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Circularity in Business: A Framework for Assessing the Circularity Potential of Small and Medium Enterprises (SMEs) and its Relation to Product Lifetime Extension

Agathou, Natalia; Constandinou, Andri

London Waste & Recycling Board (LWARB), London, United Kingdom

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Abstract: This study explored the potential outcomes of circular business activities, of small medium enterprises that are operating in London, United Kingdom and examined how they relate to product lifetime extension. The data sample consisted of 89 start-up companies, trading for 1–4 years and either at seed or growth stage. The analysis was based on the 'Theory of Change' framework and a logic model was created to illustrate the causal links between circular business activities, circular outputs and outcomes. The results of the study demonstrated that several outcomes can be attributed to circular business activities beyond product lifetime extension, including (i) material, (ii) space and (iii) packaging lifetime extension but also reduction and elimination of lifetimes. In addition, results suggested that predominantly those outcomes are linked to circular business strategies that tend to focus on resource recovery and resource efficiency, while there are fewer examples demonstrating business innovation through circular design, circular revenue models and clean resources strategies. The results also suggested that the main outputs of circular business activities are (a) prevention, (b) reusability and (c) recyclability.

Introduction

This study demonstrates that circularity of resources in a business could lead to different outcomes other than extension of a product's lifetime (e.g. material lifetime extension). In addition, the paper introduces a Circularity Framework for businesses and highlights the elements of the circular activities of a business that are more likely to contribute to different lifetime extension outcomes (i.e. product, material, space) on the basis of data collected during the first two years (2017–2018) of the Advance London business support programme for small and medium enterprises (SMEs) in London.

Methodology

The methodology used to cluster and analyse the business data was based on the 'Theory of Change' (TOC) framework (Anderson A, 2005) that defines long-term goals (i.e. outcomes: product lifetime extension) and then maps backward to identify necessary preconditions (i.e. inputs: business activities). A logic model (Coffman J., 1999) has been used to illustrate, in a simplified way, the hypothesis or 'theory of change' that circular business activities could

be connected/lead to a product's lifetime extension or other types of outcomes. It should be noted that the ultimate long-term goals (impacts) of 'product lifetime extension' – a net positive environmental impact related to waste diverted from landfill and the avoided CO₂ emissions – are beyond the scope of this study and hence haven't been quantified.

The research sample comprised of 89 SMEs that were supported to either grow their circular business (product or service based) or implement circularity initiatives, across five focus areas including food, textiles, built environment, plastics and electronics as defined in London's Circular Economy Route Map (LWARB, 2017).

Outcomes

For the purposes of this study, the lifetime of a product is defined as the cycle that begins with the product's introduction into the market, continues with the product's growth as it captures the attention of the target audience (Sampson Q, 2019) and ends with the disposal of the product by its user/owner. However, this study highlighted that business circularity

activities could lead not only to the extension of a product's lifetime but also to other outcomes related to material, packaging and space lifetime (Figure 1). Evidence was also collected to demonstrate that the expected positive material outcome could be related to the reduction of a lifetime (e.g. bio-based materials substituting fossil-based materials) or the elimination of a lifetime (i.e. reusable packaging), or the maximisation of a product's use (i.e. reuse of product's that their owners do not want to dispose). Therefore, the definition of the anticipated circularity outcome – the extension of the product lifetime – was extended to include:

- *Material lifetime extension*, referring to the potential conversion of a material (extracted from a non-functional product) to a new product.
- *Packaging lifetime extension*, referring to the extension of the lifetime of the packaging (primary or other) used to complement a product but not necessarily the product's lifetime.
- *Space lifetime extension* referring to the activities converting an idle or 'wasted' space (e.g. rooftops) to a product/service.
- *The reduction of a product's/material's /packaging's lifetime*, connected to business activities that tend to substitute technical for bio-based materials (e.g. offering a biodegradable alternative to traditionally polymer-based solutions such as alginate based versus Polyethylene terephthalate (PET) based packaging).
- *The elimination of a material's or packaging's lifetime* altogether, referring to activities that lead to the prevention of the existence of that material or packaging (i.e. single use packaging), avoiding the material or packaging to be needed for use in the first place (i.e. through packaging-free solutions).
- *The maximisation of the use of a product* during its lifetime, without extending its lifetime. The outcome is relevant to idle assets that their owners still make use of but not constantly, allowing for an increased use of their asset during its existing lifetime by another user.

