2nd Edition of the Environmental Impact Valuation as base for a Sustainable Fashion Strategy

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1. Objective of the 2nd edition of the environmental impact valuation

The white paper "The Environmental Impact Valuation as Scientific Basis for a Sustainable Apparel Strategy" published in September 2016 as a result of years of research, development and verification showed the potential of combining well established methods like Life Cycle Assessments (LCA) and the Natural Capital Protocol (NCP).

In the mean time HUGO BOSS and Quantis continued to analyze additional products and their supply chain as part of their ongoing collaboration within the initiative "World Apparel & Footwear Life Cycle Assessment Database (WALDB)".
This second edition presents all the research done until end of 2016 and integrates also the impact allocation rules for wool and leather from the european initiative Product Environmental Footprint (PEF). The allocation rules are important for sheep farming as raw material of any wool product and as well for cattle farming and slaughterhouse for leather products. The cotton production allocation remaines unchained as published in the first edition.
This second edition provides an update for the wool sweater, new cotton products and also for the first time an impact valuation of a leather product and the hot spots of its supply chain.

With this second edition of the environmental impact valuation of textile and leather products HUGO BOSS and Quantis aim to make all relevant informations for leather-, wool- and cotton products public, according to scientifcally recognized methods and with high quality data throughout the full supply chain.

Based on the impact valuation resarch and with the help of cotton experts, HUGO BOSS has also released the public available cotton commitment. This commitment entails detailed information regarding all areas of sustainability and highlights the main aspects to be considered when sourcing more sustainable cotton.

2. Life Cycle Assessments

All analyses of the products and their supply chains were made in compliance with ISO 14044.[1] In total, 159 Life Cycle Inventories (LCIs) have been conducted (31 in the leather sector and 128 in textiles). They provide detailed tracking of all flows in and out of the production process, including raw materials, water, energy by type, as well as emissions to air, water and land by specific substance.

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[1] ISO 14044:2006 describes principles and the framework for Life Cycle Assessments (LCA) including: the definition of the goal and scope of the LCA, the Life Cycle Inventory Analysis (LCI) phase, the Life Cycle Impact Assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for the use of value choices and optional elements.

The data collection was made in close collaboration with many different partners throughout the various supply chains for the different products. The data collection and the corresponding impact valuation results were discussed with the involved experts and partners. The partners who participated received a standardized report in which findings of impacts were hightlighted and explained including possible solutions.

In total, HUGO BOSS completed Life Cycle Assessments for the following product categories:
- T-shirts
- Shirts
- Wool knitwear
- Jeans, Leisure trousers
- Jersey
- Leather shoes

Additional Life Cycle Assessments were conducted for:
- Suits

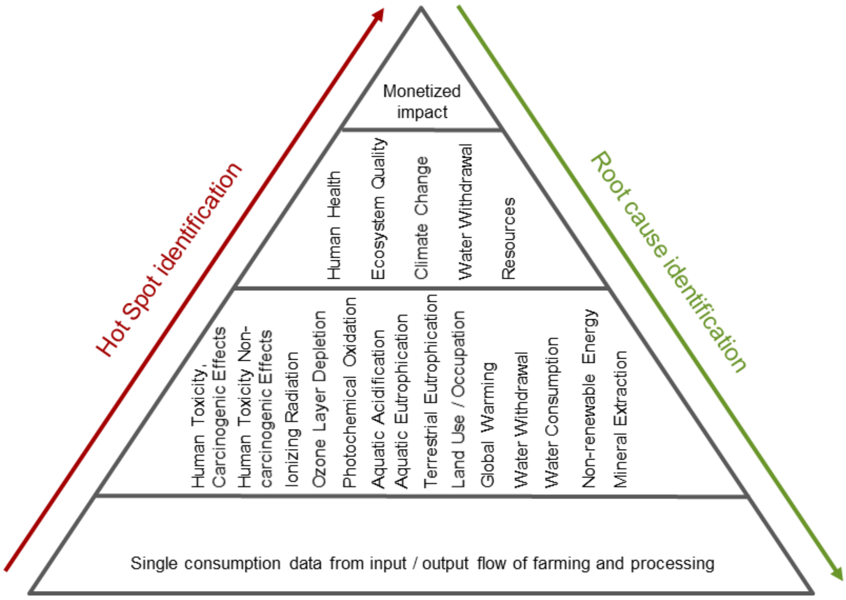
All processes from farming to end of life have been analysed by collecting the full range of specific process data throughout the whole supply chain for every product. All analyses generate a complete set of life cycle inventory according to recognized science-based methodologies like ILCD. For more details please refer to the first edition “The Environmental Impact Valuation as Scientific Basis for a Sustainable Apparel Strategy” in which all applied methodologies are described in detail.

HUGO BOSS engaged with the European initiative “Product Environmental Footprint (PEF)” by specifically analyzing two different supply chains for the production of T-shirts. All results included in this 2nd edition have been discussed in detail with the European Commission officers, in order to provide them with information regarding possible opportunities and risks. The results are cross-checked with tools like “Simapro”, always using the Ecoinvent Database for background secondary data.
The findings of those works are part of this publication with the intention to highlight the most relevant impacts (**science-based materiality analysis**) and to create awarness on the LCA complexity, with the goal of achieving precise results.

3. Natural Capital Protocol

First analyses have been conducted under the framework of the Natural Capital Protocol (NCC, 2015) established by the Natural Capital Coalition. The framework defines requirements and provides principles for the monetization of eco-system services (or natural capital).

Graph 1 Aggregation levels of the Natural Capital Evaluation



<u>Natural Capital Evaluation</u>
applying "monetizing factors" which take into account local characteristics.

<u>Damage categories</u>
according to the impact 2002+ methodology

<u>Midpoint categories</u>
according to the ILCD methodology

<u>Process data</u>
Low level process data resulting from the single input/output flows.

The graph shows the conversion of low level process data into midpoint impact categories, damage categories and finaly to a single monetized impact according to standardized and recognized methods. The last step of monetization serves also as weighting of the environmental impacts, acknowledging the specific value of ecosystem services (e.g. the value of water in different zones, water scarcity).
Therefore, this approach allows the identification of environmental hotspots among the various indicators. As the monetization process has been implemented in a transparent way, the framework can also be used to identify the root causes of the monetized impact.

The detailed description of the applied methodology can be found in the first white paper "The Environmental Impact Valuation as Scientific Basis for a Sustainable Apparel Strategy" published in October 2016.

Statistical analysis:
For each manufacturing step, minimum, mean and maximum values from all corresponding Life Cycle Inventories (LCI) were calculated in order to get an understanding of the statistical variance. For the major hotspots, sensitivity analyses were carried out. This is conducive for trackbacking the root causes. Sensitivity analyses were elaborated by applying different energy sources (fossil based versus renewable) to a specific manufacturing process, changing the transport modes (airfreight versus sea freight or rail) or comparing different irrigation methods.

4. Findings from Life Cycle Assessments

4.1 Cotton products

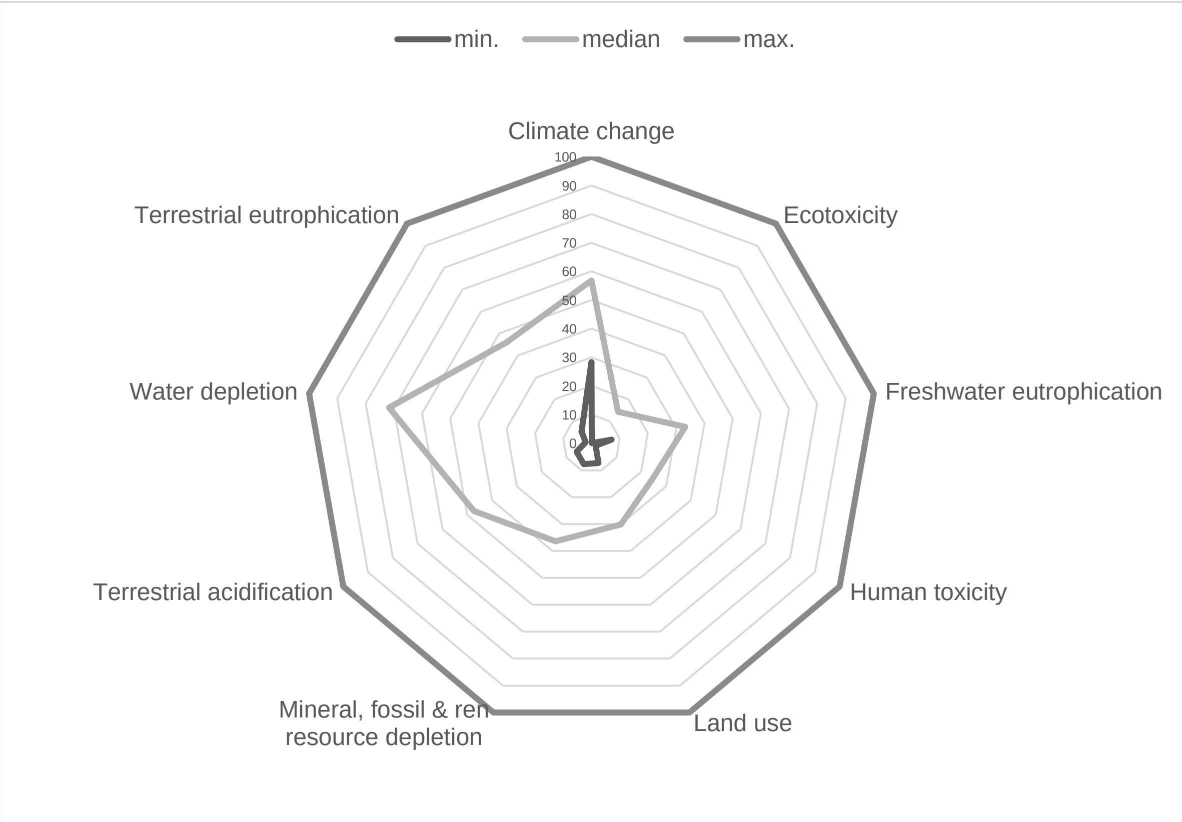
Cotton

Based on the LCA studies included in this 2nd edition, the natural capital impact valuations and additional specific literature, HUGO BOSS has published in Mai 2017 the Cotton Commitment outlining in detail the requirements of sustainable cotton. From a LCA perspective, cotton cultivation accounts to about half of the total impacts, with some variations depending on the product and its specific refinements.

The precise origin of cotton is known only in rare cases even when using one of the common sustainability certifications.

The cotton footprints show high variations expressed in % where the maximum values represent the 100% of each impact.

Figure 2.1 Cotton impacts

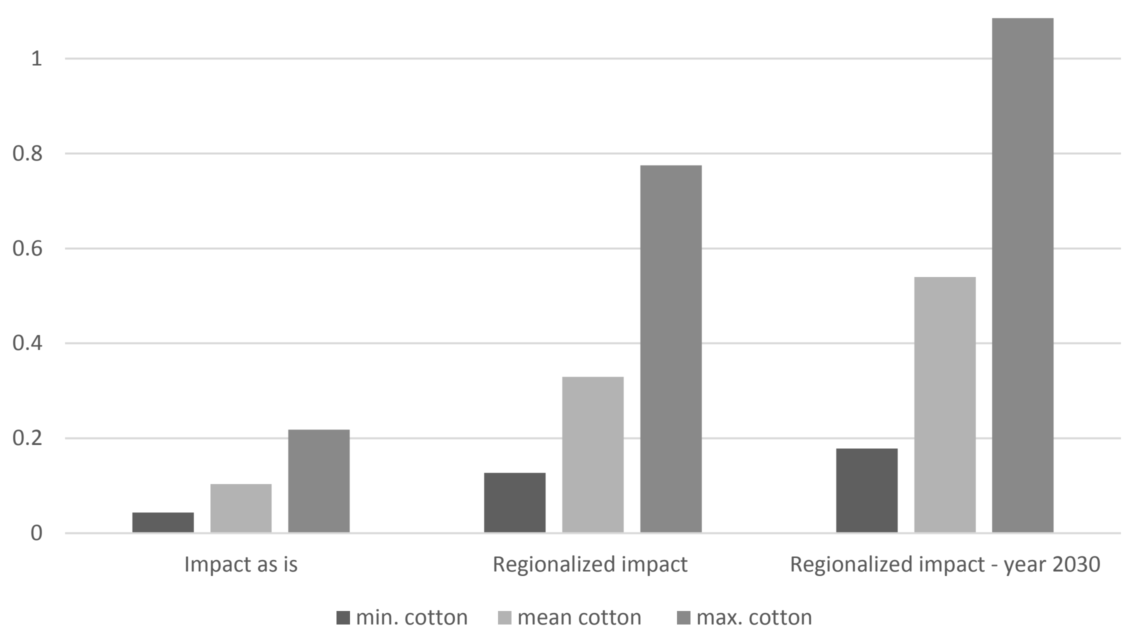


Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

The minimum value is an ideal cotton farming that is only reachable in very specific circumstances, such as rain fed cotton giving the best performance in water depletion. The median values show the average footprint of cotton farming having in place good farming practices.

The water resource depletion (Figure 1.2), a major topic for a sustainable cotton growing, adjusted by the regional and future water stress factor shows that the minimum impact as well as all the others increase significantly, especially when looking into future water stress in the various regions.

Figure 2.2 Water resource depletion for cotton growing (m³)



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

The calculation of these scenarios is based on the water stress factors from the Water Risk Atlas Aqueduct, developed by the World Resources Institute. The atlas covers physical (e.g. flood occurrence), regulatory and reputational risks (e.g. access to water, media coverage). The data are used to measure and characterize water scarcity in different world regions, since the same rate of water consumption may have different impacts depending on the climatic characteristics of a particular region. The comparison of the status by now to the forecast 2030 shows that specific regions will be facing more problems with water depletion.

