**Research Article**



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# Perceived Environmental Implications of Clothing Maintenance Among Consumers in Gauteng Province, South Africa

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***Abstract***

*In 2018, global fashion produced 2.1 billion tonnes of greenhouse emissions. According to life-cycle assessments (LCA), the use phase in clothing life cycles is the most harmful to the environment. During the use phase, clothing maintenance is associated with high water and energy consumption and is the most polluting stage in the clothing life cycle. In addressing the environmental impact of the clothing and textile industry, the design and manufacturing phases overshadow the clothing maintenance/care phase. As part of their social responsibility, clothing companies do not concern themselves with how sold garments are utilised after purchase. A disconnect emerges between seller and buyer immediately after a garment is bought and leaves the retail environment. As a result, the clothing consumer assumes full responsibility for managing the environmental impacts that characterise the use phase. Yet, most consumers need to be equipped with the knowledge to empower them to understand the ecological implications. This study aims to establish the level of sustainability awareness among young consumers in a major South African university of technology concerning clothing maintenance and to establish whether environmental knowledge translates into sustainable practice. The study applied a quantitative research approach, using semi-structured questionnaires, to gather information related to the ecological impact of washing, drying, and ironing clothing, as well as washing detergents and fabric softeners. The findings show that most participants were aware of 'eco-fashion' as a general term related to environmental welfare but were unaware of how the activities involved in the care of clothing may affect the environment. Some participants demonstrated poor knowledge, and many did not relate clothing-care equipment and products such as detergents and fabric softeners to adverse environmental impacts. Few participants consulted fabric and care label instructions during laundering and ironing to avoid ecological damage. Most participants also did not understand the health and environmental dangers caused by dry cleaning processes. The research concludes that there is a generally low level of sustainability awareness among young consumers of clothing and a low rate of translation of sustainability literacy into sustainable action in the care and maintenance of clothing. The paper recommends that clothing manufacturers and retailers provide consumers with sustainable post-purchase information as part of their environmental responsibility.*

***Keywords:*** *eco-fashion, sustainability literacy, clothing maintenance, young consumers, South Africa*

## 1. Introduction and Background

The apparel industry is resource-intensive and wasteful (Fletcher, 2009; Gwozdz, Nielsen and Müller, 2017). The fashion industry produced 2.1 billion tonnes of greenhouse emissions(GHG) in 2018, which accounts for 10% of total global emissions (U.N., 2018). Most consumer goods contribute to environmental damage, but the apparel industry is the most problematic due to its scale, and this is compounded by the high replacement rate of the product and by its characteristic speed of production (Cimatti, Campana and Carluccio 2017; Sandin et al., 2019; Mollel-Matodzi, 2021). New fashion styles emergent every season seduce customers into staying relevant with ever-changing trends. As consumers pursue fashion trends, wardrobes and closets get filled, fuelling routine care and maintenance, washing, and clothing disposal. Scholars who address the environmental impact of the clothing industry observe that the use and maintenance stage of a garment's life cycle receives less preference in comparison to clothing design and manufacturing (Bain, Beton, Schultze, and Mudgal, 2009; Fletcher, 2013). Most clothing companies relinquish their environmental concerns once the merchandise leaves the store, leaving the environmental responsibility of garment use and disposal to the consumer.

Studies indicate that the fashion and textile industry causes many environmental problems resulting from water use and herbicides, effluents and other harmful wastes produced at various stages of textile production and apparel manufacturing processes (Sandin, Roos and Johansson, 2019). Furthermore, consumers' ongoing care of apparel products has significant adverse environmental impacts (Laitala, Klepp, Kettlewell and Wiedemann, 2020; Moon, Amasawa and Hirao, 2020). The textile manufacturing process contributes to environmental pollution and degradation in diverse ways, starting with highly toxic fertilisers and sprays used at the agricultural stages of textile-producing plants, such as cotton (DEFRA, 2008; Pal, 2017). Chemicals used for factories' synthetic fibre production, fibre finishing, and gas emissions have adverse ecological effects (Pal, 2017; Moazzem, Daver, Crossin and Wang, 2018; Sandin et al., 2019). The U.N. (2018) reports that the clothing and textile supply chain accounts for 10% of GHG, highlighting that the industry uses more energy than other heavy energy users, such as the aviation and shipping industries (U.N.,2018). A combination of carbon footprints resulting from transporting apparel, chemicals and energy used during laundering processes and waste disposal causes actual damage to the environment (Allwood et al., 2006; Gwilt, 2014; Sandinet al., 2019). The energy required to run machines, treat water, and use water in residential and commercial sectors worldwide, is estimated at 290 million metric tonnes of carbon dioxide per annum (Ro, 2020). The United Kingdom accounts for 11%, while the USA accounts for 19% of all energy used in laundry processes (Ro, 2020).

Although the care of clothing is an individual activity, it has vast environmental impacts at the collective scale. Research shows that the most negative impact results from the laundering process, especially in the developed world (Wiedemann, Biggs, Nebel, Bauch, Laitala, Klepp, Swan, and Watson, 2020; Laitala, Klepp, Kettlewell and Wiedemann, 2020; Moon, Amasawa and Hirao, 2020). Fletcher (2013) observes that even if a typical garment is only washed and dried approximately 20 times in its lifetime, most of the total environmental impact from the entire life cycle arises from this laundering process. In the USA, for example, a washing machine is estimated to use at least 41 gallons (155 litres) of water per washing load. Washing loads amount to approximately 400 per household per annum, amounting to 16,400 gallons (62,080 litres) of water per household (Edwards, 2018).

According to Statistics South Africa (2018), there are 14.5 million households in South Africa, 77.6% (11.3 million) of whom live in formal dwellings. Frequent washing by 11.3 million households in South Africa means that large volumes of chemicals embedded in soaps and detergents are released, which leads to water pollution. Cloete et al. (2010) confirm that South Africa's laundry industry contributes to environmental challenges resulting from excessive water usage and effluents. With household washings and clothing care happening continuously in South Africa, excessive water and energy usage, alongside the release of accumulated chemicals, end up damaging the environment. South African annual household clothing expenditure witnessed an increase from R4,284 ($282) in

2012 to R4,687 ($308) in 2020 (Statistics South Africa, 2019). Such expenditure estimates at 10–16 additional garments acquired per consumer per year, translating into several different wash loads per household.

## 2. Research Aims

The research explored the sustainability literacy of young consumers concerning clothing maintenance. The sub-aim examined consumers' translation of sustainability literacy into current clothing maintenance behaviours. Clothing maintenance behaviour includes the selection of washing machines, tumble dryers, irons or steamers, washing detergents and fabric softeners, and practices of clothing preparation (sorting) during washing, drying, and frequency of washing. At the time of data collection for this research, in 2018, no other known study in South Africa had investigated the prevalence of consumers' clothing-use sustainability knowledge and the impact of this knowledge on clothing maintenance.

