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Case study report – 3DPW Limited

Good practice of circular economy business models

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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 3DPW Limited, based in Bradford, UK. A total of 20 case studies will be done, with five cases per country (The Netherlands, Germany, Belgium and the United Kingdom).

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

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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 a unique opportunity to study barriers, enablers and needs for circularity (and recycling) in more detail.

1.2 Company background

A short overview of 3DPW Limited is given in table 1.

Table 1: *Overview of company*

Topic	Information
Company name	3DPW Limited
Website	https://3dprintingwaste.co.uk/
Country	UK
Size of company (0-10, 10-200, 200-500, 500+ employees)	0-10
Mission/vision	3D printing is a double-edged sword. Whilst fundamentally additive, the use of plastic as a feedstock could exacerbate the plastic problem without efficient resource recovery. 3DPW Limited offers viable end-of-life solutions for 3D-printed waste that is not currently recycled or reused, thus preventing further plastic pollution of land and marine environments. 3DPW Limited seeks to disrupt existing manufacturing waste management by curating a scalable Circular Economy business model – designing-out waste and utilising previously non-recycled resources into high-value input material for various industries and markets, giving plastic waste a new life.
Product category	Service provider, recycled feedstocks, recycled consumer products
Production/operational process	Granulation, injection moulding
Used materials	PLA

1.3 Case study process

The case studies are being carried out between September 2020 and December 2022. The case study process is structured in four steps[1], 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 regard 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 3DPW Limited.

Table 2: *Overview of interviewed people*

	Interviewed person	Function
Interview 1: Circularity of business model	Narinder Kumar	Director
Interview 2: Circularity in the value chain	Narinder Kumar	Director
Interview 3: Circularity of operational activities	Narinder Kumar	Director

[1] 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).