For cotton growing some confusion is generated regarding the effective **water footprint** of cotton especially when comparing farming methodologies, whereas the water footprint's main three criteria's are: the climatic conditions that means high amount of rain-fed and in due time, implementing high efficient irrigation technology and with the highest possible yield of cotton.

For more detailed information regarding all the impacts and benefits, please consult the **public available HUGO BOSS cotton commitment** in which all environmental, social and economic topics are addressed.

Spinning and Weaving

Spinning and weaving are mechanical processes that impact on climate change but also on human health mainly due to the specific energy sources used. Depending on the applied technology, different material losses affect the impacts of upstream processes by affecting the amount of cotton fibers needed for the garment.

In the following graph (Figure 2.3) the impact of spinning technologies on climate change for the whole supply chain (upstream e.g. cotton growing and downstream e.g. wet processes, assembly, etc.) is analyzed. The six spinning technologies do not only have different energy consumption, but also a different cotton consumption, due to different levels of material losses. Among the combed yarns, compact yarn has lower material losses than air-jet but higher electricity consumption; among the carded yarns, rotor yarn has the lowest electricity consumption. Yarn quality (as yarn count) and yarn type (combed or carded) have also an influence on the environmental impacts: finer yarn production requires more electricity and has higher material losses; hence combed yarn has higher material losses than carded yarn.

Figure 2.3 Impact of spinning technology on climate change

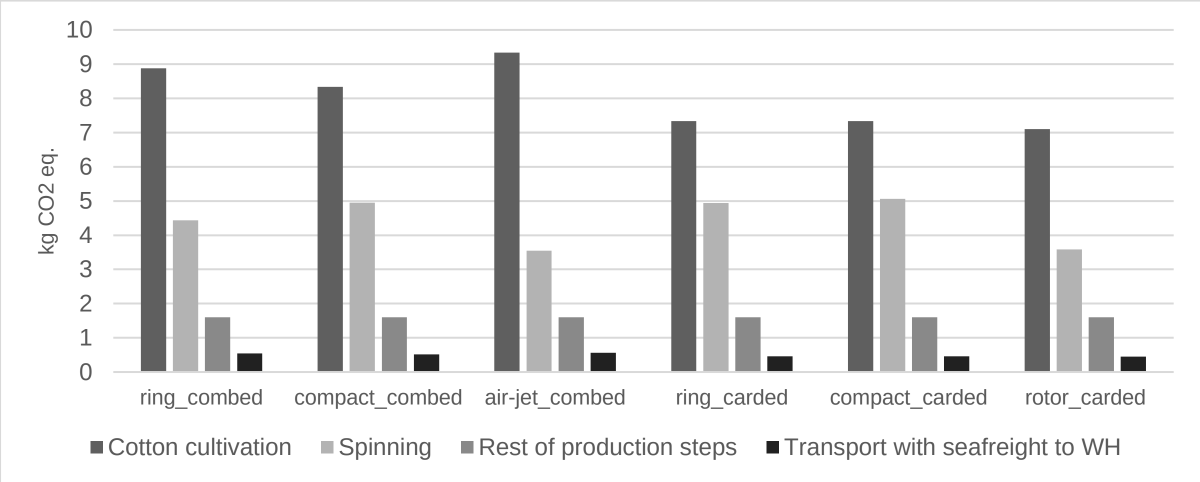
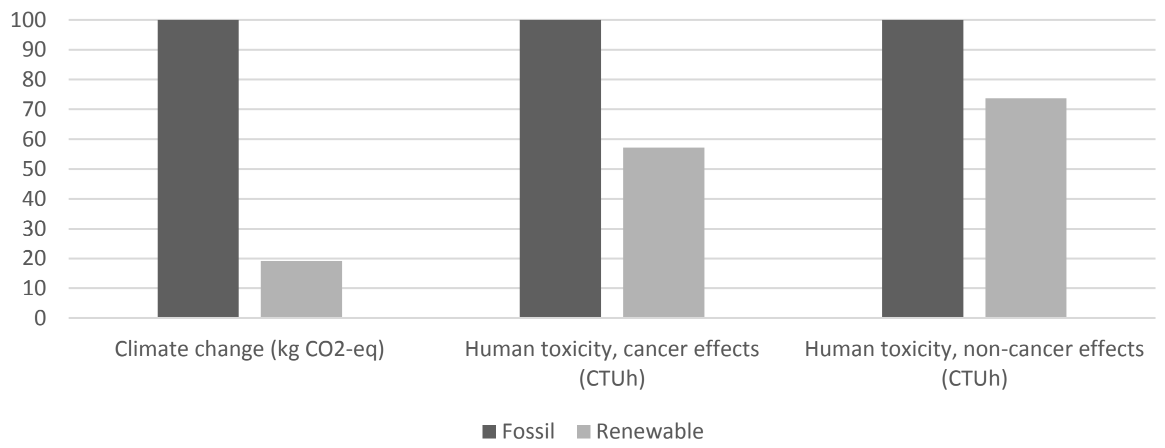


Figure 2.4 presents the climate change and human toxicity impacts of a specific spinning technology, comparing two different energy sources: one fossil-based and one with an electricity mix typically available in Switzerland (hydropower and nuclear energy). This analysis reveals that the impact on climate change (minus 80%) as well as human toxicity (cancer and non-cancer effects with minus 40%) from renewable resources shows greater potential than any modification of the spinning technologies only.

Figure 2.4 Impact of energy sources on climate change and human toxicity in %



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

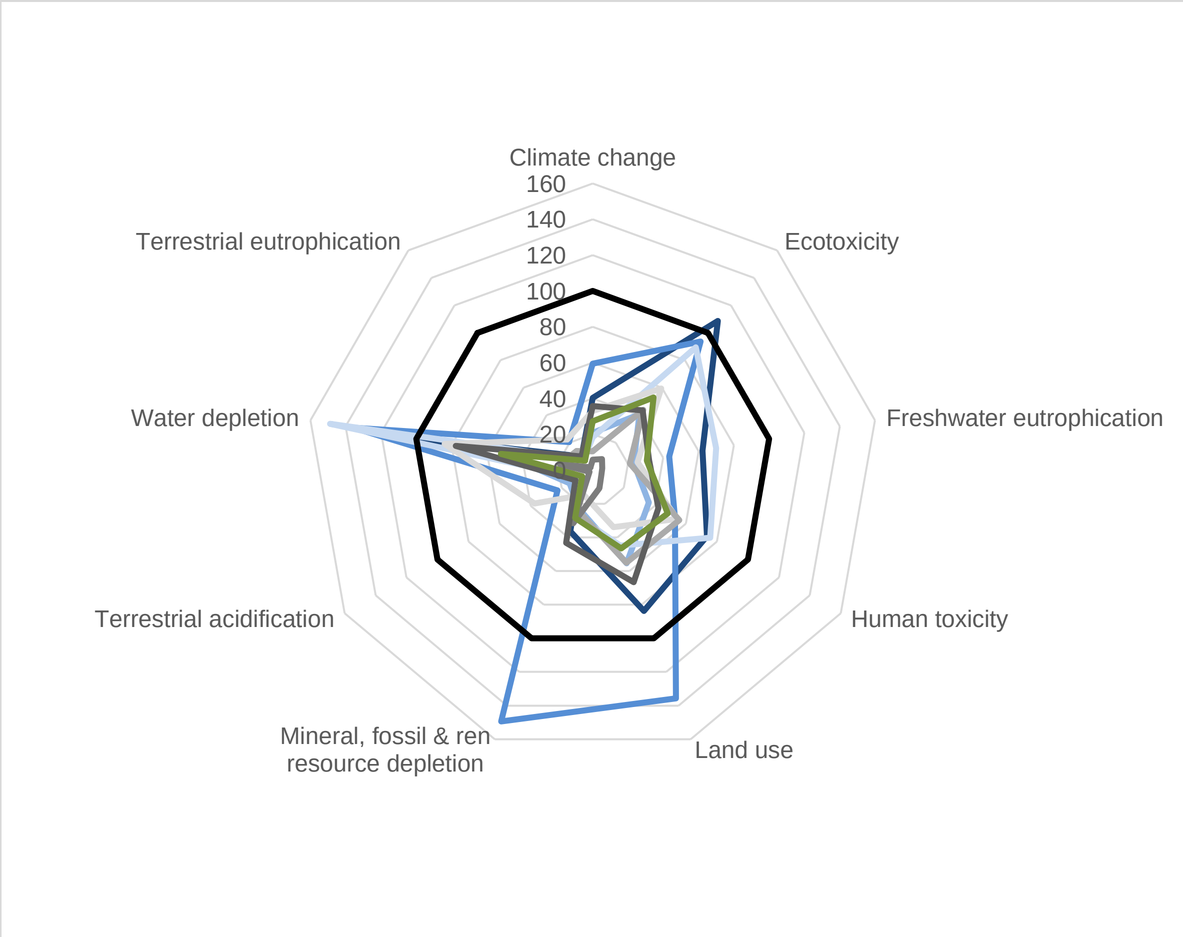
Bleaching, Dyeing and Finishing

Wet processes like bleaching and dying but also the finishing (special treatments) create impacts mainly due to energy consumption, water consumption and the generation of wastewater as well as the specific chemical refinement processes. For the chemical treatments and refinement process, it is often difficult to evaluate the precise impact since not all chemicals are characterized in detail in LCI databases (Life Cycle Inventory = LCI). For chemicals in general the topics are tackled through legal requirements but also with more advanced and strict requirements like the restricted substance list for products (RSL) and the restricted substance list for manufacturing (M-RSL). HUGO BOSS works together with several organization like the AFIRM or the zdhc in order to minimize all kinds of risk.

Figure 2.5 presents the comparison of wet processes, where one factory with its specific dyeing process is set to 100% for all impacts, and the others are scaled accordingly. Clearly, it can be stated that the water depletion is a critical issue for all the different practices applied. Similar is also the result of ecotoxicity, which in most cases shows a similar critical impact. For climate change, mitigation initiatives such as renewable energy or optimized processes can be implemented that result in a much lower impact. The other impacts show a quite big variation from min to max and therefore mitigation solutions need to be elaborated specifically for each case.

The comparison of the various dyeing processes helps to identify for each individual case the hotspots that need to be analyzed to maximize the benefits of an optimization process.

Figure 2.5 Impacts of dyeing in %

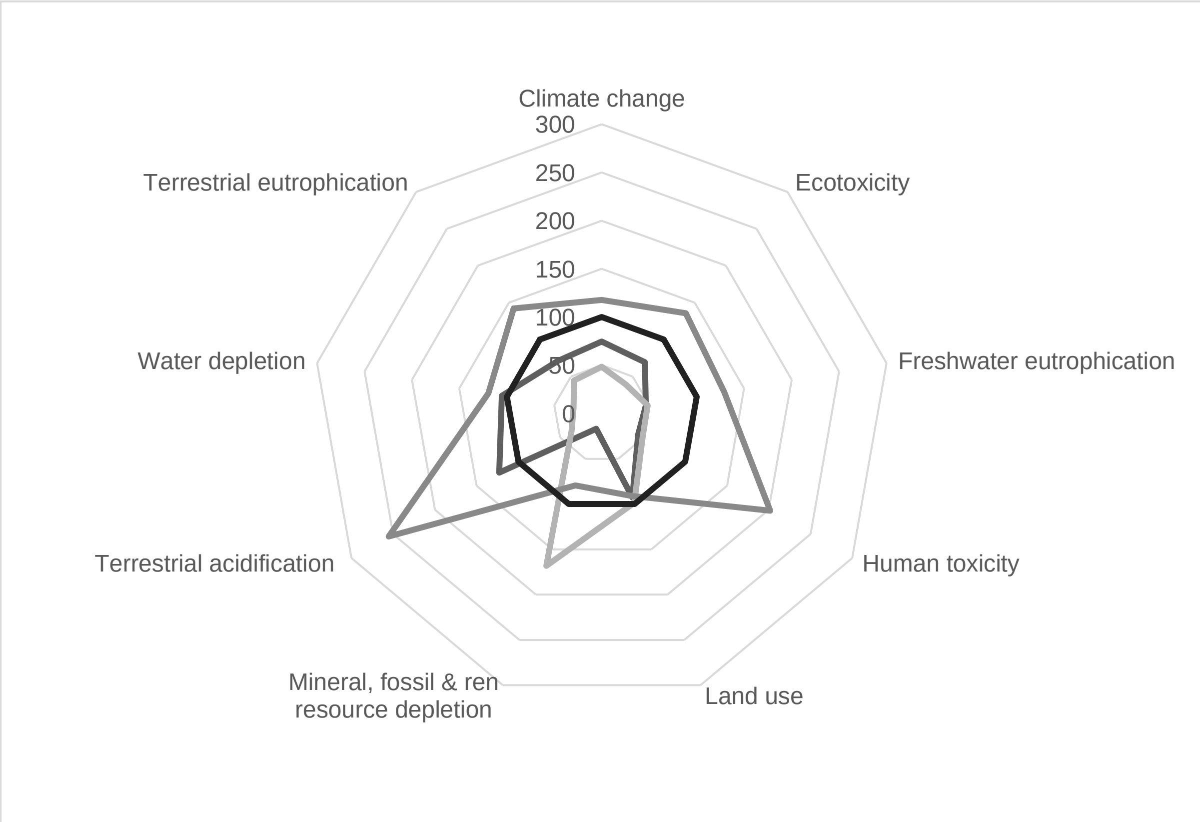


Assembly

The assembly of textile garments has limited impacts on ecosystems apart from the packaging material that is used for the protection of the products or the impacts coming from the applied accessories. In Figure 2.6 a jeans assembly has been taken as reference. Especially for jeans the accessories (e.g. zippers, metal buttons, leather patches) have a quite high impact compared to the processing and therefore in Figure 2.6 accessories are not included in order to have better comparison of the various processes, without any influence from the product groups' bill of material.