## 3. Literature Review

The textile and apparel supply chain contributes to a negative environmental impact, with the apparel use stage accounting highest harm according to life-cycle assessments (LCA). Many scholars, such as Allwood et al. (2006); Chen and Burns (2006); Bain et al. (2009); Laitala and Boks (2012); Siegle (2014); Cimatti, Campana and Carluccio (2017), and Moazzem et al. (2018) agree that the care phase consumes the most energy and water becoming the most polluting stage in the garment's life cycle.

The following section discusses the different clothing maintenance stages contributing to environmental challenges.

### *3.1 Washing and Drying*

Washing is laundering clothes, either by hand or with a washing machine. Drying clothing refers to using a tumble, condenser, or outdoor drying line (Laitala, Boks & Klep, 2011). Ironing constitutes pressing a garment to remove creases using electric irons or pressers (Cheluget, 2017). According to a study by Cloete, Gerber, and Maritz (2010), the laundry industry accounted for 0.07% (0.2340 Mm3) and 0.32% (0.2186 Mm3) in annual industrial water use and chemical emission, respectively. Home laundering uses energy to heat water in preparation for washing, adding to the force used to propel washing machines during washing and drying (Chen & Burns, 2006; Gwozdz et al., 2013). Business for Social Responsibility (2009) estimates that 90% of washing machine energy demand goes into heating the water and drying in the United States and the United Kingdom. A washing machine requires approximately 350-500 watts of energy per wash (Ibid.). Washing a pair of jean trousers is responsible for almost two-thirds of the energy consumed throughout the life cycle of the trousers (Bain, Beton, Schultze, and Mudgal, 2009; Levi Strauss & Co, 2015). Men's cotton underwear cleaning is estimated at 80% of the total U.K. household washing energy demand while laundering a polyester blouse uses around six times as much energy as required to manufacture polyester fabric (Bain et al., 2009).

Regular washing and drying account for 40-80% of the total life cycle emissions in the United States (Ibid.). Due to weather conditions in South Africa, drying machines are less used; however, washing machines still consume large amounts of energy in many South African households. Murphy (2006) observed that South African home uses between 4% and 22% of household water for laundry, estimated at 52 Litres per person daily. Therefore, South Africa has a significant amount of water usage attributed to domestic laundering. With 16.7 million South African households (Statista, 2021), it is evident that energy usage during washing activities contributes immensely to environmental challenges. Washing detergents are furthermore chemical substances used to break up and remove grease and dirt (Ameh, Isa and Oduka, 2010; Lenntech, 1998). Detergents contain soap and surfactants[1] Soap comes from natural products such as animal fat and wood ash (Wolf & Friedman, 1996). Laundry detergents, however, comprise complex chemical compounds of surfactants, builders[2], bleaches, colourants, fluorescent brighteners, fragrances, and enzymes[3] (Bajpai & Tyagi, 2007; Ameh, Isa and Oduka, 2010). Many components in detergents amalgamate from crude oil, which is non-biodegradable and forms build-ups in waterways over time (Mathew & Malcolm, 2000). Poisonous pollutants and carcinogens are lethal to aquatic life and, over time, are released during the degrading process of the detergents or when they interact with other chemicals (Ibid.).

Detergents have many uses, in many products, from hair shampoo and washing powder to shaving foam and stain removers (Mathew & Malcolm, 2000). The essential ingredients are chemicals called surfactants (a contraction of the term 'surface-active agents') (Bajpai & Tyagi, 2007; Schmitz & Stamminger, 2014). In addition, some dyes and pigments threaten human health, and removing them from detergents is environmentally significant (Malik, 2003). Detergents that contain inorganic phosphates can cause eutrophication[4]in freshwater. Eutrophication in water promotes the growth of organisms such as algae, which causes a decrease in oxygen concentration and endangers aquatic life (Schmitz & Stamminger, 2014). Human well-being and the environment depend on finding alternative cleaning processes and technologies. A household laundry equipped with an eco-friendly washing machine and eco-friendly detergent dispensers can help to keep pollutants out of the water.

Ozone [5] technology to clean laundry is another option to comply with environmental requirements (Pentiti and Paloviita, 2007; Ciabatti, Cesaro, Faralli, Fatarella and Tognotii, 2009. According to Weeter (2017), cleaning with ozone avoids chemicals and is based on a direct mechanism where the ozone breaks down chemical bonds through oxidation. Cleaning with ozone is based on an indirect agent in which the ozone reacts first with the water to produce hydroxyl (O.H.) radicals[6] that oxidise chemical bonds. Ozone does not involve hazardous chemical reactions as it leaves no chemical residues and degrades naturally.

### *3.2 Dry Cleaning*

Dry cleaning is a washing process that uses organic solvents instead of water (Izzo, 1992; MacWilliam, 2010). Environmental and social issues from the dry cleaning industry are associated with toxic chemicals (Izzo, 1992). About 80% of dry cleaning establishments use tetrachloroethylene (or perchloroethylene), commonly known as PCE. This chemical is toxic to humans and the environment and causes greenhouse gas emissions (MacWilliam, 2010). According to the Environmental Protection Agency (EPA) (1994), 80–85% of tetrachloroethylene emitted yearly in the USA happens through evaporation from dry cleaning companies.

Tetrachloroethylene is one of the most harmful air pollutants contributing to global warming (Diodovich et al., 2005). When people are exposed to this chemical and inhale the fumes, it affects the central nervous system and causes dermatitis, among other health issues (Environmental Protection Agency, 1994). Tetrachloroethylene is a possible human carcinogen resulting in

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[1] *Surfactants can be organic substances or detergents/ foaming agents that break down oils and remove dirt in the clothing during washing making them clean clothes (Ameh, Isa and Oduka, 2010).*

[2] *Builders are substances that improve the quality of the water, such as softening it to make it easy for detergents and soaps to work effectively and efficiently, thus simplifying the washing process (Wolf & Friedman, 1996).*

[3] *Enzymes are catalysts that speed up reactions. In laundering, enzymes loosen stains for soaps and detergents to work effectively. Clothing stains are composed of various molecules, so enzymes are required to loosen the molecules during washing (Ameh, Isa and Oduka, 2010).*

[4] *An increase in the rate of supply of organic matter to an ecosystem (Nixon, 1995).*

[5] *Ozone is an unstable oxidising agent with three oxygen atoms usually found in the ozone layer in the atmosphere (Weeter, 2017).*

[6] *Hydroxyl radicals are highly oxidi] sing agents that attack most organic molecules (Tchobanoglous et al., 2003).*

oesophageal cancer, cervical cancer, leukaemia, and bladder cancer, among others (Diodovich et al., 2005). According to a study done in the USA (HSIA, 1999), dry cleaning activities still accounted for 36% of PCE usage. Dry cleaning facilities are present in every city in South Africa, and they still use tetrachloroethylene. The environment, the people who work with dry cleaning chemicals, and those who wear dry-cleaned clothes continue to face health hazards. Scholars observe that dry-cleaned garments with tetrachloroethylene contribute to household air pollution (Kawauchi & Nishiyama, 1989; Weber, 1992). Further research is recommended in South Africa to establish more information on this matter.

