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## Barriers to the Circular Economy – integration of perspectives and domains

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### Abstract

Sustainable development requires disruptive changes and radical innovations, and the capability to deliver this in relation to adapt to a sustainable development is needed in mature large industrial companies. Integration between sustainability and business development is needed, which the Circular Economy model offers. Circular Economy is little implemented in practice, and in the present paper barriers to a transition to Circular Economy is identified. Barriers are financial, structural, operational, attitudinal and technological. They are also, as analyzed in relation to innovation management, characterized by a need to increase integration between a number of different perspectives and domains in industry.

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### 1. Introduction

New services and business models, as well as organizational innovations, have more recently received increased attention as economically viable innovation paths as an alternative to technical and product-oriented paths [1]. Managing this within firms is challenging as it demands new structures and new procedures explicitly involving more functions from the organization in innovation [2]. The path to extend value propositions through new services and business models is one that strongly correlates to desired paths for sustainable innovations: a sustainable development requires a decreased use of resources consumed by products and their usage, while still allowing commercial companies to gain revenues from deliverables to market. If companies can develop and accomplish value propositions for their customers increasing revenues and decreasing resource consumption, sustainable business models are defined that are of critical importance to society. This link between delivering systems of products and services leading to the reduced environmental impact of physical goods is emphasized in the area of Product-Service-Systems (PSS), which has emerged as a conceptual reply to the need for extending businesses from product-orientation to system-orientation [3, 4]. The review of [4]

reveals that managerial issues or innovation topics are not in particular covered in research so far, as this is still a rather theoretical area.

The depletion of non-renewable resources is followed by severe ecological and social impacts, and an un-reflected usage of resources leaves remarkable footprints [6] driven by that consumption for long has been considered a sign of wealth [7]. In order to move into a more sustainable economic system, a recently more frequently discussed approach for overcoming the current linearity of product lifecycles is the concept of circular economy (CE). In summary, CE suggests keeping materials available instead of disposing them, and thus closing the loop of materials within the product lifecycle, in order to reduce resource usage and energy demand. The economic growth in an economy with a circular logic is no longer achieved by producing more products, but by keeping them available for a longer time, for example by maintaining instead of replacing them [8]. Hitherto, CE has been applied rarely and only fragmentally.

Moving towards CE and other sustainability-driven business models requires a fundamental change that runs through the whole organization and also involves its stakeholders. The transition is certainly of a disruptive nature,

requiring new solutions where current ways of working need to change. It relates strongly to the capability of an organization to manage innovation, a need that is more frequently mentioned for companies in general in becoming part of sustainable development [9, 10]. In order to find ways of working for organizations to be able to handle this disruptive change, it is important to start from within the organization to understand the challenges and barriers that they face. This paper aims to report on the initial results of a study on organizational barriers to CE for traditional manufacturing firms having a product-oriented focus and following the dominant linear economy. The understanding of current barriers in industry is critical both in order to define future research and the means required for supporting companies to move towards CE. The authors also intend to relate these barriers to capabilities of managing disruptive changes in innovation as the complexity of integrating sustainability and business demands an increased capability in managing for disruptive changes and radically new innovations.

## 2. Theory

Innovation is a collective process of creating and realizing new values for customers; it is people who recognize opportunities and who develop and implement new ideas by engaging in transactions with others [11]. All employees can be regarded as sources of innovation, which, however, is not a self-organized process, but needs to be managed. It is managers who drive innovation and set the scene for innovation and, although innovation is often seen as a flexible and creative process innovation, it needs systematic management [12, 13]. In order to develop a product oriented company to be able to extend its propositions into systems of products and services, a stronger integration between different functions in the company is necessary. It goes back to models of integrated product development [14] stressing that the full complexity of achieving success on the market can only be gained by collaboration across departments within the firm. This has also been emphasized in innovation management literature, for instance by [15, 16] stressing that unexpected opportunities are more likely when different perspectives meet, and that these meetings are critical for new knowledge to be created.

Risk taking is also fundamental in innovation and one of the factors that constitute a creative climate [17]. It is mostly only by taking risks that a certain level of newness can be achieved. It requires in turn a dynamic working environment which is characterized by a willingness to learn and unlearn. When extending who is included in innovation as well as deliverables from the company aiming for more novel solutions, a skill in overcoming dominating mental models is critical [18]. It strongly relates to the ability to unlearn, to break through barriers of conventional thinking, and to enable second-order learning, i.e. to challenge core assumptions and meta-learning [19]. However, questioning the underlying business models of a company is argued to be among the hardest things to do, as it is an issue of mental models [20].

Dominant paradigms on how to address problems and what problems are considered worth resolving reduce experimentation and the development of radically different processes and routines over time, especially in successful companies [21]. This is further emphasized when dealing with initiatives beyond existing strategies and business models, because a lack of adequate technical and managerial knowledge often limits the capacity for unlearning [18]. Deliberately initiating unlearning and second-order learning is hard, and external triggers or shocks are often required [18].

Challenges coming with the need for a sustainable development demand radically new solutions [10], and managing for radical innovation is a specific stream of literature in the field of innovation management. The ambidexterity literature [e.g. 22, 23] aims to identify strategies that enable organizations to be successful in managing activities that focus on refining existing offers and processes, exploiting existing knowledge, and in managing activities that focus on realizing new offers, requiring the exploration of new knowledge [24]. The former are most likely to support operational efficiency and to produce incremental innovations while the latter are required for the production of more radical innovations. The latter put greater emphasis on allowing different knowledge perspectives to come together, searching for knowledge outside the company and experimenting with opportunities and possible solutions. Many sources in this field are characterized by a desire to find a balance between being efficient and deliver as expected and being risk-taking and ground-breaking and managing the tension that occurs between the different modes of working. This is specifically interesting for mature firms, as these have most often developed into well-structured and fully controlled organizations [25] and need to introduce more exploration.

The integration of sustainability issues and business development is of critical importance for society [26, 27], though not without some clarity on the actual relations between developing new business as becoming more sustainable [28]. Some reported cases illustrate that CE can be economically viable [29], and it is certainly a model combining sustainability and business. CE is coping with three challenges: resource scarcity, environmental impact and simultaneously increasing economic benefits [27]. This means in more concrete terms that transforming to CE is of high complexity as material and energy, product design, business models, manufacturing, service and distribution processes and data management (and more) have to be considered. CE is building on the principles of the “spiral loop system” [7]. The intention is to keep products in use, instead of disposing of them, which then requires the use of the four R-strategies: repair, reuse, recondition and recycle. A common idea (though not principally defined by the Circular Economy model) is that the product-producing firm would keep the responsibility for the product and apply these strategies at the relevant time. Consequently, firms have to consider how their business is changed according to this. A scale of possible sales models occurs, from selling a product to selling a

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