The main impacts come from the used energy sources that generate a quite notable difference between the analyzed cases. Depending on possible final treatments, human toxicity and terrestrial acidification can also result as hotspots. As for the other processes, the comparison of the applied practices supports the factory in identifying its specific hot spots and in applying the correct mitigation plan.

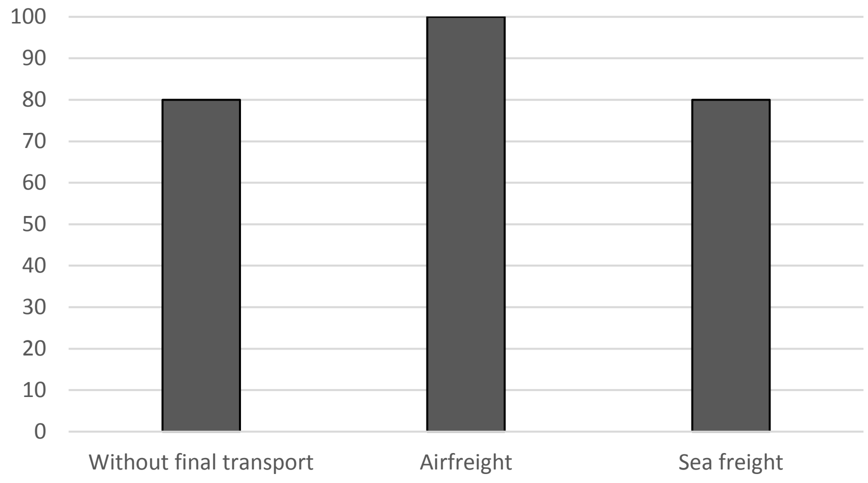
Figure 2.6 Impacts of the assembly in % (without the application of trimming datasets)



<u>Transport</u>

As long as transport modes like sea freight or rail freight are used, the impact on climate change is “not significant”, whereas airfreight accounts for 20% of the climate change impact of a garment, as shown in the below graph.

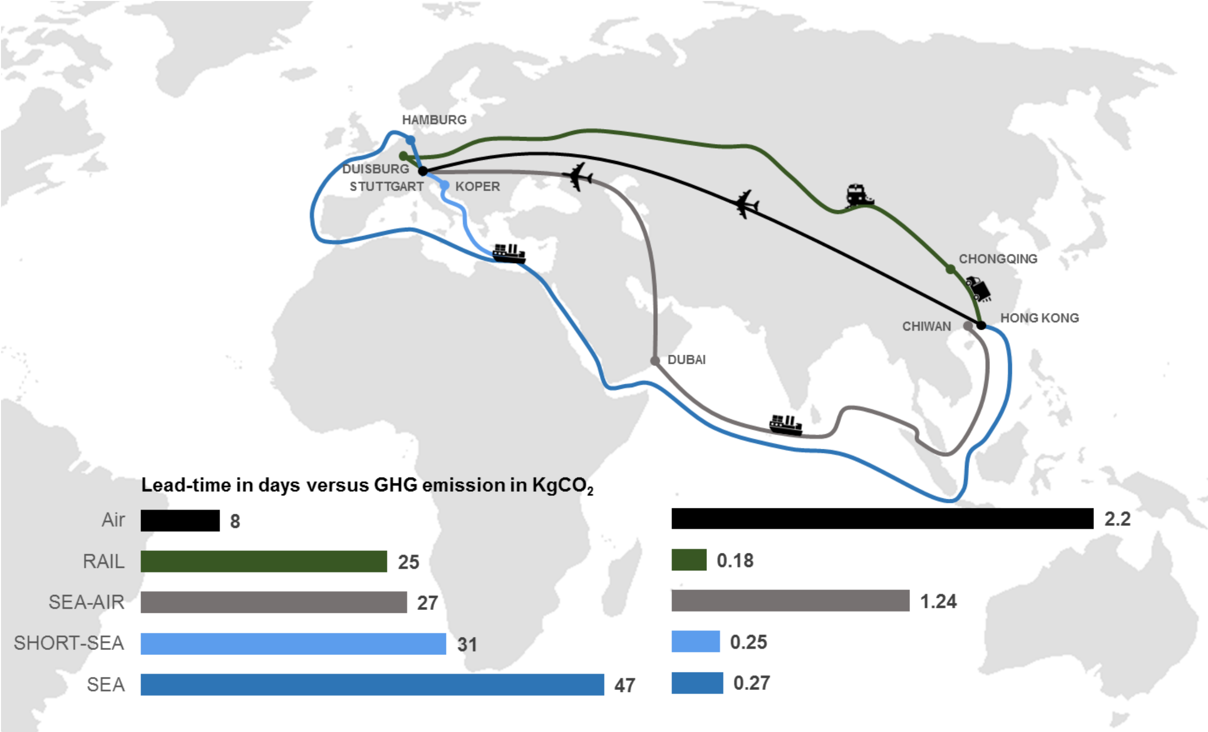
Figure 2.7 Impact of transport mode in %



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

The next graph shows a comparison between lead-time and impact on climate change shipping finished goods from China to the distribution center in Germany.

Figure 2.8 Lead time in comparison to Greenhouse Gas emission of various transport modes



Air and Sea-Air shipping modes are by far the most expensive transport modes, with also the highest impact on climate change, whereas the sea freight ship modes are the most economic ones with a rather low impact on climate change. Rail freight is an ideal ship mode for time critical products shipped at low environmental impacts and reasonable cost.

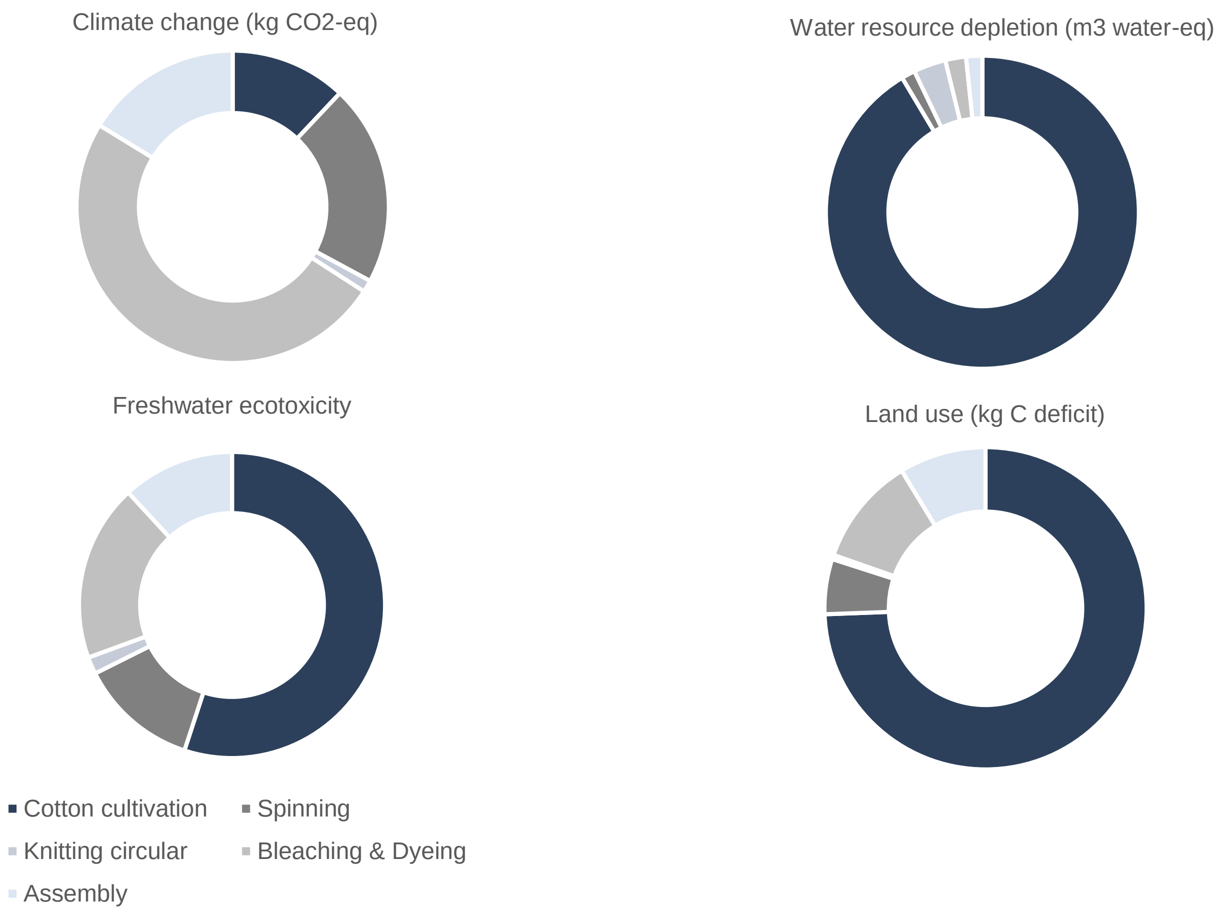
4.2 T-shirt and its supply chain

Annex 1.1 shows the environmental impact of an average cotton-based t-shirt and its respective manufacturing stages (cotton cultivation, spinning, circular knitting, bleaching and dyeing and final assembly). The impacts are indicated as a percentage of the respective impact category.

This analysis of the supply chain allows identifying the production steps most affecting the environment. The specific hotspots of the t-shirt supply chain are bleaching and dyeing, followed by cotton cultivation. The chemical processes of bleaching and dyeing have an impact on ten out of sixteen environmental indicators (climate change human toxicity, acidification, freshwater eutrophication, ozone depletion, particulate matter, ionizing radiation (HH and E), photochemical ozone formation, resource depletion) - especially linked to contamination and energy use. The stage of cotton cultivation affects indicators linked to land use, eutrophication and water scarcity. Due to the use of pesticides, cotton cultivation ultimately affects human health (see annex 1.1)

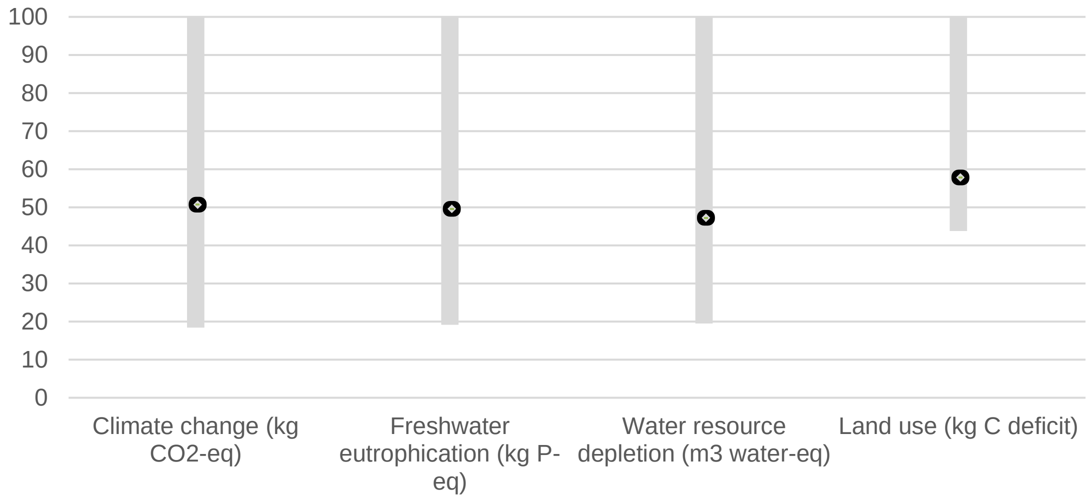
Focusing on the 4 main impacts that are climate change, water resource depletion, land use and the freshwater ecotoxicity as illustrated in figure 3.1, cotton particularly affects aspects related to water (i.e. depletion and eco toxicity) as well as land use, whereas climate change is pressured by energy intensive manufacturing processes, especially through bleaching and dyeing as well as spinning.