The second most used dry-cleaning chemical is a hydrocarbon[7] (paraffin solvent), considered a safer alternative to tetrachloroethylene (MacWilliam, 2010). Although it is less toxic, it also contributes to greenhouse gas emissions and industrial smog[8] (MacWilliam, 2010). However, there is little health-related information available on hydrocarbon. As with tetrachloroethylene, the South African dry cleaning industry has to consider safer ways of dry cleaning clothing in response to health and environmental concerns.

Safer dry cleaning alternatives are odourless and colourless (MacWilliam, 2010). The secure methods include methylsiloxane (used in antiperspirants, roll-on deodorants, and shampoos). Studies show that methylsiloxane has low toxicity levels and no adverse effects on humans or the environment (Silicones Environmental Safety Council of North America, 2008). Another alternative is propylene glycol ether which is not used much in the industry; these chemicals contain low toxicity when taken orally or inhaled (United Nations Environmental Programme, 2003). Liquid $CO_2$ is another safe chemical for dry cleaning purposes. Since $CO_2$ is a by-product of manufacturing procedures and part of the human respiratory process, there is no additional gas production and, therefore, less environmental impact (MacWilliam, 2010). Liquid $CO_2$ as a dry-cleaning agent is non-toxic; however, its use is at the infancy stage the industry still needs to use this alternative method fully (MacWilliam, 2010).

The South African dry cleaning industry should use safe alternative procedures. Consumers must be aware of the dangers of tetrachloroethylene and hydrocarbon cleaning solutions and secure alternative methods to make informed decisions about dry cleaning. Consumers can also minimise traditional dry cleaning services and wash more clothing at home in cold water.

### *3.3 Fabric Choices*

Fabrics come from a variety of fibre sources and mixtures. Differently constructed fabric types have various performance characteristics during garment use, for example, an ability to repel soiling and stains, resist creasing, a water absorption aptitude, and anti-bacterial properties, among others (Çelikel, 2019). Some easy-care fabrics, such as polyesters and those that are difficult to care for, such as silk, acetates, and velvets, require dry cleaning (Nakano, 2009; Allwood et al., 2006). Research shows that garments made of different fibres affect the environment differently, with woollen garments recording the highest environmental impact (Moazzem et al., 2018). Laing (2019) reports that garments with different fibre contents have varied ecological impacts. McQueen and Vaezafshar (2020) explain that next-to-skin clothing demands frequent washing and general maintenance, contributing to environmental hazards.

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[7] *Hydrocarbon solvents are volatile organic chemicals that contribute to smog formation, which is known to cause and aggravate asthma*

[8] *Industrial smog is the black-brown coloured smoke in the air, usually visible over some cities. The smog is composed of sulphur dioxide, small amounts of sulphuric acid, and suspended particles from burning coal and oil (Cha, 2013).*

Understanding how various fabrics behave might help consumers select easy-care fabrics that do not require heavy energy, water consumption, dry cleaning and ironing. Consumers must understand the fibre content presented on garment care labels to empower them to make informed fabric and garment choices. Some household textiles and garments shed fibres during washing that find their way to the sea and underground water. Such threads end up in the human food chain (Browne, Crump, Niven, Teuten, Tonkin, Galloway & Thompson, 2011; Napper & Thompson, 2016; Sandin, Roos and Johansson, 2019). Browne et al.(2011) report that polyester garments shed as much as 1900 fibres during washing, escaping filtration during water treatments. Unfiltered micro-fibres end up consumed through water and food. The 'advanced' textiles market contains many technologies, many of which have protected status [9]and constitute a relatively small portion of the textiles used for the consumer market (Gwozdz et al., 2013; Çelikel, 2019). Advanced fabrics include nanomaterials such as silver, titanium dioxide, and zinc oxide designed to create anti-microbial and self-cleaning layers on top of the fibres, thereby reducing body smell and soiling (Çelikel, 2019). Although there are only a few nanomaterials on the market, designers could use these more often in garment production to reduce the frequency of washing ordinary clothing to raise the demand for these materials among textile manufacturers. Other smart textiles include innovative fabrics that "sense, respond, monitor, and change according to environmental situations such as thermal, automated, chemical, magnetic, or other sources" (Çelikel, 2019, p. 2).

### *3.4 Washing and Drying Equipment*

The washing machine is multifaceted, and factors, including water temperature, wash load, frequency of use, and detergents, influence its performance (Peng et al. 2017). Consumer preferences determine all these factors alongside the machine specifications that come with each machine. Laundry can contribute significantly to the clothing's carbon footprint (Golden, Subramanian, Irizarry, White and Meier, 2010;). Berners-Lee (2010) reports that frequent washing and drying of clothes for a maximum of three times a week generates about 440 kg of CO2 yearly. A washing machine emits carbon, estimated to be 42.9% of its life cycle emissions during the usage phase (Chen et al., 2017). Table 1. provides a breakdown of CO2 emissions during Washing (Ibid.).

**Table 1:** Carbon dioxide (CO2) emissions of various washing methods (adapted from Berners-Lee, 2010)

| | Washing temperature (ºC) | Drying method | $CO_2$ emissions per kg |
|---|---|---|---|
| 1 | 30 | Line drying | 0.6 |
| 2 | 40 | Line drying | 0.7 |
| 3 | 40 | Tumble dryer | 2.4 |
| 4 | 60 | Combined washer-dryer | 3.3 |

As seen in table 1, different washing and drying methods can reduce CO2 emissions. Consumer knowledge about the relationship between energy and CO2 emissions during washing and drying, temperature control during washing, and fabric characteristics of household textiles and garments are significant in sustainable washing behaviours.

According to a study by Lippuner, Pearse and Bratrich (2011), the environmental impact variables related to washing machines are consumer habits related to washing load, the number of times the machine runs, the type and the amount of detergent used, and machine maintenance. If these factors exceed prescribed limits, higher environmental impacts arise regarding water consumption, energy use, and water pollution released into the sewage system (Ibid.). Eco-advanced

[9] *Protected status refers to new innovated textiles that have been patented.*

technology improves washing quality since the latest technologies save energy, use less water, and smaller amounts of detergents (Koerner et al., 2011).

Research, design, and innovation lead to improved products in environmental performance. Businesses and consumers can benefit from a developed product. For example, if a washing machine or any other electric appliance uses less water and minimal energy, it assistances both the environment and the entrepreneur in terms of profits. The customer benefits by paying less for both the equipment and the cost of clothing maintenance. Sustainability-literate consumers align knowledge to eco-washing machines, irons, and dryers that are friendly to the environment. Table 2 shows the standard and real-life performance of washing machines. In the standard case, a washing machine can wash a full clothing load of approximately 5.36 kg per cycle. However, in real life, the washing loads are often smaller at about 3.43 kg per cycle, nearly 64% of the standard (Presutto et al., 2007).

