Circular Advantage Study

Backgroundpaper
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Exemplary quantification of the effects of circular systems in the provision of workwear in terms of climate protection

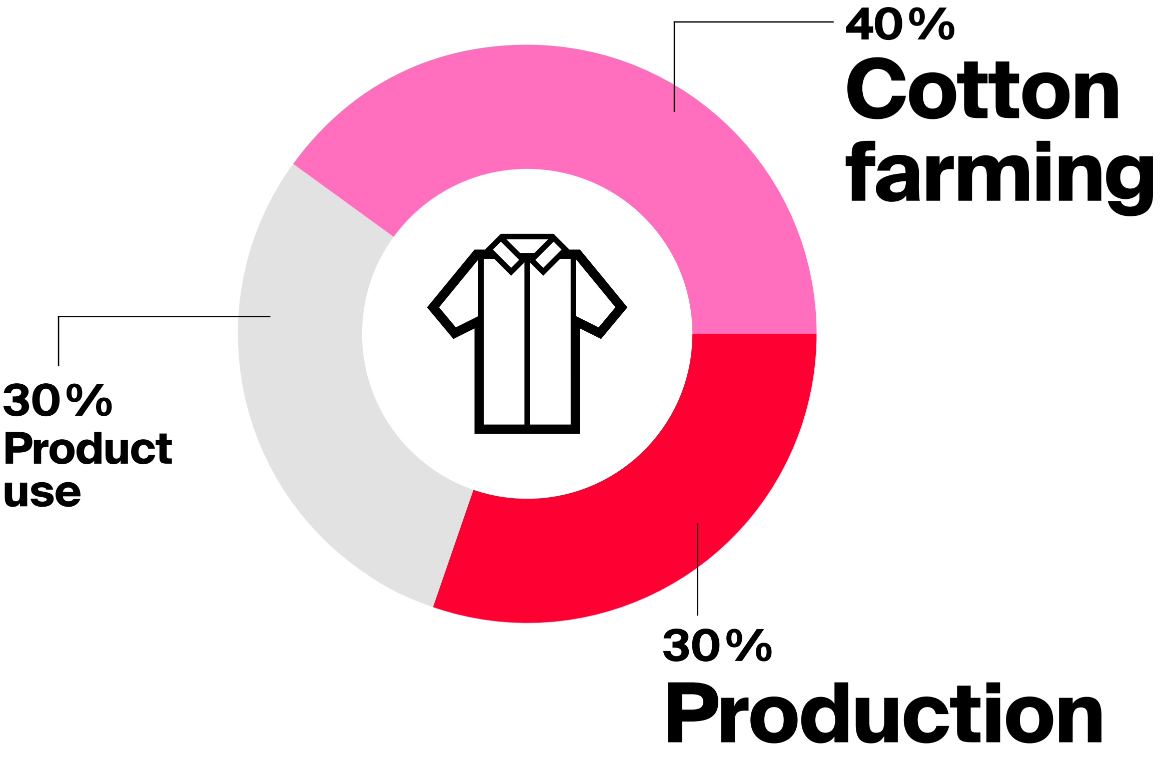
Abstract

In the modern textile industry, the majority of greenhouse gas emissions can be ascribed to the upstream production chain. First and foremost, this refers to the obtaining of raw materials and processing steps such as spinning, weaving and dyeing. Thanks to the circular economy, these emissions can be cut significantly by repairing and reusing products so they remain in use for longer than originally intended. This study analyses potential savings using the example of workwear. To this end, two scenarios are contrasted: on the one hand, a linear system in which private individuals look after their own workwear and, on the other hand, a circular system in which workwear is provided within the framework of a rental service. Evaluation of the data from these two scenarios concludes that, in contrast to a linear system, a circular system enables an average reduction in greenhouse gas emissions of 76 per cent. This figure applies to each service unit via which one person in Germany is supplied with workwear for the duration of one year. This study is based exclusively on primary data from the CWS Group as a case analysis.