Figure 3.1 Environmental impact at the respective life cycle stages



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

Figure 3.2 Cotton t-shirts impact variation (min, median, max)



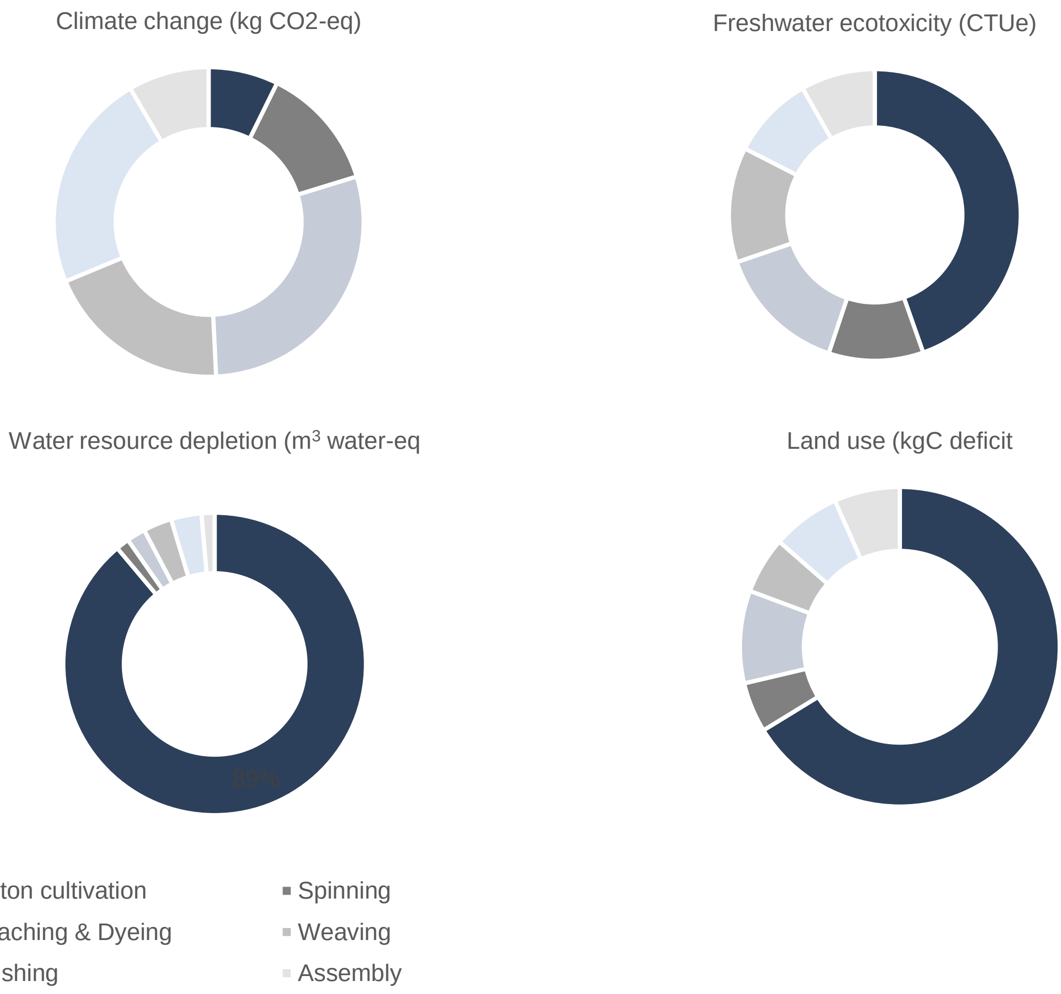
The variation from the maximum impacts compared to the minimum impacts of a high efficient farming and manufacturing shows a difference up to 80%. The median values show an improvement in comparison to the maximum impact values of roughly 50%. In sum, applying efficient farming and manufacturing methods and the use of renewable energy is crucial for reducing the main impacts on the environment. This way already a median performance reduces the impacts more than the half.

4.3 Cotton shirt and its supply chain

Similar conclusions as for the cotton t-shirt can be drawn from the analysis of the cotton shirt's supply chain. Annex 1.2 highlights the impacts of a cotton shirt linked to its specific manufacturing stage. All impacts are indicated in percentage per impact category. As for the supply chain of a t-shirt, the stage of cotton cultivation affects environmental indicators linked to eutrophication (marine, freshwater and terrestrial), land use, water scarcity and human toxicity. Chemical and industrial processes such as spinning, bleaching and dyeing or weaving highly affect indicators related to the use of fossil energy (annex 1.2).

As illustrated in figure 3.3, the process of cotton cultivation is the main hot spot for indicators related to water and land use. The impact on climate change is nearly equally distributed between the energy-intensive manufacturing process of bleaching and dying, weaving and finishing for which the use of fossil-based energy is a major root cause.

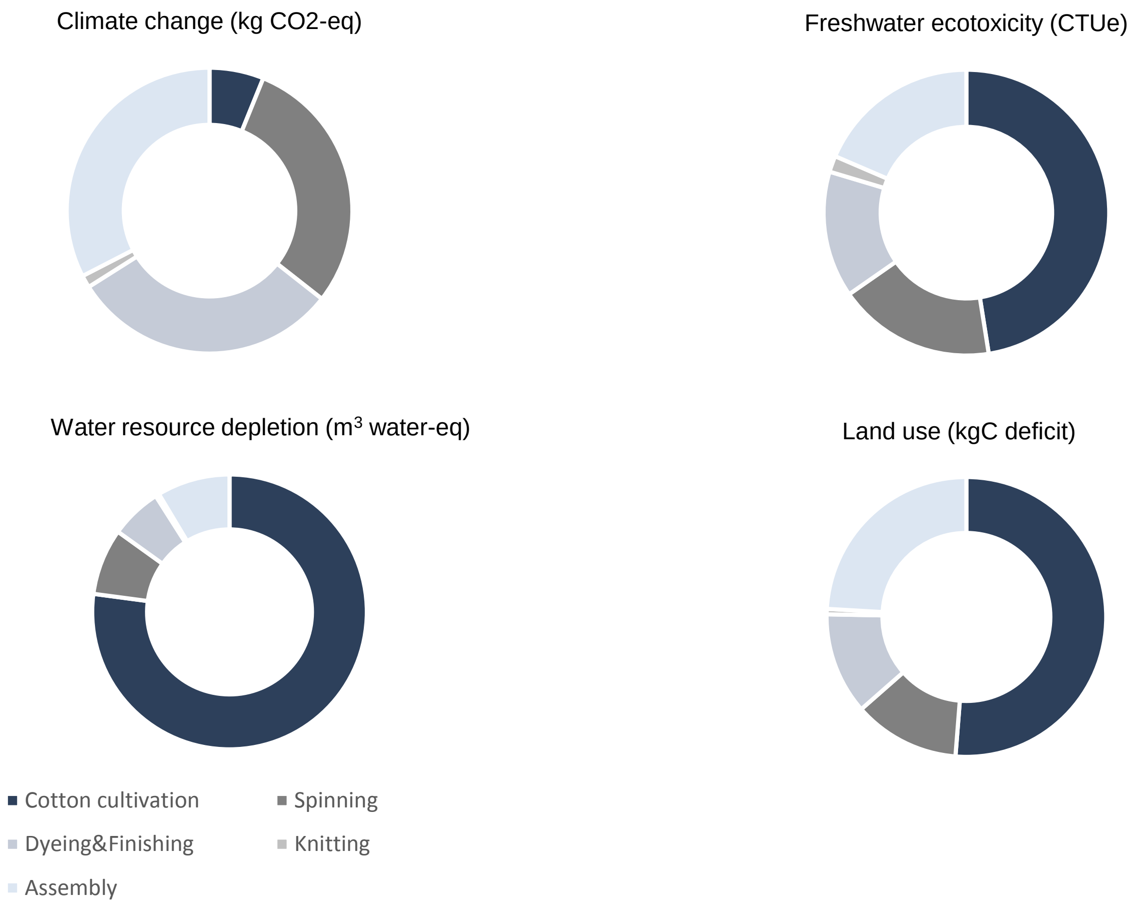
Figure 3.3 Life cycle stages and their impacts on ecological indicators



4.4 Cotton jersey and its supply chain

The conclusions for the cotton jersey are in general similar to the previous cotton products. Annex 1.3 highlights the impacts of a cotton jersey linked to its specific manufacturing stage. In comparison to a cotton shirt, having different refinement process, the distribution of impacts between the cotton farming and the chemical and mechanical refinement processes are lower for cotton. This is mainly due to a very low impacting cotton consumed in this supply chain. Nevertheless, also for this case cotton remains an important hotspot.

Figure 3.4 Life cycle stages and their impacts on ecological indicators

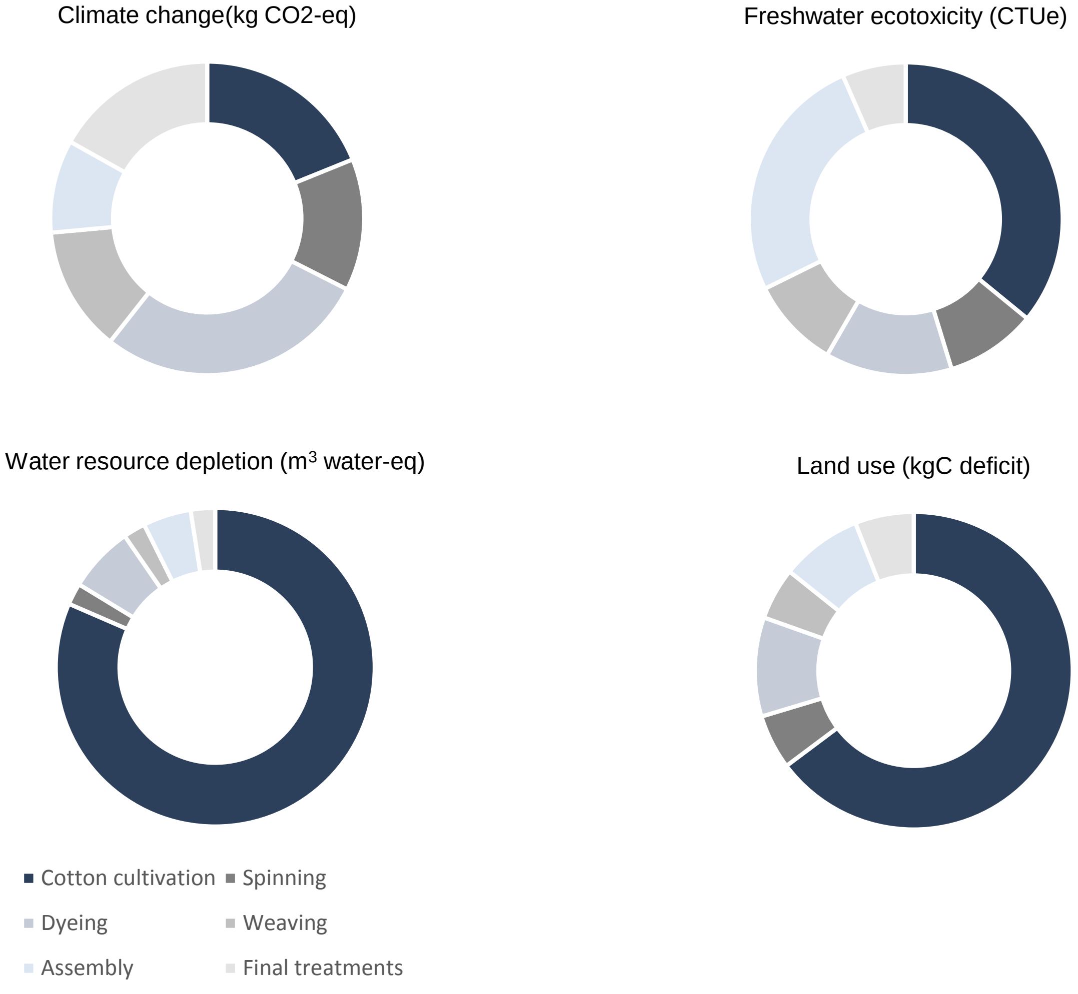


Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

4.5 Cotton Jeans and Leisure Trousers

The conclusions for the cotton jeans and leisure trouser are due to the higher amount of cotton used and the accessories (e.g. zipper, metal button, leather patches) applied during the assembly, which results in a higher impact on freshwater ecotoxicity. Annex 1.4 highlights the impacts of a cotton shirt linked to its specific manufacturing stage. All impacts are indicated in percentage per impact category.

Figure 3.5 Life cycle stages and their impacts on ecological indicators



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

Overall, the biggest levers for environmental optimization along the supply chain of cotton-based apparel are the following:

- reduction of water consumption and pollution during the cultivation of cotton;
- use of renewable energy in order to avoid harmful impacts on human health, resulting from the combustion of fossil fuels, and to reduce climate change;
- optimization of the wet processes in terms of energy consumption, wastewater treatment and the application of new chemical substances having a lower environmental impact.

The analyses show the importance of product – process – factory specific hotspot analyses, in order to invest resources where biggest improvements can be achieved.

