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Exploring the implementation of a circular economy strategy: the case of a closed-loop supply of aluminum beverage cans

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Abstract

The circular economy concept provides a key opportunity to address the challenge of resource scarcity for both policy makers and industries. Companies are urged to play their part and integrate circular economy in their business. However, little has been said about how implementation should occur and the consequences for the industry. This paper explores possibilities for the business implementation of a beverage producer's circular economy strategy, which consists in setting up a closed-loop supply of aluminum beverage cans. For this purpose, we develop a business model-inspired framework derived from literature on business models and circular economy, which we use to analyze the current business ecosystem for aluminum beverage cans in the UK.

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Keywords: Circularity; packaging; business model, value network

1. Introduction

In a linear economy, value chains are based on extracting resources, using them to make products, which are discarded at their end-of-life. Based on such logic, our current production system implies two problematic aspects in terms of resource availability and production of large amounts of waste [1]. The concept of a circular economy suggests an alternative system, aiming to decouple economic growth from resource constraints [2] and defined as a regenerative and restorative industrial system by intention and design [3].

Business motivations for shifting from a linear to a circular economy are manifold. Economic advantages, namely cost reduction, new revenue sources and employment creation, have been identified and quantified for whole sectors or regions [4]. At the micro or company level, integrating circularity in businesses may help mitigate increasing resource scarcity [5,6], and political risks of access to resources [7]. On the opportunity edge, circular businesses may be associated with new value sources for companies, e.g. enhanced reputation, closer relationship with consumers and other value chain players, access to cheaper resources etc. [8].

Any company willing to implement a circular economy strategy can expect to face major challenges in terms of resource management, stakeholders' management, regulatory issues, and financial issues. The challenges associated with resource management include geographical dispersion of goods [3,6,9], non-adapted reverse logistics infrastructure [3], difficult control over quantity, quality and delivery time of resources [8,10], and complexity of materials [3,10]. Stakeholders' management concerns are related to the fact that single companies cannot establish circular systems on their own; they need partners within or beyond their current value chain [1,2]. Here, difficulties in collaboration and alignment across companies [7,10], disinterest for non-core business activities [10], resistance from powerful stakeholders with

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high interests in current business setting [9] and misaligned consumer behaviors [6,9] can threaten very good intention to create circular systems. There may be issues related to regulation under different systems, e.g. the handling and re-use of waste materials [10] and cooperation between businesses are regulated in many industries [7]. Last, there is a need for new financial models to support large initial investments [5,9] and the financial gains for companies remain to be unearthed [11]. On top of these different aspects, the fact that environmental impacts today are not monetized and internalized into costs, and the general inertia from the status quo create barriers for the circular economy to gain ground [9]. All these aspects make concrete implementation rather difficult for companies.

Cases covering the process from the strategic idea of a circular product system to options for its concrete implementation and with emphasis on both business and environmental aspects are not widely documented in the literature. In the present paper, we contribute to filling this gap by outlining how the implementation of a circular strategy can be designed from a business perspective and highlight some of the key challenges a company faces in such undertaking.

The paper presents the case of the Carlsberg Group, one of the largest global brewing companies, which as part of its circular economy strategy, has joined forces with a selection of global partners to create a cooperation platform, named Carlsberg Circular Community which was launched in January 2014. Within the Carlsberg Circular Community, Carlsberg collaborates with for example, packaging suppliers, to develop packaging products that are "optimized for recycling and reuse, while at the same time retaining their quality and their value" [12].

Aluminum cans are one of the packaging types considered in the initiative, which have shown good circularity potential, in particular to enter a closed-loop supply, at least from an environmental point on view [12]. Aluminum beverage cans are simple products made of two different aluminum wrought alloys, one for the body and one for the lid/tab. Niero & Olsen [13] showed that a closed product loop system, producing new cans from used beverage cans (UBC) has lower impacts than using mixed aluminum packaging scrap as a source. However, the business aspects of a closed-loop supply of aluminum beverage cans are yet to be explored.