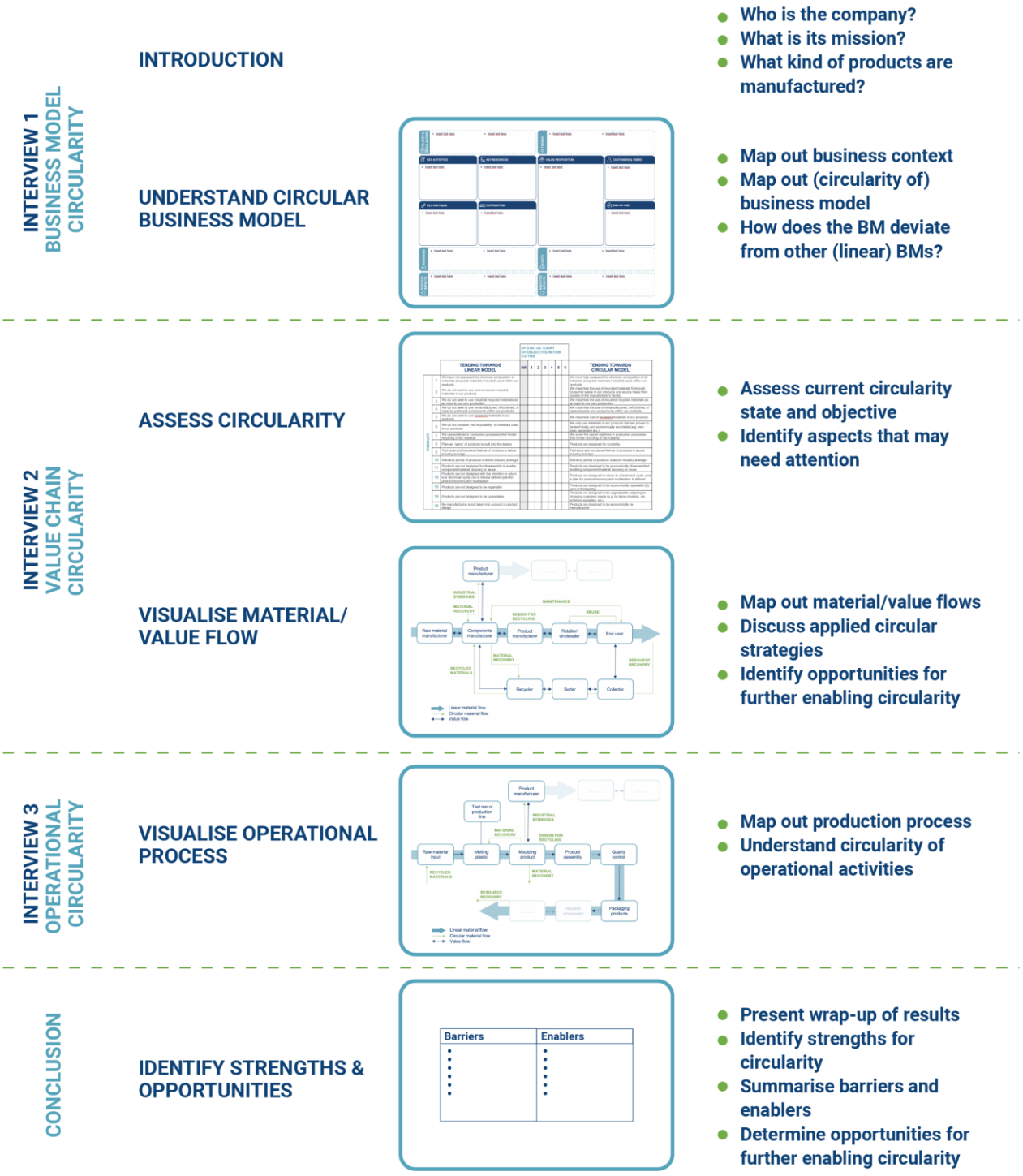

Figure 1: *Overview of case study process*

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 3DPW Limited is visible in Figure 2 and a description of each element is given below.

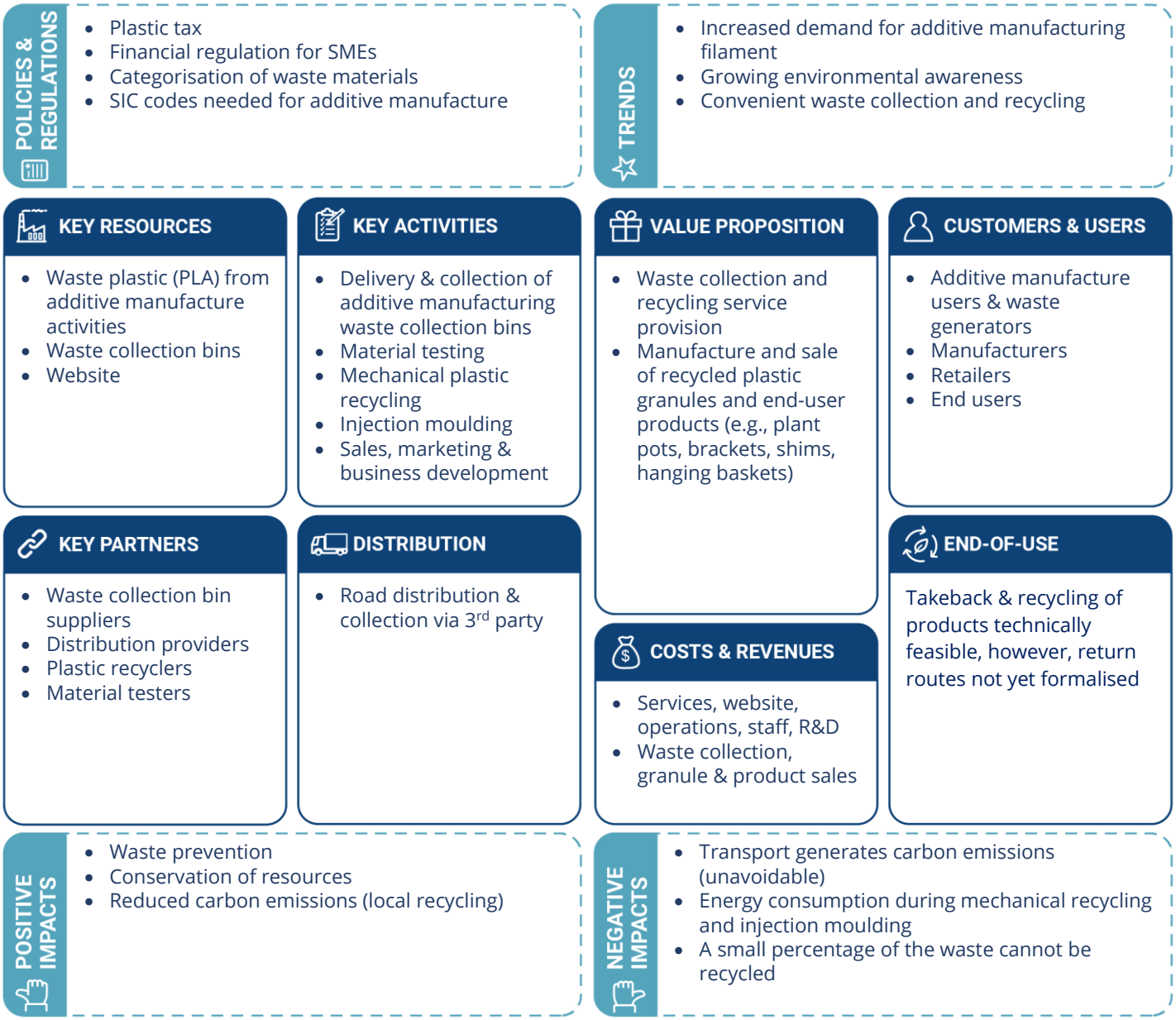

Figure 2: *CBMC of 3DPW Limited*

Value proposition

3DPW Limited are a start-up SME based in Bradford, UK. Their key value proposition is two-fold. Firstly, they offer an affordable and convenient waste collection and recycling service to organisations that operate fused filament fabrication (FFF) 3D printers on their premises. Secondly, they use third party contractors to turn the collected waste into recycled 6/8mm granules, some of which they sell to manufacturers, and the rest they turn into recycled products, such as plant pots, hanging baskets, brackets, and shims, using a 3rd party injection moulding company.