4.6 Wool products

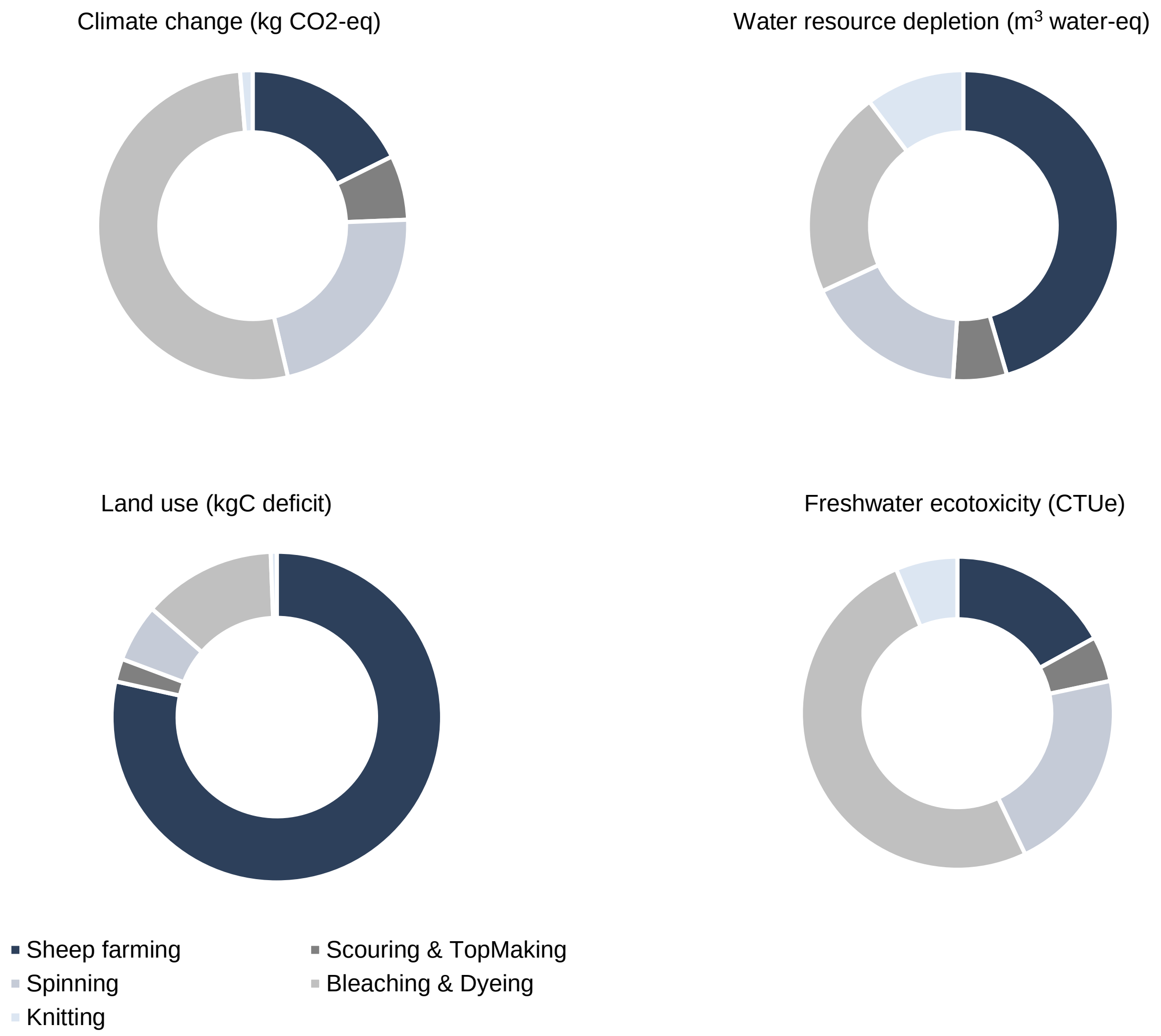
Wool products at HUGO BOSS are mainly found in the product groups of suits, knitwear and hosiery. For suits HUGO BOSS is running a detailed analysis that should be finalized within the end of 2017 and published in the next edition.

The wool knitwear was already published in the first edition but now actualized with the latest allocation rules coming from **European Product Environmental Footprint Category Rules (PEFCR) that applies an allocation factor for farming of 47%** to the textile sector.

Wool knitwear

With this latest updated allocation factor for sheep farming, the main hotspots of the wool knitwear supply chain are still attributed to the farming procedure for land use and water resource depletion, though with less intensity. Higher portions of impacts are due to chemical processes like bleaching and dyeing, followed by spinning (see annex 1.3). With the described change, the farming process is still important but the bleaching and dyeing phases increased their relevance.

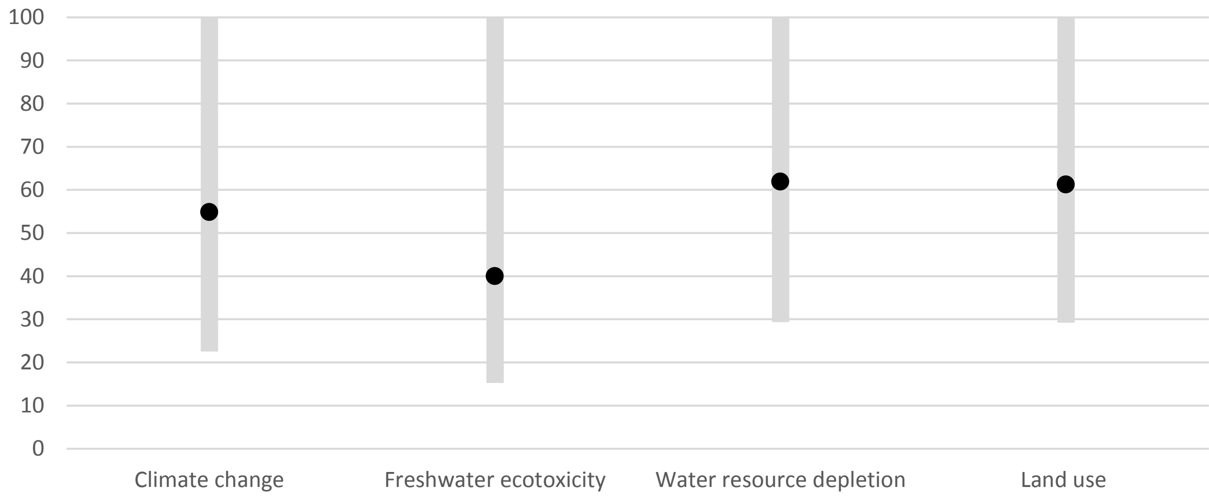
Figure 3.6 Life cycle stages and their impacts on ecological indicators



Source: World Apparel & Footwear Life Cycle Assessment Database (WALDB)

Similar to cotton-based products, water scarcity and land use issues are closely linked to the farming process whereas bleaching and dyeing lead to freshwater ecotoxicity and further contribute to climate change due to generated CO2 emissions.

Figure 3.7 Wool knitwear's impact variation (min, median, max)



The variation from the maximum impacts compared to the minimum impacts of a high efficient farming and manufacturing shows a difference up to more than 80%. The median values show an improvement in comparison to the maximum impact values of roughly -40%. Thus, applying efficient farming and manufacturing methods especially for bleaching and dyeing is crucial for reducing the main impacts on the environment.

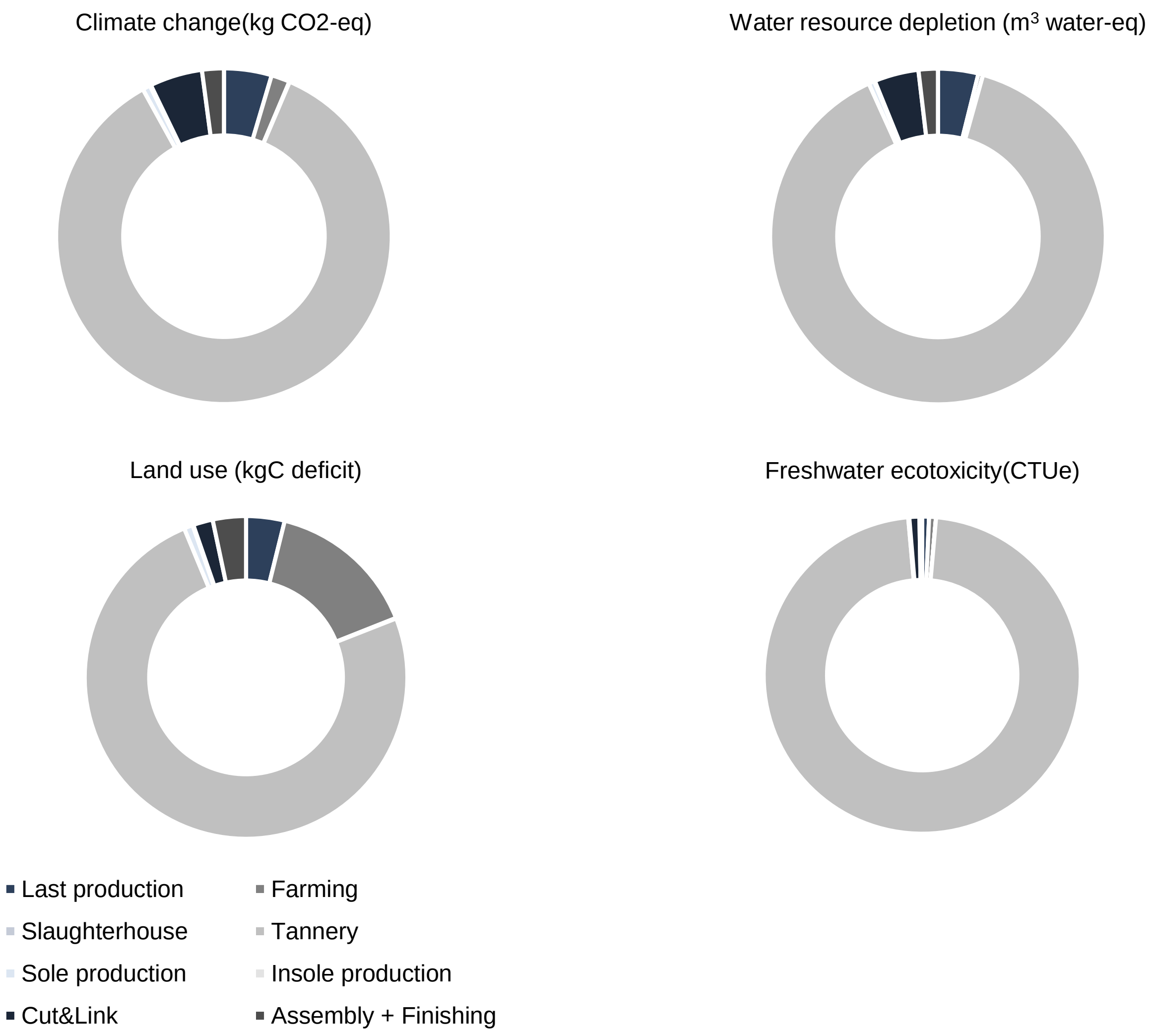
4.7 Leather products

Leather products at HUGO BOSS are mainly found in the product group's shoes, leather garments and leather accessories. The Life Cycle Assessment of leather shoes was already concluded in 2016 as part of the ecoshoes project at the HUGO BOSS shoes manufacturing in Italy. In total 31 production mills (24 tanneries and 7 other facilities) were analyzed in order to increase the reliability of the Life Cycle Inventory (LCI). Finally, the allocation rules coming from **European Product Environmental Footprint Category Rules (PERCR)** recommending a factor for farming and slaughterhouse for hides used in the leather sector was applied.

Leather shoe

As clearly visible in all the four main environmental impacts in figure 3.7 and the graph in annex 1.6, the tanning process has by far the biggest impact on all impact categories. Due to the fact that only 12% of the farming and only 3,5% of the slaughterhouse is allocated to the hides, the impacts of those two steps are relatively small for a leather shoe, which is also reflected by the commercial value of hides in correlation to the other product groups (milk and meat), which means that leather (limited to cows, goats, sheep's and buffalos for HUGO BOSS products) is in fact a byproduct of the food industry.

Figure 3.7 Life cycle stages and their impacts on ecological indicators



5. Natural Capital Valuation

Life Cycle Assessments are crucial for identifying environmental impacts. However, comparing these different impacts to each other requires a "normalization step" so that climate change impacts can be put in relation to the other environmental impacts. The Natural Capital Protocol, developed by the Natural Capital Coalition, a global multi-stakeholder initiative, offers such an approach by monetizing eco-system services.

HUGO BOSS and Quantis started to apply the idea of natural capital's monetization to its previously conducted Life Cycle Assessments in the first edition "The Environmental Impact Valuation as Scientific Basis for a Sustainable Apparel Strategy", showing the correlation (in %). In this paper it is shown in absolute values in order to better compare the various impacts of processes and supply chains.

The first step was to assign the identified impacts of the LCIAs according to the Life Cycle Inventory methodology IMPACT 2002+ vQ2.2 (see figure 1.1). This methodology is based on a combined midpoint/damage-category oriented approach.[2]

LCA midpoint impacts consider all harmful impacts in the various flows of Life Cycle Inventory. Examples include terrestrial ecotoxicity, acidification or eutrophication. These midpoint categories are assigned to damage categories, which reflect the damages to human health, to the environment, to the resources' stock, water withdrawal or climate change. The publicly available monetizing factors have been applied to these damage categories in order to transform damages into monetary expenses.[3]

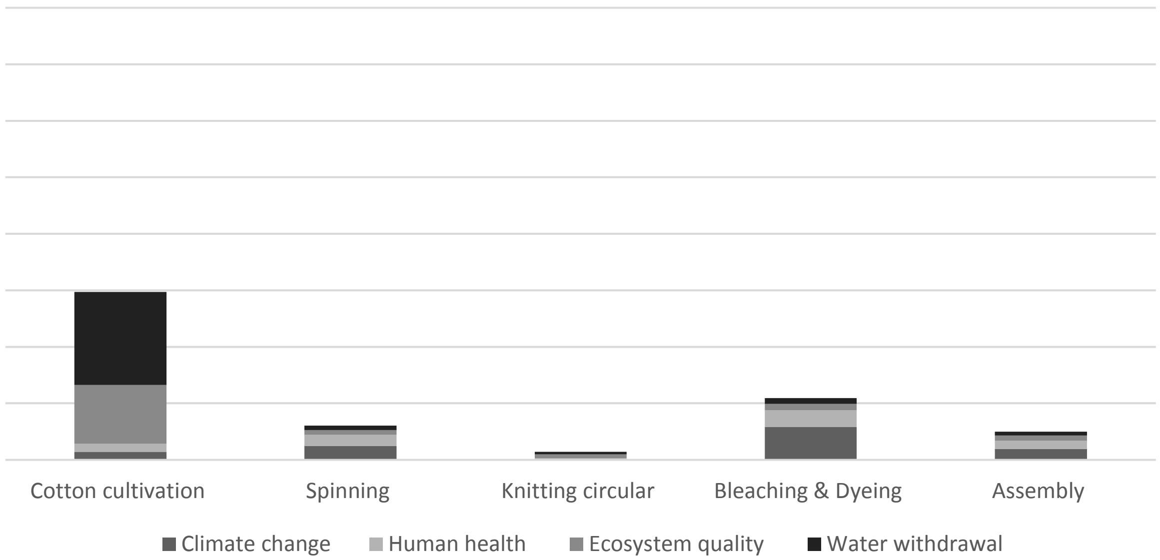
HUGO BOSS has applied the monetizing factors available for the midpoint categories calculated from the LCAs studies presented in the section above. With this approach, the hotspot areas found already by applying the classical LCA approach can be even better compared and discussed with non LCA experts since all impacts are harmonized to a monetary value. It should be however noted that these are first attempts and that further studies are definitely required to define scientifically robust factors for sector independent application.[4]

[2] See for further explanation of a midpoint/damage-oriented approach
[3] To give an example: The human health impact is measured in DALY – Disability-Adjusted Life Years (see http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/) and the monetizing factor used is 90'000 chf/DALY. Hence, the damage is quantified in Swiss Francs.
[4] For the resources category, a monetizing factor is not yet available.