**Table 2:** Characteristics of standard and real-life washing machines

| Characteristics | Standard case | Real-life case |
|---|---|---|
| Washing temperature (°C) | 60 | 45.8 |
| Load (kg or cycle) | 5.36 | 3.43 |
| Energy consumption of programme selection (kWh or cycle) | 0.998 | 0.72 |
| Water consumption of programme selection (l or cycle) | 50.7 | 46.3 |

**Source:** Presutto et al., 2007

The average washing temperature is 45.8ºC, and 139.76 g of detergent is used per wash cycle in real-life cases compared to standard testing (Presutto *et al*., 2007). For a washing load of 3.4 kg, for example, 41.1 g of detergent will be used per kilogram of clothes washed. Based on this breakdown of detergent, water, and energy consumption, consumers should be aware of real-life situations and be cautious when buying washing machines, detergents, and garments of different fibres.

Consumers are key role players in every business, which means that companies need to adopt social responsibility towards their customers, and customers must act responsibly towards the environment. Mastamet-Mason (2013) argues that consumers hold the key to slowing down consumption and have the power to employ eco-friendly technology and detergents for sustainability. Consumer behavioural change in the present can encourage responsible behaviour in the future. Consumers should be aware of available eco-technologies, eco-detergents, and eco-friendly textiles and garments to accomplish the sustainable development mandate. Van Aardt et al. (2011) suggest that a business with an eco-attitude entails knowing consumers' fundamental rights, such as the right to access safe products and services, the right to understand relevant aspects of products and services, to be heard in the event of a complaint, and to choose what to buy. The market should provide a variety of eco-products to be selected from by eco-conscious consumers.

## 4. Conceptual Framework

Based on the literature reviewed, a conceptual framework in figure 1 conceptualises the literature insights in the context of the research aims. A conceptual framework connects formulated concepts and ideas and constitutes a graphic roadmap for pursuing research outcomes (Osanloo & Grant, 2016; Chukwuere, 2021). The framework presented in Figure 1 directed the methodological approach in this paper.

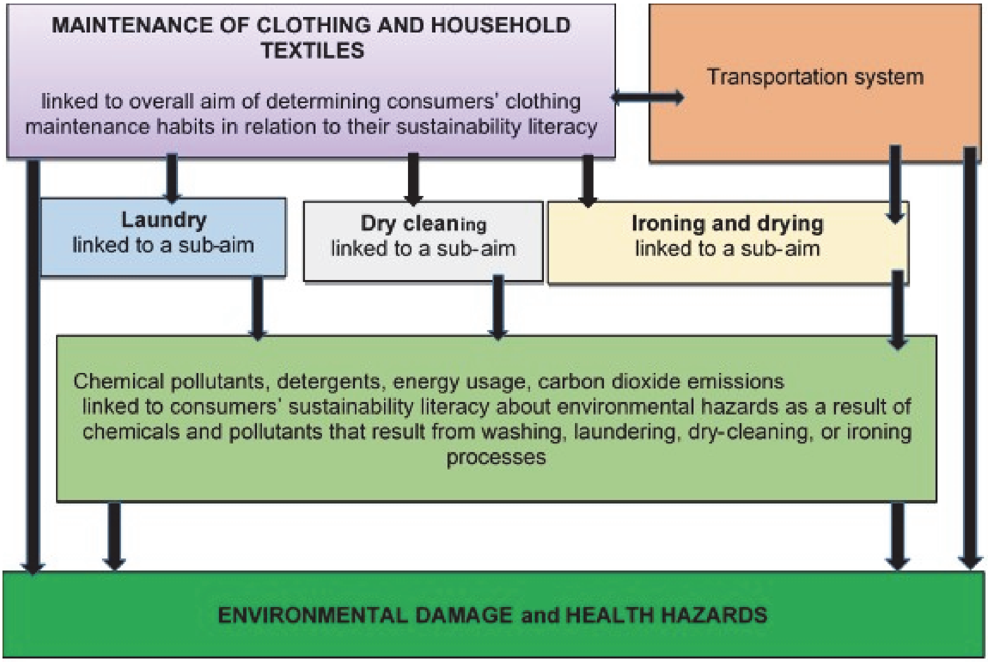


**Figure 1:** Conceptual framework of the environmental impact of clothing maintenance

## 5. Research Methodology

The research used quantitative methods to research the study aims (Bogdan and Biklen, 1998). The data collected was consistent with the study's purposes, presented in Figure 1, and as recommended by Neumann (2000). The study hypothesised that sustainable literacy (knowledge of environmental issues) is associated with selecting and buying clothing, technology, and detergents, using technology appropriately, using detergents, and using garments for prolonged periods before washing.

### *5.1 Population and Sampling*

Davies (2005, p. 228) explains that a population in the research context is a complete set or unit of analysis under investigation. A sample selected with discernment will display the same characteristics or properties as the larger group from which it is determined (Hanekom, 2006, p. 54). This study's population and sampling groups included students and staff members from one university. An advantage of quantitative research methods in this study was the ability to use smaller groups of participants from various parts of South Africa. Participants gathered in one university allowed researchers to make inferences about the larger population of South Africa, which would otherwise be prohibitively expensive to study (Holton and Burnett, 1997, p. 71).

The estimated university population of 1,962 comprised 1,702 students and 260 staff members. Statistical software EPI-INFO V6 determined the sample size representative of the entire population. According to the statistics applied, if 42% of the student population were readily available, and 35% were the worst acceptable margin with a 99.9% confidence level, then 248 participants were required. Ten per cent of the student population (n=170) and 30% of the staff (n=78) participated in the research. The research collected data from 214 out of 248 initially expected participants. The study applied systematic random sampling to select both groups of participants. The approach used reduced bias and accorded every potential participant an equal chance of being chosen (Bernard, 2000).

### 5.2 Data Collection

The researchers used the questioning method of data collection (Blumberg et al., 2008:197), ensuring that willing participants participated. Their responses were collected using semi-structured questionnaires administered during lunch breaks at the university. The data collection instrument comprised three sections. Section 1 addressed the participants' demographics, including gender and occupation; Section 2 examined the participants' sustainability literacy knowledge. Section 3 investigated participants' clothing acquisitions and garment maintenance. The use of semi-structured questionnaires was advantageous because open-ended questions enabled the participants to write answers in their own words and according to their understanding (De Vos et al., 2011, p. 186-205).

### 5.3 Data Analysis

Descriptive statistics generated the variables of interest, including means, medians, and standard deviations for continuous variables. Descriptive statistics for categories, frequencies, and proportions (%) were produced and presented in histograms, pie charts and bar graphs. The significance levels were examined at the 5% level, with inferences and interpretations made with a 95% confidence limit. The answers to the open-ended questions were coded, quantified, and double-checked to ensure that the coding and responses corresponded. Pearson's chi-square test was used to determine the association between two categorical variables, specifically to test the hypotheses formulated for the study.

