TERRACYCLE

A Circular Economy Business Model Case

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Source: TerraCycle

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Executive Summary

This report presents the results of the TerraCycle case study, selected in the framework of the R2PI project, among 17 other cases. The information contained in the report is based on the methodology designed within the framework of the R2PI project to understand the characteristics of the business model, evaluate its outcomes and identify the main barriers and enablers. TerraCycle was chosen for the study to investigate their effort and evolution towards attaining the goal of "eliminating the idea of waste".

The company was founded in 2001 in Trenton, USA as an organic fertilizer producer, using waste as the resource for production. Throughout the years TerraCycle evolved into the world leader in the collection and recycling of waste streams that are traditionally considered not-recyclable. TerraCycle typically sets up collection platforms for the waste streams. This platform is usually funded by businesses that are looking to enhance their environmental performance. The waste collected by programme participants in return for a charitable donation is recycled and sold to manufacturers that make new products and materials using them. To date, over 80 million people in 21 countries have helped TerraCycle to divert approximately 5 billion pieces of waste from landfills and incineration and in result raise over 21 million dollars for charities and schools around the world.

Those activities are enabled by the business context TerraCycle found itself in. Most importantly the company was capable to make use of the rising environmental awareness of final consumers and the growing level of corporate social responsibility among popular brands.

TerraCycle became the world leader in the collection and recycling of waste streams that are traditionally considered non-recyclable. TerraCycle typically sets up national collection platforms for hard-to-recycle waste streams. This platform is usually funded by consumer product companies, retailers, cities, manufacturing facilities, distribution centres, small businesses that are looking to enhance their environmental performance. The waste collected by programme participants in return for a charitable donation is recycled and sold to manufacturers that make new products and materials using them. Where possible, TerraCycle and their partners focus on how to integrate reclaimed materials into specific products.

By focusing on one of the collection programmes, i.e. writing instruments recycling programme, it has been established that there is a high level of circularity of their business models identified as resource recovery and circular sourcing. Although the scalability and replicability of those models is questionable as TerraCycle itself has not attained economies of scale itself it seems that it is mainly the result of the characteristics of items collected.

This is further exacerbated by the need to thoroughly ascertain that each recycling process will meet the public opinion's expectations. Adverse publicity could tarnish their reputation and reduce the value of the brand and in result reduce demand for their services. The publicity factor is also significant for replicability. It seems that without environmentally-friendly brand image such operations could not take place and establishing company's reputation is a long-term process.

1 Introduction

1.1 Background and context

R2π – Transition from Linear to Circular is a European Union Horizon 2020 project focused on enabling organisations and their value chains to transition towards a more viable, sustainable and competitive economic model. One of the missions of the project is therefore to identify and develop sustainable business models and guidelines that will facilitate the circular economy.

A core part of this project is to work with organisations that are on the journey towards developing circular economy business models, as well as those who have the ambition to do so but haven't yet begun or haven't been successful yet. Through these engagements, the R2π team's aim is to provide participating organisations with independent analysis and possibly facilitate the whole industries to challenge current business model assumptions, identify new opportunities, and catalyse change.

The case organization for this report was chosen based on the continuous effort and evolution of TerraCycle's operations towards attaining the goal of "eliminating the idea of waste". The history of the company is a tremendous source of insight for economically viable business models that put sustainability at the forefront. This also concerns the plans of the company that are described in the report.

Although the focus of TerraCycle's business model investigation was one of their collection programmes, i.e. writing instruments recycling programme, the report also takes on other activities as TerraCycle portfolio of services is constantly growing. Most of TerraCycle's activities should be assessed as successful business ventures. However, it never seems to be the case that profit is the final goal for the company.

This aspect seems particularly important when assessing the possibilities for replication and scalability of the business model in line with circular economy notion – a one that focuses primarily on social effects. As TerraCycle's business model is in fact a cooperation between the company, producers and consumers the growth in project scale and the demand for TerraCycle's services are gauges on which the business ventures successfulness was judged on. Company representatives are using term "sustainable value created", instead of financial one.

For a more detailed overview of the case organisation business see subsection below.

1.2 Business overview

TerraCycle is the world leader in the collection and recycling of waste streams that are traditionally considered not-recyclable, with an ambition to develop their business model further to effectively tackle the problem of waste. The company was founded in 2001 in Trenton, USA. It currently operates in 21 countries around the world (including 12 countries in Europe) through its subsidiaries, employing approximately 250 people. In some cases, those subsidiaries are co-owned by other companies.

FIGURE 1 COUNTRIES TERRACYCLE OPERATES IN

SOURCE: TERRACYCLE

The company's mission is to "eliminate the idea of waste" in the context of a profitable business. To attain this goal, they operate in three distinctive areas. They first focus on "making everything recyclable". This constitutes most of their business as "recycling the non-recyclable" activities – those are the most mature and popular operations. The company claims that most packaging and products are considered non-recyclable because the costs of reclaiming material are higher than the value of the material. However, using its collaborative business model TerraCycle manages to recycle those products and incentivise the process for all stakeholders.

FIGURE 2 PRODUCTS AND PACKAGES CONSIDERS RECYCLABLE AND NON-RECYCLABLE

reclaimed material value > cost of recycling e.g.	reclaimed material value < typical cost of recycling e.g.
• glass • HDPE • PET • PP • uncoated paper/ cardboard • aluminum • steel	• beauty products • coffee capsules • writing instruments • flexible packages • cigarette buds • diapers • latex gloves • toothbrushes

SOURCE: TERRACYCLE

In result TerraCycle became the world leader in the collection and recycling of waste streams that are traditionally considered non-recyclable. TerraCycle typically sets up national collection platforms for hard-to-recycle waste streams. This platform is usually funded by consumer product companies, retailers, cities, manufacturing facilities, distribution centres, small businesses that are looking to enhance their environmental performance. The waste collected by programme participants in return for a charitable donation is recycled and sold to manufacturers that make new products and materials using them. Where possible, TerraCycle and their partners focus on how to integrate reclaimed materials into specific products.

The second pillar of TerraCycle's mission - making everything from waste - is a natural consequence of the first one by using them in new products. The reclaimed material is used as a feedstock for other products. In some cases (e.g. beach plastic) it means running the whole supply chain. Starting from

beach clean-ups and finishing with the material prepared for the production process. TerraCycle logo is featured on customer's products and packages made from recycled materials to further enhance their value using company's brand recognition.

Thirdly TerraCycle will try to eliminate the concept of waste by altering the current consumption patterns. The specific operations to this end have not be started yet as they are in the preparation phase. However, from what the company has already announced the first step in this process is to implement durability into packaging of non-durable products.

The mission and three pillars have not been at the forefront of the company's business model since its inception. TerraCycle evolution towards current state has involved firstly the production of organic fertilizer. Despite its profitability this part of its business operations has been halted as in the words of the founder of the company: "the waste wasn't the hero". The evolution of the company made sustainability and social effects the prime objectives of TerraCycle, in result production activities were discontinued.

FIGURE 3 TERRACYCLE'S CURRENT MISSION AND RELATED ACTIVITIES
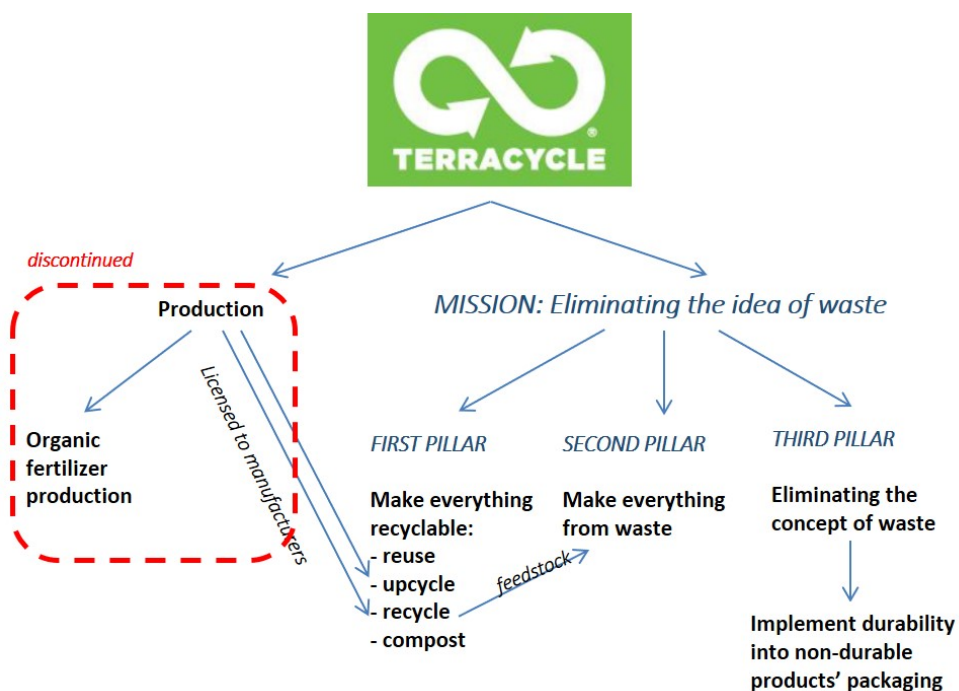
SOURCE: TERRACYCLE

The main pillar of TerraCycle's activity, i.e. making everything recyclable, is responsible for diverting billions of pieces of garbage from landfill and incineration every year, using help from millions of participants of their collection programmes. To date, over 80 million people in 21 countries have helped to collect and recycle enough waste to raise over 21 million dollars for charities and schools around the world. They are expanding the scale of their endeavour every year. The growth in waste diverted translates into company's rising revenues as well as considerable decrease in CO_2 footprint (between 40% – 80% carbon savings depending on the product).

FIGURE 4 WASTE DIVERTED BY TERRACYCLE CUMULATIVELY
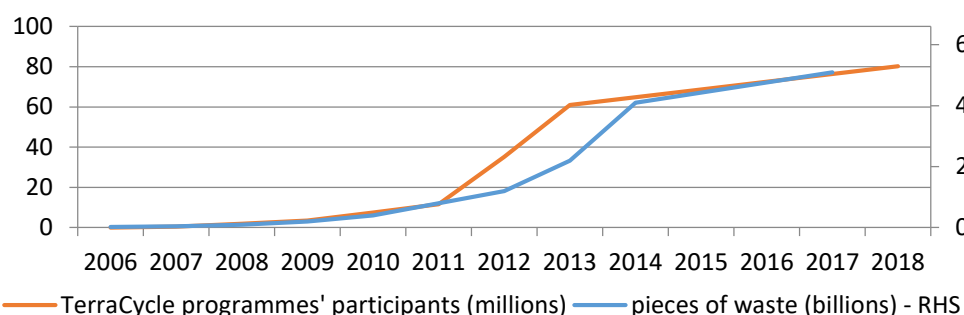
SOURCE: TERRACYCLE (DATA IS NOT CONTINUOUS)

FIGURE 5 TERRACYCLE'S REVENUES (MILLIONS USD)
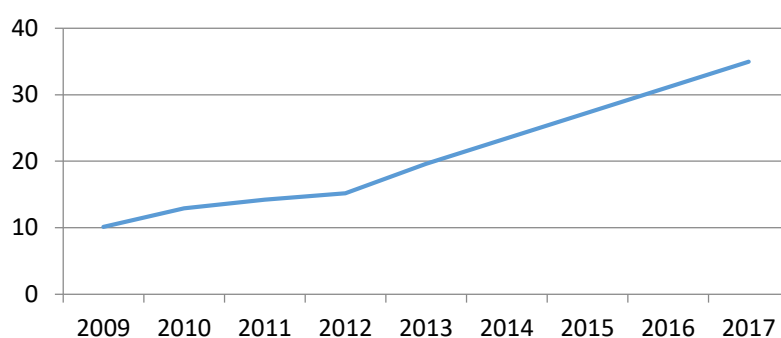
SOURCE: TERRACYCLE (DATA IS NOT CONTINUOUS)

In recent year there has been a push to increase the scope of TerraCycle's operations in two important ways. Firstly, to increase its technological prowess by buying other companies that already possess needed expertise. Secondly, to expand beyond what the company has already been doing, notably by implementing the platform needed for the third pillar of their mission to gain traction. TerraCycle activities involve recycling materials that normally would be heading to the landfill or incineration. This is the basis for the collection programmes that form the main part of company's business.

In some cases, the collection programmes' scope is much wider as it concerns not only the end-of-life phase of the products but also the design and production. TerraCycle strives to incorporate closed loop solutions, such as manufacturing of products made from reclaimed material. Those products are 100% recyclable themselves, which means that the project could possibly result in closing the product lifecycle completely.

To delve deeper in the TerraCycle's business model one of their collection programmes was chosen. Whenever there was need for a business model analysis in the micro perspective the detailed investigations focused on the writing instruments recycling programme developed and run by TerraCycle in cooperation with BIC and with the engagement of other entities**.**

BIC, the world leader in ballpoint pens production partnered with TerraCycle to launch a writing instruments recycling programme. The goal was to organize voluntary collection at schools, companies, universities etc. for the writing instruments, regardless of whether they are BIC branded, to be recycled into new products. The writing instruments recycling programme first launched in March 2011 in France. Other locations soon followed. Currently the programme operates in seven countries in Europe (France, Netherlands, Spain, Germany, United Kingdom, Belgium, and Switzerland).