Cotton products

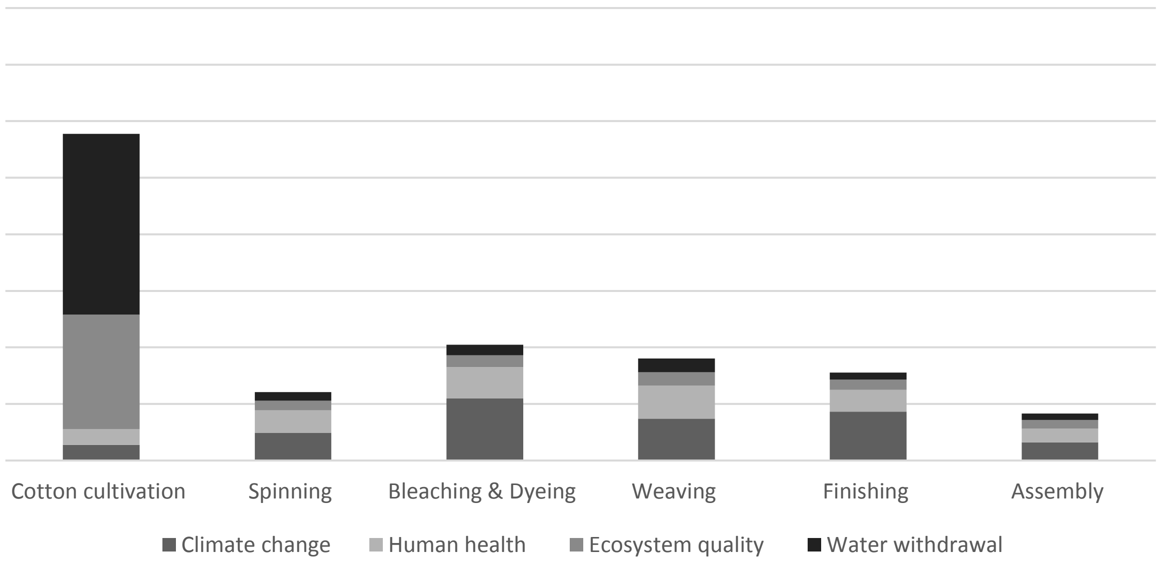
a) Cotton t-shirt

Figure 4.1 monetized impacts (in €) of the cotton t-shirt's supply chain



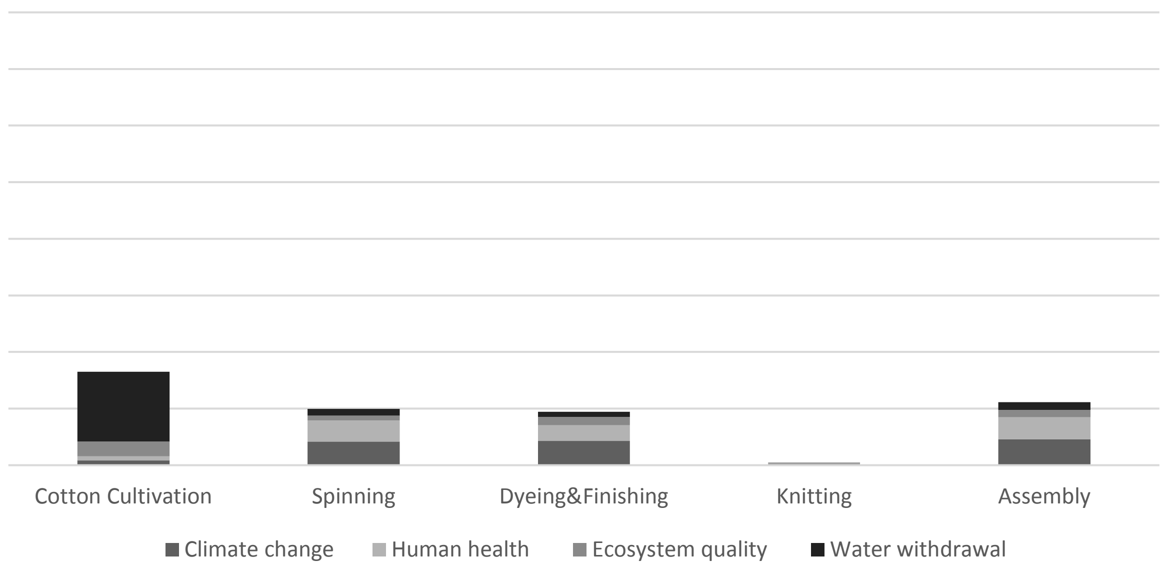
b) Cotton shirt

Figure 4.2 monetized impacts (in €) of the cotton shirt's supply chain



c) Cotton Jersey

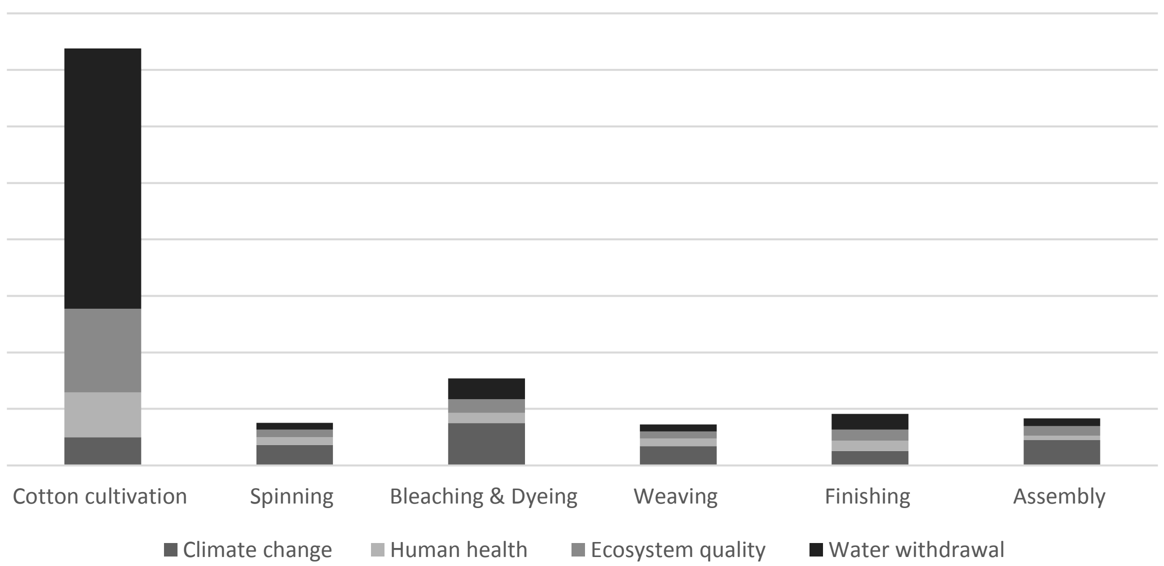
Figure 4.3 monetized impacts (in €) of the cotton jersey's supply chain



For this jersey supply chain, a cotton was selected that has a very low environmental impact.

d) Cotton Jeans & Leisure Trousers

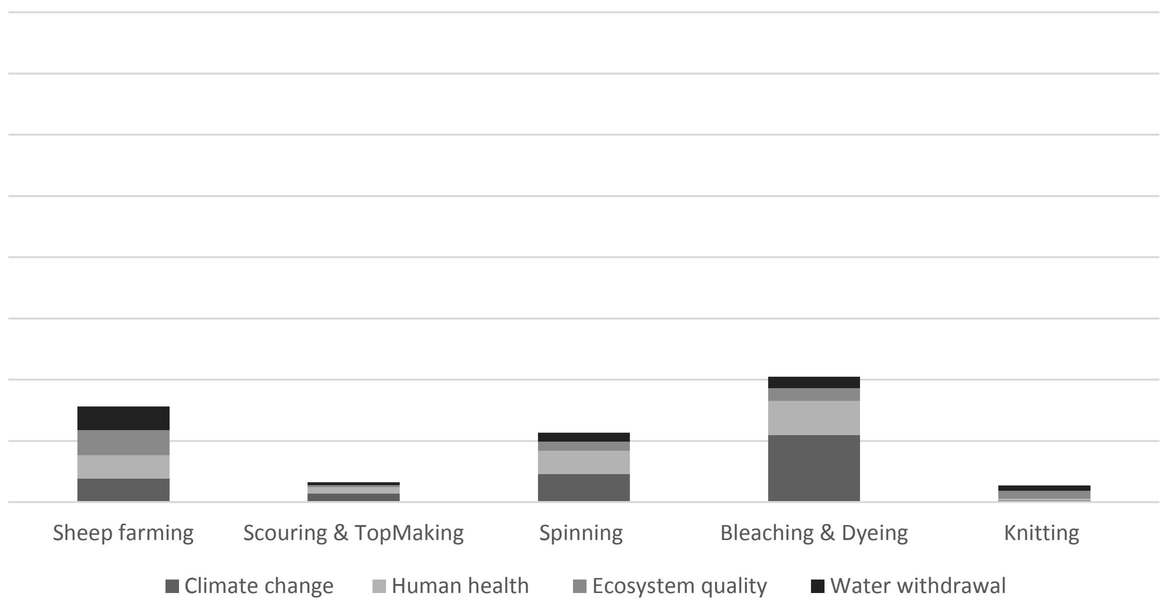
Figure 4.4 monetized impacts (in €) of the cotton jeans supply chain



Wool products

a) Wool knitwear

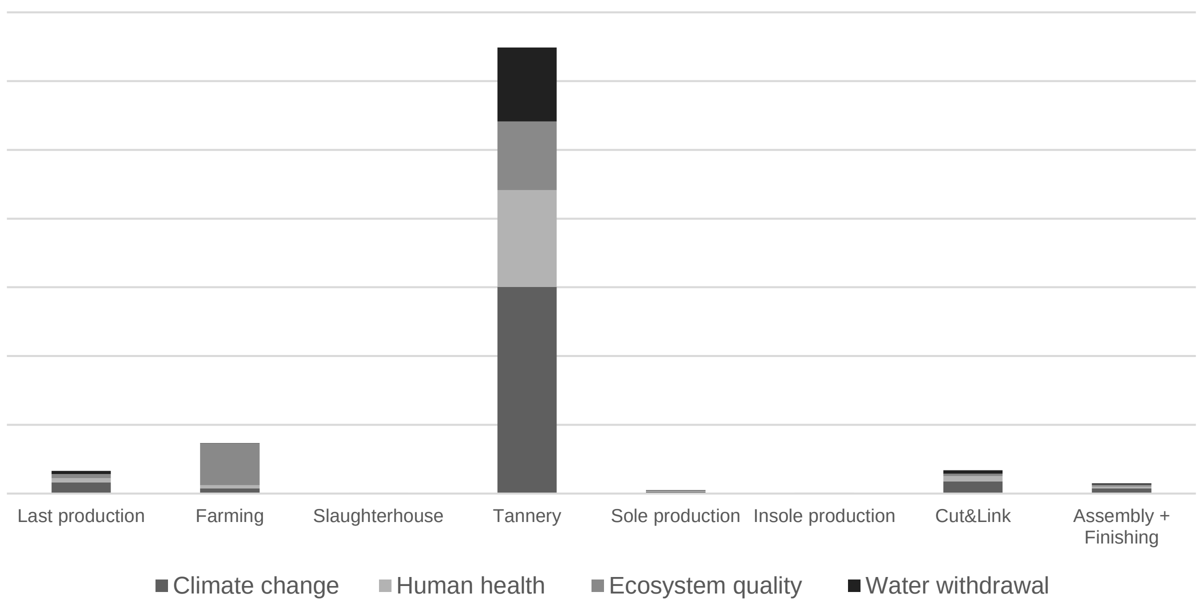
Figure 4.5 monetized impacts (in €) of the wool knitwear's supply chain