3D printing, also referred to as 'additive manufacturing', is a process whereby objects are created through the gradual layering of material, one after another. This is in contrast to subtractive manufacturing, where an object is cut, carved, or milled from a solid block of material. One particular form of 3D printing, fused filament fabrication (FFF), involves heating a long strand of thermoplastic or 'filament' through a nozzle. The nozzle then traces each layer of an object, dispensing the melted thermoplastic, which becomes solid as it cools. This allows each layer to be laid one on top of another, as the printing bed is gradually lowered.

In addition to producing finished products, FFF 3D printing is commonly used to create models and prototypes as part of the design development process. As a result, users of 3D printing tend to accumulate waste prototypes. It is also possible for prints to fail due to mechanical faults within the 3D printer or incorrect printing settings, temperature, flowrate, and bed adhesives, resulting in waste. To prevent prints from failing, operators may purge filament to clear printing nozzles or conduct initial tests, the outputs of which also become waste.

The popularity and uptake of FFF 3D printing is expected to continue to grow as the technology becomes increasingly affordable and accessible, resulting in a rise in the waste generated. Currently, there exists a lack of infrastructure and established systems for recycling this waste, which contains high-grade, recyclable thermoplastics. 3DPW Limited are tackling this issue by offering a collection and recycling service tailored to FFF 3D printing waste.

Customers & users

3DPW Limited's collection and recycling services are aimed at organisations that operate FFF 3D printers on their premises. Their customers therefore range from dedicated 3D printing service providers to schools, universities, and other organisations.

3DPW Limited's recycled granules are sold onto manufacturers and injection moulding firms as a sustainable feedstock, which will be turned into a variety of products and sold onto end users. The company also commissions the injection moulding of a range of in-house products, such as plant pots and hanging baskets, which they sell onto retailers (B2B) and directly to end users (B2C).

Key activities

3DPW Limited enlists the services of several 3rd parties for the distribution, recycling, and manufacturing aspects of their business model. As such, its key activities include the coordination of waste collection from its customers and distribution of these materials to 3rd parties, as well as

material testing. Additionally, they partake in sales, marketing, and business development activities to grow the company's customer base.

Key resources

As 3DPW Limited employs 3rd parties for many activities, their key resources are relatively limited. They include providing the waste collection bins, which are recycled and recyclable, and are procured from a supplier.

The waste materials that 3DPW Limited collects become key resources for the company once they have been collected. A variety of thermoplastic filaments are used in FFF 3D printing. The most common of these tend to be PLA (polylactic acid) and ABS (acrylonitrile butadiene styrene), as they are easy to print with and produce reliable and consistent results. Additional materials include PETg (polyethylene terephthalate glycol), PC (polycarbonate), PA (nylon) and ASA (acrylonitrile styrene acrylate). PLA is unique in that it's a renewable polymer derived from starch, which is extracted from plants. As well as being mechanically recyclable, PLA waste can also be composted at end-of-life under specific conditions (e.g., humidity, temperature, and microbial activity) available in industrial composting facilities. The other polymers listed are typically derived from non-renewable, petrochemical sources, are not biodegradable, but can be mechanically recycled.

In terms of human resources, 3DPW Limited currently employs 4 people, who are supplied with standard office equipment.

Key partners

3rd party partners are essential components of 3DPW Limited's business model. These include:

- Suppliers of the recycled and recyclable waste collection bins
- Distribution partners for the delivery and collection of bins to 3D printing organisations
- Material testing service providers for establishing waste material composition and quality
- Recycling service providers who grind and granulate the waste materials
- Injection moulding service providers who process some of the waste materials collected into valuable, new products

Distribution

3DPW Limited employ distribution service providers, both for the delivery of their waste collection and recycling service as well as the transportation of finished, recycled products from injection moulding service providers to retailers and end users.

End-of-use

Although 3DPW Limited currently have the technical capacity for taking back their products at end-of-use and returning these through the process to be recycled into further products, they have not yet established formal return routes. This is something that they are keen to explore as their business scales.

Costs & revenues

By outsourcing capital-intensive aspects of the business, such as its distribution network, recycling services and the manufacture of new products using injection moulding, 3DPW Limited has been able to keep start-up costs relatively low while the company scales organically. Costs therefore include the purchase of waste collection boxes and contracted 3rd party services, as well as the costs involved in running day-to-day business activities (staff, IT equipment and company website, etc.). 3DPW Limited has also invested in research and development, with a particular focus on the sorting of plastic waste and material analysis, including composition and quality.

