Consumption patterns of construction workwear and circular strategies to prolong its lifetime

Marianna Lena Kambanou, Karin Gagnerud and Mattias Lindahl

Kambanou, M. L., Gagnerud, K., Lindahl, M., (2023), Consumption patterns of construction workwear and circular strategies to prolong its lifetime, *PROCEEDINGS 5th Product Lifetimes And The Environment (PLATE) Conference*, pp. 474-479.

https://urn.fi/URN:ISBN:978-952-64-1367-9

Aalto University
School of Arts, Design
and Architecture

PLATE
Product Lifetimes
And The Environment

5th PLATE 2023 Conference
Espoo, Finland - 31 May - 2 June 2023

Consumption patterns of construction workwear and circular strategies to prolong its lifetime

Marianna Lena Kambanou[(a)], Karin Gagnerud [(a)], Mattias Lindahl[(a)]
a) Linköping University, Department of Management and Technology, Linköping, Sweden

Keywords: Circular business model; Textile industry; Overconsumption; Circular strategy; Uniforms.

Abstract: The textile industry is characterized by unsustainable consumption patterns so circular strategies are being implemented to reduce consumption and waste. Workwear is a significant part of the textile industry but has received little attention from the research community. The aim is to describe the consumption patterns of a specific segment of the workwear industry i.e., construction workwear and explore circular strategies that prolong its lifetime. Data is collected through two sets of interviews, one with construction companies and one with companies in workwear industry and analyzed based on seven circular strategies: Refuse, Rethink, Reduce, Reuse, Repair, Refurbish and Remanufacture. The research is conducted in Sweden where employers usually provide clothes to employees. Concerning consumption patterns, the main finding is that workwear is usually discarded due to physical defects to the product, but workwear might also lose aesthetic and comfort value. Most construction workers wash their workwear at home, but some never wash items e.g., work trousers. The most promising circular strategy for construction workwear is repair, however, it is not commonplace. Therefore, construction companies need to set up easy-to-use processes and incentivize workers to send their clothes to repair. The lifetime of clothes has already been prolonged due to design changes in recent years and there is potential for more design improvements that can facilitate various circular strategies. Some infrequent fast fashion tendencies were noted, that should be addressed through policy and other measures. This study demonstrates that the workwear industry cannot be considered a homogeneous market, because different conditions that influence circular strategies apply to different segments.

Introduction

The textile industry is a resource-intensive, highly polluting industry that produces between 8-10% of the global CO2 emissions (Niinimäki et al., 2020). The primary culprit is unsustainable consumption patterns i.e. overconsumption (Chen et al., 2021; European Commission, 2022). Workwear is a growing part of the clothing industry (Grand View Research, 2022). However, focus has been on the fashion industry, and it is not known if this growth can be attributed to unsustainable consumption patterns (Malinverno et al., 2023). A specific workwear segment is construction workwear that includes personal protective equipment e.g. gloves, a legal requirement in many countries, and other items such as jackets etc. Many companies voluntarily provide workers with clothing to increase comfort, make them instantly recognizable and for branding purposes (Grand View Research, 2022). Moreover, in some countries there are collective agreements in the construction sector that require employers to provide workwear.

Circular economy strategies, such as sharing and reusing (Bocken et al., 2016), are being implemented to reduce consumption and waste in the textile industry and to support a transition towards a circular economy "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized" (European Commission, 2015). Although there has been a fair amount of research on circular economy in the fashion industry (Shirvanimoghaddam et al., 2020) and some segments in the workwear industry e.g., healthcare (Kumar et al., 2022), no study focusing specifically on construction workwear could be identified.

This research, therefore, seeks to fulfil two specific aims:

- to present data on the consumption patterns of construction workwear,
- to explore which circular strategies that prolong construction workwear's lifetime e.g., reuse, are applicable in the context of these consumption patterns.

The research is conducted in Sweden, where the use of certain types of personal protective equipment is regulated and where most employments are governed by collective agreements assigning responsibility to the employer to provide workwear.

Research method

To meet the two research aims stated in the introduction, two separate sets of interviews are done, separately analysed, and then synthesized. Participants are informed of the purpose of the study and their participation is voluntary.