Leather products

a) Leather shoes

Figure 4.6 monetized impacts (in €) of the leather shoe's supply chain



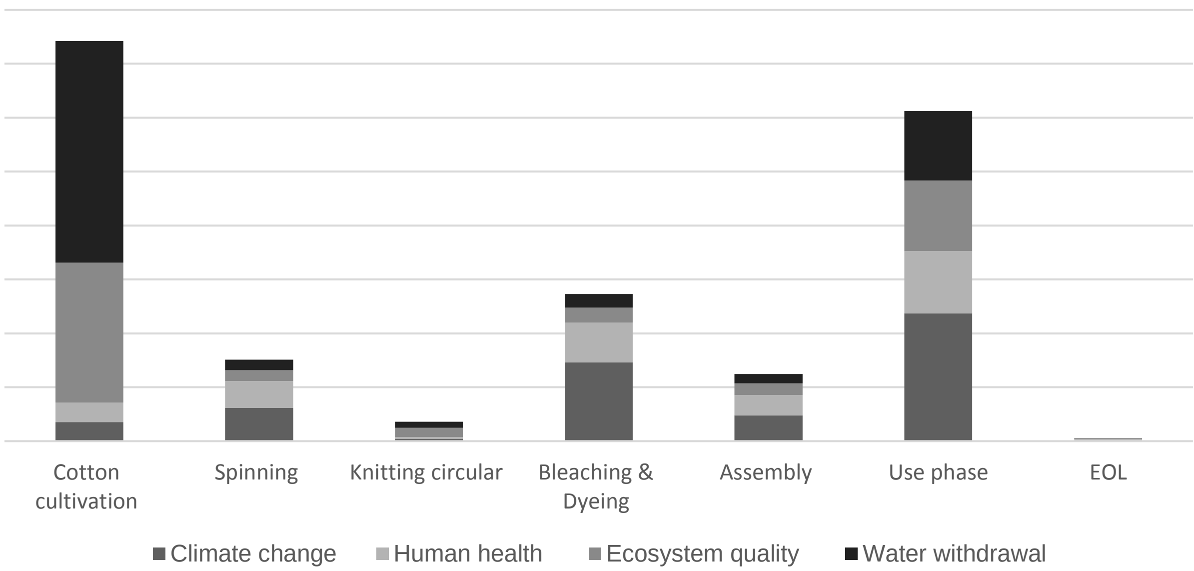
The scale for the leather shoe is more than 3 times as for the textile products and the tannery process is clearly the main hotspot. Climate change is the main driver for the impacts within the various tanning processes and the LCA made by ecobilan in 2011 for BLC (see https://echa.europa.eu/documents/10162/8ff2f208-c6a7-4ab8-8573-4100ac8214df on page 84) highlights that the chrome-free (aldehyde) tanning method is the most energy intense tanning process. HUGO BOSS is in contact with tanning experts in order to analyze all the latest tanning technologies and make them public as part of the extension of the Environmental Impact Valuation.

Examples of complete value chain, including the use phase and end of life (EOL)

In order to show the comparison of impacts deriving from manufacturing steps, versus the use phase and the final disposal of a product, specific scenarios have been realized. For the t-shirt case the use phase has been calculated with the theoretical assumption of 52 cleaning processes in one product life, resulting in the addition of 43% of impacts (compared to the cradle to gate LCA), due to water and energy use, while the end of life only accounts for an additional 0.3% of the product‘s total impact.

Cotton t-shirt

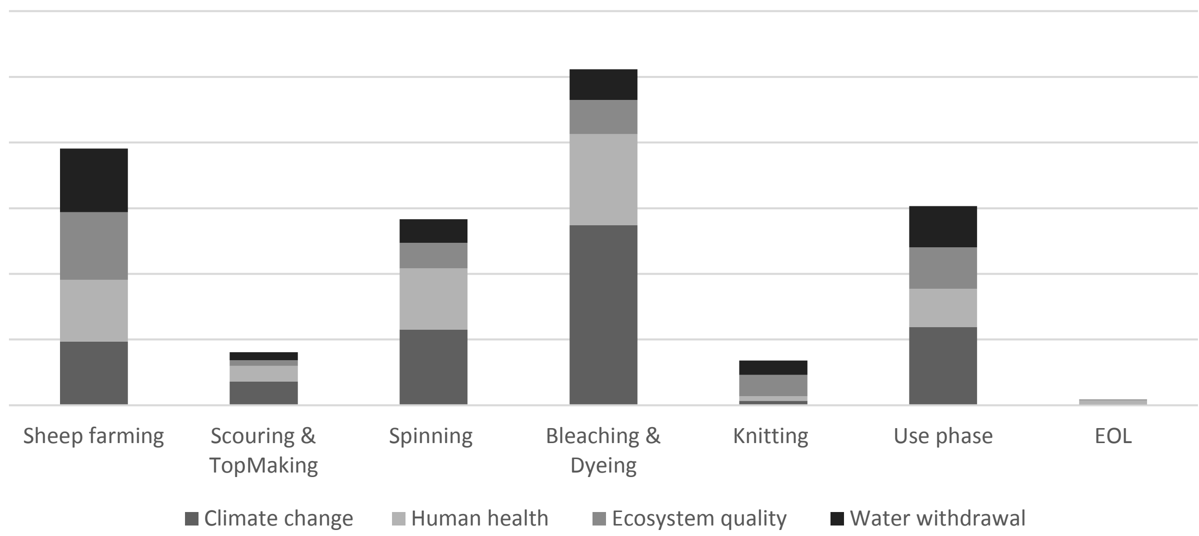
Figure 4.7 monetized impacts (in €) of the cotton t-shirt’s supply chain including use phase and end of life (EOL)



Wool knitwear

For a typical wool sweater the use phase adds about 23% of impacts, which is less than for a cotton t-shirt due a more careful handling that is required for wool products, while the end of life only accounts for an additional 0.6 % of the product's total impact.

Figure 4.8 monetized impacts (in €) of the wool knitwear's supply chain including use phase and end of life (EOL)



Leather shoe

For the use phase of a leather shoe roughly 0.07% - due to the waxing of the leather need to be added and the end of life which mainly goes into landfill accounts for another 0,5 to 1%, unfortunately no precise data are yet available.

Summary

The use phase depends much on the customer's habits and those reported above are just theoretical indications to show the relation between manufacturing and use phase. For HUGO BOSS high quality garments the use phase is probably much longer in comparison to fast fashion items and the supply chain impacts are drastically reduced per single wearing occasion.

Normalizing the impacts by applying monetizing factors underscores the major findings of the conducted Life Cycle Assessments but also make them better comparable outlining the "hotspots" of a single product but also of the product portfolio.

The key learnings from the natural capital evaluation are that the ecosystem quality impacts (e.g. water depletion, ecotoxicity) are important for tanneries, bleaching and dyeing as well as cotton cultivation. Furthermore, the type of energy used for the refinement processes or the ship mode are decisive for climate change.

6. Conclusions and Next Steps

This second paper represents an overview of now eight years of research in the area of sustainable supply chain management. The most important natural raw materials (cotton, wool and leather) have been analyzed and the conclusions can be made as follow:

Life Cycle Assessments (including Life Cycle Inventories) remains the key tool for a holistic understanding of impacts on ecosystems caused by a product's value chain. Cotton cultivation, farming and the chemical refinement processes are of particularly relevance and local or even factory specific conditions need to be considered before developing mitigation strategies.

HUGO BOSS and Quantis together with their partners of the World Apparel and Footwear Life Cycle Assessment Database (WALDB) will continue to investigate on environmental impacts focusing on understanding better wool, leather but also products made of other natural or man-made fibers. With the expertise of the scientific partners, HUGO BOSS will develop as a next step a sustainable leather strategy with the aim to outline all possible impact mitigations with a particular focus on tanning methods but also looking at all other refinement processes.

Monetizing eco-system services provides a tool to compare best the various impacts on the environment with each other. Hotspots become more visible. HUGO BOSS with the support of Quantis has started to address also social impacts according to existing standards with a similar approach as described in the environmental impact. Furthermore, collaborations on national and international level in cross sectorial working groups have been established to enable a triple bottom line impact valuation meaning social, environmental but also economic impacts and benefits.

To conclude, HUGO BOSS and its partners will continue to investigate on impact valuation and make them public to best support efficient mitigation strategies throughout the whole supply chain HUGO BOSS will be further promoting the approach of the Natural and Social Capital by conducting additional in-depth analyses so as to find ways to efficiently reduce impacts on society and ecosystem services.

Mai 31, 2017

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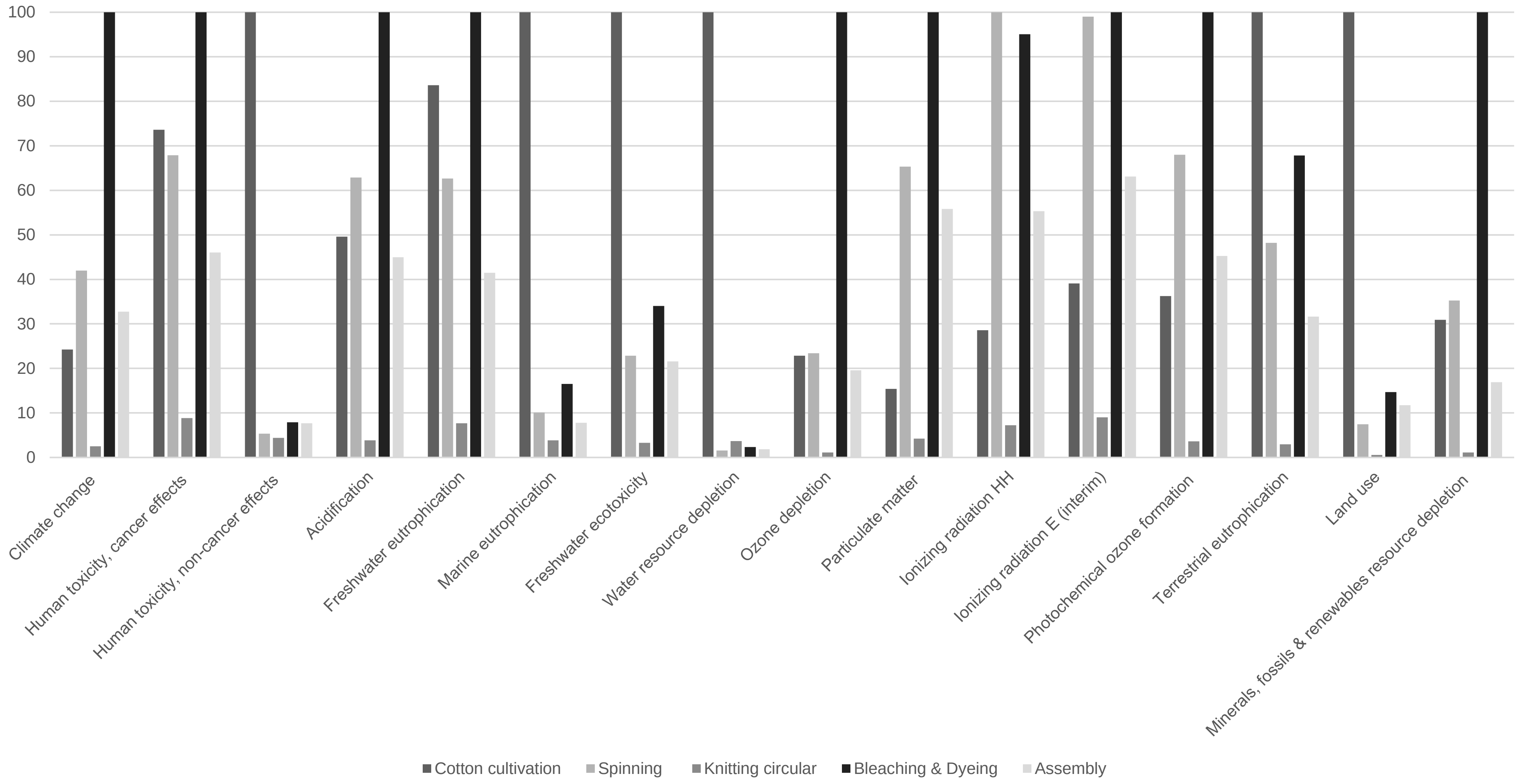
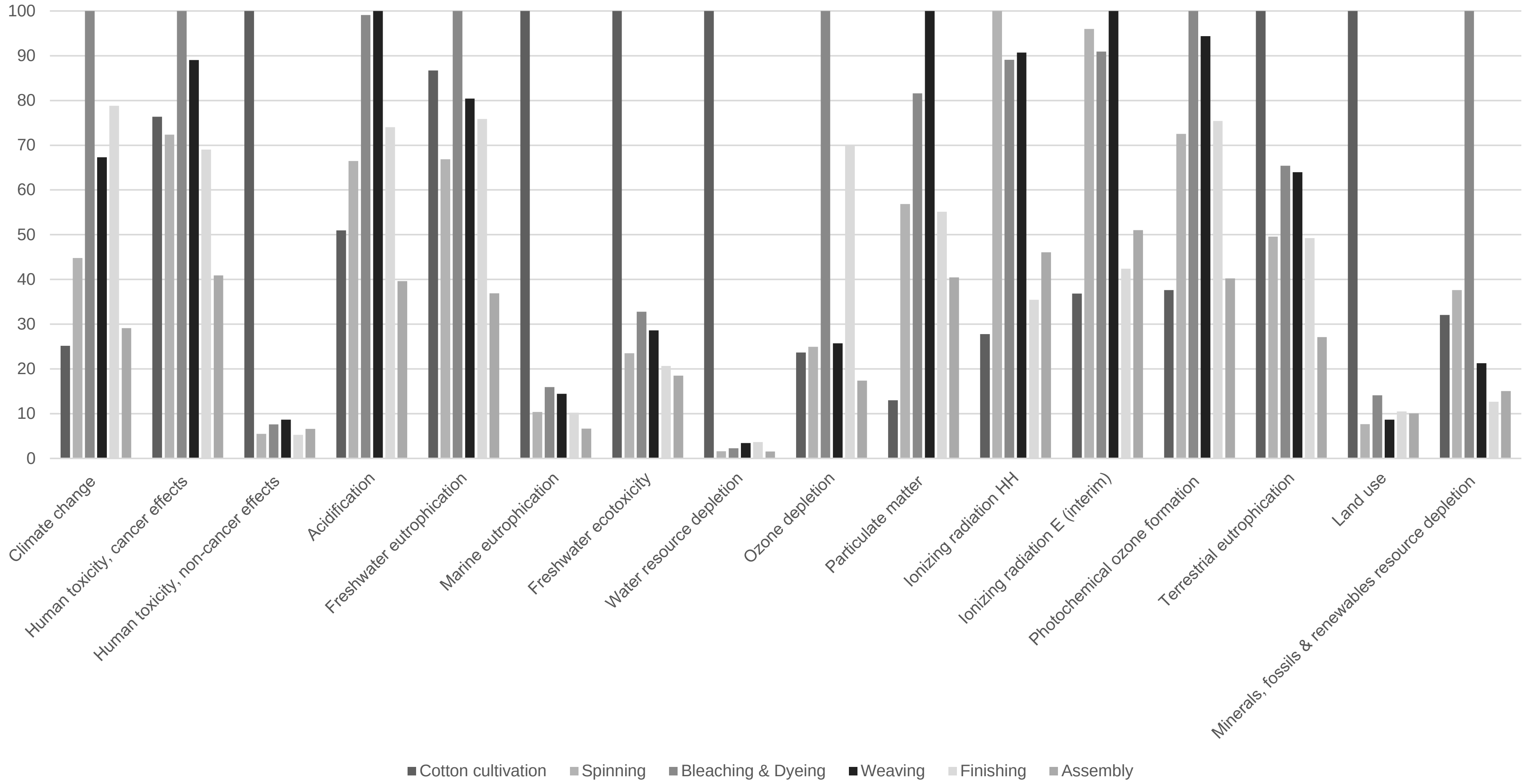
Appendix