In terms of revenues, 3DPW Limited sells waste collection as a service. Customers pay a fee to the company, who then provide a reusable waste collection box (Figure 3), complete with reusable zip ties to secure its contents in transit, delivered by a 3rd party distribution network. The same network then collects the waste plastic and transports it to a 3rd party recycler. 3DPW Limited pay the recycler to turn the waste plastic into feedstock suitable for injection moulding, which they then sell to manufacturers. 3DPW Limited also pay select manufacturers to injection mould a range of products from the recycled materials, which they sell to both retailers (B2B) or direct to customers (B2C). As a relatively new company, 3DPW Limited derives most of its revenue from its waste collection service fees, however, it is also continuing to explore market expansion opportunities for the recycled materials and products, to generate additional revenue.

Figure 3: *Collection box, empty (Left) and filled within 3D printing waste (Right).*

Policies & regulations

In terms of policy and regulation, 3DPW Limited highlighted challenges regarding the classification of the materials. As an SME processing waste, it can be, at times, difficult to access financial products due to current regulations applicable to the waste industry, despite the fact that the materials they collect are transformed into a valuable resource as part of a circular economy.

Additionally, a lack of SIC (Standard Industrial Classification of economic activities) codes relevant to additive manufacture have further complicated compliance with certain regulations and the completion of paperwork.

Whilst the recently introduced Plastic Packaging Tax (2022) in the UK is not directly applicable to 3DPW Limited, such legislation is indicative of a shift towards a circular economy for plastics and a move away from virgin materials.

Trends

A key trend relevant to 3DPW Limited is the 5.5% growth rate of the UK 3D printing and rapid prototyping services industry, valued at £468 million in 2022 (IBISWorld, 2022). As the popularity of 3D printing increases, it is also likely that the volume of material processed and therefore the volume of waste plastic generated will increase. This presents significant opportunities for 3DPW Limited to scale up its collection and recycling services.

3DPW Limited also highlighted growing environmental awareness within the 3D printing industry and community as another key trend supporting the growth of their business. As a result, those using 3D printing tend to be looking for convenient waste collection and recycling options for the waste generated.

Beyond trends influencing the uptake of 3DPW Limited's collection services, other external forces, such as the price of oil, can have an impact on the market value of the waste materials 3DPW Limited collect, recycle, and sell. When the price of oil, and therefore virgin, petroleum-based plastics, rises above that of recycled polymers, the latter can gain a competitive advantage and see demand increase. As recycled polymers tend to incur additional processing costs, such as collection, sorting and washing, it can be difficult to compete with traditional, virgin plastics when the price of oil is low.

Increased environmental awareness and consumer demand for more environmentally friendly products can also influence manufacturers' choices when specifying and sourcing materials. However, in the experience of 3DPW Limited, price and quality tend to be prioritised. This is sometimes due to misconceptions and a lack of understanding regarding 'waste' and 'recycled' materials. The wastes collected by 3DPW Limited, for instance, tend to be very high quality, pure and uncontaminated, compared to other forms of waste that manufacturers may be more familiar with. There is a hesitancy to compromise on quality, as degraded or contaminated materials may cause issues in manufacture, such as blockages, leading to costly down-time.

Positive and negative impacts

Many of the materials used to 3D print products are not readily accepted in standard plastic recycling schemes. PLA, for example, is a particularly popular material used in FFF 3D printing. It is a bioplastic derived from starch and will biodegrade, however, to do so it must be industrially composted under specific humidity, temperature, and microbial conditions. Collection and industrial composting infrastructure in the UK is currently limited and therefore the quantity of PLA waste industrially composted is low.

As is the case with most FFF 3D printing filaments, the materials can be mechanically recycled using heat to re-melt it. This allows prototypes and unwanted and failed prints to be turned into new, recycled feedstocks and products. 3DPW Limited therefore offers a unique solution for 3D printing waste streams, for which there are no established recycling or reprocessing options. By doing so, 3DPW Limited is helping to conserve resources, by offering manufacturers recycled plastic feedstocks, and retailers and consumers recycled plastic products. They are also helping to combat the generation of waste and plastic pollution.

As 3DPW Limited works with local recyclers to process the waste collected in the area, there are also carbon emission reduction benefits compared to alternatives, such as sending collected waste overseas for processing.

Despite these positive impacts, there are some negative impacts associated with 3DPW Limited's current set up. Whilst working with local 3rd party suppliers has reduced 3DPW Limited's overall carbon emissions, the transport required to collect and process the waste will continue to generate unavoidable carbon emissions. This is in addition to the energy consumed (and associated carbon emissions) during the different processing steps, i.e., mechanical recycling and injection moulding. Finally, a small percentage of the waste cannot be recycled and will be landfilled or incinerated.

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 3DPW Limited is presented in Figure 3. 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.

