



A circular business model mapping tool for creating value from prolonged product lifetime and closed material loops

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ABSTRACT

The concept of circular business models has been identified as an important enabler for companies moving towards circular practices. Circular business models help to prolong lifetimes of products and parts through successive cycles of reuse, repair, remanufacturing and closing material loops. To realise economic viability and reductions in environmental impacts from innovating towards a circular business model, integrated planning of the product lifecycle and value creation architectures for each cycle is pivotal. One key approach used to support business model innovation in management studies has been the visualisation of business models. Visual representations reduce complexity and reveal tacit structures to help understand and communicate the business model, generate and develop new business model ideas, and remove obstacles to innovation. However, for circular business models, there are no visualisation tools that help plan the product lifecycle in a way that creates and captures value from multiple use cycles and closed material loops, and that can capture how business model elements are adjusted to effectively implement each cycle. This paper presents a *visualisation tool to map circular business models*. The tool offers a standardised representation of the elements and possible cycles of circular business models to prolong the useful life of products and parts, and close material loops. A pilot case based on the company Fairphone exemplifies various potential benefits, including the tool's ability to reduce complexity and order potential interventions for embedding circularity in the business model. Suggestions for future research are made to refine and test the tool.

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1. Introduction

To address the unsustainable levels and speed of primary resources extracted and waste created, the transition towards a circular economy is high on the political agenda (European Commission, 2015; Milios, 2016; Kirchherr et al., 2017). The circular economy is a paradigm that suggests a redesign of the current economic system, largely based on linear resource flows, towards closed-loop resource flows that can preserve the embedded environmental and economic value in resources for as long as possible (Stahel, 1994; Lifset and Graedel, 2002; Frosch and Gallopoulos, 1989).

The concept of a *circular business model* has been developed to help companies adopt circular practices (MacArthur, 2013; Van Renswoude et al., 2015; Bakker et al., 2014b; Bocken et al., 2016). The aim of circular business models is to reconcile creation of commercial value with adoption of circular strategies that can

prolong the useful life of products and parts (e.g. repair and remanufacturing) and close material loops (e.g. recycling) (Nußholz, 2017). In contrast to linear business models, in which a product is commonly downgraded after a single use phase and its embedded value is lost, circular business models support the development of product systems that preserve the embedded environmental and economic value at the highest possible level of utility (Stahel, 1994; Velte and Steinhilper, 2016). While this provides new possibilities for creating and capturing value for companies (Bakker et al., 2014b; Den Hollander and Bakker, 2016; Moreno et al., 2016), adopting circular strategies also requires holistic and radical changes in companies' offers and value chains (Wells and Seitz, 2005).

Business model innovation has been identified as an important enabler to realise these changes and capitalise on circular strategies (Bocken et al., 2016; Bakker et al., 2014a). Business models describe the elements of a company's value creation architecture (Osterwalder et al., 2005; Wirtz et al., 2016) that define how an organisation converts resources and capabilities into economic

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value (Teece, 2010). Innovating the business model comprises altering the content of some of its elements and the links between them (Massa and Tucci, 2014). Innovating the business model can help coordinate technological and organisational innovations and secure partner networks or capabilities that are required to preserve and utilise the embedded value in resources.

To support business model design, it has been recognized in management literature and practice that the innovation process requires “structure and guidance to frame and focus thought” (Eppler et al., 2011). A key approach used in innovating business models has been the *visualisation of business models* (Täuscher and Abdelkafi, 2017). Visual business model representations are artefacts that reduce complexity (Doz and Kosonen, 2010), reveal tacit structures within a business model (Casadesus-Masanell and Ricart, 2007), thereby creating a common understanding of mental models. Practical experience has shown that such “visual thinking is indispensable to working with business models” (Osterwalder and Pigneur, 2010a) to help better understand and communicate the current business model (Osterwalder, 2004), generate and develop new business model ideas, and remove obstacles to innovation (Eppler and Hoffmann, 2011). They can be a tool for knowledge sharing (Doganova and Eyquem-Renault, 2009) and for collaborative innovation (Eppler et al., 2011) between employees and between the company and its external stakeholders (Zhang, 2012). Several different visual business model representations have been developed that standardise the elements that a business model is thought to comprise. A widely used representation is the ‘business model canvas’ developed by Osterwalder and Pigneur (2010a).