FIGURE 6 WRITING INSTRUMENTS RECYCLING PROGRAMME
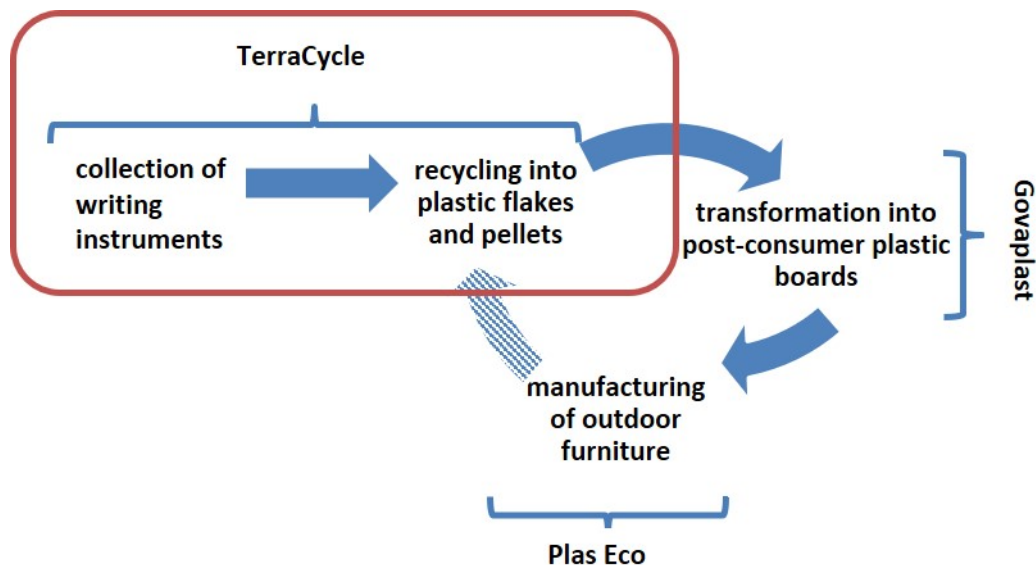
SOURCE: OWN RESEARCH

From 2017 BIC has taken a step to expand the writing instruments recycling programme. The reclaimed material from writing instruments is being transformed by Govaplast company into post-consumer plastic boards to be used further by Plas Eco, which makes outdoor furniture out of the material. Products designed, manufactured and sold by the Plas Eco are entirely made of recycled plastics and are themselves recyclable. The following type of high weather resistant and low maintenance products are produced:

- bench-type seats for secondary and high schools;
- school benches;
- educational planters for schools;
- picnic tables;
- tree seats to protect trees and provide seating (2 types);
- standing seats for secondary and high schools.

As TerraCycle tries to implement economic incentives into each of their projects to enable profitability for every entity in the value chain, this is also the case with writing instruments recycling programme:

- TerraCycle receives payment from BIC to design and operate the programme.

- The collectors receive an award for every writing instrument send to TerraCycle that they can donate to a charity or school. In return 1 Euro cents per writing instrument collected are donated to a charity, school or not-for-profit organization chosen by the entity responsible (in the case of United Kingdom and Switzerland 0.01GBP and 0.01CHF prize per instrument applies respectively). There are almost 8000 locations participating in the programme throughout Europe. Since 2011 over 27 million writing instruments were collected and recycled. Donations to charities and schools amounted to over EUR 430 000.

- BIC has a meaningful return on investment by generating media coverage (339 media placements in years 2011-2014 with ad value equivalency of ca. USD 1.5 million), in result

enhancing brand's image and establishing it as environmentally friendly. This can result in increased brand recognition and growth in sales.

The above-mentioned value flows are crucial for the process to work. The programme must generate value well beyond the material value of the waste collected. Otherwise there would be no incentives to act for BIC, except for the socially beneficial aspect of collecting non-recyclable waste. Secondly, the award for the collectors must be enough to trigger action. Finally, TerraCycle's revenues must cover the costs of the programme design, logistics and waste handling.

1.3 The case study analysis process

The case study process was structured in three main steps and concludes with this document as the final report (see diagram below).

FIGURE 7 CASE STUDY STRUCTURE
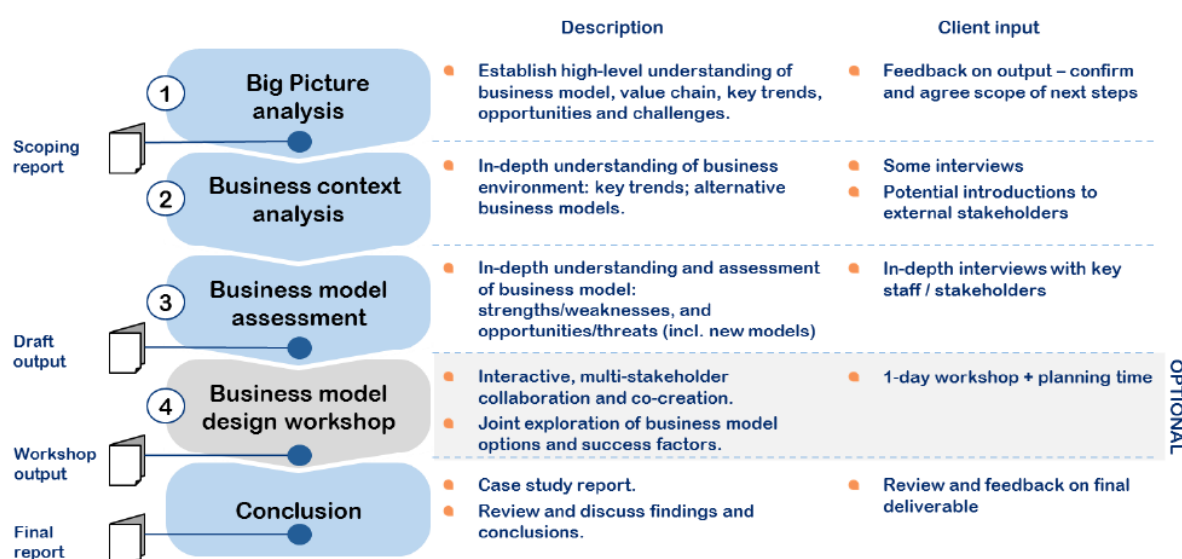
SOURCE: R2π

Prior to starting the big picture analysis, a kick-off and planning conference with TerraCycle was conducted to discuss the project's objectives. The meeting also resulted in establishing the processes for communication (email and telephone contact), identifying a project sponsor within the company (TerraCycle Europe general manager, employees in the global programmes development department), confirming the project timeline and plan of activities and identifying key TerraCycle stakeholders who will be relevant for the project.

Following the kick-off meeting several valuable internal materials were sent for investigation. Basing on those sources and publicly available information big picture analysis was conducted. After discussing the findings with the company, business context analysis was conducted, mainly in the form of desk research. Findings from the business context analysis were used in business model assessment. Business model design workshop was not conducted.

The process of gathering information, desk research and interviews took place in the period December 2017 - May 2018. The preparation of the final report ended in June 2018 with additional changes implemented later.

1.4 Report outline

In line with the case study process analysis big picture analysis, that was already presented, will be followed by business context analysis in section 2. This will be based specifically on business context canvas with description of some elements of the canvas and referrals to sources on relevant business trends.

Section 3 takes on business model assessment based specifically on the business model canvas elements and their description, identifying its strengths and weaknesses.

Last section discusses the main findings and concludes on the assessment of the business model, focusing on further circular possibilities, scalability replication and key messages for business leaders and policy makers.

2 TerraCycle's business context analysis

2.1 Scope of the business context analysis

The business context analysis identifies the key trends and developments that impact TerraCycle's business model and broader value chain dynamics. The objective of the context analysis is to identify the main external factors that are to be considered to explain the success or failure of Circular Economy Business Model (CEBM), as well as its potential role in accelerating the transition towards a Circular Economy. Specific focus was given to the identification of key barriers and enablers to circular economy business models within the case organisation's business environment and its value chain.

2.2 Contextual factor analysis

The dimensions considered in the TerraCycle's contextual factor analysis are summarised below using the context map canvas. The contextual analysis tool was used for these investigation (see appendix A). Next, those contextual factors relevant for the perishable goods industry and TerraCycle's business model, are described.

FIGURE 8 TERRACYCLE CONTEXT MAP CANVAS
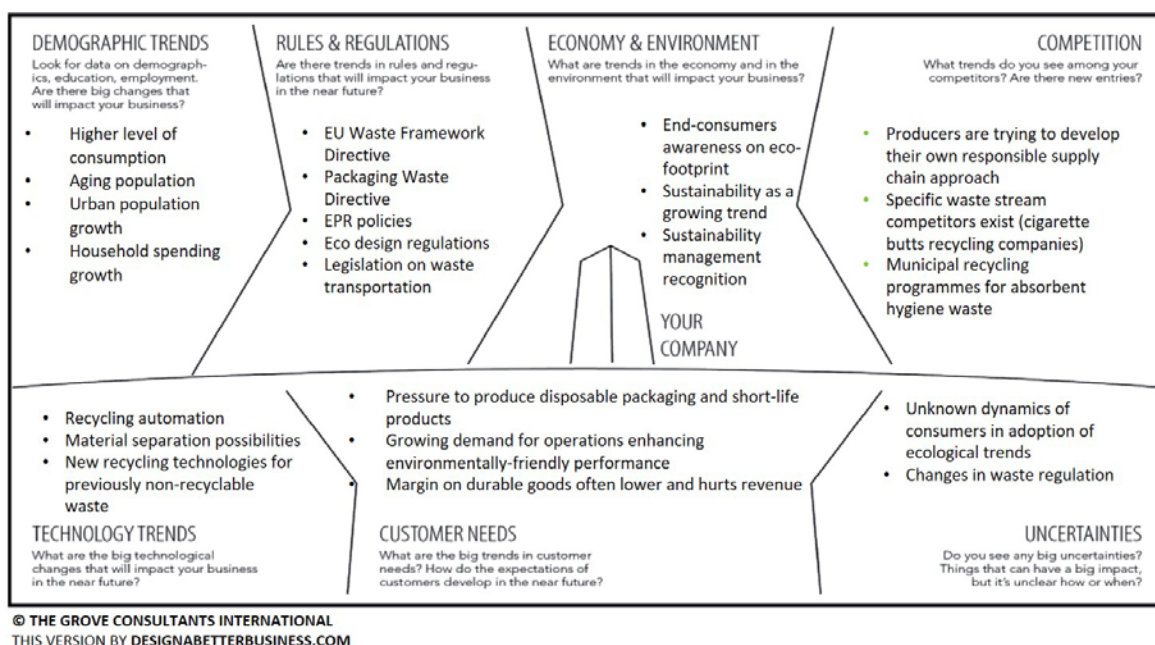
SOURCE: OWN RESEARCH

2.2.1 Demographic trends

Growing amount of waste and depletion of natural resources is considered an important issue by young generations. In effect a greater sense of responsibility for the environment we live in and for the consumer choices we make is seen. In case of TerraCycle's business model it has also implications for the number of collectors of waste participating in their programmes, who in many cases comprise

of young generation (notably students). Their growing understanding of environmental issues could translate into increase scale of the whole endeavour.

Among the countries taking part in the writing instruments recycling programme (which is the main subject of report's investigation) there are visible discrepancies when it comes to urban and rural population, even on the regional level. Urban population seems to be more aware of the implications of their consumer choices and the need in their participation in circular economy implementation. According to Eurobarometer publication (EC, 2014) respondents living in large towns are the most likely to agree that environmental issues have a direct effect on daily life (81%) compared to 74% for those who live in rural villages.

FIGURE 9 SHARE OF URBAN POPULATION AT REGIONAL LEVEL IN 2014
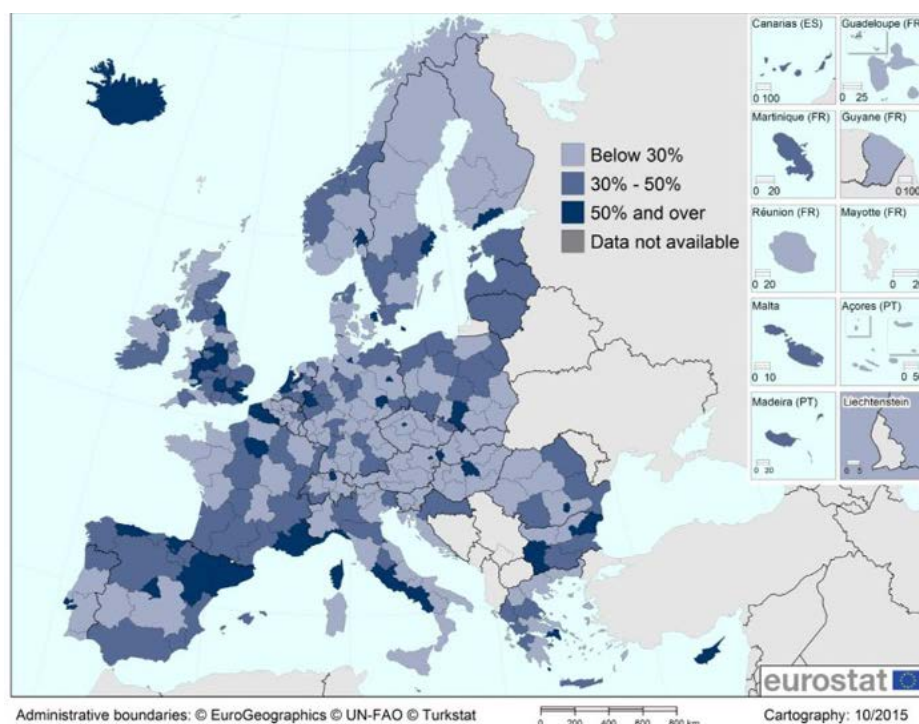
SOURCE: EUROSTAT

These findings are promoting TerraCycle's business model as their services are mostly available to urban population (they have an easier access to collection points). Municipalities total population is of little concern in this aspect as the points are organized in small towns as well as big cities (see figure FIGURE 10). However it seems that in the next years the industry has to stop relying on urbanization and its consumption effects as the process, according to some sources (McKinsey, 2016), will stall as global population growth is slowing (expanding population have been the key driver of urban growth, contributing almost 60 percent of urban GDP growth between 2000 and 2012) and rural-to-urban migration or urbanization is plateauing in many countries.

Among the countries taking part in the programme there are visible discrepancies even on the regional level, e.g. central Germany seems more active in this program than the rest of the country.