The aim of the present paper is to explore possibilities for the business implementation of a circular economy strategy for a beverage producer, i.e. setting up a closed-loop supply of aluminum beverage cans in the UK market. The question in focus is whether there is business relevance for Carlsberg to implement a circular system for aluminum beverage cans in the UK market. To answer this question, we first develop a business model-inspired framework by integrating business models and circular economy literature and gain insights about the current aluminum beverage can business ecosystem in the UK. We then use the framework to explore options for the implementation of the circular economy strategy.

2. A business model-inspired framework for circular economy strategy implementation

A business model is a conceptual tool that helps understanding how a company does business and is usually designed around three pillars, namely the value proposition, value creation & delivery, and value capture [14]. The value proposition describes the value the company intends to deliver to its customers. The value creation & delivery describes the activities performed, the resources used, the partners and technology that support and enable the fulfilment of the value proposition, while value capture describes the cost structure and revenue model and shows how delivering the value proposition may generate earnings for the company [15].

Following Zott & Amit's [16] activity-based perspective on business models and along with the need for cooperation among stakeholders in the business ecosystem to establish circular businesses [1], we consider that emphasis should be put on the network of interdependent activities that need to be established. Establishing a functional value network is only a first step, engaging the relevant actors to participate in this network is fundamental as well. Since cooperation across actors in circular business models may go beyond mere supplier-buyer transactions and is likely to occur outside actors' core activities [10], the value network-centered approach of business model seems relevant. Indeed, the approach is less customer-focused and puts specific efforts on outlining the value capture potential for the set of actors collaborating in the business model. Our framework is derived from the basic three pillar-based understanding of business models, with a focus on three main objectives connected to the pillars, and specifically relevant for the circular economy strategy being explored: building the value network, engaging network actors and generating combined environmental & economic value, see Figure 1.

Building the value network consists in outlining the set of interdependent activities or functions necessary to be established in the circular business model [16]. *Engaging value network actors* is about identifying the sources of value generation for all network actors. We use the typology proposed by Schenkel et al. which classifies value sources related to closed-loop supply chains in four main types [17]:

- Economic: cost reduction, new revenue source, risk reduction;
- Environmental: fulfilment of environmental objectives, compliance or anticipation of regulation;
- Informational: feedback from consumer behavior, product life-cycle, product and process performance; and
- Customer: higher customer satisfaction, corporate image and consumer loyalty enhancement.

In exploring how the company's circular economy strategy can be implemented with both business and environmental relevance, the concept of green business model change or innovation is important. A business model innovation for sustainability is defined as changes in the value proposition, delivery means or capture mechanisms developed by an organization, and more globally its value network, which leads

to a significant positive impact or a significant reduction of negative impact for the environment and/or the society [15]. Hence, the last objective of the framework is *generating combined economic and environmental value*, which can both be quantified in comparable terms, if environmental impacts are given a monetary value, although such approach is associated with high uncertainties [18].

Finally, we take the stand that the framework should enable direct links between its elements and the key challenges of implementing circular economy strategies. These are classified under stakeholders' management, resource management, regulation issues, and financial issues (see section 1). Figure 1 outlines the critical aspects of the proposed framework for designing a circular business model.

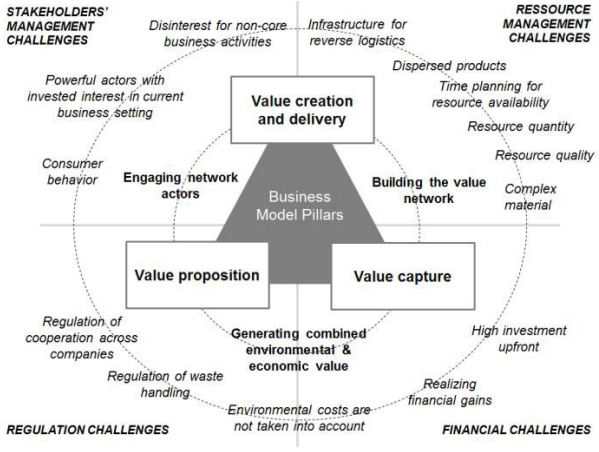

Fig. 1. Business model-based framework to support the implementation of the circular economy strategy, with indication of its three main objectives (engaging network actors, building the value network and generating combined environmental and economic value) and main challenges to be overcome in relation to stakeholders' management, resource management, regulation and financial elements.