The first set consists of short interviews with construction companies to reveal workwear consumption patterns. This is a structured interview study involving a total of 25 randomly selected companies in construction, of which 14 have fewer and 11 have more than 20 employees. The interviews are conducted with workers or workwear buyers. The interview questions investigate the following areas: (i) the number of discarded work trousers per year, (ii) reasons for and attitude towards discarding workwear, (iii) washing routines for work clothes, (iv) attitude towards circular strategies. The interviews lasted 10-45 minutes and were conducted over the phone, and notes were taken.

The second set consists of 5 long semi-structured interviews with companies implementing a variety of circular strategies for workwear identified through an internet search or through the authors' networks. Company 1 has its own brand of construction workwear including a modular design that makes washing and repairing work trousers easier. Company 2 provides washing service contracts for workwear that may or may not include workwear rental. It is exploring entering the construction sector. Company 3 is a group of tailors offering repair services for all types of clothing including workwear. Company 4 and Company 5 are both primarily retailers for large construction workwear manufacturers but also offer washing services. Both encourage reduced consumption and Company 4 is in the process of setting up a repair option. Each interview lasted for about 1 hour. They were conducted and transcribed using the MS Teams software.

The data from the two sets of interviews are combined and analysed using the circular strategies framework, presented by Potting et al. (2017). They have a detailed framework of ten different strategies Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle and Recover that can be applied to products. The three last strategies are however, considered out of scope because they do not focus on prolonging the lifespan of a product but either of its parts (Repurpose) or of the materials it comprises (Recycle and Recover).

The study is limited to the construction industry and any attempt to generalize the results to other industries must be done with care. Similarly, when generalizing the results to other countries their similarities to the Swedish workwear industry should be considered. Finally, the study is also limited by the number of participants, as for example, no large workwear manufacturers were included in the study.

Consumption patterns of workwear

In this section the results from the first set of interviews with the construction companies are presented. The interviewees provided a variety of reasons for discarding workwear and explained their attitude towards circular strategies that can prolong workwear lifetime.

Discarding workwear

The number of discarded work trousers per year can be seen in Figure 1. The average is 2.3 pairs of trousers per year per worker. The reasons for discarding workwear can be categorized into two overarching groups. In the first group are the reasons connected to damage which means that the garment loses its functional properties. Damage includes ripped seams, holes in the knees and pockets, abrasions in the crotch, holes in shoes, and broken zippers and buttons etc. The second

group of reasons concerns workwear losing its aesthetic and comfort properties. Workwear can become dirty or stained with concrete and paint, or can lose its colour, logo, or shape over time, making it less attractive or uncomfortable to wear. Many stated that gloves are disposed of at a very high frequency.

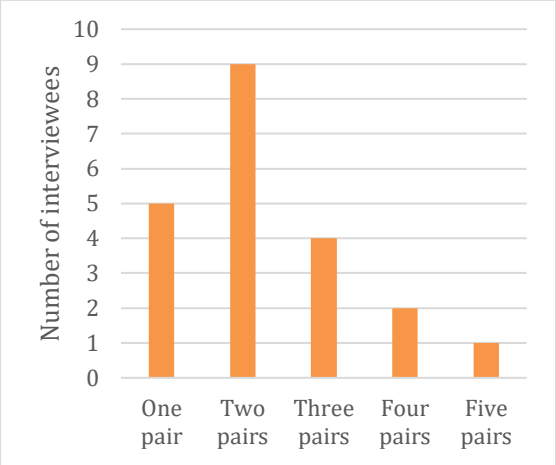

Figure 1. Number of discarded trousers per year.

Two opposing forces have affected how often clothes get discarded in the workwear industry in recent years. On the one hand, the design of clothing in the last 15 years has contributed to increasing its lifetime. Fabrics with stretch properties, better fitting clothes, crotch gussets i.e., a diamond-shaped piece of fabric sewn into the crotch area, better reinforcement in the knees and materials that are easier to wash have all contributed to prolonging the lifetime of the clothes.

On the other hand, many said that both construction companies as well as individuals are more concerned about their appearance than they used to be. Appearance is part of a company's branding, and it is also a question of personal image on the individual level.

Therefore, new and fresh-looking garments are considered important. As one interviewee said: "Some people change clothes just because they are done with a construction project". However, this attitude is not true of everyone as a number of interviewees stated that workwear is used until it is worn out and it can image consciousness can mean that some people take more care of their workwear.