FIGURE 10 COLLECTION POINTS FOR WRITING INSTRUMENTS
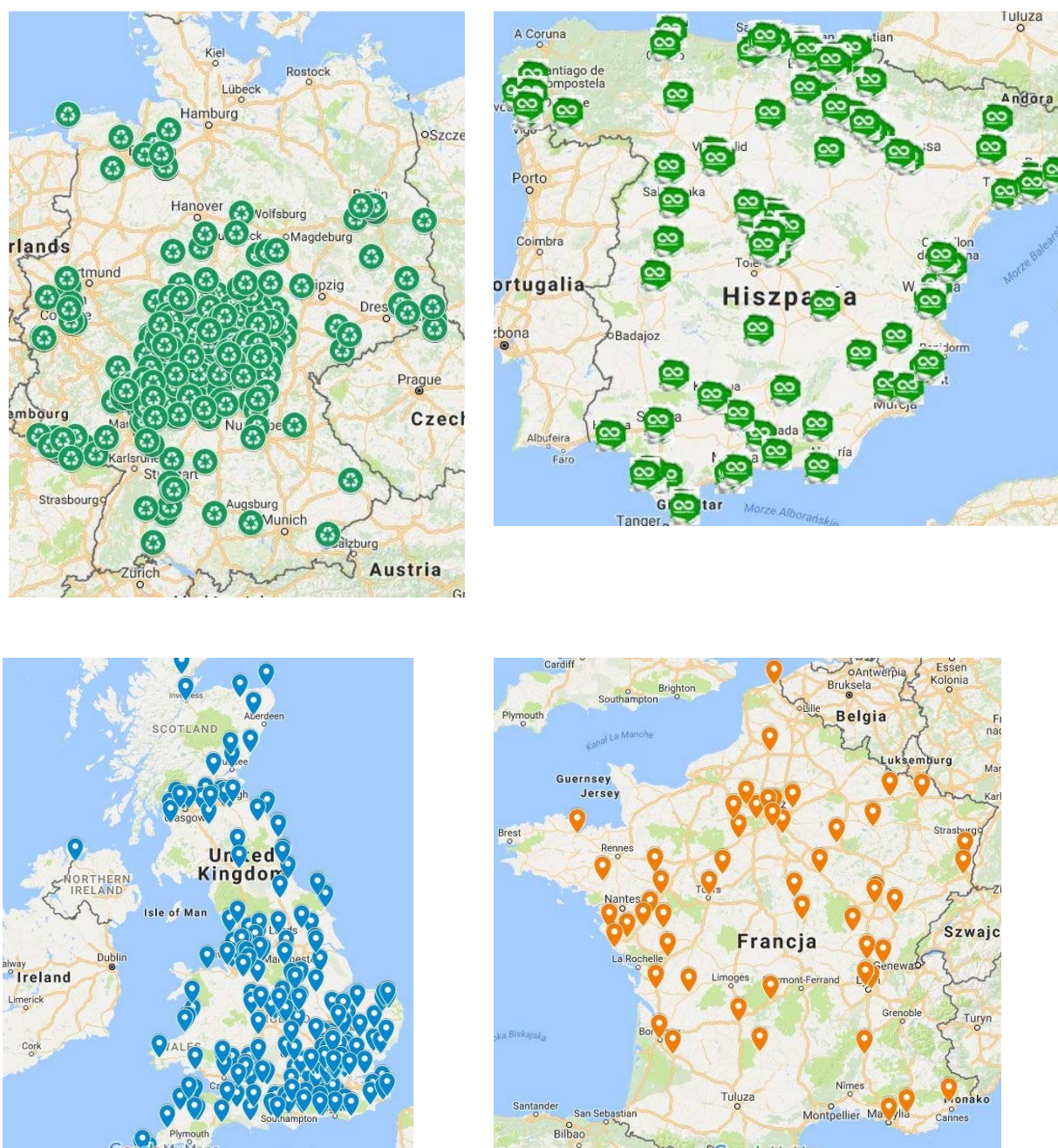
SOURCE: TERRACYCLE

Most of the entities participating in writing instruments collection are schools of any type. This is understandable as the waste that is being collected is directly used at schools. They also are a relatively easy collection point for individual others than students.

FIGURE 11 TYPES OF PARTICIPANTS
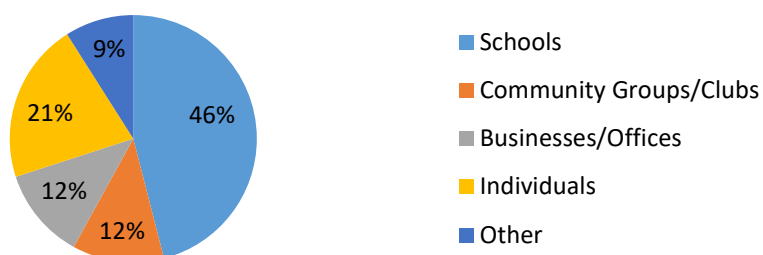
SOURCE: TERRACYCLE

For the writing instruments recycling programme, the collectors are mostly female but is difficult to assess what is the reason for this. Possibly most of the teachers in schools in Europe – where the collection takes place - are female.

FIGURE 12 GENDER OF PARTICIPANTS
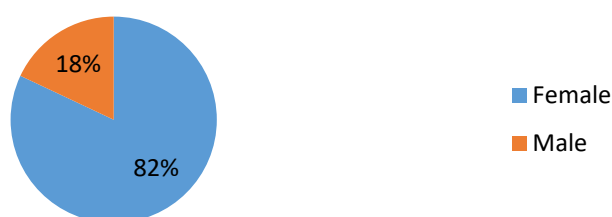
SOURCE: TERRACYCLE

The difference between age compositions of countries' populations suggests that the impact of this factor on the business model may not be negligible. However, the relationship between age and the sustainable lifestyle in consumer choices is not significant (EC, 2014). 45% of respondents in the 15-24 age brackets consider growing amount of waste an important issue compared to 43% for respondents over 55 years old. Depletion of natural resources is considered important by 39% and 32% respectively.

The writing instruments collectors are typically school teachers in their working age (61% of collectors are 26-50 years old). Nevertheless, it must be emphasised that the individual collectors are school students in the young age. Therefore, the European population aging can cause considerable problem for TerraCycle business model. It is a long-term, gradual process.

FIGURE 13 COLECTORS' AGE
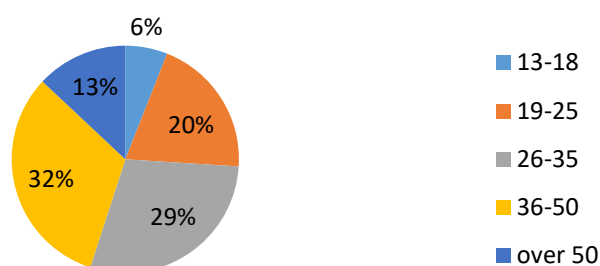
SOURCE: TERRACYCLE

2.2.2 Rules and regulations

In the EU member countries, the 2015 Circular Economy Package is an overarching action plan that needs to be implemented in national legislation. The same applies to 2018 Circular Economy Package that focuses on plastic waste. European laws should have their continuation in legislative framework for every EU member country, however the legislation on the national level is very heterogeneous.

Some countries aim to implement a circular economy as part of a general long-term strategy for the economy and sustainable development (Agenda 2030). Subsequently, developing a circular economy is not the sole goal of these strategies. Among countries that have a general long-term strategic approach for implementing circular economy are: Netherlands (A Circular Economy in the Netherlands by 2050), and France (Circular Economy Roadmap). The federal governments of both Belgium and Germany have opted for other, more short-term types of initiatives by launching policies which are solely dedicated to supporting the implementation of a circular economy in shorter time span. Other countries have policies in place that support specific elements of a circular economy, but which do not deliver an overarching and integrated strategy to a circular economy as such (e.g. UK).

The overarching documents on the EU and country level do not affect the TerraCycle's business model directly. The new regulations towards circular economy implementation could positively impact the demand for the company's services by increasing the scope of its programmes or the number of interested customers trying to meet the necessary requirements. On the other hand, those regulations push producers towards a more sustainable product and packaging design which could make TerraCycle's business model redundant if applied to full extent.

The industry TerraCycle operates in is the subject of various regulations, specifically those concerning waste transportation and handling on the EU level. This specifically applies to the main objects they collect and recycle/upcycle that is packaging waste. The rules concerning processing them are encapsulated in the Directive on packaging and packaging waste.

Other objects that are recycled are simple products e.g. writing instruments, plastic cups. Collection and recycling of those products is only indirectly influenced by Directive on waste, as it takes a macro and meso perspective, rather than applying rules for each entity in the industry. In near future EU Strategy for Plastics will have great influence on industry's operations. Notably by banning some single-use plastic items that may be the subject of TerraCycle's collection programmes. This would make those programmes void. European Commission already proposed a ban on plastic straws, hygiene buds etc. and could increase the scope of the ban in the future.

In the EU, particularly in Germany, where there is an Extended Producer Responsibility program through Greendot (even though most flexible plastics are incinerated), brands believe they are already

paying for a circular solution and therefore deny the need for TerraCycle's circular services. Regulation that leads to incineration rather than true recycling hurts recycling - a more circular solution.

Rising resource efficiency targets in the EU does affect TerraCycle's business positively as it increases the demand for its services. As most of the TerraCycle's processed material is plastic the company's operation work towards meeting the EU Waste Framework Directive goals (50% of the plastic must undergo material recovery by 2020) and Packaging Waste Directive requirements (55% of plastic packages must be available for reuse or recycling by 2025).

Rising material and design standards could affect TerraCycle's business model. The scope of eco-design directive that is currently in law does not consider packages, however in the future such regulatory changes are possible. This could lead to a decrease in the number and amounts of hard-to-recycle waste. Getting rid of it completely would be and immense endeavour that is hard to imagine at the current level of technology and considering current socio-economic factors.

An important tool for TerraCycle's operations is the legislation on waste handling and transportation. TerraCycle is a multinational company that typically aggregates their materials in a warehouse from the collectors from different countries before transporting them to processing facility. To do so cross border transportation of waste is needed. The main legislative act that regulates waste transportation is the Regulation on shipment on waste. Different regimes apply to shipments of wastes for disposal and for recovery, as well as to hazardous and "green-listed" non-hazardous wastes. The shipment of hazardous wastes and of wastes destined for disposal is generally subject to notification procedures with the prior written consent of all relevant authorities of dispatch, transit and destination.

However, as a rule, the shipment of "green-listed" wastes for recovery within the EU and OECD does not require the consent of the authorities. Though waste transportation is simplified for "green-listed" wastes for recovery within the EU and OECD as they do not require the consent of the authorities other somewhat difficult requirements have to be met. Growing recycling requirements from EU and around the world and lack of possibility to export some types of waste to different countries (notably China) could possibly facilitate greater use of TerraCycle's services.

2.2.3 Economy and environment

The packaging and waste sector are rising quickly. According to ecoprog (2015) the demand for plastic recycling plants in Europe will increase significantly in the years to come: by 2025, sorting and recycling plants with an estimated capacity of 5.2 million tons will be commissioned. This is a growth of 25% and the number of plants will increase by about 300 from 1200 in 2015.

The scale of the programme depends directly on the population of the country it takes place in. However great discrepancies between different countries are seen in the efficiency of those programs. Basing on the example of writing instruments recycling programme some of the smaller countries with a smaller number of collection points have managed to gather relatively large amounts of waste (e.g. Netherlands) which may be attributed to social factors.

TABLE 14 WRITING INSTRUMENTS PROGRAMME IN PARTICULAR MARKETS

Country	Participating locations	Waste recycled (units)	Money raised (EUR)
France	4,100	13,704,453	213,355.56
Netherlands	267	3,449,343	59,256.63
Spain	740	3,386,391	57,244.61
Germany	1,000	3,378,373	55,888.61
United Kingdom	1,200	2,388,867	33,975.63 (GBP)
Belgium	133	617,151	10,101.63
Switzerland	278	203,213	3,647.48 (CHF)

SOURCE: TERRACYCLE (MAY 2018)

Countries where writing instruments recycling programme currently takes place in are homogenous concerning green economic performance with Spain being an outlier. Some Spanish regions are clearly below European average however this has not impacted the programmes results directly.

FIGURE 15 REGIONAL GREEN ECONOMIC PERFORMANCE, 2010

Regional green economic performance
(Aggregate typology, 20% - quantiles, EU27 plus Iceland, Liechtenstein, Norway and Switzerland)

- Clearly below average green economic performance (24.1 - 42.3)
- Below average green economic performance (42.4 - 51.4)
- Around average green economic performance (51.5 - 56.5)
- Above average green economic performance (56.6 - 62.3)
- Clearly above average green economic performance (62.4 - 84.0)
- No data

SOURCE: EUROSTAT

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The source of TerraCycle's revenues are differentiated thus market prices for raw material play a role in their economic performance but only to some extent. Furthermore, TerraCycle does not sell traditional commoditized plastics. They sell traditionally non-recyclable plastics to processors and end users. These materials are not in high demand, it takes a unique pitch to convince an outside company to use these materials in their supply chain. The used products and packages that are currently in TerraCycle's focus have no market value before processing as there are considered non-recyclable. They pose economic costs because they are directed to landfill as in many cases they are not even considered appropriate for incineration.

Cost of the reclaimed material poses uncertainty concerns in the industry. The volatility of prices can be as high as 15% each month. Nevertheless, the long-term price trends are stable. The raw product price after TerraCycle's processing is currently lower than market price of similar raw material. If increasing the amount of waste processed could be possible markets would certainly meet the increased supply of reclaimed material.