All outcomes defined above, have a positive material footprint – raw material use is prevented – through the extension of the lifetime of products/packaging/materials /spaces and waste is diverted from landfill or incineration. However, further research needs to be conducted on the wider environmental impact of the business activities deployed in achieving lifetime extension. It should be noted that the term 'resources' used below, will refer from now on to all of the following product /packaging/material/space.

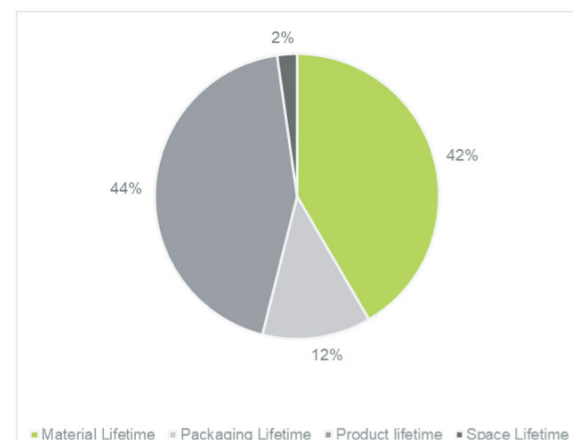


Figure 1. Extended focus areas of lifetime extension activities assessed in the study.

Outputs

Three main outputs –the direct results of circular business activities – on the resources were identified and included: recyclability, re-usability and prevention. The recyclability aspect refers to the material recycling as defined in the European standard EN 13430 and EN 16848 (European Commission, 2004) and results in the mechanical or chemical conversion of a resources for a different purpose (e.g. from chicken feathers to thermo-packaging, from food waste to building materials) and it covers both technical and biological cycles, as defined by the Ellen McArthur Foundation in 2013. The re-usability aspect refers to the use of the resources for the same purpose (e.g. from cup to cup) and the prevention output to the avoidance of using a resources (e.g. packaging-free groceries).

Circularity Business Activities

The outputs above resulted from a wide range of circular business activities on the input resources. The occurrence of those business

activities within the business sample of the study is showed in Table 1.

Circularity Business Activity	(%)
Material conversion	26 %
Redistribution	8 %
Renewable inputs	8 %
Modularity	7 %
Packaging reuse	7 %
Product as a service	6 %
Refurbishment	6 %
Material monitoring & tracking	4 %
Sales of used/refurbished products	4 %
Customer education	3 %
Recycled inputs	3 %
Behaviour monitoring	2 %
Material repurposing	2 %
Reuse	2 %
Second hand purchasing & sale of refurbished products	2 %
Take-back scheme	2 %
Asset rental	1 %
Data monitoring & Tracking	1 %
Expandable design	1 %
Recyclable inputs	1 %
Sharing platform	1 %
Space repurposing	1 %

Table 1. Circularity Activities deployed by SMEs in London © LWARB, 2019.

Inputs

The businesses assessed during this study either handled products/others made of technical materials (67%) or biological materials (33%).

Circularity Strategies

This study recognises a ‘circular’ business as one that keeps natural resources (both resources required as inputs and resource outputs produced from its operations) in circulation for as long as possible, that defines its strategic objectives in line with these principles and/or generates revenue through multiple sales cycles of the same products. As

such, the ‘circular’ businesses assessed in this study have deployed any or more of the following strategies:

At an operational level

- Clean resources (inputs): Ensured that all inputs into a new product/service are from renewable and toxic free sources.
- Resource Efficiency (process): Created, packaged, distributed and sold products or services through the most resource efficient processes, ultimately aiming at reducing energy, water and material use.
- Resource Recovery (outputs): Captured all resources that are no longer needed so they can be used again either in the business’s value chain or others.

At a strategic level

- Circular Design: Designed products or services in a way that allows them to be used multiple times, easily adapted, repaired or remanufactured; and when they are no longer needed, they can be easily dismantled to allow the recovered materials to be used again.

At a financial level

- Circular Revenue Model: Generated revenue through keeping products in use for as long as possible at the highest value possible.