3. Case study: current business ecosystem for aluminum beverage cans in the UK

For the case analysis, primary (i.e. emails and semi-structured phone interviews) and secondary data (i.e. from actors' website, annual and sustainability reports) were collected during the second half of 2015, to explore the current aluminum beverage can business ecosystem in the UK.

Aluminum beverage cans for UK consumption are produced out of coils manufactured in France, Greece and Germany and the coils can be produced from primary or secondary (from reprocessing) aluminum. 70% of beverages in aluminum cans are consumed at home [19]. Recycling behaviors are more and more common among consumers in the UK. Curbside collection schemes, run by local authorities or large waste management companies, enable the collection of UBC scrap in a stream of mixed aluminum packaging, also including e.g. aerosol packaging and food packaging. A collection scheme for consumption of beverage cans on-the-go is run under the program Every Can Counts [19]. However, the flow collected through this channel is incremental [20]. In the UK, the recycling rate has increased from 55% to 65% between 2009 and 2014 [13]. When accounting for losses in the recycling process, we can deduce a collection rate of 68% in 2014. The UK recycling rate remains lower than in other European countries, e.g. Finland and Belgium (97%) [21].

The collectors decide to whom the collected UBC scrap is sold. Around 84% of the UBCs collected in the UK are reprocessed in the UK. Most of this flow is reprocessed by Novelis, which estimates to buy 70-80% of UK sourced UBC scrap. The secondary aluminum market is competitive, with increasing pressure from Asian countries. UBC scrap is a source of high quality aluminum, i.e. low presence of alloying elements, thus increasing the collection rates of UBCs is a relevant objective from the reprocessors' perspective.

Novelis produces secondary aluminum can body coils out of the UBC scrap. Thus, the concept of "circularity" is not new in the UK for aluminum beverage cans, since one major interaction is already set, i.e. the link between UBC collection and reprocessing. However, since UBCs are not collected separately from other aluminum packaging scrap in the curbside collection schemes, the scrap quality is low due to the presence of mixed aluminum alloys. Hence, in order to produce new beverage cans out of the currently collected scrap, higher quality aluminum must be added. A summary of the current aluminum beverage can business ecosystem in the UK is presented in Figure 2.

In the UK, the main packaging raw material suppliers and manufacturers, beverage producers, importers and sellers are held financially responsible for packaging end-of-life, according to the Producer Responsibility Obligations (Packaging Waste) Regulations 2007 [22]. Based on the volume handled and their role, each actor has to buy obligations called Packaging Recovery Notes (PRN) that are emitted by reprocessors (and exporters) of packaging waste and are traded on an open market [22]. However, this internalized environmental cost remains rather low for all actors and this is due to the fact that current recycling rates are close to the national targets [23].

4. Results and discussion

4.1. Building the value network

In the UK, the curbside collection scheme delivers a mixed aluminum packaging stream with poor scrap quality. To increase scrap quality a pure aluminum UBC stream, either at the source or after sorting should be established. The current process used at material recovery facilities to separate aluminum packaging from other items does not allow separating aluminum beverage cans from the general aluminum household waste stream. Consequently, aluminum beverage cans should either be collected in separate containers on a curbside basis or at dedicated return points.