According to European Commission (2014) 96% of Europeans think it is important that the EU uses its resources more efficiently. Reducing and recycling waste both at home and in industry and construction is seen as the way to make the biggest difference in how efficiently resources are used (51% and 50% respectively). Among a list of potential initiatives that would convince customers to separate more of their waste, the reassurance that waste is effectively recycled is mentioned by a clear majority (71%). Financial incentives are third on the list (59%). There is a very high level of agreement with most initiatives to tackle plastic waste: more initiatives by industry to limit plastic waste and increase recycling (96%), better information about which plastics are recyclable (94%) and the stopping of non-recyclable plastics production and the use of recyclable materials as an alternative (93%).

All these gauges indicate there is a high awareness of the environmental and sustainability issues among Europeans. However, there is a problem of internalization. People do not recognize that their individual consumer decisions are affecting the whole society and economy.

FIGURE 16 WASTE GENERATION AWARENESS
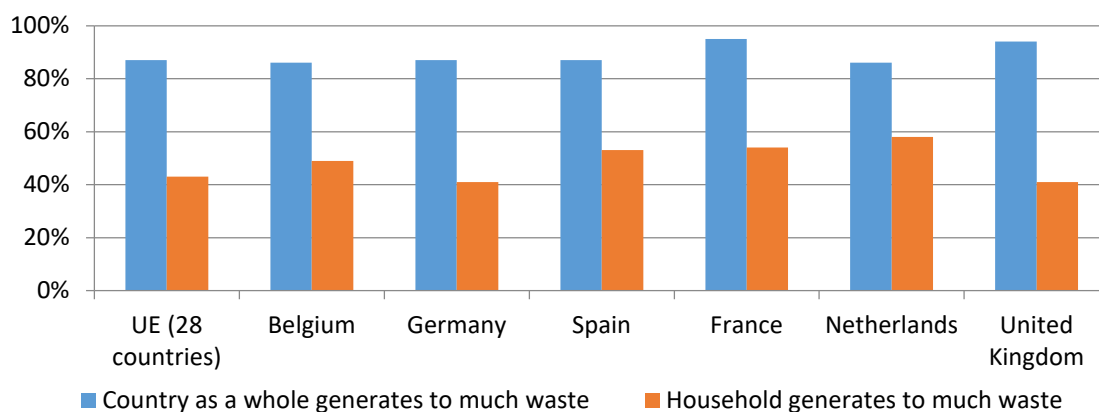
SOURCE: EUROBAROMETER 388, (2014)

There is no information on direct problems with insufficient labour demand or with qualified employees either with technological, marketing or any other skill in the industry of waste handling. In most of the countries TerraCycle operates in, the number of employees in the industry is on the steady rise.

FIGURE 17 EMPLOYMENT IN WASTE AND MATERIAL RECOVERY SECTOR
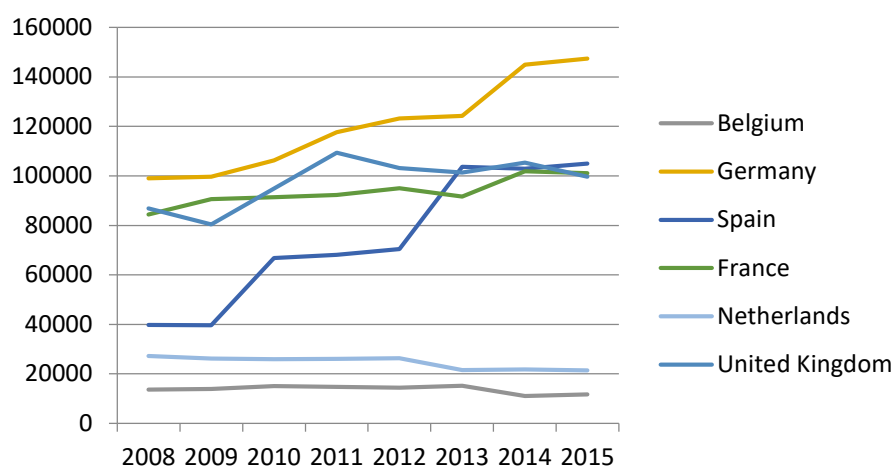
SOURCE: EUROSTAT

Current scale of TerraCycle's enterprise and the industry is working in does not create problems with insufficient demand for their services or problems with qualified employees either with technological, marketing or any other skill. The need for additional employees does not influence supply in any way as it is quite low for every TerraCycle's program (e.g. writing instruments recycling programme resulted in 6 additional employees being employed).

2.2.4 Competition

There is no direct competition for TerraCycle. Some of the companies propose projects solving problems of selected waste streams that TerraCycle also takes care of, e.g. Indian company Code recycles cigarette butts. However, none of them proposes a comprehensive approach to hard-to-recycle waste. Potential single waste stream competitors do not seek sponsoring from brands, which can diminish the impact of their projects as the revenues from reclaimed materials could not fully compensate for the total costs in small enterprises.

Among close competition on hard-to-recycle waste Knowaste company is a notable rival. The company recycles absorbent hygiene waste (e.g. diapers). It appeals to companies, by enabling disseminating ecological benefits among consumers and municipalities by offering kerbside services. Thus, their customers are like those of TerraCycle.

Another indirect competitor is Dell, a company that manufactures computers but has developed a supply chain for the beach plastic like TerraCycle's one. The difference is far greater scale of TerraCycle's operations. Dell is processing plastics collected from beaches, waterways, and coastal areas by entrepreneurial pickers, volunteer groups, and professional recycling organizations. After the plastic goes through processing and refinement (to ensure a clean supply), Dell mixes the ocean plastic with other recycled high-density polyethylene plastics and uses them as the new packaging system for one laptop' brand globally.

2.2.5 Technology trends

It now seems that innovations could decrease the costs of segregation of hard-to-recycle waste. The same applies to further stages of recycling process which is getting more and more automated. These new possible technological trends have another advantage of increasing efficiency of recycling and raising the quality of the reclaimed material. In result cost of reclaimed material could rise.

There are new approaches towards tackling the problem of hard-to-recycle waste developed constantly. Some of them require complicated processes and technology (e.g. Knowaste) others require only basic technology that was available beforehand (e.g. Case company). The process of technological advance in this industry is currently ongoing and fairy specific as every type of waste stream is different and needs tailor-made approach.

2.2.6 Customer needs

Companies producing hard-to-recycle products or packaging notice that consumers awareness on the issue of their ecological footprint and economic sustainability is constantly growing. This trend has a direct impact on consumer choices. According to a market report by Havas (2014) 34 percent of consumers worldwide always or often bought one brand over the another because they were aware it was more socially or environmentally responsible. In 2015 some 67 percent of consumers worldwide were planning to buy brands that let them support issues of well-being and sustainability throughout their purchase.

This specifically translates to increased responsibility of producers for their products and packages. As there is more understanding among societies around the world, especially in developed countries, that there is a need for change towards circular model of economy, companies cooperate with other entities to increase the possibility of reusing/upcycling/recycling their products and packages.

However, manufacturers (consumer packaged goods producers, especially fast-moving goods) are also aware of the public pressure to produce simple to use, disposable packaging and short-life products. As the margin on durable goods is often lower and hurts revenue due to fewer repeated purchases, producers appear to be increasingly interested in circular solutions for their disposable products and packaging. Changing the economic model by producing more durable products and packages would be questionable as it is too soon to say if the environmental awareness would compensate for the loss of simplicity in customer's consumption patterns.

2.2.7 Uncertainties

Main uncertainties for TerraCycle's business concern the dynamics of consumers in adoption of ecological sustainability trends. It now seems that customers are more aware of the issue but that does not necessary translate into actions. This is especially important for the future endeavours of TerraCycle, notably its 'Loop' platform (third pillar of TerraCycle's mission) that offers over 1000 products in durable, refillable packages.

Regulation around the world concerning waste changes continuously. This is especially visible in countries that typically import waste. The ongoing trend is that those countries limit the amount of waste or types of waste their import, however this trend is still uncertain. The regulatory uncertainties also concern the legislation on plastic, notably the possibilities to ban some of the products that are subject to TerraCycle's collection programmes.

3 Business model assessment

The business model assessment has been conducted through a combination of publicly available information, interviews with managers, employees and stakeholders of the case organisation and internal documents provided by the organisation.

The objectives were to gain a deeper understanding of the circular business model and to map out the value chain and interactions in more detail to enable an analysis of the strengths and weaknesses as well as to consider the replicability and transferability of such a model to other entities and sectors.

3.1 TerraCycle's business model

3.1.1 Business model evolution

TerraCycle was incorporated in 2001 as organic fertilizer producer. TerraCycle's first product was a fertilizer made from vermicompost, which is made by feeding organic waste, specific food waste, to worms. The worms' excrement was then liquefied by mixing it with air and warm water. The product was packaged in reused plastic bottles with spray bottle tops that were rejects from other companies. The business became profitable and the revenues grew from 70,000 to 3 million USD. The financial aspect however was not enough for TerraCycle to remain a fertilizer producer. In the words of TerraCycle's founder: "(…) we realized we were making the product the hero. We wanted to make the garbage the hero."

Therefore, TerraCycle modified its business model building on the positive experiences with "bottle brigade", i.e. used soda bottles collection programme for vermicompost packaging. The programme became a huge success with 5000 locations participating in the used bottles collection in only two years. Other collection programmes soon followed, with the same basic pattern: to pay schools and not-for-profit organizations to collect waste considered non-recyclable sponsored typically by its producers and upcycle the reclaimed products and packaging into new merchandise. The unique approach was to keep the brand on waste by proudly carrying a logo.

TerraCycle has created approximately 200 products from the materials recovered from those seemingly non-recyclable products. Those products are licensed to manufacturers instead of made by TerraCycle itself. TerraCycle products could be divided into two main groups:

- "Upcycled" products: the company diversified its production into upcycling around 2007 and began creating products from other waste items.

- Recycled products and materials: waste that is not upcycled is recycled into a raw material that can be used in products including playgrounds, plastic lumber, plastic pavers, bike racks, park benches, and garbage and recycling cans.

In consecutive years collection programmes focused more on recycling to reclaim raw materials instead of upcycling and reusing. This business model was described already in more detail using the example of writing instruments recycling programme.

Currently the sponsored waste collection programmes constitute approximately 75% of TerraCycle's business. However, the company strives to "eliminate the idea of waste" by gradually altering their business model. Currently the company tries not only to make everything recyclable but also to make everything from waste. Those two tasks are interconnected as the outcome of recycling the non-recyclable is the feedstock for the second process – using the reclaimed material in new products and their packages. In some cases, this is the fundamental part of the collection programme as TerraCycle in many cases cooperates with companies to develop closed-loop solutions for various waste materials.

TerraCycle is planning to expand its business model in near future to tackle the basic issues concerning excessive waste generation – the non-durable packaging. To this end the company will launch a platform that will offer over a thousand non-durable products in durable, refillable packaging. The product will come at the same price as the one in non-durable packaging, however a one-off deposit equal to the value of the durable packaging must be paid. This process will be supplemented with the system for logistics and sterilization of the packages to answer consumers' needs and simplify their experiences.

FIGURE 18 TERRACYCLE'S BUSINESS MODEL EVOLUTION

2001	•Production of organic fertilizer based on food waste
2005	•First waste collection programme - used soda bottles for fertilizer packaging
2007	•Transition to sponsored waste collection programmes •Manufacturing using the collected waste follows
2019	•Introducing durable packaging for non-durablle products
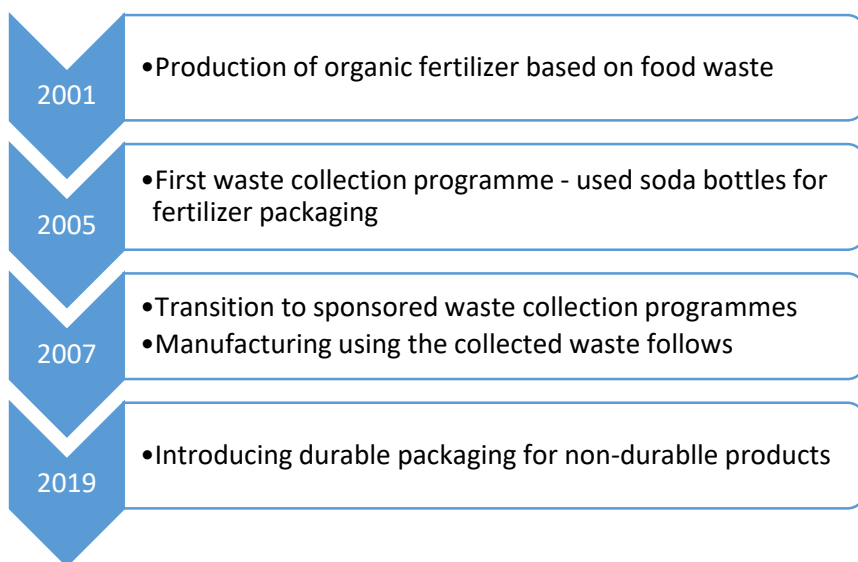
SOURCE: OWN RESEARCH

3.1.2 Business model overview

To achieve their mission, TerraCycle has created an array of collection programmes that generate value well beyond the material worth of the waste that is collected, allowing them to recycle waste that is considered valueless. As those programmes constitute 75% of TerraCycle current business but they are highly heterogeneous, for this report one of those programmes – writing instruments recycling programme was chosen to delve deeper into TerraCycle business patterns.

TerraCycle became the world leader for collection of non-recyclable waste by using several programmes types:

- Collection programmes: funded by brands, manufacturers, and retailers to collect and recycle waste considered non-recyclable. The programmes enable collection at home, school, or office and provide free shipping labels for waste to be sent for recycling. In many cases waste is exchanged for rewards for schools or non-profit organizations;

- Municipal programmes: zero waste solutions that range from city-wide to kerbside programmes to recycle non-recyclable products and packages.

- Zero Waste Boxes programmes: businesses and consumers buy a turnkey recycling solution in the form of a box for specific waste collection. The waste is then sent to TerraCycle, shipping of waste is included.