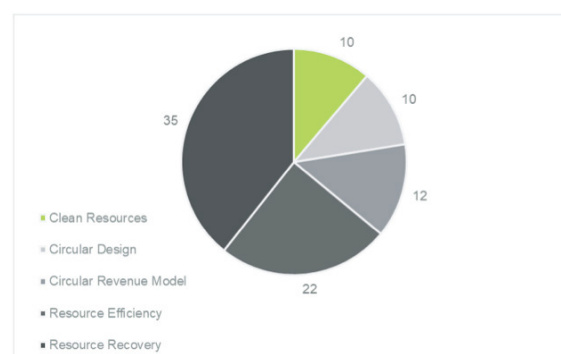


Figure 2. Number of businesses deploying different circularity strategies, © LWARB, 2019.

Results

The study showed that from the four possible outcomes – extension, reduction, elimination or maximisation of resources lifetime, 82% of small and medium businesses, included in the study, are focusing on extending resources

lifetimes (Table 2), of which the majority is most likely to focus on material lifetime extension (47%), on product lifetime extension (45%) and to a lesser extent on packaging (5%) or space (3%). This reinforces the need for the sector to attribute outcomes to circular activities that are not only related to product lifetime extension and distinguish between different outcomes that include materials, space and packaging.

Outcome on Lifetime	% of total businesses	Focus Area	% within the outcome category
Eliminate	9%	Material lifetime	38%
		Packaging lifetime	63%
Extend	82%	Material lifetime	47%
		Packaging lifetime	5%
		Product lifetime	45%
		Space lifetime	3%
Maximise	2%	Use of product	100%
Reduce	7%	Packaging lifetime	33%
		Product lifetime	67%

Table 2. Key outcomes attributed to circular business activities © LWARB, 2019.

The assessment of the various business activities for both types of inputs – biological and technical – resulted in the following observations.

On product lifetimes: The majority of businesses (82%) with outcomes at a product-level would extend a product's lifetime through achieving reusability of the product (e.g. Rype Office, Reyooz, Too Good to Go). There are also businesses that contribute, with their product, to the extension of the lifetime of another product(s). This activity has been demonstrated by Mimica, who through freshness indicators for all types of perishable products aims to maximize their lifetime and by Jiva Materials, who through Soluboard®, a recyclable Printed Circuit Board (PCB) laminate, extends the lifetime of all products usually attached to a PCB (i.e. microchips).

Some of the businesses (Twipes, Adaptavate, Green Oil) who are managing products with biological inputs, by achieving recyclability of the product, they have demonstrated that they reduce the product's lifetime, allowing for the product to biodegrade at a faster pace or in a more efficient way, resulting in a positive material impact.

On material lifetimes: Traditionally a material's lifetime is extended through a recycling process, which is confirmed by 76% of the businesses of the study who are aiming to extend material lifetimes. However, 22% of businesses with outcomes at a material-level (Eiravato, Customem, Rehandle), aim in predominantly extending material lifetimes by enabling the reusability of those materials, through refurbishment activities, material monitoring and tracking or through the use of renewable inputs in the making of the material.

On packaging and space lifetimes: Businesses contributing to outcomes on packaging or space (13/89), are fostering prevention (46%), reusability (38%) and recyclability (15%) that is achieved through reuse of the packaging/space (54%), through renewable inputs (15%), product as a service or take-back schemes and circular activities (31%).

Figure 3, illustrates the logic model of all the circular activities described above, their expected outputs and respective outcomes.

The study also examined differences in the logic model between businesses with biological and technical inputs. As figures 4 and 5 suggest, there are significant differences both in terms of circularity strategies and activities deployed by the businesses to deal with biological and technological inputs but also in terms of final outcomes.