To guarantee resource quantity there is a need to collect large volume of UBCs by motivating consumers to return cans at their end-of-life. Beverage packaging collection rates are generally higher in countries where a monetary incentive is provided to the consumers, e.g. Denmark, Sweden, and Germany [21]. Monetary incentives can be of different forms including: *deposit and return system (DRS)* in which a deposit is paid by the customer at purchase and redeemed if the can is

returned later on; a *cash-for-can scheme* where consumers are financially rewarded for bringing cans back without paying any additional fee at purchase; a *lottery system* which randomly rewards the return of cans with a high value gift. Based on preliminary calculations with current value of UBCs, the incentive for consumers in a cash-for-can system would be very low. Rewarding only a few random cans is likely to be less motivating than getting fixed revenue from cans. Thus the deposit option is preferred.

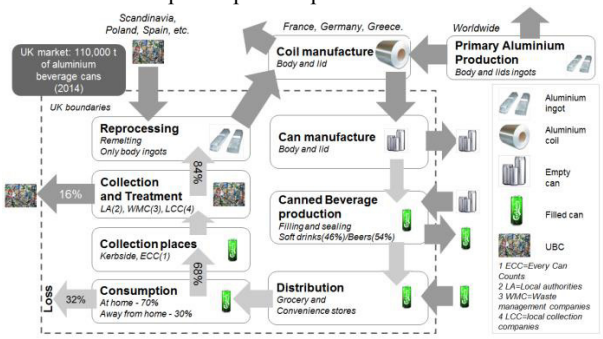

Fig. 2. Current aluminum beverage can business ecosystem in the UK, with indication of main flows and actors.

The current curbside collection scheme seems hardly compatible with introducing a monetary incentive because of a lack of traceability of cans. In this study we therefore analyze a DRS system collecting UBCs at grocery stores, as it is common in other European countries, e.g. in Scandinavia. In a DRS, only cans sold with a deposit can be collected. Thus, if Carlsberg UK ran a DRS on its own, only a restricted share of the aluminum beverage cans market would be targeted by the collection system. This volume would not generate economies of scale and a partnership between the main beverage can brands is therefore considered. The identified potential partners are Heineken, AB InBev, Molson Coors, Coca Cola Europe, Britvic and Red Bull which together represent around 73% of the canned beverage market in the UK. It enables to target a large volume of UBCs, while keeping the number of partners down and limiting the complexity of the partnership.

The circular economy strategy is associated with different value sources for Carlsberg. From an environmental perspective, by targeting a closed-loop for its aluminum beverage packaging, it may decrease the environmental impacts, e.g. waste generation, raw material use, of its business and overall its value network, in comparison with its current can sourcing scheme. From an economic perspective, Carlsberg may have access to cheaper aluminum packaging and improve its profitability. In terms of consumer value, a green branding could derive from the strategy. To benefit from cheaper aluminum packaging, UBC ownership plays a key role. The current collection scheme makes large waste management companies and local authorities the owners of UBC scrap who capture value by selling them to reprocessors. Reprocessors also capture value because secondary and primary aluminum coils are sold at similar market price.

There are several possibilities for Carlsberg to capture value from using secondary resources. One option is to keep UBCs in a closed-loop by partnering with external collectors, and possibly negotiate the price of secondary aluminum coils with reprocessors, on the basis of a guaranteed and high-quality resource for the latter. Another possibility is to control the entire or part of the collection system of UBCs. The first option for owning a UBC collection system considers the beverage companies investing in the collection infrastructure at return points and leaves the collection from these points to the reprocessor under the responsibility of waste management companies. In the second option beverage companies invest in a UBC collection system and additionally manage the logistics between the return points and the reprocessors. The latter is selected because backhauling UBCs was viewed as a more interesting option by Carlsberg to avoid moving empty trucks and thus to create more value.