TerraCycle also provides related services that further enhance the circular elements in the cooperation with their customers:

- Industrial waste solutions: TerraCycle partners with manufacturing to recycle waste traditionally considered non-recyclable at the facility level. Company also provides zero waste consulting and closed-loop R&D support.

- Commercial services and route logistics: the company cooperates with mobile, service-based companies to enhance their platforms with unique recycling programmes.

- Event services: TerraCycle provides comprehensive event services for businesses and organizations, from collection and recycling to promotion and sponsorship.

The subject of TerraCycle's operation is typically waste streams that are considered non-recyclable. The reason why they are not recycled - and are instead sent to landfill or are incinerated - is because the cost to collect and process them far outweighs the value generated from the recovered material. However, the company found methods to implement economic incentives into each of their projects to enable profitability for every entity in the value chain.

Firstly, by using the unpaid media coverage of their programmes and their effects, basing on their sheer publicity value TerraCycle generates additional value for the sponsoring company mainly by increasing its positive perception. This effect in many cases directly translates into meaningful return on investment through a variety of measures from driving increased market share and incremental sales to in-store traffic. For TerraCycle the revenue results from services and products they provide to corporations: strategy design, research and development, preparation of the logistics and promotions. Incentives are provided to collectors, beyond the accomplishment of recycling, by donating money per piece of waste collected to a charity or school and to a smaller extent in the form of incremental promotions, e.g. option to win playground equipment.

FIGURE 149 TERRACYCLE'S PATTERN FOR PROVIDING VALUE TO SPONSORING COMPANIES

environmetal effects
- litter reduction, *e.g. 87% cigarette buts litter reduction in Sydney municipal programme*
- diverting waste from landfills and incineration, *e.g. 97,3% waste diversion for GreenBiz programme*
- reusing reclaimed materials, thus limiting ecological footprint, *e.g. 91.1% CO2 reduction for cotton pencil production from reclaimed materials instead of virgin ones*

image enhancement
- increased media coverage, *e.g. over 1400 media plcements for Pepsico programme worth over USD 8 million*
- establishing brand as ecologically-friendly, *e.g. undisclosed brand's positive perception increase by 78%*

increased sales
- increased repurchase rates, *e.g. 40% rate growth for Kenco programme*
- growing in-store traffic, *e.g. in effect of Northeast grocery chain programme*
- increased market share, *e.g. market share increse following an over 100% sale increse of an undisclosed home care brand*

SOURCE: OWN RESEARCH, TERRACYCLE

3.1.2.1 Value proposition and customer needs assessment

TerraCycle's mission is to eliminate the idea of waste. This mission is based on three pillars:

1. Make everything recyclable

2. Make everything from waste

3. Eliminate the concept of waste

The first two pillars are interconnected as reusing, upcycling or in the most cases recycling goods that are typically considered non-recyclable results with feedstock for other production being reclaimed from waste. Thus, the main value proposition of the company, i.e. cooperation for collection and further usage of waste considered non-recyclable, incorporates both of those pillars. The third pillar focuses on the reduction of waste generated. However, it has not been in operation yet (launch of specific actions is planned for 2019) and has not been considered in the value proposition assessment.

FIGURE 20 VALUE PROPOSITION CANVAS
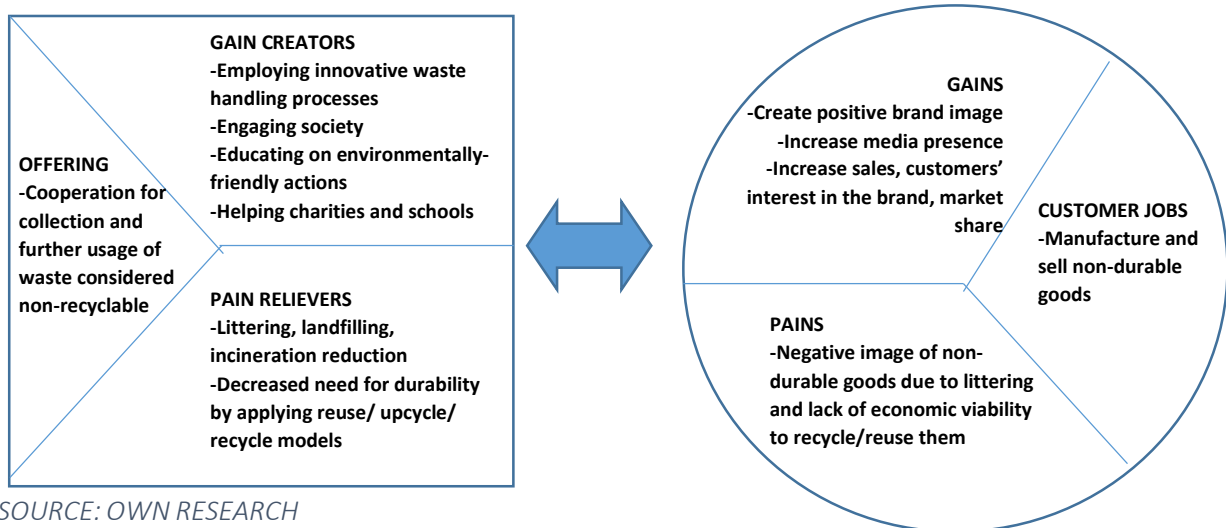
SOURCE: OWN RESEARCH

TerraCycle's value proposition caters to producers of non-durable goods. These goods' simplicity of usage and utilization outbalance the sustainability value for the society. Perishable goods and their packaging have been designed for one-time use with a linear economic model in mind. TerraCycle strives to implement circularity elements in this model by employing innovative and creative technical processes to upcycle or recycle them.

However, those actions would not be economically viable as the cost of the process of collection of said waste and its processing outweighs the value of the reclaimed materials. TerraCycle found a solution to this problem. The company tries to implement economic incentives for every participant in the programme. First, it must engage society in the collection practices. It achieves that by offering a reward for waste collection in the form of charitable or school donation. This in return decreases littering, landfilling and incineration as it puts value to otherwise worthless waste.

To finance this process customer pays TerraCycle. In return the company, using only unpaid media coverage, increases the customer's brand media presence using its brand image and vast expertise in the subject of marketing. It does so also by using publicity engaging topics, mainly environmental issues and charitable causes.

The additional outcome of this process is that perishable products are perceived as less environmentally-damaging. This has caused some commentators to pour scorn on TerraCycle as the critics claim this is not the solution to the problem of excessive waste generation but merely a cover-up for the company's customers unsustainable production patterns (Consumertrap, 2011). However, TerraCycle asserts that although this is an interim solution - "Band-Aid" in the words of company's founder - it has considerable positive effects. Without such programmes the environment and society would be worse off.

3.1.3 Business Model Canvas

This case study takes on the TerraCycle's recycling programmes, in the vein of writing instruments recycling programme. The visual representation of TerraCycle's business model is based on the Business Model Canvas. This is to incorporate the way in which the value proposition and customer needs assessment and circular economy principles are applied and embedded. Each building block of the business model is described next.

FIGURE 21 TERRACYCLE BUSINESS MODEL CANVAS
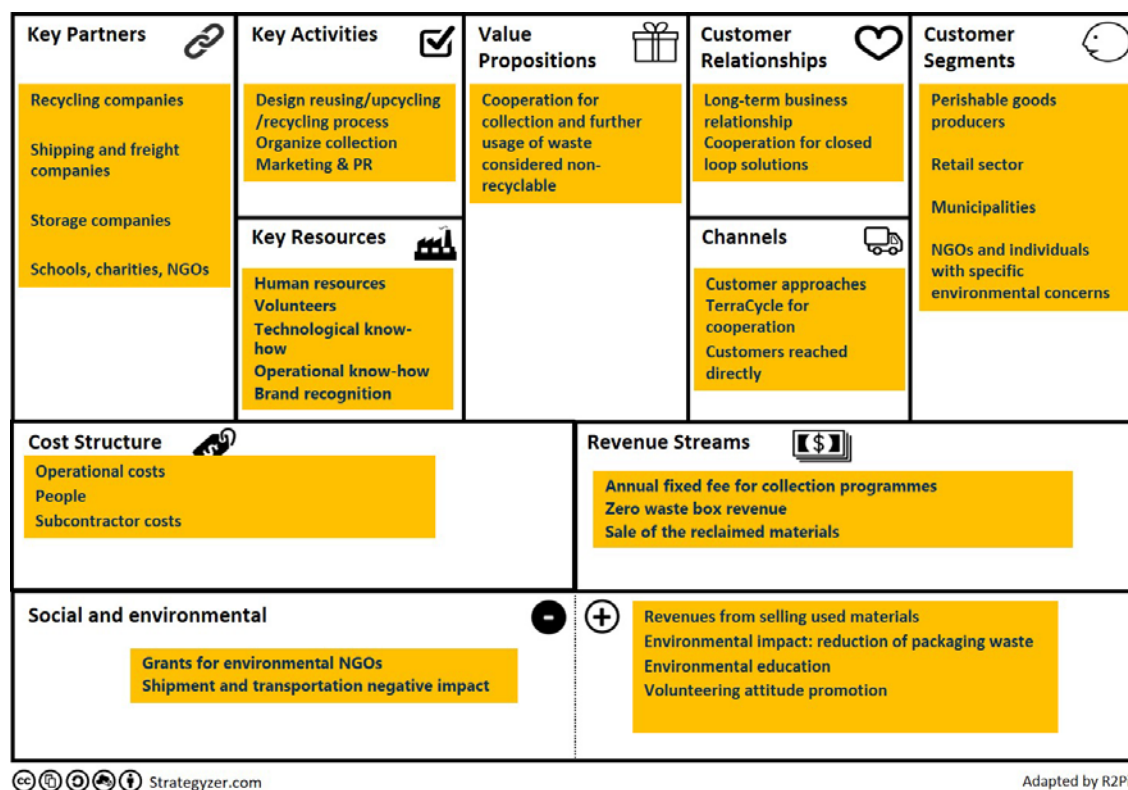
SOURCE: OWN RESEARCH

Key partners

As TerraCycle does not own any production, warehousing, sorting facilities the company uses subcontractors for processing waste and for related services in this process. All key partners are therefore TerraCycle's subcontractors.

Recycling companies should be assessed as TerraCycle's most important partners as they provide the core services of processing the collected material. The company does not own processing facilities as it produces CAPEX risk and lowers nimbleness. TerraCycle uses many recycling companies' services depending on the type of waste, collection programme and its location. Typically, TerraCycle aggregates the waste collected by its type and only then sends it to the recycler. The amounts of waste processed should be considered small compared to the waste processed in recycling companies' typical operations. Thus, although there is a continuing relationship with recyclers, the services provided are not continuous as they require appropriate amounts of waste to be aggregated and

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sorted. Therefore, TerraCycle could make use of economic effects of scale in their cooperation with recycling companies in case of growing amount of waste collected.

The cooperation with recycling companies must be assessed positively, especially considering that many of the sub-contractors that process waste willing to either use their existing equipment to process company's unique waste streams or install new equipment as needed. In rare cases, TerraCycle sells waste directly to a recycler and do not retain ownership of the end-product, e.g. Ultra-Poly (one of TerraCycle's major waste processors in the US) purchases certain polypropylene and polyethylene blends.

Shipping and freight companies are another key partner of TerraCycle in their operations. TerraCycle finances the transportation of aggregated waste from the collection point using money paid by the sponsoring company. It seems that TerraCycle has been largely reliant on UPS shipping company since 2012, when their cooperation started. Using only one global transportation services provider may be assessed as posing uncertainties to the company's business model. In recent stock selling offering for one of its subsidiaries, i.e. TerraCycle US Inc., the company claims that UPS services are expensive compared to transportation using own fleet if enough volume of waste could be collected at a time. This hints the possibility of exploring options for diversifying logistic services in the future. Freights services to transport waste and materials between warehouses and recycling facilities are provided by an array of different companies depending on the location of the operations.

Storage services are necessary in TerraCycle's operations as the collected waste must be sorted and aggregated before being transported to recycling facilities. The choice of warehouses used in this process is typically dependable on location of relevant activities.

Key activities

The process of organizing the collection programme typically starts with designing the process of reusing/upcycling/recycling the product or its packaging. The design is tailor-made for each type of product as its characteristics are highly heterogeneous (e.g. cigarette buds and diapers). The company has its own R&D facilities, tools and workforce with relevant know-how, specifically material processing.

The company also organizes the system for collection of the used products and product packages. To this end it typically launches the system by putting relevant information on its platform. The platform facilitates finding the collection point by users, provides free shipping labels that can be printed and used by collection points, promotes the programmes, etc. Media coverage for the programme results in increasing the number of collectors. TerraCycle's educates on the appropriate waste to be collected which is dependable on the reusing/upcycling/recycling process designed beforehand. TerraCycle also establishes business relationships with warehouses and recycling companies and in some cases, when closed loop solutions are concerned, with products' manufacturers.

The marketing of the programme is essential for the programme's success. The company takes a unique approach to marketing and public relations and is a great example for other lean operations as it never uses paid media. To achieve this ecological image of the company and its operations is indispensable as the media presence is often based on specific actions and events and does not focus on either TerraCycle or sponsoring company. In the words of TerraCycle's former Global Vice President of Marketing & Communications: "The key is to make sure the content is not overly promotional, is valuable to the reader and maintains an expert-level discussion.".

Key resources

The identified TerraCycle's key resources are interconnected as each one of them is essential for delivering their value propositions. The first one is human capital, mainly the R&D team, marketing

specialists and executives renowned for their engagement in environmental issues. These people have the required technical and operational know-how which is another key resource obtained during 17 years of company's operations. Through this knowledge the process for reclaiming material and manufacturing it into new products is designed. This design focuses on enabling circular economy within the business model. It allows the company to establish effective collection systems.

A unique key resource is TerraCycle's brand recognition. This is a result of media coverage of the company's action through the years of its activity. Engaging societies in collection programmes also becomes easier thanks to a brand that connotes environment and charitable notions. To this day the company has no direct competitors and it is a strength of its brand recognition.