### 5.4 Reliability and Validity of the Data

Davies (2005, p. 219) posits that pre-testing can identify problems in wording, questionnaire format, and other areas that profoundly impact the findings' validity. Pre-testing can showcase ambiguity in instructions, questions, and words and indicate the time required to complete the questionnaire. The reliability of this study was ensured by conducting a pilot test of the questionnaire on a convenient sample of 12 participants (ten students and two lecturers from Tshwane University of Technology's Faculty of Arts) before assuming fieldwork. The questions were modified to suit the South African situation. A test-retest was conducted through pilot testing and adapting some of the questions from related previous studies (Waste & Resources Action Programme, 2012; Mashinini-Langwenya, 2013, p. 45; Fletcher, 2013). Test-retest ensures that the same instrument is reliable if retested on the same sample at various times (Neuman, 2006, p. 189). Cronbach's alpha test determined the questions' reliability. The alpha test establishes the average of all split-half reliability coefficients, according to Jonker and Pennink (2010). Cronbach's Alpha level of reliability indicates the strength of reliability from 0.6 and above scores. Cronbach's Alpha dependability level reveals the degree of reliability for values of 0.6 and higher (Ibid.). The researchers of the study omitted questions with p-values below 0.6.

A measure of representative dependability is the consistency or uniformity of results across subgroups like age and race (Davies, 2005, p. 219). The students and staff in this study represented a variety of South African cultural subpopulations. A representative sample ensures the dependability of the findings. The study's content validity determined how well the questionnaire captured the intended outcomes (Babbie and Mouton, 2001, p. 2-4; Babbie, 2007, p. 146). All the conceptual definitions of a construct's components, as described in Figure 1, were present in every inquiry. The research had a clear construct definition that guided selected samples of critical ideas. Subsequently, indicators were developed from all parts of the descriptions as recommended by Neuman (2006, p. 179).

### 5.5 *Ethical Concerns*

The South African Human Sciences Research Council highlights various essential principles that all researchers should uphold in their research undertakings (De Vos et al., 2011, p. 126-130). This study maintained all the possible measures and followed ethical procedures. The study received an ethics clearance certificate (REC/2015/05/004) from the relevant authorities. The research further ensured that no human rights were infringed upon during data collection while respecting the confidentiality of the participants.

## 6. Research Findings

### 6.1 *Demographic Findings*

Gender, age, and profession were all part of the participant's demographic profile. According to the findings in Figure 2, out of the 214 participants, 22% were working, and 78% were students. Concerning gender, 61.68% were women, while 38% were male participants. Young adults between 18 and 30 comprised the most significant percentage of the participants (79.91%), and the majority (78.04%) in this age bracket were students.

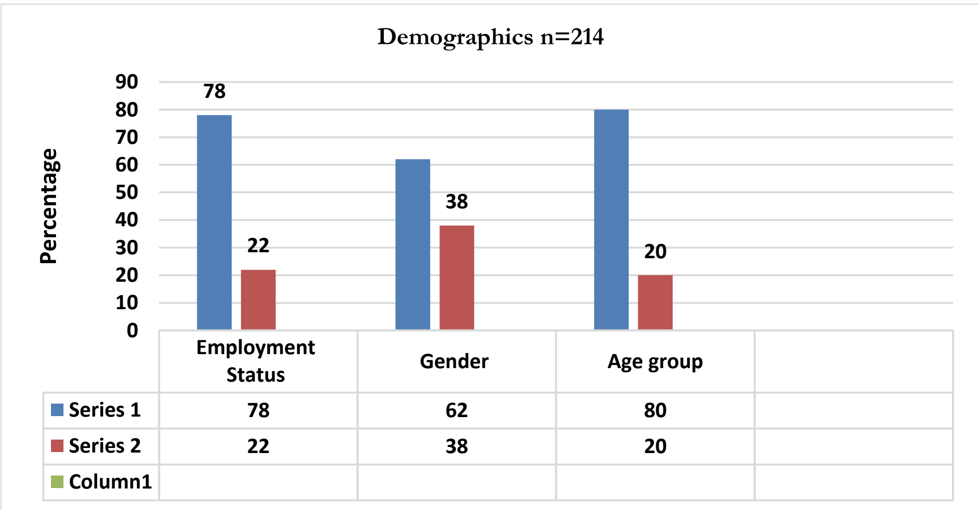


**Figure 2:** Demographic Information of the Participants

The results show that most of the study's respondents were youthful customers. Age, employment level, and participants' garment maintenance habits did not significantly correlate with one another ($p>0.05$). The reports show no appreciable differences between students, staff, or age groups regarding washing behaviour, technology choice, detergent choice, fabric softener choice and personal clothing care practices of the different participants. The hypothesis states that the garment maintenance habits of the participants differed significantly; however, the results reject this view.

### 6.2 *Results according to participant's current clothing maintenance practices, which include laundering/washing, dry cleaning, and ironing*

It was critical to understand washing machine ownership among participants to determine whether they were familiar with environmentally friendly machines and how they functioned. According to the results in Table 2, the majority (63.6%) of the 214 participants owned at least one washing machine, 36.0% did not own one, and 0.5% did not respond. To relate participants' environmental knowledge to machine selection, the researcher asked them to list all the factors they considered before purchasing a washing machine.

As shown in Table 3, 41% of those who own devices listed environmental considerations such as "energy saver," "less water consumption," and "environmental benefits." Most washing machine owners (59%) said they chose their machines based on personal utility factors such as cost, efficiency, or automation (labour saving).

The selection of washing machines revealed a disconnect between sustainability literacy and machine selection. The findings corroborate with Mashinini-Langweya et al. (2018), which showed that young consumers prioritise fashion trends and brands rather than environmental considerations. There was no significant relationship between sustainability literacy and the choice of an eco-washing device among the participants ($p>0.05$). As shown above, 59% of participants did not consider environmental factors when choosing and purchasing washing machines. The study hypothesised that participants' eco-knowledge influences the eco-washing device's selection; therefore, the findings reject the hypothesis.

**Table 3:** Washing Machine selection versus sustainability knowledge (n=214)

<table>
<tr><td colspan="2" rowspan="2">Machine Ownership</td><td>Yes</td><td>No</td><td>Undecided</td><td>P-Value</td></tr>
<tr><td>136 (63.6%)</td><td>77 (36%)</td><td>0%</td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Factors considered in the purchase of a washing machine</td><td>Environmental factors</td><td>56 (41 %)</td><td>0%</td><td>0%</td><td rowspan="4">No significant (p>0.05) association between sustainability literacy and factors considered in the purchase of the washing machines</td></tr>
<tr><td>Personal utility factors</td><td>80 (59%)</td><td>0%</td><td>0%</td></tr>
<tr><td colspan="2">Awareness on eco-machines</td><td>39 (15.4%)</td><td>175 (82.2%)</td><td>0%</td></tr>
<tr><td colspan="2">Awareness of eco-brands</td><td>0%</td><td>0%</td><td></td></tr>
</table>