Overview of contents

1. Introduction

The textile industry is known for its intensive use of resources, which, in turn, has an enormous impact on the environment (see Systain and Adelphi 2017, p. 12 ff.). In the context of climate change, it is estimated that this industry is responsible for around 4 per cent of global greenhouse gases (cf. McKinsey 2020, p. 3). The vast majority of adverse environmental impacts arise in the upstream value chain, i.e., in connection with the obtaining of raw materials and the production procedures employed (cf. McKinsey 2020, p. 5; Systain and Adelphi 2017, p. 12 ff. and Quantis and Hugo Boss 2017). Given that the upstream value chain processes have the greatest influence on the environment, extending the usage phase of the end product can be seen as a valid strategy for effectively reducing the negative impact on the environment resulting from the creation phase. This assumption is based on the elementary premises of the circular economy: the longer products stay in use without their effectiveness being compromised, the fewer the number of products which need to be produced to replace the old ones. The fewer the number of products produced, the lower the environmental impact in the upstream value chain. In specific terms, this means that if the lifetime of a textile product is doubled, the greenhouse gas emissions per use are halved (see Mistra Future Fashion 2019, p. 8).



Graphic 1: Environmental hotspots

Source: Quantis and Hugo Boss (2017): 2nd Edition of the Environmental Impact Valuation as base for a Sustainable Fashion Strategy.

2. Initial situation

The CWS Group is a provider of sustainable solutions in the fields of Hygiene, Workwear and Fire Safety and, within this context, offers workwear in a rental service. CWS offers its products in a so-called product service system (PSS), whereby garments are rented, washed, repaired and recycled. In 2019, CWS repaired in excess of 2.3 million workwear products in Germany alone. Damaged garments are replaced. CWS relies on its stock of used garments which still meet standard quality requirements as workwear replacements. In 2019, more than 600,000 already used items were reintroduced into the CWS service cycle. The PSS which CWS operates focuses on the provision of high-quality, long-lasting products, repair services and the reuse of used clothing as equivalent replacements for damaged older goods. Based on these facts, this is a paradigmatic case of the applied circular economy (cf. Accenture 2014, p. 12).

3. Object of study

This study contrasts two specific scenarios for the handling of workwear: a linear one and a circular one. In the linear system, a private individual is responsible for his or her own workwear. He or she washes all garments at home, makes minor repairs and replaces worn items with new ones. In the circular system, workwear is provided via the CWS rental service, which is responsible for cleaning, repair and replacement in the event of damage.

The following pages detail how the circular structure of the CWS rental system is able to reduce environmental impact in the form of greenhouse gas emissions significantly compared to a linear system. The study is based on three key central presumptions: First, that a general extension of product life effectively reduces environmental impacts. Second, that CWS operates a PSS in which environmental and economic incentives are created to extend product life. Third, that product life extension is not systematically promoted in a linear system.