Value proposition

TerraCycle's value proposition described in detail in section 3.1.2.1. is to cooperate for the collection and further usage of waste considered to be non-recyclable. Through company's engagement with the public in the collection network the sponsoring brands expand its environmental performance, receive positive recognition in the press and social media for their role in enabling recycling of otherwise non-recyclable waste. Programmes are targeted at establishing the customer brand as eco-friendly which then can result in increased brand recognition, higher market reputation and consecutively growth in sales.

From the viewpoint of circular economy, the company establishes a platform that facilitates circular sourcing - greater material reuse and decreases usage of virgin raw materials.

Customer relationships

Each of the relationships with the customer is personalized as there is no standard approach to specific problems – they differ on collection possibilities, technology used, marketing and the material or reused/upcycled product that is the output of the process.

The relationship with customers is long-term and collaborative as in most cases the contracts are renewed every year (e.g. it is already the 7th year of writing instruments recycling programme operations). The working relationships engage senior management as well as the revenue producing side of major corporations: branding, sales and marketing. TerraCycle rarely enters a potential client through the customer's operational and procurement teams.

In some cases, TerraCycle engages in even wider cooperation as there is an opportunity for extending programmes, e.g. by using the reclaimed material from the used product or packages in a specific manner chosen by the customer. To deliver those closed-loop solutions to its clients requires collaboration not only with the customer but also with other entities (e.g. writing instruments recycling programme).

One of TerraCycle's products - Zero Waste Boxes that are bought by individuals and organizations willing to collect waste considered non-recyclable does not require close relationships with the purchaser. In many cases however the sale of Zero Waste Boxes purchase is a recurring operation.

Municipalities use the company's services to decrease littering and implement circular solutions into their operations. These are long-term, continual relationships.

Channels

It is the customer that reaches out to TerraCycle after the needs for environmental performance is recognised. Then TerraCycle employees engage in talks on possible cooperation and its design. This channel is enabled by the TerraCycle's brand recognition and high media presence. However, it was not always the case. Before establishing the world recognition of TerraCycle brand the customer was searched for proactively. This channel is used to this day although its importance has diminished.

Customer segments

The main customers segments for TerraCycle are non-durable goods producers whose used products or product packages are sent to landfills or incinerated. These companies:

- pack their products in type of packaging considered non-recyclable (e.g. juice pouches, contact lenses packaging, coffee pods);

- their products themselves are considered inappropriate for recycling due to their characteristics, e.g. material complexity and lack of eco-design. Typically, they are:

  o low-cost products, small size, that need enormous amount of work to collect and aggregate (e.g. cigarettes, writing instruments) and thus this process becomes economically inviable.

  o products that are used for relatively long amount of time in small numbers and thus it is hard to aggregate worthwhile amount of material for recycling activities (e.g. musical instrument strings, water filtering dispensers).

Part of the company's customers are also organizations and individuals who buy Zero Waste Boxes to answer specific environmental needs, e.g. to collect end-of-life printing materials in an office.

Municipalities also form one of TerraCycle's customer segments. They use kerbside services to decrease littering and implement circularity in the society's day-to-day activities (e.g. municipal cigarette buds collection programmes).

Cost structure

Circular economy is embedded within each programme as products and product packages would be diverted from landfills or incineration. This is enabled by establishing the collection system and then reusing/upcycling/recycling used products or packages. As TerraCycle does not own processing facilities recycling, storage and shipping companies are subcontracted for this process to work. Their compensation constitutes the one of the main costs of the programmes. The resignation to own facilities increases nimbleness of the business.

Subcontracted services include:

- sorting and aggregation,
- storage,
- logistics,
- cleaning, shredding and recycling.

Except subcontracting costs human resource expenses seem to be an important item in TerraCycle's costs structure. In the case of standard collection programmes this particularly concerns:

- dedicated account manager,
- marketing and communications team,
- R&D design team.

It must be emphasized that the company has never used paid advertising services either for their brand or individual collection programmes and products.

Revenue streams

The recent offering documents (TerraCycle, 2018) shed light on the company's revenue structure basing on the example of TerraCycle US Inc. in 2016, one of the company's subsidiaries. This example was used as a proxy for the revenue structure of the whole company.

Key revenue sources of TerraCycle US Inc. are:

- Collection programmes operated under contract with brand companies. The contracts pay the material shipping, sorting and processing costs. Customers pay an annual fixed fee for the recycling programme and the amount dependable on the quantity of collected material.

- Material sales: selling of recycled materials, mostly plastics, collected via the collection programmes and Zero Waste Boxes. TerraCycle estimates only 3 percent of material is sent to disposal. This business segment is growing steadily; however, it has lower margins than TerraCycle's other revenue sources.

- Zero Waste Boxes: selling prepaid shipping boxes for a specific category of waste. Material handling and processing costs are factored into the price of the box which is dependent on size, weight, costs to recycle, value of recycled materials, and whether sorting is needed.

FIGURE 22 TERRACYCLE'S US INC. REVENUE SOURCES
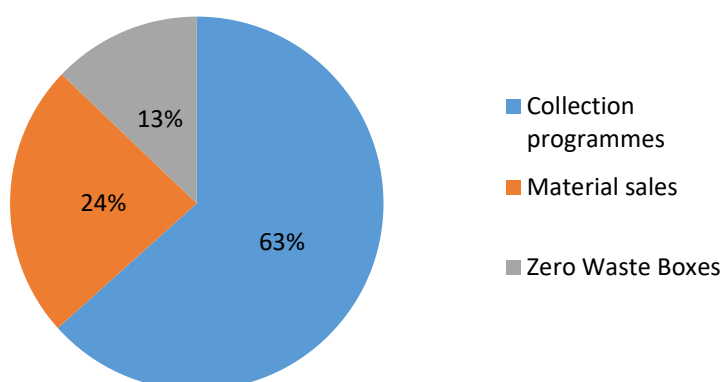
SOURCE: TERRACYCLE (2018)

Environmental/social costs and benefits

TerraCycle is a mission-driven company built on a sustainable model that combines economic, social and environmental value creation. The main impact of its activity is to create the possibility to collect waste considered non-recyclable and to involve different stakeholders in this process. It can promote transition towards circular economy by providing innovative solutions to reduce packaging and better use of packaging waste.

The biggest positive environmental impact is reduction of packaging waste. Additional benefits are connected to the ongoing environmental education and volunteering attitude promotion

Some costs are connected to the grants delivered to schools and charities (they are covered by fixed fee from the cooperating brands). Shipment and transportation costs could have negative impact on the environment.

3.1.4 The Value Network

Writing instruments recycling programme was chosen as an exemplary programme to depict material and value flow, because the TerraCycle's collection programmes are highly heterogeneous.

3.1.4.1 Material Flow

The writing instruments recycling programme is cooperation between TerraCycle, BIC, Govaplast and Plas Eco to facilitate collection of waste to process it and manufacture new products from reclaimed material. The material flow description embraces the whole programme although with a focus on TerraCycle's operations.

The collection of writing instruments is dependable on the individual collectors participating in the programme that collects writing eligible writing instruments and delivers it to almost 8000 collection points in seven European countries. The collection points aggregate the waste as sending at least 15 kg of writing instruments is required. Otherwise no charitable donation would be made.

SOURCE: TERRACYCLE

The waste is then sent to facilities indicated by TerraCycle. The facilities sort the writing instruments and aggregate it until an amount eligible for recycling process is amassed. Only then storage and sorting company transport waste to recycling companies indicated by TerraCycle. Using the process designed by TerraCycle recycling companies reclaim material. Only small portion of it is lost to disposal (~3%), mainly for energy recovery. In most cases this is inevitable as the remaining materials are hazardous. Most of the materials are processed into plastic flakes and pellets.

A small portion of low-value offbeat material is also reclaimed. The customer decides how to handle this material, usually it is used as a feedstock for manufacturing new products by specific manufacturers. The main outcome of the process – reclaimed plastic goes to Govaplast to produce post-consumer plastic boards. These boards are then used by Plas Eco to manufacture outdoor furniture. The furniture made from 100% recycled material is then sold to consumers.

FIGURE 23 TERRACYCLE MATERIAL FLOW (BASED ON WRITING INSTRUMENTS PROGRAMME)
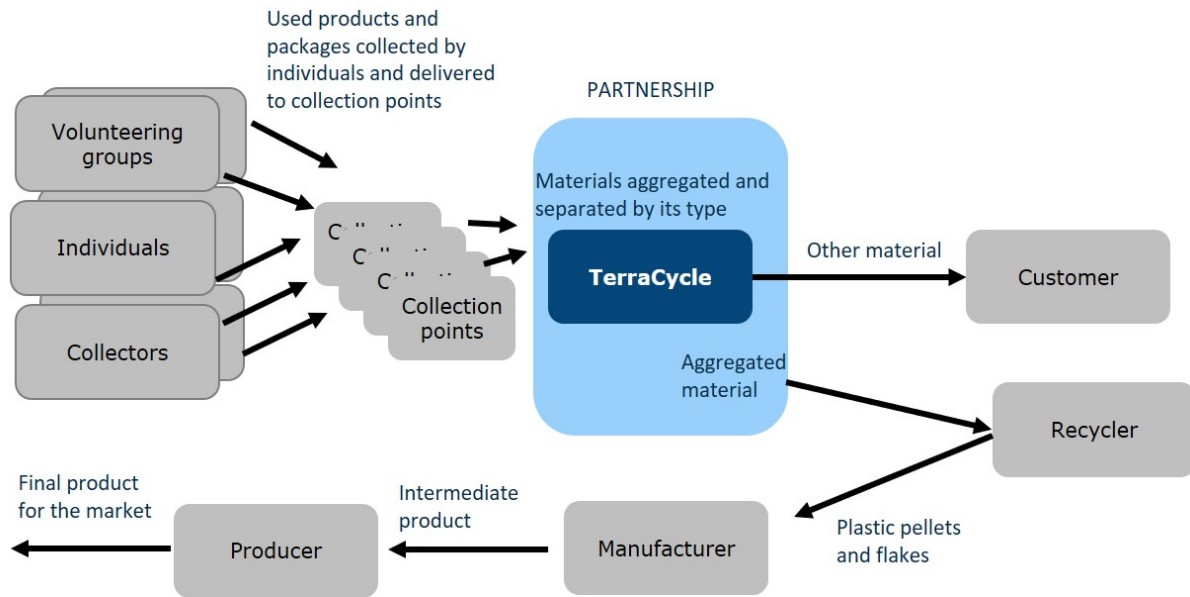
SOURCE: OWN RESEARCH

3.1.4.2   Value Flow

Building on the material flow the above diagram depicts the value exchange between entities present in TerraCycle's writing instruments recycling programme. It is worth noting that the value exchange is programme specific and may vary significantly.

Though TerraCycle does not own any processing facilities and thus is not directly present in the material flow it takes the critical place in the value flow map. It organizes the collection of waste, rewards collectors with charitable or school donations in the amount based on the number of writing instruments collected. It pays the shipping company to transport the waste into sorting and storage facilities and remunerates those facilities for their services as well.

After enough waste has been aggregated it goes to the recycling facilities. In the example of writing instruments recycling programme, the sponsor of the programme (BIC) also pays for the reclaimed material to the recycling company (which is unusual for TerraCycle's programmes) and handles it from now on. The materials are transported to intermediate manufacturer (Govaplast), who uses the material for producing post-consumer plastic boards. The boards are then sent to final goods producer who manufactures outdoor furniture and sells it to consumers. Both processes, i.e. intermediate and final product manufacturing value flows are beyond the scope of this assessment.

FIGURE 24 WRITING INSTRUMENTS PROGRAMME VALUE FLOW MAP
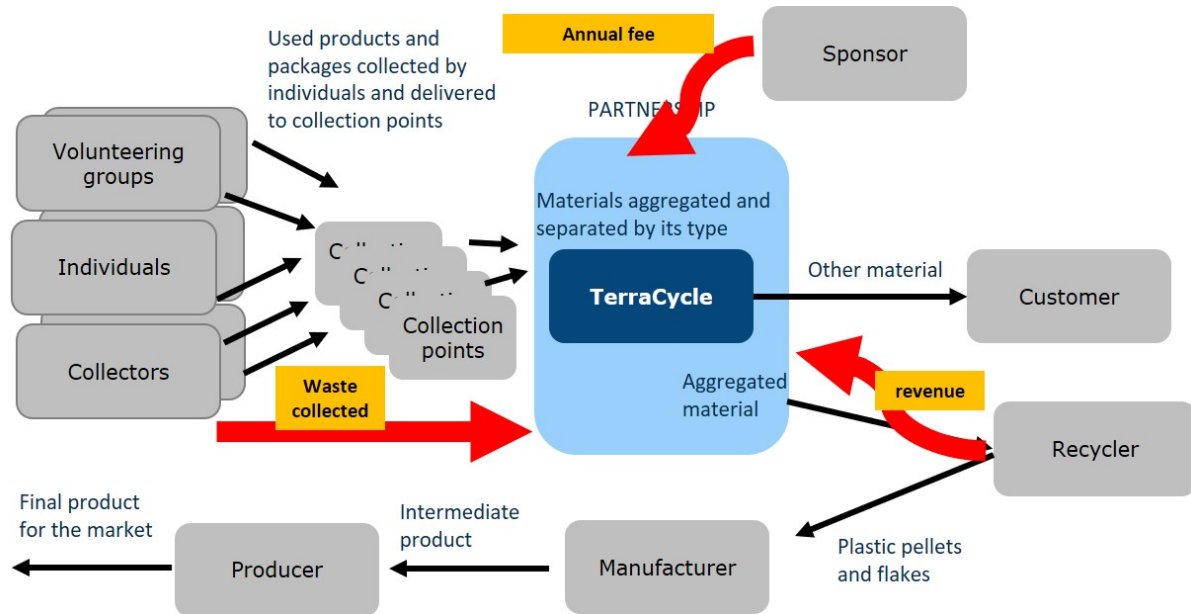
SOURCE: OWN RESEARCH

3.2 Business model circularity assessment

In this section the business model that has been presented previously is assessed from a circularity point of view. The objective is to reveal strengths and weaknesses of the TerraCycle business model, and to identify the business model opportunities and threats, based on the case study presented, literature and discussions with TerraCycle respondents. The assessment is based on a specific tool presented in the Appendix.

