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Reshaping the washing machine industry through circular economy and product-service system business models

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Abstract

Although circular economy is usually indicated as a way to reconcile economic growth and sustainability, circular business models and related product-service systems are not implemented on a large scale yet. Providing information about how to develop circular business models and methods to evaluate their expected impacts, can support stakeholders to embrace this transition. To this regard, the aim of this paper is to propose and discuss the actions required for reshaping the washing machine industry towards a circular economy scenario. The paper, based on a recently launched research project, describes a set of actions and develops very preliminary computations of their expected impact. Results show that customers could benefit from an average yearly saving of almost 30% of the current washing cost, while country total electricity generation and water consumption could be reduced of about 0.6% and 1% respectively. Albeit they are only preliminary estimates and further research and empirical validation are certainly needed, these outcomes gives an idea about the order of magnitude of benefits gathered by a circular economy transition for a mass durable consumer goods industry such as washing machines.

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Keywords: Circular economy; Product-Service System; Washing machine; Circular business model.

1. Introduction

Circular economy has received increasing attention in recent years, from both companies and policymakers. For instance, China has issued a circular economy law in 2008 with a top-down approach, based on the “command and control” principle rather than market instruments, as in the European, American or Japanese policies [1].

In general, circular economy is indicated as a way to reconcile economic development and sustainability and, thus, as a major trend for the future. [2] However, real circular economy projects are not always taking off so far, especially due to limitations like risk of cannibalization, fashion vulnerability, financial and operational risk, customer irrationality and lack of supporting regulation and knowledge [3][4]. Despite these barriers, the circular economy potential is high in several sectors. For instance, O’Connel et al. [5] have demonstrated how a reuse policy for white goods and especially for washing machines adheres to all the three pillars of sustainability, since it brings advantages to the environment (e.g. lower pressure on raw materials), the economy (e.g. usage cost reduction thanks to lower energy and water consumption) and the society as a whole (e.g. job opportunities and an increased quality of life by providing low-price refurbished appliances to low income households).

In order to foster the circular transition, this paper proposes and discusses the actions needed for reshaping the washing machine industry towards a more circular scenario. The research presented in this paper is still at a preliminary stage and will be further deepened by a three-year study. However, the aim of this paper is to highlight and to provide insights regarding: (i.) the washing machine industry suitability to move towards a circular model, (ii.) the actions needed to trigger this transition, and (iii.) the main expected impacts.

To this purpose, section 2 provides a literature review on circular economy and product-service systems, based on a

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preliminary research conducted on Scopus and improved with cross-references analyses. Section 3 describes the set of envisaged actions, while a short discussion of the expected impacts is detailed in Section 4. Lastly, concluding remarks and future research are reported in Section 5.

2. Literature review

2.1. Circular economy

The dominant economic model, based on growth and throughput, reflects linear material flows [6] in which resources are taken from natural finite stocks, products are manufactured from these resources, sold to consumers and then disposed as waste after use. The principle underlying this linear flow is a cradle-to-grave concept through industrial systems [7], where these cycles of production-consumption inevitably transform resources into waste. Moreover, the economic growth is directly connected to material and energy flows, in what might be called the "river economy" [8]. The classical linear economy paves the way for the so-called "throwaway society", based on manufacturing of short-lived products, planned obsolescence, economies of scale and a consequent growing demand for new products by consumers [9]. In particular, economies of scales reached in the last 150 years are the most significant barrier that prevent the emergence of reuse activities [9] and, above all, new sustainable economic models. This linear model relies on large quantities of cheap and easily accessible materials and energy: during the last century the total material extraction has exponentially increased by a factor of 8 and there is no evidence that this growth will slow down or eventually decline [10]. Yet, with 3 billion more consumers expected to enter the market by 2030 [11] this model is deemed to be not sustainable. Consequently, a transition towards an economy able to decouple economic growth from resource throughput is needed, and an answer for this issue is circular economy, since it pushes the frontiers of sustainability by implementing production systems in which products and materials are used over and over again [1][2][12][13].

Circular economy is restorative and regenerative by design, because it aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles [2]. In fact, materials are turned into nutrients by enabling a perpetual flow within a biological metabolism – composed of biodegradable materials – or within a technical metabolism – composed of synthetic or mineral materials that have the potential to remain in a closed-loop system of reuse, remanufacture, refurbishment or recycle activities [7].

Three major changes can help the transition towards circular economy. First, resource and material prices are on a constant rise and are becoming more volatile than in the past, making more attractive the recovery of raw materials from products at the end-of-life [4]. Second, new information technologies (e.g. Internet of things, 3D printing, etc.) are enabling the creation of new business models [14] that enhance products utilization and enable reuse, remanufacture, refurbishment and recycle. Third, green consumers are rapidly growing [15] and an "access instead of ownership" attitude is increasingly taking shape among customers [2].

2.2. Product-service systems

Following [16], we define a product-service system (PSS) as an integrated bundle of products and services which aims at creating customer utility and value. Despite the fact that customer value generation is the ultimate purpose of a PSS, it is commonplace that PSSs must fulfill other goals, especially sustainability ones. For instance, Mont [17] defines a PSS as a system of products, services, supporting networks and infrastructure that is designed to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models, pointing out the need to support PSSs with a business model evolution.

Tukker [18] identifies three main categories of PSSs:

- product-oriented, where the business model is still mainly geared towards selling products but some additional services are added (e.g. maintenance contracts);
- use-oriented, where the product's ownership remains with the provider who makes it available in various forms (e.g. leasing, renting, sharing or product pooling);
- result-oriented, where the client and the provider agree in principle on a result, with no pre-determined product involved (e.g. catering service, pay per use).

While in traditional product-oriented business models firms have the incentive to maximize the number of products sold, in solution-oriented ones companies are paid for the services they provide. Thus, the materials involved in the product become cost factors and firms have the incentive to minimize them by extending their lifespan, reusing, remanufacturing or recycling them. According to Tukker [19], the result-oriented PSS is the most effective category for shifting to circular economy.

2.3. Circular economy and PSSs

More specifically, Linder and Williander [3] define a circular business model (CBM) as one in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings. Thus, a CBM entails a reverse logistics able to return products from users to producer, involving activities such as reuse, repair, remanufacturing, refurbishment and recycling. When feasible, a hierarchy among these activities should be followed: reuse is preferable to recycling, since much of the value still remains with the components [20].

Previous considerations show to which an extent circular business models are aligned with the provision of PSS. According to the literature, in fact, a transition towards circular economy entails four building blocks [2] [4] [21]:

- circular design: in order to be restorative and regenerative by design, circular economy addresses the recovery of materials not only at the end of use. Consequently, companies need to build skills in circular design to improve product reuse, remanufacturing, recycling and cascading.