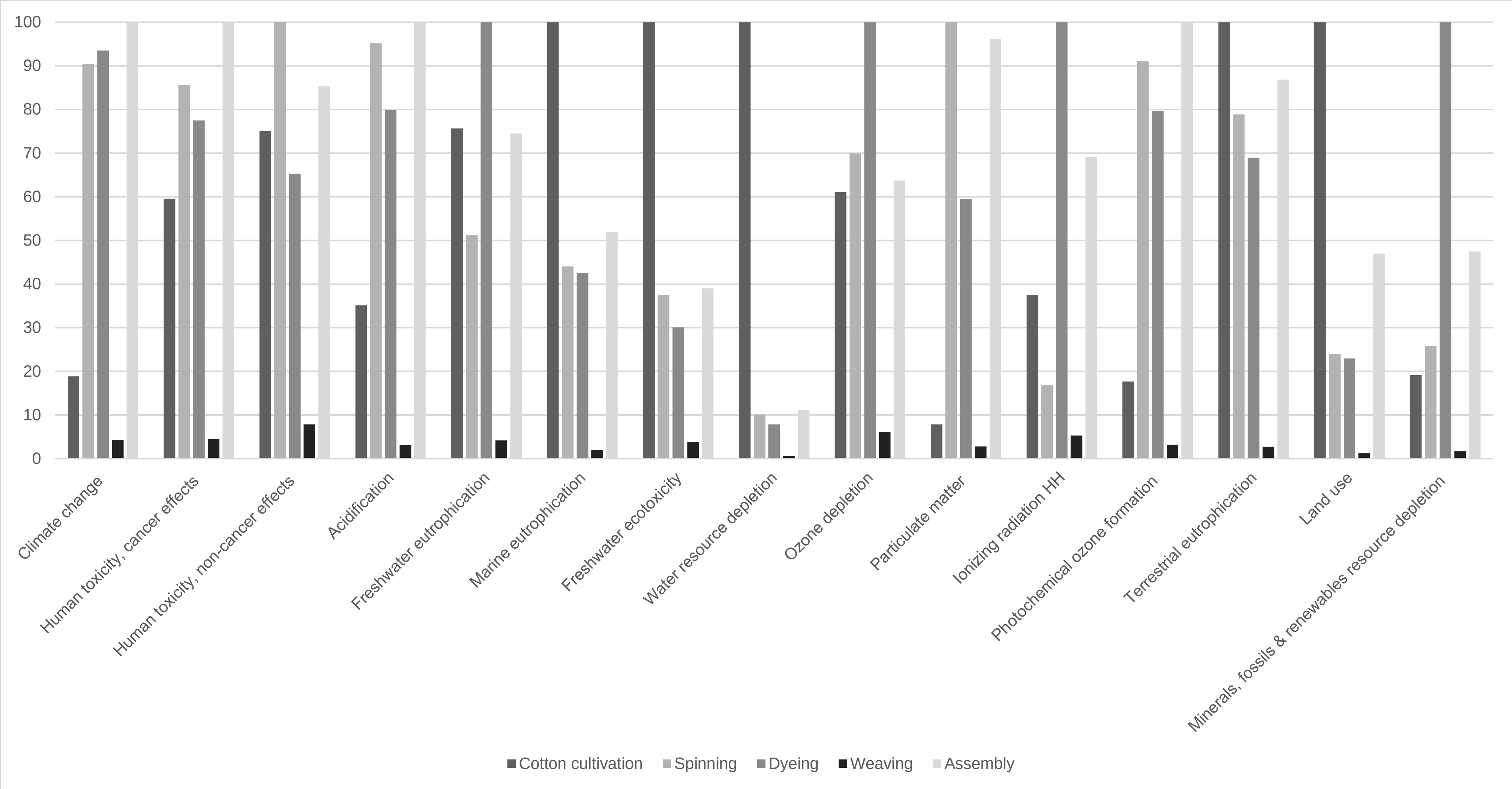
Annex 1.1 Cotton t-shirt, median ecological impacts along the supply chain in %



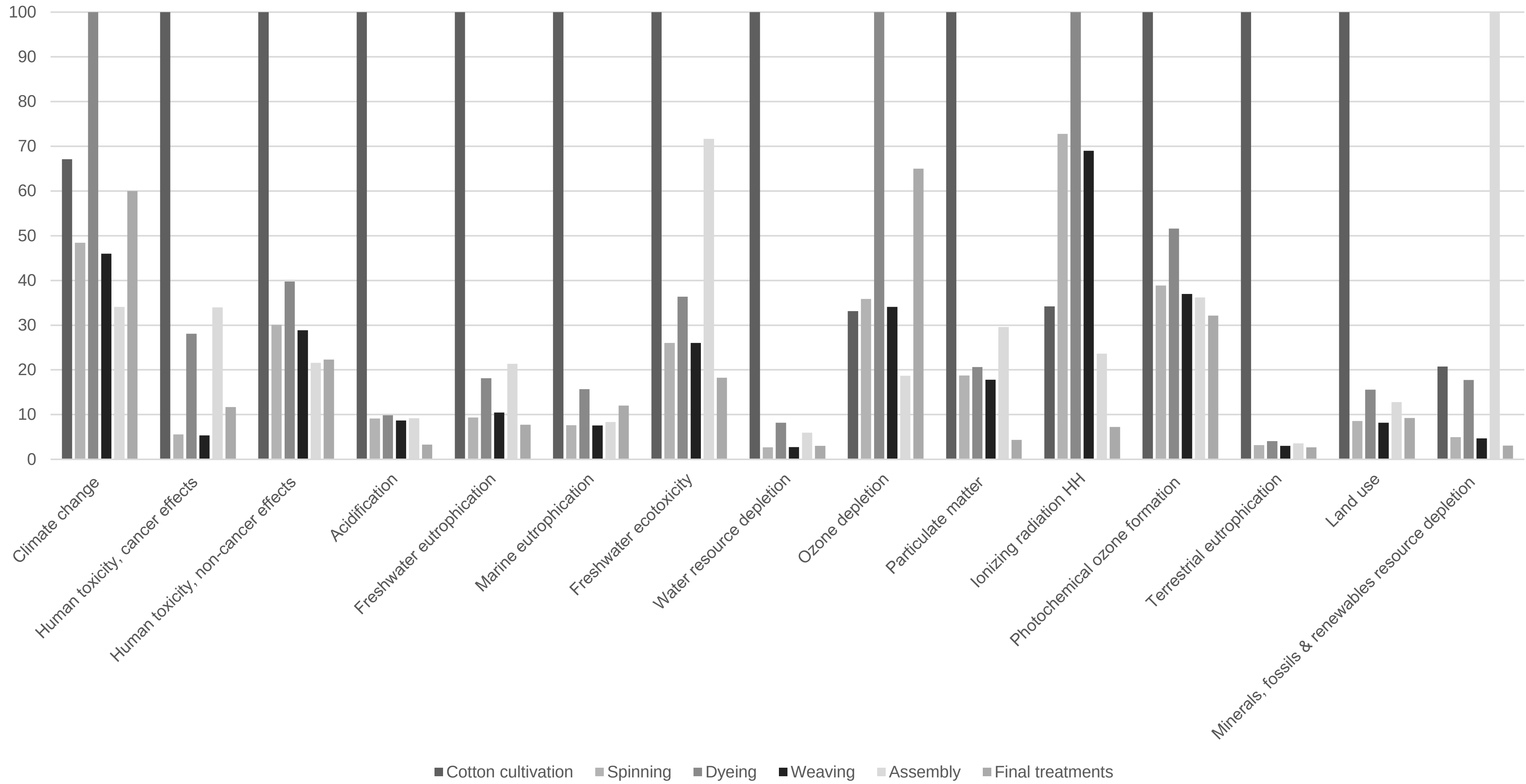
Annex 1.2 Cotton shirt, median ecological impacts along the supply chain in %



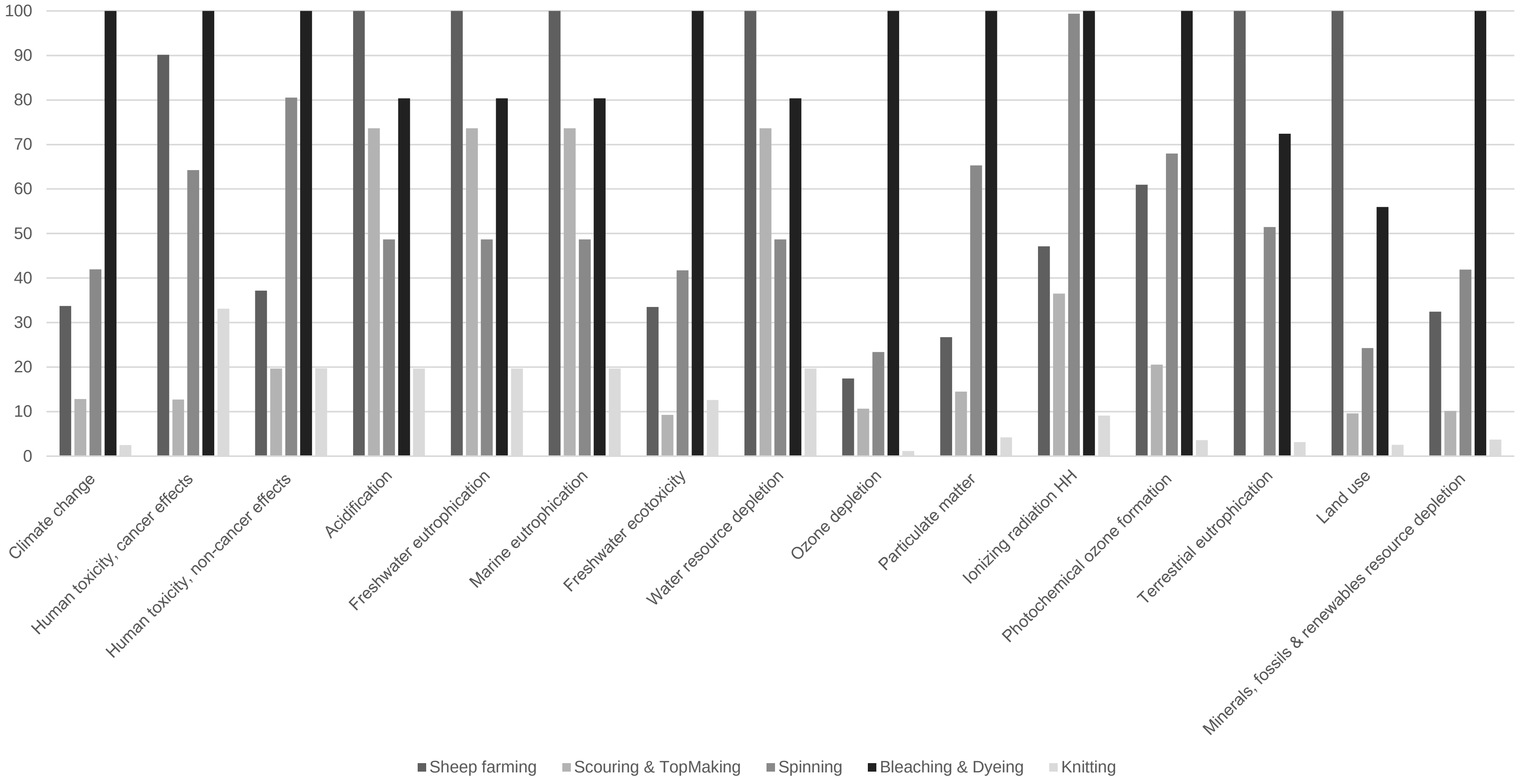
Annex 1.3: Cotton Jersey, median ecological impacts along the supply chain in %



Annex 1.4: Cotton Jeans / Leisure Trousers, median ecological impacts along the supply chain in %



Annex 1.5: Wool knitwear, median ecological impacts along the supply chain in %



Annex 1.6: Leather shoes, median ecological impacts along the supply chain in %