The researchers questioned the participants further on washing machines advertised as eco-friendly or that have reduced their operational impact on the environment. Only 15.4% of participants were aware of environmentally friendly devices, while most participants (82.2%) were clueless. Numerous participants were unaware of the eco-friendly features of the different washing machines linked to energy and water savings. None of the respondents specified a specific manufacturer, although 15.4% of participants claimed to be aware of washing machines with eco-friendly labelling. The results suggest that participants are ignorant of eco-friendly equipment or there aren't many available eco-devices on the market. Thus, there was no definite connection between sustainability literacy and the selection of an eco-washing machine among the participants ($p>0.05$). The lack of information on eco-technology suggests that consumers in south Africa practise unsustainable washing. These findings align with Cheluget's (2017) study in Kenya, where most (80%) consumers do not relate environmental knowledge to purchasing their washing equipment. Participants of this research cite price and quality associated with reputable brands (such as L.G. and Samsung) as the main factors in buying any washing equipment. Suppose consumers' perceptions of eco-friendly clothing influence their pre- and post-purchasing behaviour; in that case, their perceptions of eco-labelled washing machines would affect their selection criteria and usage. Consumers tend to be selective towards familiar/branded washing machines, and therefore consumers may not associate the brand as a stimulus with the sustainability concept. Consumers select what stimulates their sensory receptors while purchasing household goods (Mastamet-Mason, De Klerk, & Ashdown, 2012). If consumers do not devote attention to a stimulus, their sensory receptors are unlikely to process it. Consumers' push directs attention by clearly communicating memories to form an interpretation. Eco-labelled washing machines, in this case, have not been familiarised by consumers and have nothing to stimulate their purchase sensory receptors. These findings raise the question of how machine users align their values with their chosen equipment. Given that the end user only partially understands the product attributes at the time of purchase, how well can technologies or branding be modified to match the information that will allow consumers to make better decisions?

As seen in Table 4, the participants reported the frequency of washing their garments and the methods used according to washing habits. The majority (85%) reported washing at least 2-3 loads of clothing per week, while 15% reported washing 2-3 loads every 2-3 weeks. The laundry industry accounts for 0.07% (0.2340 Mm3) and 0.32% (0.2186 Mm3) in annual industrial water use, microfibre pollution, and chemical emission, respectively (Cloete, Gerber, and Maritz, 2010).

**Table 4:** Pre-washing/laundry preparations and the frequency of washings/laundering

| | | Frequent washings | | | P-Value |
|---|---|---|---|---|---|
| Frequency of Washing | 2-3 loads a wk. | 182 (85%) | | | No significant (p>0.05) association between sustainability literacy and how frequently the participants washed their clothes |
| | 2-3 loads a fortnight (2 weeks) | 32 (15%) | | | |
| | 2-3 loads every 3 wks. | 0 (0%) | | | |
| Awareness about the Environmental impact of frequent washing | | Yes | No | Undecided | |
| | | 27 (13%) | 133 62%) | 54 (25%) | |
| Preparations for Washing | Full load | 184 (86.4%) | | | No significant (p>0.05) association between sustainability literacy and how the participants prepare clothes and machines before washing |
| | Less load | 30 (14%) | | | |
| | Temperature setting @30ºC | 96 (45%) | | | |
| | No temperature concerns | 118 (55%) | | | |

Washing clothes at least three times a week by 85% of participants indicates that many households in South Africa contribute to energy used to heat water in preparation for washing over and above the energy needed to drive washing machines during washing and microfibre released pollutants (Gwozdz et al., 2013; Herweyers, Cartney, Scheelen, Watts and Du Bois, 2020). In the U.K. and USA, an estimated 90% of washing machine energy demand goes into heating the water and driving the machine in the process of Washing (Business for Social Responsibility, 2009).

Regarding their awareness of the environmental impact of frequent washing, 62% of the participants reported being unaware of the ecological implications, while 25% remained undecided. Only a negligible number of participants agreed that frequent washing is not suitable for the environment. There was no significant association between sustainability literacy and the frequency of washing or laundering practices among the participants ($p>0.05$). Environmental knowledge related to excess water use and pollutants from detergents seems to play no significant role in sustainable washing behaviour. Participants did their washing based on the practices they had been accustomed to since they were young. Regarding various washing approaches used by the participants, 95% reported using washing machines for laundering, while 66% hand wash delicate garments that would be damaged if washed in a washing machine. Handwashing is carried out weekly or monthly, depending on the clothes' nature and the amount of dirt. Hand washing can be sustainable since no energy is needed to drive machines. Chemicals from the soaps and detergents continue to be released during hand washing, even though it happens on a smaller scale. As discussed in the literature review section, washing detergents are chemical substances that break up and remove grease and dirt. Detergents contain soap and surfactants, builders, bleaches, colourants, fluorescent brighteners, fragrances, and enzymes that pollute and destabilise the ecosystem (Ameh et al., 2010). Mathew & Malcolm (2000) claim that components in detergents combine with crude oil, a non-biodegradable ingredient that accumulates over time in waterways (Mathew & Malcolm, 2000). Laundry detergents used by the participants break down or mix with other chemicals, dangerous pollutants and carcinogens that end up in South Africa's underground water affecting aquatic life.

Regarding washing preparations, the majority (86.4%) of the participants wash a full load of clothes frequently, and the remaining 14% reported passing any load size of dirty garments without any consideration for maximising load capacity. The 14% who do not consider load size demonstrate wasteful washing that violates the rule of sustainable development, primarily as water and detergents are used beyond the machine's capacity when the load is small.

Most participants (55%) did not check the water temperature during washing. Forty-five per cent reported using eco-settings and 30ºC water temperature. The same group reported sorting clothes before washing into garments that require hot washing and those that do not. The same participants said they often sort laundry into garments that require a longer wash and those that need a quick wash - depending on the amount of dirt and the fabric type. Sorting has a positive environmental impact because it eases energy, water, and detergent control, thus saving water and energy. In addition, mixing clothes may result in staining some clothing since dyes loosen up, ultimately shortening the lifespan of the stained garments. The hypothesis predicted a significant association between sustainability literacy and how the participants prepared their washings; however, the findings show no associations ($p>0.05$). Environmental knowledge related to excess water use and pollutants from detergents seems to play no significant role in sustainable washing behaviour. Cheluget's (2017: 215) findings substantiate the findings of this study whereby Kenyan consumers did not apply sustainability knowledge in their daily household activities.

**Dry cleaning**: A majority (63.4%) of the participants understand that chemicals released by dry cleaning facilities have a negative environmental impact. When asked how frequently they dry clean their garments, 99% of the participants (both students and working group) reported that they sometimes used traditional dry cleaning services because they did not know any alternative eco-dry cleaning methods. The working participants (making 22% of all the participants) mentioned that some of their tailored garments, particularly winter and delicate garments, require dry cleaning. Sheer clothes are dry-cleaned every two to 12 months, depending on demand and the degree of soiling of the garment. Participants who dry clean their garments (46.4%) do so with varying frequency, ranging from one month (25.2%) to three months (6.2), to six months (4.7%), to once a year (10.3%). Since most participants were students, the results will not be generalised to all the study participants. It is a common understanding that most participants in employment wear higher-priced garments that require dry cleaning as opposed to students whose clothing is skewed more towards casual wear that requires basic washing. No significant association ($p>0.05$) between sustainability knowledge and the frequency of dry-cleaning garments. The findings of this study confirm the results of Yavorsky (2014) in the USA, which indicate no association between knowledge and behaviour. By 2005, environmental literacy among citizens in the USA was worrisome (Coyle, 2005, P 3). Although it is 17 years after the American study, the situation now in South Africa could be similar to the American position in 2005. Studies need to be undertaken to precisely understand the status of sustainability literacy in South Africa.