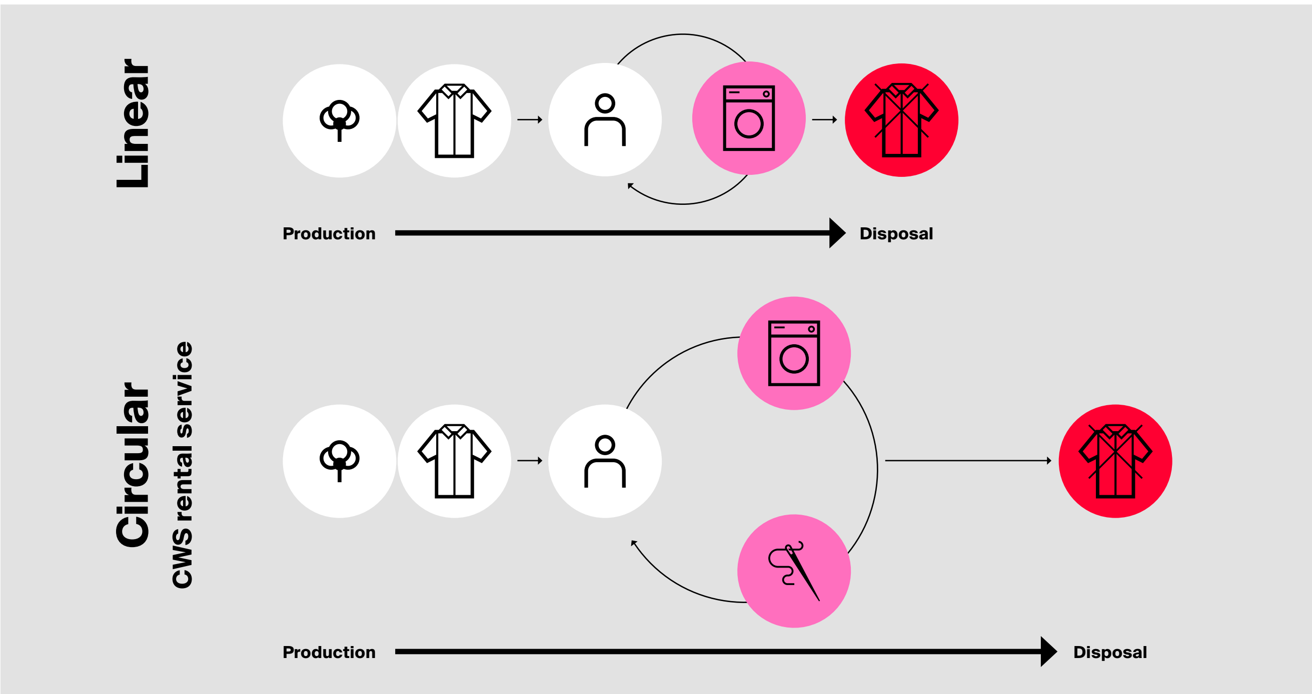
This analysis attempts to quantify the ecological advantages of the circular system based on CO_2 equivalents. These data refer to each service unit via which one person in Germany is supplied with workwear for the duration of one year. This study was compiled with the help of the consultancy firm sustainable thinking and was also supported by experts from Product Management and the Engineering and Operational Excellence departments at CWS.

4. Methodology

To determine the potential CO_2 savings offered by the circular system compared to the linear system, this study focuses solely on two aspects of the usage phase: the reuse of used clothing and the repair of damaged items of clothing. This focus results from the significant differences between the systems under examination: As a rule, the products in the circular system are of a higher quality, the washing services are optimised in terms of their environmental performance and a repair and replacement service is provided. For a linear system, which, in this case, works on the basis of private households, neither the product quality nor the washing processes can be quantified with any real degree of reliability. At the same time, the fundamental possibility of repair and replacement in the linear system is presumed and quantified accordingly (see database studied).

For this reason, it was decided not to take product quality and washing performance, together with the resulting environmental impact, into account. Rather, it is assumed that the products from the linear and circular systems are of the same quality and that the washing processes performed in all areas are equally efficient. As such, the study deliberately omits possible advantages of the circular system, which may be regarded as probable in the areas mentioned: If the quality of the products in the circular system is higher, the environmental benefit could be higher per se thanks to a longer service life. If washing processes in the circular system are more environmentally friendly as the washing load, energy, water and detergent consumption are optimised, the environmental benefit could also be greater. By excluding product quality and washing services, it is possible to get a clear understanding of the environmental benefits of repairs and reuse in circular systems.