Washing workwear

Out of the 25 interviewees, 68% and 16% report washing their workwear at home or on the company's premises respectively. While washing at home is not a problem for most workers, removing concrete and paint stains proves to be a challenge. Additionally, two workers report damaging their washing machines due to forgotten nails and screws in their pockets. T-shirts are consistently washed after every use, but the frequency of washing trousers varies greatly. 20% of workers wash their trousers once a week, 20% every other week, 20% once a month or longer, and 12% somewhat unexpectedly never wash their trousers and 28% are unsure how often they do. With regards to procuring washing services, most interviewees represented small to medium-sized companies that operate at various building sites and therefore didn't view it as a possibility due to logistics challenges. Moreover, construction workers have clothes which fit their size in both length and width, as well as the type of work they do and thus a washing solution with shared clothes, similar to the healthcare sector, is not considered an option.

Circular strategies

None of the interviewees carry out repairs to their workwear. Many expressed that it is not worth their time or effort to repair their garments, instead opting to discard them when they become too damaged. Both repairing them themselves and using repair services e.g., tailor is considered time consuming. Moreover, there are no formal and easy-to-use processes for using repair services. There is also a lack of incentives as it is the company's job to provide new workwear and they personally gain nothing by repairing. One worker said *"if the holes in the workwear become too numerous, it is simply time to dispose of the garment"*.

Workwear cannot be reused by others due to the existence of company logos on the clothes. However, there is potential for reusing the same clothes within the company for seasonal staff, if they are the right size, for the right application and in a good enough condition. Clothes are discarded by the individuals who decide themselves whether to sort them into textile recycling bins or household waste.

Circular strategies to prolong the lifetime of workwear

Circular strategies describe how companies can go about prolonging the lifetime of a product. In this section we provide an overview of possible circular strategies for workwear based on the results of both sets of interviews. The findings are analysed using the framework of circular strategies presented by Potting et al. (2017).

Refuse means abandoning the function of workwear. Workwear is necessary because people need to be clothed and construction workwear fulfils an important safety function. According to the interviews with the construction companies design has already increased the workwear's lifetime and Company 1 said that there is potential for more design improvements. The interviews also revealed that some few workers are replacing clothes due to a desire for new rather than damage, a behaviour which can be targeted.

Rethink means that workwear is used more intensively e.g., through sharing. Workers need their specific clothes on a daily basis and there is no time to wash between shifts thus sharing is not an option for this industry. However, Company 1 and one of the interviewees from the construction companies mentioned that through better inventory management seasonal and short-term staff could share clothes. Company 2, similarly, said that some companies have back-up clothes that never get used and could be managed differently.

Reduce means increasing efficiency during the manufacturing and use phases. Companies 1, 2, 4, 5 said that manufacturers implement ambitious efficiency measures in production, but that reducing quality will have an adverse effect on the lifetime. According to Companies 2, 4 and 5 there is a potential to increase efficiency during washing by using professional wash services. However, there is a trade-off between the energy saved in the washing and the energy needed to transport the clothes back and forth.

Reuse means using discarded workwear, by another worker without intervention to the clothes. Firstly, the consumption patterns show that most of the workwear is discarded when it is damaged thus reuse is not possible. Moreover, the Swedish tax agency states that workwear has to bear the employer's name or logo, so it noticeably differs from ordinary garments if it is to be tax deductible. To make clothes usable by people outside of the company, they should either be re-designed so that the logo is removable e.g., stitched on or the regulations would need to be removed (Companies 1 and 2).

Repair means using workwear with its original function, by the same or another construction worker, after its repair and or maintenance. Firstly, repair must not compromise workwear safety (Companies 4 and 5). Nevertheless, physical defects to the product are, according to the construction companies, the most common reason for discarding workwear. Therefore, repair holds a large potential for prolonging the lifetime and is a relatively simple solution that Companies 2, 3, 4 and 5 are implementing. However, Companies 3 and 4 said that workwear is still relatively cheap, and labour costs for repair and freight are expensive, making repair only marginally cheaper that buying new. These costs could be lowered by sending workwear in bulk for repair. Similarly, to the construction companies, Company 4 said that incentives were missing for workers to repair and suggested lowering their allowance for buying new clothes. Both Companies 4 and 1 said that the workers need a simple and well-organized process for sending and receiving garments and paying so as to make repair more convenient. The interview study also revealed that 12% do not wash their work trousers and 20% do it once a month s, and thus, washing could potentially prolong workwear lifetime. Moreover, wash contracts usually include repair. Wash contracts is a strategy that Companies 2, 4 and 5 implement although they are in complete agreement with the construction companies, that it is not currently suited to small companies that move around different construction sites. Moreover, Company 2 who is experienced in this sector said that the environmental benefits are uncertain due to impacts from digitalization, transport and the amount of clothing needed per person.