### *6.3 Drying and Ironing Practices*

The research sought to establish ownership of an ironing device from the participants. As seen in Table 5, the vast majority (87.4%) of the participants indicated owning one. When asked to list the factors considered when choosing an iron, only a small number (10%) of the participants listed the brand name and energy efficiency. None of the participants listed environmental factors. Most participants reported selecting their irons based on efficiency or labour-saving factors. All the participants reported ironing at least 90% of all their washed garments

**Table 5:** Drying and Ironing Practices

| | Brand name | Efficiency | Environmental /energy saving | | P-Value |
|---|---|---|---|---|---|
| | Yes | No | | | |
| Iron ownership | 87.4% | 12.6% | | | |
| Factors considered when buying an iron device | 10% | 90% | 0% | | No significant (p>0.05) association between sustainability literacy and the frequency of ironing clothes |
| Frequency of Ironing Clothes | Most Frequently | Frequently | Less frequently | Not at all | |
| | 90% | 10% | 0% | 0% | |
| | Yes | No | | | |
| Tumble dryer ownership | 10% | 90% | | | |

Regarding tumble dryer ownership, only 10% of the participants reported owning a tumble dryer, suggesting that most participants dry their clothes outdoors since the South African climate supports it. No significant association between sustainability literacy and the frequency of ironing clothes, suggesting that participants' ironing behaviour does not relate to their environmental knowledge. A disconnection exists between knowledge and the purchase of ironing devices and the ironing of clothes. There is, thus, a direct association (($p<0.05$) between laundering and ironing practices among most participants. This correlation means that the 11.3 million South Africans living in formal settlements wash and iron their clothes regularly, which leads to significant energy use and adds to the pollutants released during the process.

### *6.4 Extension of Garment's Life (Mending, Repairs, and Alterations)*

The study sought to understand if the participants related fabric knowledge while purchasing and washing clothes. Most (87%) participants indicated that fabric choice was always a reference point before buying a garment. Care labels assist the participants in maintaining their clothing rather than a deep understanding of the functional aspects of selected fibre or fabric. About half (54.2%) of the participants understood that mending garments extends their life by prolonging use. Nearly half of the participants (56%) did not understand the connection between the prolonged use of a garment and the subsequent benefits to the environment. The same group of 56% of participants did not link fabric characteristics to the extended life of a garment.

Mending prevents frequent disposal of clothing that encourages more garment production, and garment production has subsequent detrimental effects on the environment throughout the textile and apparel supply chain (Fletcher, 2013).

The study further assessed if the participants continued to wear their clothes after body size changes, when fashion items became obsolete, or when the clothing was damaged, worn, or stained. The results showed that half (52.3%) of the participants do not wear most of their clothing beyond one year, citing body size changes or fashion obsolescence as the main reasons. Most participants (60%) reported mending or altering garments to prolong their lifespan. The restored clothes included some with minor stains and signs of wear for use around the house for various applications. No significant association ($p>0.05$) between sustainability knowledge and the participants' prolonged use of garments. The findings confirm the results of Yavorsky (2014) in the USA and Cheluget (2017) in Kenya, which show a lack of associations between knowledge and eco-behaviour. According to Kent-Onah & Mastamet-Mason (2013), consumers' sustainability literacy aligned to the use of clothing is generally poor in Africa. The same situation is applicable in the South African context since topics related to the environmental impact of the textile supply chain are in their infancy stages.

Regarding the disposal of clothes, most (73%) participants disagreed that they throw away clothes they no longer wear but keep them for donation later. The findings corroborate Malepa (2014 that most South African consumers prefer to hold on to garments and pass them on to their loved ones rather than throw them or donate them to unknown people. According to Malepa's study (2014), clothing becomes part of one's life, and when clothes are thrown or donated, it feels like part of one's life is thrown away, so it would only be meaningful to present to close relatives. Contrary to Malepa (2014), Cheluget discovered that Kenyan consumers burnt and threw away their unwanted clothes.

### 6.5 *Participants' Selection, Use of Washing Detergents and Fabric Softeners*

The study sought to understand if participants were aware of environmentally friendly detergents and fabric softeners. The participants responded they were familiar with a few eco-soaps or detergents but were unaware of eco-fabric softeners. Most (79%) of the participants reported using the most popular branded washing powders available in South Africa's supermarkets most of the time, and 21% reported using the few available environmentally sustainable detergents sometimes. As for eco-fabric softeners, none of the participants reported using them due to a lack of awareness. No significant association ($p>0.05$) between sustainability knowledge and the choice of detergents and fabric softeners. These results show that participants use detergents and fabric softeners available in the market but are unaware of specific eco-friendly products. Environmentally sustainable certified detergents and fabric softeners are scarce in the marketplace and are typically more costly than regular products (Cheluget & Mastamet-Mason, 2018). Manufacturers should tap the new market for eco-detergents and softeners by ensuring that such products are price competitive. On the other hand, consumers need sustainable civic education on various aspects of life, particularly those related to house chores such as washing and drying and choosing eco-detergents, eco-fabric softeners, and eco-selection criteria for household equipment.

### 6.6 *Implementation of Care Label Instructions During Washing and Ironing*

Care labels attached to garments are essential guiding tools and guide how to care for a garment after its purchase. It was necessary to understand if consumers consult care label instructions when buying garments and how their knowledge of fibre content and care instructions influence their decisions around washing, laundering, and ironing their garments.

**Table 6:** Care label as the point of reference in washing and ironing

| | Most frequency | Frequently | Sometimes | Never | Undecided | P-Value |
|---|---|---|---|---|---|---|
| I used the care label as a point of reference during the garment purchase | 40% | 16% | 33% | 11% | 0% | There is a significant association ($p<0.05$) between older participants and the use of care labels as a point of reference in selecting garments, washing, ironing and during dry cleaning |
| I use the care label as a point of reference before washing my | 31% | 22% | 43% | | 3% | |
| I use a care label as a point of reference before ironing | 50% | 23% | 25% | | 2% | |
| I use a care label as a point of reference before dry-cleaning my clothes | 30% | 10% | 10% | 10% | 40% | |
| I use a care label as a point of reference before mending clothes | 0 | 5% | 5% | 3% | 87% | |

Results show that fabric choice is a point of reference for 56% of the participants, while 33% sometimes consider fabric content before buying a garment; only 11% never make any references to the fabric. Fifty-three per cent of the participants consult the fabric care instructions when laundering their garments; they refer to the care label instructions to sort their garments into various categories. The same 53% group read care label instructions before loading clothes and setting the machines before starting. The remaining 47% of the participants reported not reading care labels, pointing to the need for education on the importance of such knowledge in supporting sustainable behaviour.

As for ironing, 73% of the participants refer to care labels regularly for control of temperature according to different fabric content, and 25% of the participants sometimes refer to fabric contents while ironing clothes. The results imply that most participants consult fabric characteristics to avoid burning and scorching their garments.