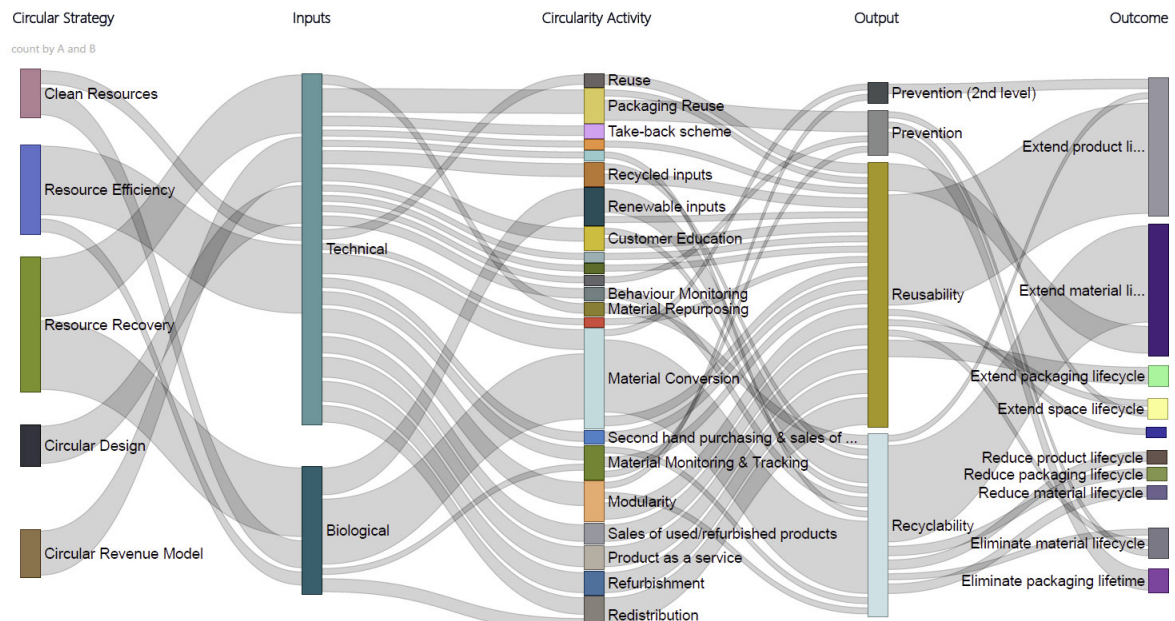


Figure 3. Logic Model of Circular Business Activities © LWARB, 2019.

The predominant 'theory of change' for businesses handling biological inputs starts from a resource recovery business strategy that, through material conversion, a waste stream will be recycled to a new material, resulting in the extension of the lifetime of that material. In comparison, a business using technical inputs is most likely to deploy a

resource efficiency strategy that through modularity or material conversion or reuse or refurbishment, products will be reused, resulting in the extension of their lifetime. The results also suggest that businesses with biological inputs have not deployed any circularity strategies in circular design, circular revenue models or clean resources.

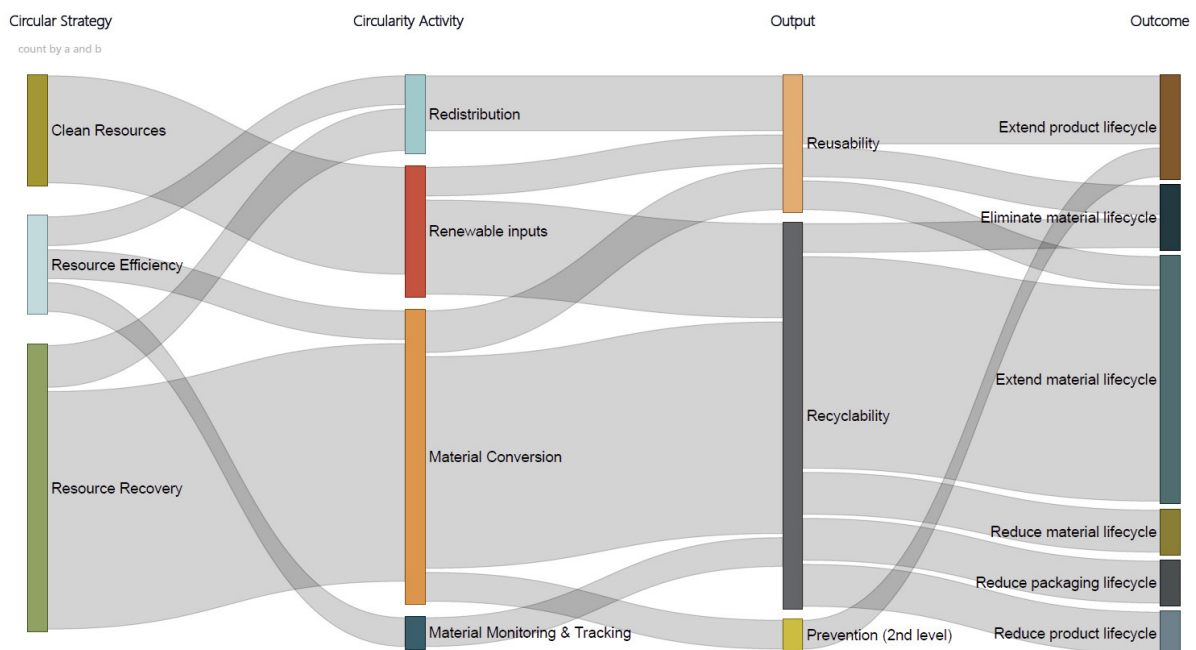


Figure 4. Logic Model of circular business activities with biological Inputs © LWARB, 2019.