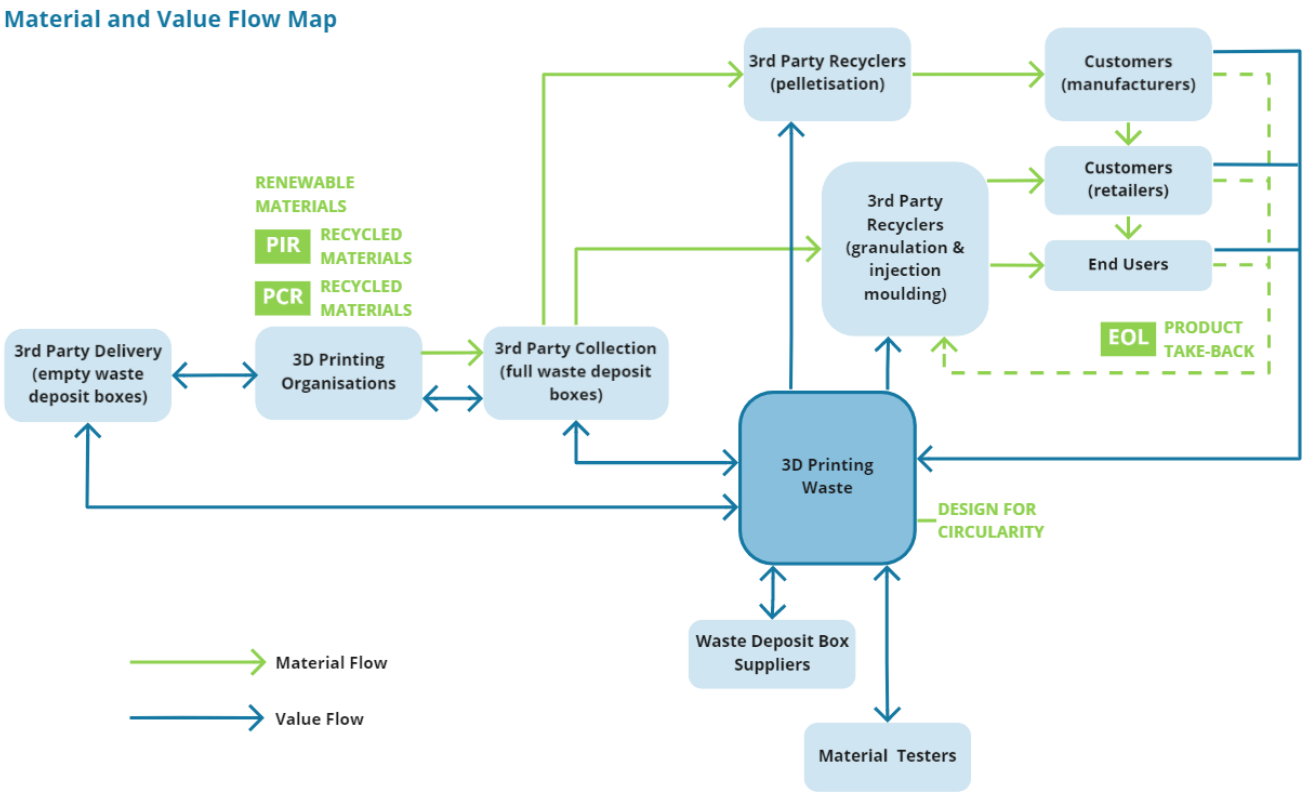

Figure 4: *Material/value flow map of 3DPW Limited (with PCR: post-consumer resin, PIR: post-industrial resin and EOL: end-of-life materials)*

3.2 Circular strategies

As shown in Figure 4, 3DPW Limited applies multiple circular strategies: recycled materials, renewable materials, product take-back and design for circularity.
Each of the strategies is further explained below.

Recycled materials

3DPW Limited provide a mechanism in which waste PLA generated through 3D printing, is collected from the companies that generate it, and then transported to 3rd party companies for processing. The collected waste materials are sorted, granulated, and sold to companies that would then use the recycled PLA as a feedstock in their own product manufacturing processes. 3DPW Limited also commission the use of the recycled PLA in product manufacture, which includes a range of in-house products, such as plant pots and hanging baskets, which are injected moulded by 3rd party suppliers then sold onto retailers (B2B) and directly to end users (B2C).

Renewable materials

The 3DPW Limited business model focuses particularly on the collection and processing of PLA waste generated from FFF 3D printing. PLA is a particularly popular material used in FFF 3D printing, it is a bioplastic derived from starch (renewable material) which is recyclable and will

biodegrade under certain conditions (industrially compostable under specific humidity, temperature, and microbial conditions). Collection and industrial composting infrastructure in the UK is currently limited and therefore the quantity of PLA waste industrially composted is low. By providing a system where waste PLA can be collected, processed, and recycled, 3DPW Limited has created an efficient disposal route for PLA and in processing and granulating the material will also increase its lifespan.