Despite the benefits that visualisation of business models can provide in the innovation process and the widespread application of business model representations in traditional management literature and practice, only a few tools and frameworks that can visually represent circular business models have been developed. These usually incorporate elements as take-back channels or account for the sustainability value created from the business model. In view of the challenges of designing circular business models that prolong the life of products and parts and close material flows, early consideration and integrated planning of the business model and its cycles is pivotal. Newly emerging tools (Antikainen and Valkokari, 2016; Rashid et al., 2013; Lenssen et al., 2013), such as the *framework for sustainable circular business model innovation* (Antikainen and Valkokari, 2016) or the *Circular Board* (Circulab, 2018) do not visually integrate the goal of prolonged product lifetimes and closed loops. They have not been designed to recognise the possible interventions throughout the product lifecycle to create and capture additional value from multiple use cycles and closed material loops, and that the business model elements must be adjusted to ensure effective implementation of each cycle (Velte and Steinhilper, 2016; Spring and Araujo, 2016; Nussholz, 2017). Consequently, their guiding function for practitioners to manage value creation from multiple use cycles and closed loops is limited.

This paper aims to develop a visualisation tool to map circular business models that prolong the useful life of products, parts and close material loops. The tool is based on the current understanding of circular strategies (Bocken et al., 2016; Willskytt et al., 2014) and systematically integrates lifecycle value management with traditional business model design thinking. The developed tool offers a standardised representation of the elements and possible cycles of circular business models to prolong the useful life of products, parts and close material loops. The aim is that the tool will serve as guidance for circular business model innovation by supporting the mapping, analysis, design, and communication of circular business models developed for multiple cycles. The paper describes the

development process of the tool, including iterative rounds of literature review, comparative case studies, and workshops. The paper provides an initial pilot study of a case company operating a circular business model to discuss the value and effectiveness of the developed tool. Based on this, further refinements are suggested.

The paper continues with a review of the literature on circular business models, lifecycle value management, and existing visualisation tools (section 2), followed by the methodology involved in developing the tool (section 3). Section 4 presents the development process of the tool and an exemplification of its effectiveness and value, followed by a discussion and concluding remarks in section 5.

2. Literature background

This section presents existing literature on circular strategies (section 2.1), business model innovation (section 2.2), and managing product lifecycle for value creation in circular business models (section 2.3). Although literature is evolving, tools for visualising circular business models have not yet sufficiently integrated its key principles (section 2.4).

2.1. Circular strategies

To reduce the level and speed of resource flows through the economic system, scholars in the resource efficiency field have developed a range of strategies that cycle resources at product, part or material level (in this study referred to as circular strategies) (Stahel, 1994, 1997; Cooper and Gutowski, 2017; Allwood et al., 2011). Circular strategies have the potential to save embodied energy and reduce resource intensive primary production and waste generation by first *slowing* resource loops and then *closing* resource loops (Stahel, 1994; Bocken et al., 2016).

Slowing resource loops refers to prolonging the useful life of products and parts. This can be achieved through circular strategies involving design for longevity, repair, refurbishment, and remanufacturing to prolong the useful life of resources either for the same user, or through creating additional use cycles for other users. *Closing* resource loops refers to material recovery once the end-of-life is irreversibly reached (Bocken et al., 2016; Stahel, 1994).

To bring about these changes in resource flows, products, parts, and materials need to be collected in some way at the end-of-use and reintegrated into the value chain (Wells and Seitz, 2005). This can take place either upstream in a companies' value chain processes (e.g. collection of a product after sale to their user) or downstream (e.g. acquiring supply of secondary materials as input for their own production), and can involve different actors depending on, for instance, whether cycling of resources is realised only between companies or includes consumers (Wells and Seitz, 2005). Consequently, implementing circular strategies often requires holistic and radical changes beyond the boundary of a company.

The idea of business model innovation has gained prominence as a way to efficiently implement these changes and capitalise on circular strategies (Planing, 2015; Bakker et al., 2014b). How business model innovation can help implement circular strategies is investigated in the following section.

2.2. Business model innovation

Business models can be used to present the organisational structure and value creation processes of a company (Wirtz et al., 2016), defining how an organisation will convert resources and capabilities into economic value (Teece, 2010). They can be understood as a template for organising business activities based on a

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