The Sustainability Potential of Upcycling

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The upcycling trend has received renewed attention in the past few years due to growing concerns for the environment related to increased resource consumption and waste volumes. Indeed, cities across the world are supporting resource upcycling initiatives by establishing do-it-yourself (DIY) repair cafes and makerspaces as a means to transform societies towards sustainable development. However, the sustainability potential of such upcycling initiatives is unknown due to the lack of theoretical frameworks.

Keywords: upcycling; do-it-yourself (DIY); presumption

1. Background

Upcycling is defined as “a process in which products and materials that are no longer in use, or are about to be disposed of, are instead repurposed, repaired, upgraded and remanufactured in a way that increases their value” \(^1\) (p. 1). In contrast to recycling, upcycling maintains the resource quality and increases the overall value of the product. This research work studies upcycling in the context to do-it-yourself (DIY) repairing activities performed at initiatives, such as repair cafes and DIY makerspaces that focus on encouraging the circular economy and sustainable production and consumption in cities.

Upcycling trend has received renewed attention in the past few years due to growing concerns for the environment related to increased resource consumption and waste volumes. In the context of the circular economy, upcycling is regarded as a strategy to reduce resource consumption by slowing and closing material cycles \(^2\)\(^3\)\(^4\)\(^5\) by improving the quality of products and materials in the value chain \(^6\) and countering the planned and premature obsolescence \(^7\). Upcycling also has the potential to create economic and employment opportunities, encourage entrepreneurship \(^8\), and promote environmentally sustainable consumption behaviors through re-use \(^9\).

Recently, cities have been recognized as leading forces in achieving sustainable development goals including sustainable resource management. Indeed, several cities in Europe are encouraging a circular economy by establishing product repair initiatives. Such initiatives have been studied in relation to providing technological solutions for degrowth \(^8\); reducing overall consumption through time expenditure in repairing \(^8\); improving resource efficiency by enhancing product longevity and spare parts recovery from urban waste flows \(^1\); and offering added social benefits by establishing social interaction, co-creation and mutual learning \(^1\)\(^1\)\(^1\)\(^10\). DIY repair studios could act as catalysts for reviving the repair culture in our societies by providing platforms for skills, tools, and resource exchanges. Indeed, Bradley \(^8\) proposed that bike repair cafes have the potential to enhance autonomy and creativity among citizens, assist them in liberating themselves from commercial relationships, and enable them in establishing non-capitalist relationships.

These DIY repair activities have been identified with closing and slowing the material flows by extending the lifespan of products through repair, upgrade, reuse, and recovery of spare parts or material resources from urban waste. Product sharing, mending, and repairing initiatives have the potential to prevent the purchase of the new products and spare parts and, therefore, are considered environmentally sustainable \(^1\)\(^1\)\(^1\). In addition, these initiatives are closely linked with creating positive social and economic benefits, for example, enhancing repair skills and sufficiency, as well as social cohesion in the local communities. This research assesses multifaceted social, economic, and environmental impacts of DIY bike repair \(^8\).

Literature suggests that carbon footprint related to individual consumption are closely linked to personal time use, socio-economic situation, and material consumption \(^1\)\(^1\)\(^1\). Repairing a product requires spending time on carrying out the repair activity. The time spent may replace or induce other activities impacting the overall resource consumption. Therefore, DIY repair activities have high prospects of stimulating behavioral changes in individual time use and consumption patterns to create a new set of complex socio-economic interactions driving sustainable consumption in societies. This research explores the potential and implications of the users' behavioral changes induced by the DIY repair activities.
In summary, the upcycling activities through DIY repair offer several positive social, economic, and environmental opportunities. However, the design, operational, and institutional contexts may impact the overall sustainability profile of collaborative production initiatives.

2. Collaborative Production: Production, Consumption, and Presumption

Until the 19th century, upcycling in the forms of repairing and repurposing products or resources was an integral part of society. The consumers of products were often also their producers. However, the industrial revolution in the past century has gradually replaced such sufficiency-based lifestyles with new ways of (over)consumption, characterized by exchangeability, replaceability, and throwing away. Some of the reasons for this shift were increase in productivity of industrial processes, and an increased focus on the marketing of products. These not only delinked the producer and consumer of a product, but also cut their traditional relationships with a product established through its repair, maintenance, or up-gradation. Consequently, the rise of consumerism in the western world has largely led to the loss of several traditional skills of maintenance and repair. Moreover, this shift in the consumption paradigm has resulted in rapid product replacement and discarding.

In today’s economies, the production follows consumption and vice versa. However, in the beginning of the industrial revolution, this was not the case, the western societies were defined predominantly by production. In the latter half of the 20th century, consumption became important in economies, as compared to production, due to an increase in the number of consumer products and the consumers and intensification of consumption processes through marketing, advertising, and branding. According to Toffler, this was called “the second wave” of marketization. Consequently, production and consumption became two separate functions dividing two entities—the producers and the consumers.