Refurbish and Remanufacture means to restore workwear to its original function by making quite large interventions or by only using parts of it. This strategy was not mentioned by any interviewee, probably because the properties of

workwear do not allow for larger interventions beyond repair. Company 1 however has designed modular clothes where the knees which wear out fast can be replaced by the user. The aim is to sell this as an on-demand refurbish option. This demonstrates that design might make this strategy possible.

Conclusions

This research presents data on the consumption patterns of construction workwear and explores the potential of various circular strategies to prolong construction workwear's lifetime. The main findings are that construction workwear is discarded because it loses its functional properties e.g., damage but also because it loses its aesthetic and comfort properties. Most workers wash their clothes at home but 20% wash their trousers once a month or more seldom and 12% never wash them. The effects of this are unknown but could potentially shorten the lifespan.

The most promising circular strategy for construction workwear is repair although construction companies need to set up easy-to-use processes and incentivize workers to send clothes to repair. Improving quality through design to extend the lifespan is also promising. Design plays a key role in enabling many circular strategies for workwear e.g., refurbishing. Some strategies might need government support such as putting a stop to some fast fashion tendencies that have been observed before they become commonplace and changing regulation about company branding of workwear to allow for reuse.

Similarly to Kumar et al. (2022) and Malinverno et al. (2023) this study also finds that workwear offers a different set of opportunities in terms of circular strategies compared to fashion because, for example, it is a B2B transaction so freight costs for repair can be minimized. This study goes a step further and shows that the workwear industry cannot be considered a homogeneous market, because different conditions that influence circular strategies apply to different segments. For example, rental contracts that include wash services and sharing of clothes between staff commonly used in the healthcare sector cannot be easily transferred to the construction industry where construction workers move around various construction sites and need clothes that fit their size and job. Therefore, the workwear industry should be both differentiated from the fashion industry and further segmented when exploring circular strategies on a granular level. Further research is needed into the various workwear segments and their contexts.

Acknowledgements

This research is part of the project "Circular workwear in construction and industry" No.52057-1 funded by The Swedish Energy Agency, Sweden´s Innovation Agency and The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning. The authors would also like to thank Jeanette Engzell, Annelie Carlsson, Herbert Jacobson and Johannes Matschewsky for their support.

References

Bocken, N. M. P., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33(5), 308-320.

Chen, X., Memon, H. A., Wang, Y., Marriam, I., & Tebyetekerwa, M. (2021). Circular Economy and Sustainability of the Clothing and Textile Industry. Materials Circular Economy, 3(1), 12.

European Commission. (2015). Closing the Loop - an EU Action Plan for the Circular Economy. Brussels, 2.12.2015 COM(2015) 614 final

European Commission. (2022). EU Strategy for Sustainable and Circular Textiles. Brussels, 30.3.2022 COM(2022) 141 final

Grand View Research. (2022). Workwear Market Size, Share & Trends Analysis Report By Product (Apparel, Footwear), By Application (Chemical, Power, Biological), By Demography (Men, Women), By Region, And Segment Forecasts, 2022 - 2030.

Kumar, V., Ekwall, D., & Zhang, D. S. (2022). Investigation of rental business model for collaborative consumption - workwear garment renting in business-to-business scenario. Resources, Conservation and Recycling, 182, 106314.

Malinverno, N., Schmutz, M., Nowack, B., & Som, C. (2023). Identifying the needs for a circular workwear textile management – A material flow analysis of workwear textile waste within Swiss Companies. Resources, Conservation and Recycling, 189, 106728.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. Nature Reviews Earth & Environment, 1(4), 189-200.

Potting, J., Hekkert, M., Worrell, E., & Hanemaaijer, A. (2017). Cicular Economy: Measuring innovation in the product chain. In: PBL Netherlands Environmental Assessment Agen,cy.

Shirvanimoghaddam, K., Motamed, B., Ramakrishna, S., & Naebe, M. (2020). Death by waste: Fashion and textile circular economy case. Science of the Total Environment, 718, 137317.