The proposed closed-loop value network is based on Carlsberg and the main beverage can brands in the UK collaborating to invest and develop a new collection infrastructure dedicated to UBCs. Reverse Vending Machines are bought by the partners and set up at the main grocery stores in the UK which are financially compensated for hosting and processing deposit returns. Drink cans produced by partner brands and sold in network grocery stores have a deposit. This deposit is redeemable when empties are returned within the network. Returned UBCs are backhauled by the retailers to their distribution centers against a fee paid by the beverage brands. Further, they are transported by Carlsberg UK and sold at the closest Novelis aggregation center on the way back to the warehouse after delivering products to the retailer distribution centers. Novelis produces ingots out of the UBC, further transformed into can body coils, and is committed to sell them to the can manufacturers who respectively supply the beverage brands involved. The revenue from UBC sales and the volume of can body coils produced out of UBCs are shared between the beverage brands depending on their contribution to the system.

4.2. Engaging network actors

The identification of clear sources of value for all network actors is important to foster engagement in the new business model. Aluminum can producers would support their sustainability commitment in terms of promoting the best recovery system for the aluminum cans without engaging major resources to do so but letting their customers decide on the choice of the aluminum coil supplier. By controlling the UBC resource at a low cost, the beverage brands could have access to a cheaper aluminum packaging resource and more power to negotiate good contracts with the reprocessor for coil prices. They may also enhance their green image, gain information about and a closer relationship with their consumers, and anticipate future regulation changes. All beverage brands considered for the partnership are committed to the Courtauld Commitment which among other topics aims at reducing the weight and carbon impact of packaging [24]. In their sustainability commitments, the beverage brands already emphasize different strategies for their packaging, e.g. light weighting, material recyclability, using recycled material, encouraging recycling among consumers. However, commitment levels remain heterogeneous across beverage

producers. The retail brands are also part of the Courtauld Commitment [24] and could become key and visible actors of the circular economy in the new collection system. Some retailers have high ambitions regarding fostering recycling in the UK. By returning cans to the new collection infrastructure, consumers retrieve the fee paid when buying the drinks, and play their part of shared responsibility in recycling following the leadership of beverage companies, with a rather low effort since UBCs can be brought back when shopping. By taking part to the network, the reprocessor has access to more and higher quality UBC scrap from the UK, as well as secures its sales by long term contracts with the major beverage brands.

4.3. Generating combined environmental & economic value

From the perspective of the case company (and by extension the beverage brand partners), a first financial indicator of the business feasibility is the Return on Investment. In the present case, the acceptance of the new system might be low as a start and thus generate high initial cash flows from unredeemed deposits for the beverage brand partners which may compensate for any decline in sales volume due to the overall increase in the retail price of beverages. However, in the long term, when the acceptance of the new system has increased and thus most deposits are redeemed, in order to guarantee profitability, the economic cost & revenue structures in the new system must be studied. New money flows are related to the sales of UBCs to the reprocessor and unredeemed deposits when UBCs are not returned by consumers. New costs are generated from the collection, transport and handling of UBCs. From the environmental perspective, even if companies partnering in the new business model were exempt from paying the Packaging Recovery Notes, this would make little difference on their bottom line considering the low current value of the latter. Thus the profitability for the beverage brand partners is mainly based on three parameters: the deposit set on the cans, the price at which UBCs can be sold to reprocessors and the difference in beverage cans cost for the beverage producers in the current and new system. Other forms of less tangible value identified by the literature on closed-loop models may be more difficult to evaluate and account for in the business model assessment, e.g. consumer information or brand image.

Niero & Olsen found an environmental benefit, driven by a lower climate impact, from closing the loop of aluminum beverage cans, as opposed to producing aluminum beverage cans from mixed aluminum packaging scrap [13]. However, transport was not included in the calculations and could have a significant influence in the new business model. The environmental savings from closing the loop of aluminum beverage cans represent a benefit for the overall beverage value chain. They could be translated into a monetary value so that environmental impacts can be included into a discussion at financial level in the beverage value chain. Yet, this level of analysis would imply a proactive and collective approach in the value chain for coordinating changes. Determining whether the society at large could benefit environmentally from a change of business model in the beverage value chain would need further modeling of consequences, e.g. the recapture of UBCs would have consequences in other industries using aluminum and could lead to a sub-optimization overall.