The purpose of the business model circularity assessment is to produce an overall evaluation of the business model 'state of play' and to identify specific areas in which to focus follow-on discussions. These follow-on discussions will enable exploration of the transition towards circular economy.

3.2.1 Circularity assessment

To understand circularity within TerraCycle business model, we use the circular business model patterns figure – CEBM. This model presents the different steps of products life-cycle from production to consumption and end-of-life. It is presented in a circular way to illustrate the possibilities of creating circular business model by connecting products' end-of-life to the production of new products.

FIGURE 25 CIRCULAR BUSINESS MODEL PATTERNS

Co-product recovery. Residual / secondary outputs from one process (or value chain) become inputs for another process (or value chain).

Circular sourcing. Sourcing recycled or renewable materials that can be returned to either the technical or biological cycle.

Resource recovery. Materials or products at end-of-cycle are incorporated into different products, or used as feedstock/inputs for another process (or value chain).

Source: R2Pi

Re-condition. Fixing of a fault / aesthetic improvement of a product, but with no new/additional warranty on the product as a whole. Includes repair and refurbishment.

Re-make. Manufacturing steps acting on an end-of-life part or product in order to return it to like-new or better performance, with warranty to match.

Access. Providing end-users with access to the functionality of products/assets, instead of ownership.

Performance. Focus on guaranteed performance level or outcome based on the functionality of a product/asset. Typically provided as a product-service bundle.

Resource recovery is the main circular economy business model pattern in the writing instruments recycling programme coordinated by TerraCycle. The whole partnership and coordination implemented by TerraCycle is allowing recovery of resources started in the collection activity. Resource recovery is the separation of certain materials from the waste produced, with the aim of using them again or turning them into raw materials and using it in production once again.

FIGURE 26 CIRCULAR BUSINESS MODEL FOR TERRACYCLE

Resource recovery. Materials or products at end-of-cycle are incorporated into different products, or used as feedstock/inputs for another process (or value chain).
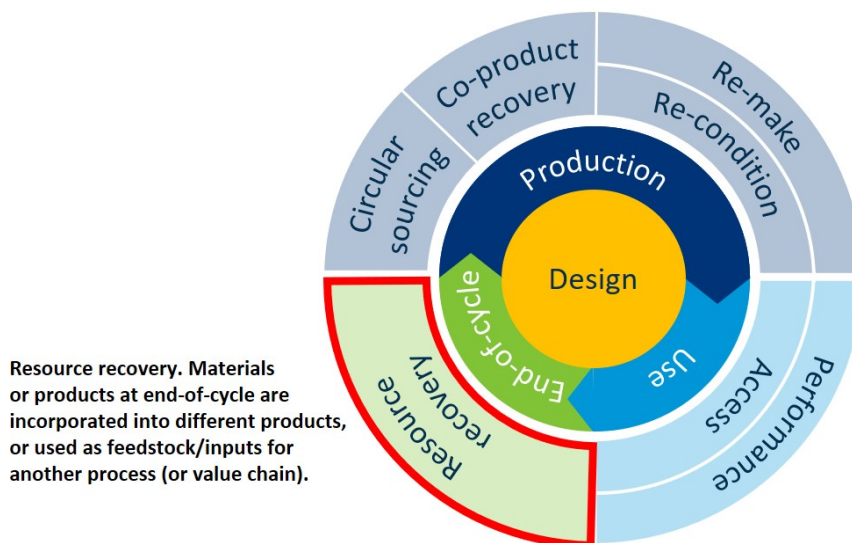
SOURCE: OWN ELABORATION

TerraCycle activities involve recycling materials that normally would be heading to the landfill or incineration. This is the basis for the collection programmes that form the main part of company's business. Such programmes consist of collecting materials or products at end-of-life that are then recycled/upcycled into materials that could be incorporated into different products or used as inputs for another process. They answer the need identified in the first pillar of their mission – make everything recyclable.

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In some cases, other than presented here, the collection programmes' scope is much wider as it concerns not only the end-of-life phase of the products but also the design and production. TerraCycle strives to incorporate closed loop solutions, such as manufacturing of products made from reclaimed material. Those products are 100% recyclable themselves. This production practices could be described as circular sourcing business model. This is TerraCycle's secondary business pattern along the second pillar of their mission – make everything from waste.

TerraCycle plans to meet the objectives stated in the third pillar of their mission, i.e. eliminate the concept of waste, mainly by introducing durability into non-durable products packaging. In result the decrease of waste generated is expected. The launch of these operations is planned for January 2019. The service, called "Loop" will provide consumers firstly with durable containers for non-durable products. The consumer will pay the standard price for the product and a one-time deposit amount. After the product is used the package is handled by TerraCycle. It is washed, sterilized and prepared for refilling. The packaged product is then sent to the consumer. In case the consumer does not want the product anymore he can return that empty container and reclaim the deposit.

The "Loop" project will also handle durable products, e.g. clothes for children. There would be an option to buy used products that have been sent to TerraCycle for repair and cleaning. The details of the project are yet unknown however it seems that part of the operation regarding durable products should be described as re-make or re-condition business models. In case of durable packages for non-durable products access or performance business model would be applied as it concerns the use phase of the products life-cycle. Consumers would be provided with a products-service bundle of reusing the container and transporting it. Although the deposit would be equal to the value of the container end-users would probably only access the functionality of the container instead of permanent ownership (the packaging could be easily returned to reclaim the deposit).

TerraCycle's operations are based on circular concepts applied to handling and generating waste. The circularity in terms of the products delivered, whether it is the intermediate or final good, must be assessed as high. The chemical composition and material characteristics are fully known to allow using the material for production. The material enables manufacturing of products that are fully-recyclable themselves. Closing the loop completely is achievable. The manufacturing of products they participate in maximises the use of recycled materials. The product's characteristics itself are dependable on the type of product and the decision of TerraCycle's customer. Nevertheless, products are typically designed to enable component/material recovery or reuse, with a defined plan for product recovery. The end-of-life phase of the final product is beyond TerraCycle's operations.

3.2.2 Financial and non-financial outcomes assessment

TerraCycle bring profit and has lower material production costs than raw materials' producers (the supply of collected waste seems to constrict positive profit effects). The economic incentives for every entity engaged in collection programme have vastly contributed the venture's success. The charitable and school donations amounted to over USD 21 million since TerraCycle inception. The collection programmes' sponsors gain valuable press coverage.

TABLE 17 EXAMPLES OF PUBLICITY EFFECTS OF TERRACYCLE'S COLLECTION PROGRAMMES

	BIC (2011)	PepsiCo (2009)	British American Tobacco (2012)	L'Oréal (2011)
Media placements	339	1413	392	375
Impressions	159 215 096	870 740 163	486 738 027	409 998 433

Advertisement value equivalency (USD)	1 472 740	8 119 096	5 259 997	3 792 485

SOURCE: TERRACYCLE

Except the positive financial effects there have been positive environmental effects for all the key stakeholders of the collection programmes. The waste considered non-recyclable is routinely incinerated or simply landfilled, resulting in high greenhouse gas emissions and toxic leaching into soil and groundwater. There are numerous examples that corroborate the notion that collecting, recycling and using material from so-called non-recyclable items brings positive and significant environmental outcomes.

TerraCycle claims that for an average product over 90% of the environmental impact comes from extracting and refining the raw materials from which it is made. For example, 91.1% of carbon emissions for new, "virgin" cotton pencils cases are a result from processing raw materials. Therefore, using candy wrappers for cotton pencils cases production decreases the CO_2 emission by ca. 70%. Additionally, reintroducing the materials into the cycle, ultimately reduces material needs in the market.

FIGURE 28 CO2 EMISSION FOR COTTON PENCILS

Legend:
- ■ raw materials processing
- ■ Manufacturing and waste
- ■ Additional materials processing
- ■ Waste Transport and disposal
- ■ Transport to retailers
- ■ transport to manufacturing

0,1% 1,2% 1,1% 0,2% 6,3% 91,1%
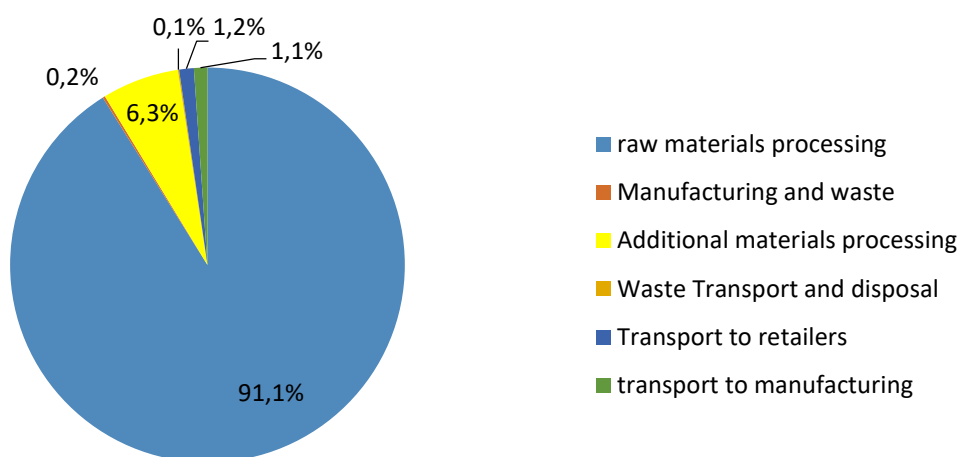
SOURCE: TERRACYCLE

Other examples validate the beneficial outcomes of collection programmes. It seems to be the case that recycling is the most ecologically friendly option for waste disposal regardless of its type. This is enhanced further by the design of the recycling process and its environmentally-friendly goals.

3.2.3 SWOT analysis

This section contains an analysis of the strengths, weaknesses, opportunities and threats (SWOT) associated with the circular business model of TerraCycle. The analysis of strengths and weaknesses is based on previously prepared questionnaire - see Appendix B. The assessment of opportunities and threats is based on business context assessment presented in Appendix A.

A SWOT is a basic matrix to give a useful overall, view of a company possible strategic orientation. It is composed of internal positive and negative dimensions (strengths and weakness, top of the matrix) and external positive and negative dimensions (opportunities and threats, bottom of the matrix).

Strengths	**Weaknesses**	Are **internal** to the business – relate to key aspects of the business model
Opportunities	**Threats**	Are **external** to the business – relate to key trends/business context

Enablers   **Barriers**
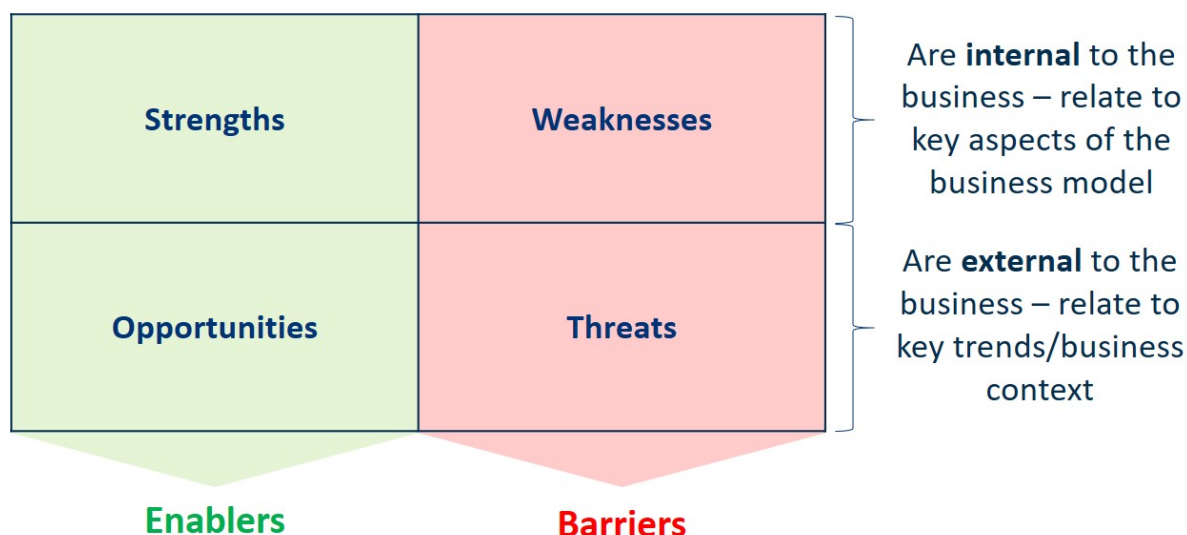
Source: R2Pi

TerraCycle's strength and weakness assessment implies that the company's internal advantages outbalance the disadvantages by a high margin. This particularly concerns the lack of direct competition in result of key resources being hard to acquire or duplicate. Specifically, TerraCycle has made a brand for itself that is associated with charitable actions, environmentally-friendly collection programmes and products manufactured in cooperation with their customers. It is the brand recognition accompanied by TerraCycle's marketing experience that is the key factors for company's success.