Product take-back

While 3DPW Limited currently have the technical capacity for taking back their products at end-of-use and returning these through the process to be recycled into further products, they have not yet established formal return routes. This is something that they are keen to explore as their business scales. Currently, 3DPW Limited does not provide a formal warranty for the product they sell, they do have an informal return and replacement policy. This return process is encouraged by 3DPW Limited, but they do acknowledge that some end-user products may end up in other waste streams and therefore outside of their control.

Design for circularity

Design for circularity by 3DPW Limited manifests itself in two ways: *design for recycling* and *design for durability and performance*.

Design for recycling

In-house products are designed to use mono-materials, which is always recyclable. Products are also designed to be produced using injection moulding, so that no glues or additional joining structures are required. By designing the products this way simplifies the recycling process. Furthermore, 3DPW Limited seek to maximise innovation in the design of their in-house products and in the formulations of the recycled plastic to improve recyclability.

Design for durability and performance

The in-house products are designed to be durable. For example, the 14" Hanging Basket (Figure 5) is produced from waste PLA and is manufactured to a high standard and designed for a long life and high-quality performance. In addition, 3DPW Limited offer an informal return and replacement policy for products that do fail.

Figure 5: *Products made from recycled 3D printing waste, paint tray (top) and hanging basket (bottom).*

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.

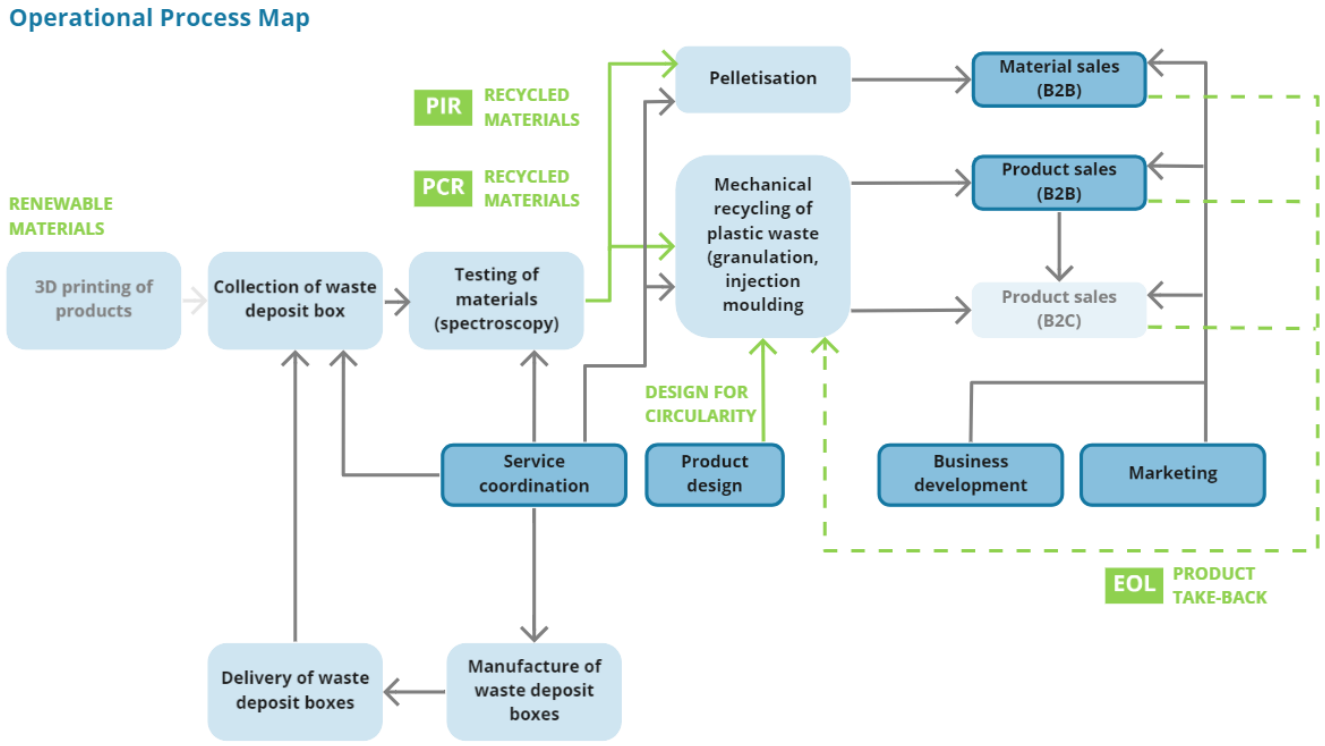

Figure 6: *Operational process map of 3DPW Limited (with PCR: post-consumer resin, PIR: post-industrial resin and EOL: end-of-life materials)*

4.2 Circular sourcing and design

Material sourcing

3DPW Limited's collection and recycling services are aimed at organisations that operate FFF 3D printers on their premises. Their customers therefore range from dedicated 3D printing service providers to schools, universities, and other organisations. Customers are provided with collection boxes and instructions (3DPW Limited box safety guidelines) on which types of 3D printing waste can be disposed of using this route (Eligible items: waste printing material made only from PLA including reel ends, failed prints, used supports etc. Non-eligible items: other plastic wastes e.g., PP, ABS, PETg, etc., hazardous wastes, electronic wastes, clothing or fabric wastes, food or liquid

wates and batteries, etc.). The safety guidelines ensure that the material received is of a very high quality, pure and uncontaminated. The filled waste boxes are collected, emptied, and returned to the customer through a 3rd party service provider, a service that is coordinated by 3DPW Limited.