4.4. Review of challenges of the business model for a closed-loop aluminum beverage can supply in the UK

Several of the challenges for implementing circular economy strategies in a business context (see Fig. 1) are alleviated in the present case. Thanks to the presence of the end of waste criteria in the EU, which allows for scrap trading, *regulation of waste handling* is less of an issue. Since aluminum cans are rather simple products composed of two alloys of the same material *challenges related to complex material* are rather low. Because beverage cans are fast moving consumer goods there is less *time planning for resource availability*. Challenges that are more significant are associated with developing the value network, e.g. *resource quality*, *resource quantity*, *consumer behavior* and *dispersed products*. They require establishing a separate waste stream for UBCs, joining with other beverage brands and creating incentives for consumers to return UBCs in the new collection infrastructure. *High upfront investment* and *realizing financial gains* also necessitate teaming up with other beverage brands to cover initial investments and generate economies of scale. Cooperation between beverage brands and an increase in beverage can price due to the added deposit, have implication for competition laws and the regulation of cooperation across companies and needs to be explored further. *Realizing financial gains* also depends on the parameters outlined in section 4.3. The full environmental benefit from adapting the new business model cannot be currently accounted for financially since *environmental costs* are only taken into account in limited ways in the producer responsibility regulation as outlined in section 3. *Infrastructure and reverse logistics* represents both a strength and a challenge in the current case. There are indeed strong recycling capabilities for UBCs in the UK. However, the current system gives benefits to waste management companies and local authorities, which own the waste, and collect revenues from its sales and reprocessors, which produce and sell secondary aluminum at the same price as primary aluminum. *Powerful actors with invested interest in current business systems* may thus be the biggest challenge to overcome, to initiate a change in the business ecosystem. *Disinterest for non-core business activities* might prevent retailers from engaging in the value network, e.g. they might have no interest in sacrificing commercial gains to set up reverse vending machines in exchange for a green image which is only a perceived value.

5. Conclusions

We developed a business model-inspired framework supporting the design of a circular economy strategy and applied it in the case of a closed-loop supply of aluminum beverage cans. The general nature of this conceptual tool derived from the literature on business models and business implementation of circular economy makes it applicable in other contexts, e.g. in different sectors and for different

approaches like reuse or remanufacture. The strength of the framework is its specific focus on the challenges generally met when seeking to develop the concept of circular economy in a business implementation context. The outer circle of the framework could indeed allow for a quick initial check of possible challenges for the circular economy strategy and be taken as critical inputs in the reflection process around the three objectives: *building the value network*, e*ngaging network actors* and g*enerating combined economic & environmental value*. The framework seems suited to evaluate the feasibility of a pre-selected circular economy strategy from the company's perspective. Less challenge-focused frameworks could be more suitable in an ideation context of exploring how circular economy influences a certain business.

Moreover, we showed how a business model can be elaborated to implement the circular economy strategy of a beverage producer aiming to close the loop of aluminum beverage cans. Both environmental and economic relevance of the business model were emphasized. We found that the business implementation is far from straightforward, regardless of the environmental rationale for creating a closed-loop supply of aluminum cans. High upfront investment for non-core activities, need for alliance with other beverage brands, need for cooperation within the value chain with reprocessors, can producers and retailers, high dependence on consumer behaviors and resistance from powerful actors in the current context who would be excluded in the new business model are all challenges for the case company. There is a need to internalize environmental impacts in business costs which could create incentives for value chain actors to improve the system altogether; to better understand what would drive best recycling behaviors among consumers; and to design business model changes which carefully take into account the current situation and power distribution among actors. While this case study certainly raises more questions than it brings answers, it illustrates how the developed framework can be used to reflect on a specific circular economy strategy from a business perspective.

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