TABLE 29 TERRACYCLE SWOT ANALYSIS

Strengths	Weaknesses
• Predictable revenues and costs • High customer satisfaction, loyalty and retention • Strong and long-term customer relationships aligned with expectations • Effective pricing models • Revenue comes before costs • Asset-light cost structure • Full support of the circular economy • Key resources are hard to acquire • Brand recognition • Unpaid advertising know-how and experience	• Key partners do not contribute value for free • Low economies of scale • Relatively small number of seemingly non-recyclable products to be processed under existing technology • Dependence on one logistics contractor
Opportunities	**Threats**
• Growing recognition of corporate sustainability and environmental performance • Rising ecological awareness of the final product consumers • Growing recycling requirements and resource efficiency targets • No direct competition • Non-durable consumer products are still popular among consumers	• Regulations on hard-to-recycle waste are enacted (e.g. ban on plastic straws) • Eco-design regulations require more and more recyclability • European population aging • Urbanization reached a plateau in many European countries

SOURCE: OWN RESEARCH

The company has developed a reputation for innovations, social and environmental responsibility, achievements, and unique business model and their brand symbolizes these attributes. The brand name, trademarks and logos, and their reputation are powerful sales and marketing tools. It now seems that entering the same market by a competitor would be difficult as building the brand and

marketing skills would require high amount of time and resources in a business environment where TerraCycle is already a reputable player.

Additionally, customers are satisfied with TerraCycle services and their pricing. In effect their relationships are typically long-term and recurring. This fact is further enhanced by the network effect of TerraCycle's operation in the terms of waste collection, processing and manufacturing new products enabled by effective communication of those activities to the public.

The main internal weakness of TerraCycle's business model is the lack of scalability in result of low amount of materials collected. The company would benefit from raising the quantity of waste by decreasing the unit costs of material aggregation, segregation and processing. However, it seems that the characteristics of items collected (small size, cheap) imply that this would require radically increase of the collector's network. This is further exacerbated by the need to thoroughly ascertain that each recycling process will meet the public opinion's expectations. Adverse publicity relating to the company could tarnish their reputation and reduce the value of the brand and in result reduce demand for their services. Therefore, not every waste can meet this condition under current technology making the number of products ready to be handled by TerraCycle relatively small.

Among the external factors that affect TerraCycle's business the positive ones are: the rising ecological awareness of final consumers and the growing recognition of sustainability and social responsibility of companies that cater to those customers.

Regulations are both an advantage and a disadvantage for TerraCycle's business model. On one hand the recycling requirements and resource efficiency targets are growing, which can result in the rising interest for the company's products. On the other hand, eco-design regulation requires more recyclability which could diminish the amount of seemingly non-recyclable products. The legislation on some types of products may have similar results (e.g. ban on plastic straws). Therefore, in the future it is possible that there will be less and less hard to recycle used products and packages. This could be potentially harmful for TerraCycle's business model as the supply for their process could be limited. However, TerraCycle currently handles only a small portion of non-recyclable waste and it will possibly take a lot of time before such wastes disappears in the scale that would make TerraCycle's business model inviable.

3.2.4 Final assessments

On every stage of TerraCycle's operations a push towards circular economy is visible. The company was incorporated as a fertilizer producer that used food waste as the resource for production. However, this was not enough to comply with TerraCycle's mission to eliminate the idea of waste. The fertilizer production was scrapped to focusing on waste itself. The company, in cooperation with other entities, enables recyclability/reusability/upcyclability of seemingly non-recyclable products. In some cases, resource recovery is supplemented by the design and production of new items, sometimes fully recyclable themselves, closing the economic loop completely.

The scalability and replicability of the business models is somewhat limited due to two main factors. Firstly, not every product can be recycled in a socially accepted manner using the current technology. Recycling process must be efficient and highly sustainable, otherwise it could tarnish TerraCycle's brand and reputation, which are company's main assets. Brand recognition enables marketing practices effectiveness, replicating this business model would require long-term commitment which is a high barrier to entry. Secondly, the products considered non-recyclable are small and cheap which limits economies of scale.

The company works mainly by its collection programmes sponsored by manufacturers. The programmes involve large number of participants in collecting non-recyclable waste. This has been somewhat criticized as "greenwashing" of non-durable, low recyclability goods producers. However,

there is no doubt that even though it would be better to decrease the waste generation, the processing of end-of-life products has significant benefits for the society and the environment.

Among the identified options for enhancing TerraCycle's current business model is the extension of the collection programmes. Currently, solutions for closing the loop are only an option, not a default. The company could use its vast network and experiences in proposing closed loop solutions as a standard. In effect, the company would take over the organization of such production from the sponsoring brands, as it is sometimes the case. One of the goals of such programme extension would be to reassure the final products made from recycled material are recyclable and that the take back system for the product exists. It would not take considerable resources to establish such systems by TerraCycle as already functioning collection points could be used.

4 Discussion & Conclusions

In this report the analysis of the Circular Economy Business Model of TerraCycle was made. One of the R2π project's aim is to identify and develop sustainable business models and guidelines that will facilitate the circular economy implementation in new entities and markets. Having those objectives in mind TerraCycle was chosen as one of the case organizations because of their ambition: "eliminating the idea of waste". As a long-term effort it is fundamental for circular economy business models.

It never seems to be the case that profit is the final goal for the company. TerraCycle is sustainable value creation-oriented organization. This aspect seems particularly important when assessing the possibilities for replication and scalability of the business model in line with circular economy notion – a one that focuses primarily on social effects instead of financial results. The company currently focuses on collecting, processing waste into raw materials and possibly manufacturing new recyclable products. The circularity notion is at the forefront of all its ventures.

The basis of TerraCycle business model, which is classified as a resource recovery CEBM following the R2PI framework, is the collection programme that form the main part of company's business. Such programmes consist of collecting materials or products at end-of-life that are then recycled/upcycled into materials that could be incorporated into different products or used as inputs for another process. They answer the need identified in the first pillar of their mission – make everything recyclable.

TerraCycle has made a brand for itself that is associated with citizens activity, environmentally-friendly collection programmes and products manufactured in cooperation with their customers. It is the brand recognition accompanied by TerraCycle's marketing experience that is the key factors for company's success.

Throughout the report, based on the use of different methods, enablers and barriers have been described. Among key enablers are:

- Key activities and resources hard to duplicate or acquire
- Growing corporate sustainability fuelled by rising ecological awareness of consumers
- High customer satisfaction
- Strong, long-term customer relationship

Key barriers:

- Small number of products that can be recycled in a socially-accepted way
- Possible restrictions of using some non-recyclable products
- Low economies of scale

The above implemented circular business model pattern seem to a certain extend replicable and transferable to other entities, partnerships and offer substantial potential for positive environmental and economic benefits. But building the brand value can take time. Companies in different sectors, different regions, can reflect on their specific context and product design based on resource recovery.

Among key managerial considerations are:

- Collaborate across companies and sectors to find the best solutions for resource recovery

- Use the power of the crowd – environmental-minded volunteers

- Make efficient use of resources in different phases of the life cycle

- Design for reusability and for the lowest negative impact on environment and human health

Key considerations for policy makers:

- Ensure consistent regulations across EU

- Introduction of restrictive requirements in waste management is necessary

- Introduce on a wider scale a circular public procurement

- Monitor implementation of circular package legislation in different EU countries

TerraCycle's current business model has been founded of circularity notions. Throughout the years it has proved to be successful financially and environmentally beneficial. The current business environment and its outlook of higher regulatory standards for recyclability, together with a strong drive toward sustainability performance could result in radical changes. In the future TerraCycle should be deeper involved into process of eliminating the idea of waste, not only focusing on public image of the biggest consumer brands.

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Appendix A: TerraCycle's contextual analysis tool results

DRIVER						Please, rank the following according to how much of a driver / barrier you think they represented for implementing your CEBM (put an X where appropriate)	BARRIER					
Not at all important	Slightly important	Moderately important	Very important	Extremely important	N/A		Not at all important	Slightly important	Moderately important	Very important	Extremely important	N/A
			X			CE roadmap / initiative at the national / regional / local level						
		X				Setting of end-goals and monitoring (CO2, noise, movements) at the national / regional level						
						Activity permit (license)			X			
					X	Warranties law (e.g. second-hand products)						
			X			Intellectual property rights (e.g. components susceptibles of being reused)						
						International trade agreements (e.g. requirements in certain markets)		X				
						Dramatic change in a target market regulation (e.g. banning the use of plastic bags in China)			X			
					X	Competition regulation (e.g. positive discrimination for CE products is not permitted in public procurement)						
					X	Public subsidies that support linear economy (e.g. subsidies to fossil fuels, car purchase incentives)						
			X			Resource efficiency targets, requirements of reusing percentage of components and raw materials in new products						
						Waste regulation, recycling regulation, water regulation, energy regulation and choice restriction						
		X				End of life regulations						
			X			Mandatory take-backs						
		X				Extended Producer Responsibility						
						Material and design standards (national and across industries)						
					X	Controls and penalties (e.g. controls and sanctions on the use of specific products)						
					X	Fiscal measures (green taxes): land-value taxes, value-extracted tax, product levy and recovery rewards						
					X	Differentiated VAT rates (e.g. products with high recycled content included among VAT reduced goods)						
		X				Green public procurement (e.g. performance procurement by public sector)						
						Public subsidies for eco-innovation, eco-design						
			X			Public support for demonstration and commercialisation of innovation in Circular Economy (technology platforms, pre-commercial procurement, lead markets)						
					X	Availability or prices of raw materials that support linear economy (water and energy included)						
					X	Availability or prices of raw materials and products that support CE						
						General economic "health"of incumbent companies in a sector (crisis, decline, stability, growth)						
						Competition trends in the market		X				
		X				CE-supportive business environment (technology providers, advanced services, eco-design businesses…)						
			X			Relevant and expanding CE / environmentally oriented market segment in the country / region						
						Market purchase capacity		X				
						Suitable infrastructure for recycling and recovery / other (e.g. supporting shared use)				X		
		X				IT-infrastructure (supporting transparency and information sharing; joint collection systems; match-maker mechanisms)						
					X	Extensive raw materials information service						
		X				Funding opportunities / venture capital for CE-related investment						
					X	(Green) lending programmes from banks						
						Apropriated technologies for CE			X			
			X			Major technological trends in the sector; new sectoral developments						
		X				R&D capacities and strengths (innovation agency, university research groups supportive to CE)						
		X				R&D capacities and strenghts in green energy						
		X				Public support for CE-related R&D (new materials, new products/services, supply chain resource tracking)						
			X			Training in CE-oriented activities						
					X	Rural vs urban distribution of population						
		X				Ratio of young vs old population						
		X				Social attitudes towards waste and recycling in the country						
		X				Social attitudes towards eco-friendly production and consumption in the country						
					X	Social attitudes towards water use in the country						
					X	Social attitudes towards energy use in the country						
			X			Social movements pressure regarding environmental problems (NGOs, civil society)						
			X			Preference for green brands / products, services by consumers in the country						
			X			Perception of environmental problems by businesses in the sector / country						

Appendix B: TerraCycle's business model strengths and weaknesses

Weaknesses	N/A	1	2	3	4	5	Strengths
Our value proposition leaves significant customer segments' needs unmet					X		Our value proposition fulfils all significant needs of target customer segments
Customer satisfaction is low						X	Customer satisfaction is high
Our value proposition has no network effects					X		Our value proposition has strong network effects
Our charging and pricing models don't meet customer needs and expectations					X		Our charging and pricing models effectively meet customer needs and expectations
We do not capture 'sustainability value' created for customers							*We fully capture 'sustainability value' created for customers*
Our margins are low compared with competitors							Our margins are high compared with competitors
Our revenues are unpredictable					X		Our revenues are predictable
Each sale requires additional effort					X		Each sale generates follow-on recurring revenue / repeat purchases
We earn no revenue before incurring costs of goods/services sold					X		We earn revenue before incurring costs of goods/services sold
Our costs are unpredictable				X			Our costs are predictable
Our product cost structure is substantially higher than that of competitors	X						Our product cost structure is substantially lower than that of competitors
Our service cost structure is substantially higher than that of competitors	X						Our service cost structure is substantially lower than that of competitors
Our cost structue has low economies of scale			X				Our cost structure has high economies of scale
Our cost structure is asset-heavy and costs are mainly fixed						X	Our cost structure is asset light and costs are mainly variable
Our cost to serve customers is misaligned with customer segments							Our cost to serve customers is aligned with customer segments
Our key activities can be easily copied by competitors						X	Our key activities are hard to copy by competitors
Our key activities need significant investment in order to scale with growth				X			Our key activities easily scale with growth without needing significant investment
Our key activities do not fulfil the core competencies we need						X	Our key activities match the core competencies we need
Our key activities poorly support circular economy within our business model						X	*Our key activities fully support circular economy within our business model*
Our key resources do not meet the needs of our business model					X		Our key resources fully support the needs of our business model
Our key resources poorly support circular economy in our business model						X	*Our key resources fully support circular economy in our business model*
Our key resources can be easily built or acquire by competitors					X		Our key resources are very hard to build or acquire by competitors
Key partners do not provide us with competitive advantage					X		Key partners provide us with exclusive competitive advantage
Key partners poorly support circular economy within our business model					X		*Key partners enable circular economy within our business model*
Key partners do not contribute any value to us for free		X					Key partners contribute value to us for free
Customers do not contribute any value to us				X			Customers contribute value to us (for free)
We do not understand the full potential value that could be created for customers						X	We understand the full potential value that could be created for customers
Customer loyalty is low					X		Customer loyalty is high
Customer churn is high (customer retention is low)					X		Customer churn is low (customer retention is high)
New customer acquisition rate is low					X		New customer acquisition rate is high
Our market share is shrinking	X						Our market share is growing
Our customer channels do not effectively communicate our value proposition					X		Our customer channels effectively communicate our value proposition
Our customer channels do not effectively deliver our value proposition					X		Our customer channels effectively deliver our value proposition
Our customer channels are misaligned to target customer segments					X		Our customer channels are well aligned to target customer segments
Our customer channels do not effectively reach target customer segments					X		Our customer channels effectively reach target customer segments
Our customer relationships are weak					X		Our customer relationships are strong
Our customer relationship model(s) are misaligned with customer expectations					X		Our customer relationship model(s) are aligned with customer expectations
Our customer relationship model(s) are misaligned with our value proposition					X		Our customer relationship model(s) enhance our value proposition
Our customers can switch to a competitor at any time					X		Our customers are locked into long-term relationships