The current database on repair and reuse processes was analysed in order to compare the two systems. Based on the qualified assessments of experts the following was established: 1. The repairs which can be performed by a private individual in a linear system. 2. The reuse patterns which can be expected in a linear system. The average greenhouse gas emission values per kilogram were determined for the textile quantities under consideration so that emission differences between the two systems could be calculated using a common reference value. This analysis uses the greenhouse gas emission values of an LCA benchmark study from 2013 in which comprehensive data for the upstream production of textiles (obtaining of raw materials, spinning, weaving, dyeing, etc.) were determined (cf. van der Velden et al. 2013, p. 351).



Graphic 2: System differences

5. Database studied

This analysis examines the specific data for repairs, replacements and reuse of four different workwear collections available in Germany from CWS. In order to ensure a representative sample, a Bluewear collection, an Industry collection, a Catering & Service collection and a PPE collection were all put under the spotlight. The data evaluation takes account of the entire processing volume of these collections in Germany in 2019 with a total of around 550,000 item processing operations. The assumption is that there are 46 washing cycles in the circular and linear system per functional unit.

5.1 Repairs

A total of 86,748 repair events were recorded in Germany for the four collections over the course of the defined study period. Based on the processing volume of 546,345 items, this equates to an average repair rate of 16 per cent. Bluewear trousers in particular undergo frequent repairs, indeed a figure of up to 25 per cent was noted in part. In contrast, items from the Service and Gastronomy sector, especially T-shirts, have a very low repair rate of just 2 per cent.

Workwear experts analysed the repair results and evaluated which repairs could, in principle, be performed as part of a linear system. They concluded that

- 19,985 repair results were feasible (e.g., stuffing)
- 58,592 repair results were feasible but with limitations (e.g., repairs to seams)
- 6,300 repair results were not feasible (e.g., replacement of knee pad pockets)

Table 1: Repair rates

Repairs	Number of repair events	Percentage of overall volume
Regarded as viable in the linear system	19,985	23%
Regarded as viable but with limitations in the linear system	58,592	67.5%
Regarded as not possible in the linear system	6,300	7.2%
Other	1,871	2.1%
Total	**86,748**	**99.8%**

It cannot be assumed that the fundamental feasibility of a repair will mean that a private individual will actually carry it out in 100 per cent of cases in the linear system. Market analyses indicate that only around 50 per cent of wearers repair damaged garments (cf. ETSA and GfK 2014). If we take this value as given, 50 per cent of viable repairs are carried out in the linear system. This equates to around 39,288 repairs or 45 per cent of the total number of repair events. The workwear experts consulted thus agreed on the conservative assumption that around 50 per cent of the repairs performed in the circular system are also carried out in the linear system.[1]

5.2 Replacement

For the four collections analysed in terms of replacements in 2019 in Germany, the processing throughput was 546,375 garments. On average, 0.63 per cent of the processing throughput was replaced with a new or used item. Workwear trousers have a comparatively high replacement rate (up to 5 %) whereas jackets have a lower rate (in part just 0.13 %). An analysis of the CWS data (n= 21,000,000) concluded that 26 per cent of the items exchanged in the circular system were replaced with garments which had already been used. It is assumed that private individuals in the linear system do not use previously owned items for replacements, since a company's stock of used garments is likely to be too small to facilitate a reuse system.

5.3 Calculation scheme

The weight of the initial stock and the processing throughput via which one person in Germany is supplied with workwear for one year were established for each of the collections in this study. Each garment was weighted by applying the actual repair and replacement rates in Germany from 2019 according to CWS data. The weight differences between the new textiles required per collection and system were calculated based on the assumptions that a) 50 per cent of repairs from the circular system are also carried out in the linear system and b) garment reuse is 0 per cent in the linear system and 26 per cent in the circular system. The environmental impact from textile production (unit of measurement: kg CO_2 / kg fabric) was put in relation to this, allowing the environmental benefits of the circular system to be calculated in terms of greenhouse gas emission reductions.

