes, and circular business models. In-depth support will also be provided to a range of businesses across North-West Europe, whilst the insights generated through TRANSFORM-CE will be consolidated into an EU Plastic Circular Economy Roadmap to provide wider businesses with the 'know-how' necessary to replicate and up-scale the developed solutions.

Lead partner organisation

Manchester Metropolitan University

Partner organisations

Materia Nova
Social Environmental and Economic Solutions (SOENECS)
Ltd
Gemeente Almere
Save Plastics
Technische Universiteit Delft
Hogeschool Utrecht
Hochschule Trier Umwelt-Campus Birkenfeld Institut für
angewandtes Stoffstrommanagement (IfaS)
bCircular GmbH
Viridor Waste Management Limited

Countries

UK | BE | NL | DE

Timeline

2019-2023