The term “prosumer”, i.e., the one who consumes and produces a product was first coined by Toffler. According to Toffler, the present-day presumption known as “the third wave”, was an integral part of the pre-industrial societies. Collaboration production through the sharing of skills and locally available material resources was an integral part of several societies throughout history.

Proponents of collaborative production argue that it offers economic empowerment, improves social cohesion, and reduces environmental impacts. The marketed interests in DIY repair and skills, tools, and spaces sharing have indeed been supported by many European cities to support sustainable production and consumption among their citizens.

3. Circular Economy and Upcycling Activities at the DIY “Bike Repair” Studios

Grassroot DIY repair initiatives are supported by government, and non-governmental organizations and volunteer groups because of their sustainability potential. Bradley explored the “Bike Kitchens” in relation to degrowth. The concept of a bike kitchen is not new. Indeed, one of the oldest bike kitchens, Biciclot, Barcelona, was initiated in 1987. Biciclot has become an established institution that cooperates with the City Council of Barcelona to promote cycling and walking in the city.

The DIY bike repair studios create positive environmental benefits by (1) recovering and reusing parts from the urban discards, (2) sharing of tools needed for repairing or servicing, and (3) extending products’ lifetime through repair and servicing. The upcycling activities at these repair studios have positive social and economic impacts for the users and society. According to Bradley, bike kitchens enhance autonomy and creativity among citizens and help them in forming noncapitalist relations with others. Bike kitchens are explored in the context of the democratization of technology because they enable everyone to access the technology, tools, and skills needed for repairing or servicing.

4. Time Use Rebound Effects and Collaborative Production and Consumption

Everyday consumption activities are closely interlinked with the product and services and the temporal dimension in which these are utilized to satisfy the consumers’ needs. To reduce environmental impacts, efficient consumption of products and services is needed. Indeed, taking a functional perspective on consumption activities, a significant amount of research focuses on the eco-efficiency of products. However, Jalas contends that modern consumption serves needs that are not always functional and universal, but are subjective and obscured from products. Jalas describes these subjective consumer preferences and needs as driven by cognition of goals and available means for striving towards them. Therefore, the consumption being interlinked with everyday life activities makes it important to include their
temporal dimension because it requires both physical inputs and time. Considering that not only money but also time is a scarce resource to fulfill a consumer need, it is important to understand the intricate relationships between time use and the environmental impacts (energy or material consumption) of the activities.

Understanding these interrelationships requires analyzing time use or a rational allocation of time. The concept of rational allocation of time has been studied and theorized in the field of household economics [19]. To rationally allocate individual time use, Smetschka [20] utilizes a functional time-use analysis to evaluate the environmental footprints of everyday activities in Austria. For this purpose, the direct and indirect carbon footprints of time use were evaluated, including the time use rebounds. The time use rebound effect was defined as the new activities that a consumer engages in when an existing activity is replaced by a less environmentally harmful product or service [20][21]. These new activities are termed rebound activities. In this context, the rebound activities, i.e., the activities that are induced or replaced due to time spent on the activity in focus, can provide insights into understanding the intricate relationships and dynamics driving everyday consumption.

Understanding these relationships and dynamics further requires establishing a link between time use and carbon footprint of the consumed or avoided products and services. Previously, studies [11][18][20][21] evaluated the direct and indirect carbon footprints of time use in everyday activities. For this purpose, these studies classify daily functional time available into personal time for personal care and sleep, committed time for household, family care and support, contracted time for employment and study, free time for social activities, culture, and leisure, and travel time taken to link spatially distinct activities. This classification makes the basis for assigning carbon intensity to a particular activity that requires time use.

From the perspective of individual time, bike kitchens make an important case because repairing activities require spending individual users’ time. In fact, Lehner [18] and Singh et al. [19] highlighted that bike kitchens have the potential to reduce consumption among the users of the bike kitchens based on their time expenditure on the repair activities and the environmental intensities of the rebound activity. In the context of the repair activities at the bike kitchens, the rebound activity can be defined as the activity the user would have otherwise engaged in instead of the time spent on repairs. A sustainable lifestyle, from a time-use perspective, can be defined as a lifestyle with no increase in the materials intensity of everyday life [21][22]. Bike kitchens could contribute to a sustainable lifestyle among the users in case the repairing activity is concurrent with or replaces another existing activity with a greater environmental impact (see Figure 1). This research highlights the potential contribution of repair activities in driving environmentally sustainable consumer behaviors and proposes a framework to evaluate the environmental impacts such behavior changes.

![Figure 1](image)

**Figure 1.** (a) A hypothetical example illustrating the net effect of upcycling activity due to changes in user behavior leading to replacement or avoidance of another activity that is more impactful than the upcycling activity. (b) An illustration of possible activities that can be avoided or replaced or induced due to upcycling with various impacts and time-use profiles depending on their impacts and time use. The activities that fall in the upper quadrants represent more impacts, and the activities in the lower quadrants represent lower impacts.

### References


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