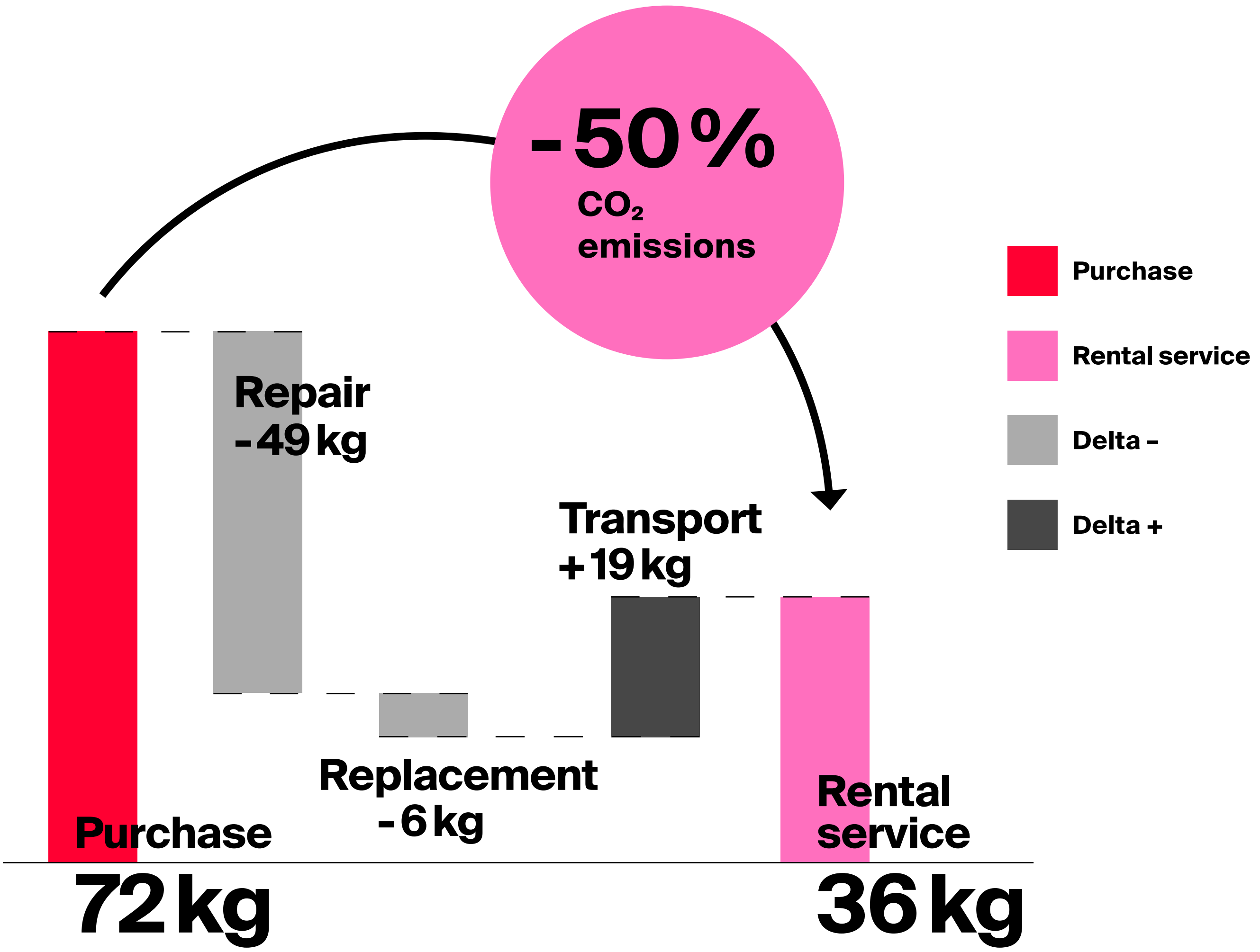
1 More recent studies even suggest that just 23 per cent of wearers repair their clothing (cf. Zalando 2021, p. 22).