Regarding the consultation of care label text before dry cleaning the garment, the findings indicate approximately 50% of respondents do so and take garments for dry cleaning because the care label suggests so. The remaining participants had different responses, with 40% remaining undecided (10%), stating that they never consult the care label for dry-cleaning purposes. Most of the older participants, mostly staff members, reported that they consult care labels and apply the given information before taking their garments for dry-cleaning purposes. The staff members with discretionary income are those who dry clean their delicate garments, while the majority are students who rarely dry clean their garments.

Concerning the mending of the garments, only 10% referred to the care label instructions before mending their garments. For the few older participants, care label instructions guide them to select appropriate sewing notions to restore and alter an old garment. As already seen above, care labels are essential in directing consumers to wash, ironing and mend garments in an environmentally conscious manner.

A significant association ($p<0.05$) exist between older participants and the use of care labels as a point of reference in selecting garments, washing, ironing and dry cleaning. Most employed participants consulted care labels during clothing maintenance exercises much more than the student participants. The young participants showed no serious consideration given to the type of fabric, care label instructions, ironing instructions when washing or laundering, dry cleaning, and ironing of the garments compared to the employed participants.

Lack of knowledge on fabric characteristics and mending skills underscores the need to educate consumers on the importance of care labels during purchase and when using their garments. Consumer education on fabric content and characteristics relevant to ironing and general clothing maintenance are also needed. Such knowledge will empower consumers to use eco-friendly maintenance processes, for example, sorting clothing before washing, mending clothing to prolong the life of a garment and reducing the production of new items, thus avoiding environmental damage.

## 7. Conclusions

The results of this study clearly illustrate that knowledge of the environmental impacts of clothing maintenance is not widespread, nor does environmental awareness greatly influence clothing maintenance practices amongst the participants. The results further point to suitable methods to create environmental awareness among fashion and textile goods consumers.

This study's findings revealed that most participants own equipment for clothing maintenance. Washing machines, tumble dryers, and irons are standard purchases. It was clear that participants' purchases of maintenance equipment had no relationship with environmental concerns but were driven by the participants' utility they expected. Regular use of these products contributes to adverse environmental impacts. Frequent washing of 2-3 loads per week is alarming because of water consumption and chemicals released into the sewage system from such washing behaviour.

Most of the participants in this study demonstrated poor knowledge of how to obtain and maintain their clothing responsibly, although this is a basic human need and, therefore, necessary. Consumers must understand sustainability literacy associated with the whole clothing and textile supply chain. They should also understand the responsible use and disposal of clothing and textile products. Lack of adequate knowledge and care leads to unsustainable clothing purchase, maintenance, and removal, which may impact preserving planetary resources for future generations. The study also shows that most participants understand eco-fashion in general terms. However, consumers do not understand the link between eco-fashion and the environmental impact of various clothing and textile supply chain stages, particularly the clothing maintenance phase over which the consumer has total control.

Low levels of environmental awareness on the environmental impacts of clothing maintenance amongst the sample indicate a deficiency of relevant information available to consumers. It raises the question of how to address this problem. Clothing manufacturers and retailers should provide sustainable education to consumers as an after-sale environmental responsibility. Clothing manufacturers should provide care labels attached to every clothing item they sell with two sections; one to describe the fibre content of the fabric and garment materials, and the second to give washing and ironing instructions. The information provided on care labels is left entirely to the discretion of the consumer's understanding/interpretation and application. Consumers' inadequate understanding of textile characteristics or care label symbols makes the information provided meaningless.

This study confirms that only 50% of the participants consulted care labels during garment selection and when washing or ironing the garments. The other 50% do not use care labels. The reasons range from insufficient understanding of label content and symbols to inadequate knowledge of textile characteristics influencing how best to handle the garment. Basic knowledge about fabric characteristics directs the selection of fabrics that do not require constant ironing, which can compromise functional expectations from the garment (Laing, 2019). A more profound knowledge of textile fibres and fabrics can assist consumers in selecting materials suitable for various functions and yarns and fabrics that are more eco-friendly than others (Mastamet-Mason, 2014; Laing, 2019). Knowledge about fabric characteristics can also assist consumers in choosing the best methods to prolong the life of various fabrics. For example, it is more worthwhile to mend a five or 10-year-old polyester garment than to mend a five-year-old cotton dress because cotton starts to disintegrate after five years while polyester starts to deteriorate at 35 years (Mastamet-Mason, 2014).

Without motivating environmental behaviours, most participants use natural methods to dry their laundry, which benefits the environment. Choosing all washing and laundry appliances with ecological considerations would reduce energy consumption and water waste, especially if consumers know the environmental problems associated with using these appliances. This study aimed to examine consumers' sustainability literacy concerning clothing care and how consumers translate their sustainability literacy into their current clothing care behaviours. One way to do this is to equip consumers with sustainability literacy to understand how various industries negatively impact the environment and human health (Nikolitsa-Winter, Mauch, and Maalou, UNESCO, 2019, p.128).

Based on the findings of this research, Figure 3 illustrates appropriate sustainable management that minimises environmental damage from clothing care. The diagram demonstrates that sustainable literacy catalyses ecological improvement through the following actions.

- Appropriate selection of eco-washing, eco-drying and eco-ironing equipment
- The utilisation of fabric care labels in the selection of garments and the sorting of garments before washing
- Prolonged use of garments before washing (repeated wearing and airing) and before disposal (mending and repairing)
- Use of eco-detergents and eco-softeners
- Use of eco-drycleaning services
- Donate, recycle and upcycling of unwanted garments

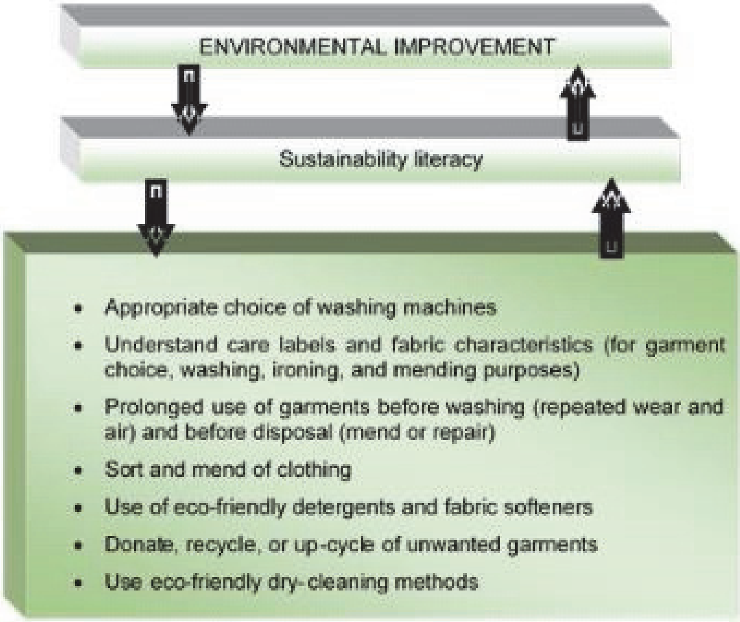


**Figure 3:** Sustainable clothing maintenance practices

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