Product design
As well as selling the recycled granules onto manufacturers and injection moulding firms as a sustainable feedstock, 3DPW Limited also commissions a range of in-house products, such as plant pots and hanging baskets. The in-house products are designed to use recycled PLA, for durability (increased lifespan), and to be eventually recycled when no longer useful. It is estimated that the in-house products can be recycled up to three times without any deterioration in the quality.

4.3 Production process

Material collection
Customers of 3DPW Limited's collection and recycling services are provided with collection boxes which they are instructed to fill with the waste generated by the FFF 3D printers. 3DPW Limited liaises with a 3rd party service provider to collect the boxes when full and transport the waste material for processing (sorting and granulated). The collection boxes are then redistributed and reused.

Material processing
3DPW Limited use 3rd party contractors to turn the collected waste into recycled granules. Some of the recycled granules is then sold onto manufacturers as a sustainable feedstock for production systems. The rest is turned into recycled products, such as plant pots, hanging baskets, brackets, and shims, using a 3rd party injection moulding company.

Production using injection moulding
3DPW Limited's recycled granules is sold onto manufacturers and injection moulding firms as a sustainable feedstock, which will be turned into a variety of products and sold onto end users. The company also commissions the injection moulding of a range of in-house products, such as plant pots and hanging baskets, which they sell onto retailers (B2B) and directly to end users (B2C).

4.4 Quality assurance and product sale

Material Testing and Formulation
Testing the quality of collected materials is completed using spectroscopy, via a 3rd party service provider. The wastes collected by 3DPW Limited tends to be of a very high quality, pure and uncontaminated. 3DPW Limited, through 3rd party companies have experimented with formulations to improve recyclability of the recycled granules. The addition of PP has been identified as promising, where the PP improves the quality of the PLA (reduces how brittle the material is) and improves recyclability. However, 3DPW Limited note that such an addition would mean that the material is no longer industrially compostable and that they have limited agency when sourcing and testing potential additives.

Packaging and fulfilment

3DPW Limited employ distribution service providers, both for the delivery of their waste collection and recycling service as well as the transportation of finished, recycled products from injection moulding service providers to retailers and end users. 3DPW Limited are working with the companies across the supply chain to improve circularity during the packaging and fulfilment stage. For example, the company that manufactures the boxes should ensure that they are both reusable and recyclable.

Marketing and business development

3DPW Limited enlists the services of several 3rd parties for the distribution, recycling, and manufacturing aspects of their business model. As such, its key activities include the coordination of waste collection from its customers and distribution of these materials to 3rd parties, as well as material testing. Additionally, they partake in sales, marketing, and business development activities to grow the company's customer base.

Take-back scheme

Although 3DPW Limited currently have the technical capacity for taking back their products at end-of-use and returning these through the process to be recycled into further products, they have not yet established formal return routes. This is something that they are keen to explore as their business scales.

5. Conclusion and recommendations

Based on the outputs derived from all three interviews with 3DPW Limited, strengths of the business model and operational process in regard to circularity are identified, barriers and enablers for circularity are summarised, and opportunities for circularity are described.

5.1 Strengths for circularity

Business model

3DPW Limited provides a mechanism to address the amount of waste created through the increased uptake in 3D printing across different sectors and industries. This business model has identified a gap in the market, where an established route to collect, process and recycle waste PLA was non-existent. By coordinating the collection and recycling of this growing waste stream, 3DPW Limited divert waste away from landfill and/or incineration and provides an avenue where the material can be recycled with the inherit value maintained over multiple lifecycles. The service provided by 3DPW Limited is underpinned by a small team that is invested in the circular economy, maximised through internal communications and implementations plans, as well as employee education and training.

Circular strategies in the value chain

3DPW Limited support a wide range of circular strategies across the supply chain. The boxes used to collect the 3D printing waste are made locally with recycled PET and are reusable. The recycled granules produced from the recycling process is made available to manufacturing companies as a sustainable feedstock within their own production systems. In-house products commissioned by 3DPW Limited are designed for circularity (being both durable and recyclable) and produced locally by 3rd party service providers, for sale either through retailers (B2B) and directly to end users (B2C). The integration of circularity principles into their design process has also optimised their in-house products for a circular economy and helped to create a joined-up, circular business model that is as efficient as possible.