6. Results

The proposed calculation model shows that use of the circular system reduces the impact on the environment in the form of greenhouse gas emissions by 76 per cent on average compared to the linear system. If a person in Germany is provided with workwear via the linear system for one year, the new textiles required for this generate 72.16 kg of greenhouse gas emissions. The direct comparison between both systems demonstrates that circular services such as repair and reuse reduce the environmental impact considerably, since fewer new textiles are required.

- Repairs reduce the impact on the environment by 49.11 kg of greenhouse gas emissions per person and year.
- The reuse of used clothing lowers greenhouse gas emissions by 5.99 kg per person and year.

Consequently, circular systems require far fewer new textiles overall and the environmental impact is a mere 17.06 kg of greenhouse gas emissions per person and year.



Graphic 3: Advantages of the circular system

Renting v. buying: Average CO_2 emissions
(kg of CO_2 emitted to supply one worker with workwear for one year)

6.1 Detailed analysis

In the following, the respective results for all four collections included in this study are outlined:

- The greatest absolute and relative reduction in greenhouse gas emissions was recorded for the Bluewear collection. In the linear system, 152.55 kilograms of CO_2 equivalents are produced per person per year. In the circular system, this figure is a mere 28.42 kilograms of CO_2 equivalents per person per year. This represents an 81 per cent overall reduction in emissions.

- The Service & Catering collection achieved the lowest absolute and relative reduction in greenhouse gas emissions. In the linear system, 3.68 kilograms of CO_2 equivalents are produced per person per year. In the circular system, 2.28 kilograms of CO_2 equivalents result per person per year. This represents a 38 per cent overall reduction in emissions.

- The absolute and relative reduction in greenhouse gas emissions for the Industry and PPE collection lie in the mid-range. With the linear system, 70.45 kilograms of CO_2 equivalents are generated per person and year for the Industry collection whereas this figure is 61.96 CO_2 equivalents per person and year for the PPE collection. In contrast to this, with the linear system 19.03 kilograms of CO_2 equivalents result per person and year for the Industry collection and 18.64 CO_2 equivalents per person and year for the PPE collection. This is the equivalent of an overall reduction in emissions of 73 per cent for the Industry collection and an overall reduction of 70 per cent for the PPE collection.

Table 2: Comparison of systems based on collections

	Linear system*		Circular system*		Reduction (%)
Collection	**Kg of new textiles which are required per service unit**	**Greenhouse gas emissions per service unit**	**Kg of new textiles which are required per service unit**	**Greenhouse gas emissions per service unit**	
Bluewear	11.45	152.55	2.13	28.42	81%
Industry	5.29	70.45	1.43	19.03	73%
PPE	4.49	61.96	1.35	18.64	70%
Service & Catering	0.27	3.68	0.17	2.28	38%

* Provision of workwear to one person for one year in Germany

6.2 Consideration of transport emissions

With regard to the overall potential savings for greenhouse gas emissions, a central disadvantage of the circular system must be addressed: the additional transportation requirements for the clothing used which do not apply to the linear system. This presents the question as to whether the additional transport emissions cancel out the benefits of the circular system. The additional effects of transportation on the climate were calculated for the circular system based on the data on greenhouse gas emission efficiency in the CWS logistics department (0.16 kg CO_2 equivalents per kg of washed laundry for Germany) and the weight of the laundry per person and year for each of the analysed collections.

On average, 118.87 kg of textiles are washed per person and per year, which result in 19.01 kg of greenhouse gas emissions when transported. Despite the additional transport requirements, the total amount of greenhouse gas emissions caused is still significantly less in the circular system. In the linear system, 72.16 kilograms of greenhouse gas emissions are produced per person and year (as already explained above). In the circular system, this figure is 36.06 kilograms of greenhouse gas emissions per person and year, including the transport emissions that occur. Therefore, despite transportation, the total emissions in the circular system are still down by almost 50 per cent.