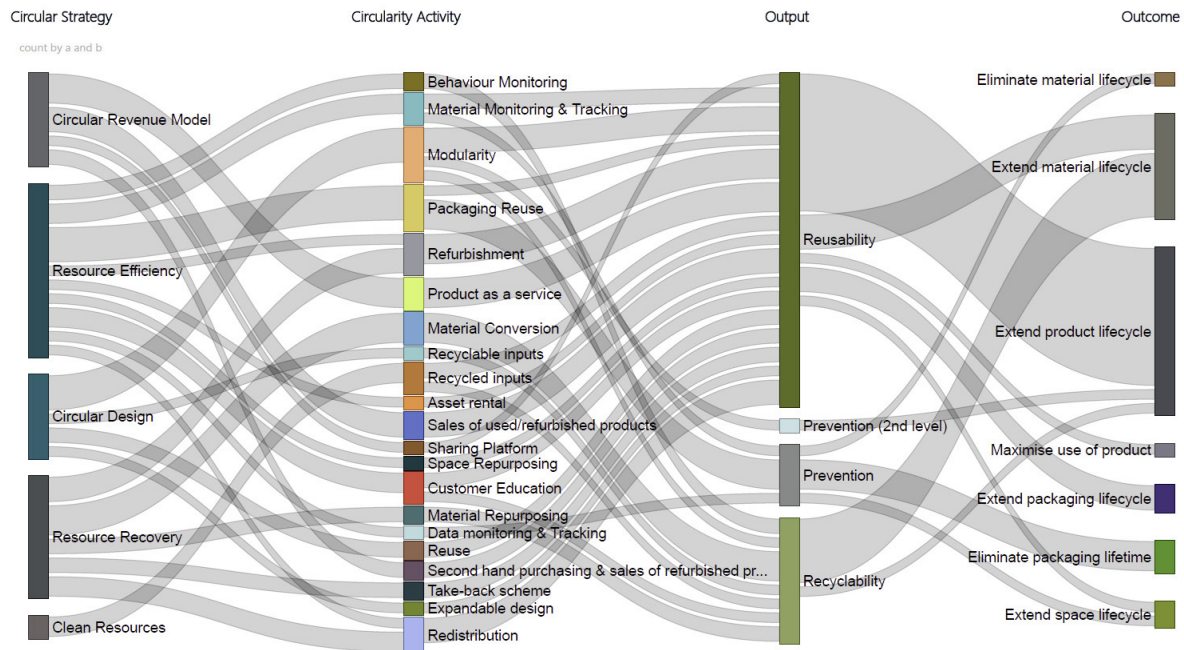


Figure 5. Logic Model of circular business activities with technical Inputs © LWARB, 2019.

Conclusions

Circular business activities can contribute to outcomes beyond product lifetime extension, including material, space and packaging lifetime extension, reduction or elimination. Businesses in London have demonstrated that circularity activities can also result in maximisation of a product's use within its current lifetime. This paper highlighted that those outcomes should all be considered as equally valuable as a product life extension outcome when aiming to illustrate and/or assess the impact of circular economy in a business context. Further research should be conducted in order to quantify specific material impacts and business benefits coupled with those outcomes.

Based on the sample of 89 small and medium businesses supported through the Advance London programme, the main outcome achieved from circular business activities in London, is predominantly extension of product and material lifetimes. The notion of converting waste streams to new products and therefore expanding the product or material lifetime is the most frequently encountered type of circular business. Both from a design perspective/available technology as well as a business readiness perspective, entrepreneurs

are more likely to identify a waste stream and launch a business that will tackle it.

However, some entrepreneurs have focused their business activities on eliminating or reducing lifetimes of packaging and materials. Fewer entrepreneurs are venturing into extending the product/material lifetime by redesigning the product or by offering products in the form of a service.

The study has also validated that certain circularity strategies – circular revenue models and circular design – are applicable to technological inputs and it is yet to be explored whether there is a possibility for businesses handling biological inputs to deploy those strategies as well.

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