Operational process

Operationally, 3DPW Limited provide waste collection as a service. Customers pay a fee to the company, who then provide a reusable waste collection box which is delivered by a 3rd party distribution network. The same network then collects the waste plastic and transports it to a 3rd party recycler. 3DPW Limited pay the recycler to turn the waste plastic into feedstock suitable for injection moulding, which they then sell to manufacturers. 3DPW Limited have established important relationships with 3rd party service providers to collect, process and recycle the waste generated by their customers. By maintaining localised services, 3DPW Limited have reduced carbon emissions related to transportation across the service.

5.2 Barriers and enablers for circularity

To ensure circularity for 3DPW Limited and its value chain, several barriers and enablers can be pointed out. The biggest barrier for 3DPW Limited related to existing policy and regulation, where 3DPW Limited have highlighted challenges regarding the classification of the materials. As an SME

processing waste, it can be, at times, difficult to access financial products due to current regulations applicable to the waste industry, despite the fact that the materials they collect are transformed into a valuable resource as part of a circular economy. Furthermore, a lack of SIC (Standard Industrial Classification of economic activities) codes relevant to 3D printing have further complicated compliance with certain regulations and the completion of paperwork.

The biggest enablers for 3DPW Limited's offering are the increased uptake of 3D printing across various sectors and industries (thus the rising generation of 3D printing waste) and the growing demand for recycled and/or renewable materials (such as the recycled PLA granules) in the manufacturing process to make renewable, recycled, and recyclable products.

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 3DPW Limited.*

Barriers	Enablers
• Grey areas and loopholes in current / new policy and legislation • Low comparative price of virgin plastics, recycled plastics are competing with low price points. • The lack of established formal return routes to enable take-back schemes for their products after end-of-life. • Transportation costs and associated emissions. • Currently the recycled plastic is downcycled (from 3D printing filament) for use as a feedstock in injection moulding.	• Growing demand for recycled and renewable materials. • Increased acceptance (and even desirability) of plastic materials that are recycled and/or renewable. • Embedding sustainability and circular economy within the company's core strategy. • Employees with the necessary skills and knowledge to implement the service provided. • Embedding circular design principles into the design phase of in-house products. • Ongoing relationships with different 3rd party service providers.

5.3 Opportunities for circularity

By providing a route for a new, but growing, waste stream (waste from 3D printing) to be collected, processed, and recycled, 3DPW Limited address the issue of waste generation and management. 3DPW Limited actively uphold circular economy principles by working with 3rd party companies to provide sustainable feedstock from production systems, thus finding new uses for waste materials, employing eco-design in product development, providing up-skilling and green jobs opportunities, and improving awareness of sustainability issues through education and outreach initiatives.

However, further opportunities to enhance the circularity of the 3DPW Limited business model may remain.

Noting the biggest enablers for 3DPW Limited's business model to become more circular revolve around the demands of stakeholders, the company could seek to further improve their engagement with customers at both sides of the value chain. As schools and universities make up a large part of 3DPW Limited's client base, the company could provide education visits which explains what/how the company works. To this end, 3DPW Limited are already working on educational videos on how the processes work. At the other end of the supply chain, 3DPW Limited could embark on an outreach programme that engages with producers (users of the recycled feedstock) and end-users (buyers of the products) through roadshows, exhibitions, etc. 3DPW Limited have indicated that they are open to further opportunities to expand their outreach and educational activities.

Currently the service provided by 3DPW Limited focuses on PLA, as the most commonly used 3D printing filament (and therefore greatest waste stream from 3D printing). In the future, 3DPW Limited could look to expand this service to include other filament types. For example, while not as popular as PLA, ABS is another commonly used filament that could be a good contender for 3DPW Limited to expand their operations. Furthermore, there are currently no existing routes to recycling ABS from 3D printing, other than through specialist recycling companies.

Although 3DPW Limited currently have the technical capacity for taking back their products at end-of-use and returning these through the process to be recycled into further products, they have not yet established formal return routes. This is something that they are keen to explore as their business scales. By setting up a take-back scheme, 3DPW Limited could reduce the volume of waste going to landfill or incineration. As the products are made from PLA, the most likely waste management strategy used (at the local authority level) would be to collect them with the general wastes, where depending on the location they would be landfilled or sent for energy recovery through incineration. By setting a formal returns route, 3DPW Limited would be providing a mechanism where the products could be re-collected and processed/recycled. It would also feed into a more circular ethos, where the product would be reprocessed and the resultant recycled feedstock could be used to make another product, thereby maintaining the value of the inherent resources over another lifecycle.

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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 innovative technologies – intrusion-extrusion moulding (IEM) and additive manufacturing (AM) – will be used to turn plastic waste into recycled feedstock and new products. To support this, an R&D Centre (UK) and Prototyping Unit (BE) have been set up to develop and scale the production of recycled filaments for AM, whilst an Intrusion-Extrusion Moulding Facility, the Green Plastic Factory, has been established in the NL to expand the range of products manufactured using IEM.

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

Countries

UK | BE | NL | DE

Timeline

2019-2023

www.nweurope.eu/transform-ce