7. Conclusion and discussion

This study clearly shows that circular services such as repair and reuse offer significant environmental benefits. For CWS, these environmental benefits correspond to an average reduction in greenhouse gas emissions of 76 per cent per service unit. The study explicitly does not consider the impact of laundry services and product quality. Yet, as it can be assumed that circular system operators optimise their products to ensure high quality and durability and, at the same time, also design their laundry services to be as environmentally friendly as possible, even more striking saving effects in connection with CO_2 equivalents could be revealed were these data also to be factored in.

It must be made clear that this paper does not claim to be a scientific study. Rather, it is an attempt to quantify the potential environmental benefits of circular services employing primary data from CWS and to present these for public discussion. For this reason, possible critical points are summarised below.

Self interests:

As a rental service provider for workwear, CWS has not only an ecological but also an economic interest in this issue. Given that the workwear is rented and not sold in the conventional manner, CWS sets great store by high-quality and durable products for economic reasons. For the same reasons, CWS has an interest in repairing the products and replacing damaged items with previously used ones. This clear interest-bound position is reflected at multiple points throughout this study, for example through the choice of methodology which deliberately ignores factors that cannot be quantified reliably and the use of conservative estimates that have not been determined empirically. The consistent transparency of the method used is intended to help ensure intersubjective comprehensibility.

Estimated values:

The value of this analysis depends essentially on two factors that could only be estimated. The reference here is, of course, to the repair and reuse rates that were postulated for the linear system. The repair rate in particular has a decisive influence on the results of the study. This poses the question: What would the results be like if a considerably higher repair rate were to be presumed for the linear system? If one assumed that a private individual using a linear system performs all the repairs which can be done with limitations, this would correspond to 90.5 per cent of all repairs in the circular system (cf. Table 1). However, even if this unrealistically high repair rate is applied to the linear system, the circular system still boasts a significant relative environmental advantage of 48 per cent (linear system: 32.91 kg of greenhouse gas emissions per person and year. Circular system: 17.09 kg of greenhouse gas emissions per person and year.

Collections:

The environmental advantages in terms of reduced greenhouse gas emissions are particularly striking when companies use collections which are subject to considerable wear and tear, e.g., Bluewear. For customers with Service and Gastronomy collections, the effects of repairs and reuse are on the lower side in absolute terms. If one takes into account the rather low absolute environmental benefit and the rather high absolute effects from transport (each in terms of GHG emissions) in these cases, the circular system could, in fact, generate higher greenhouse gas emissions overall. Nevertheless, the overall effects of all the collections are positive.

8. References

Accenture 2014: https://www.accenture.com/t20150523t053139__w__/us-en/_acnmedia/accenture/conversion-assets/dotcom/documents/global/pdf/strategy_6/accenture-circular-advantage-innovative-business-models-technologies-value-growth.pdf

ETSA and Gfk: https://www.textile-services.eu/news/new-study-reveals-risks-when-workwear-is-washed-at-home.cfm

Mistra Future Fashion 2019: http://mistrafuturefashion.com/wp-content/uploads/2019/08/G.Sandin-Environmental-assessment-of-Swedish-clothing-consumption.MistraFutureFashionReport-2019.05.pdf

McKinsey 2020: https://www.mckinsey.com/~/media/McKinsey/Industries/Retail/Our%20Insights/Fashion%20on%20climate/Fashion-on-climate-Full-report.pdf

Quantis and Hugo Boss 2017: https://group.hugoboss.com/fileadmin/media/pdf/sustainability/2017-05-31_2nd_White_Paper_EIV.pdf

Systain and Adelphi 2017: https://www.adelphi.de/en/system/files/mediathek/bilder/Umweltatlas%20Lieferkette%20-%20adelphi-Systain-englisch.pdf

Van der Velden et al. 2013: https://link.springer.com/article/10.1007/s11367-013-0626-9

Zalando 2021: https://corporate.zalando.com/en/attitude-behavior-gap-report

9. Graphics and tables