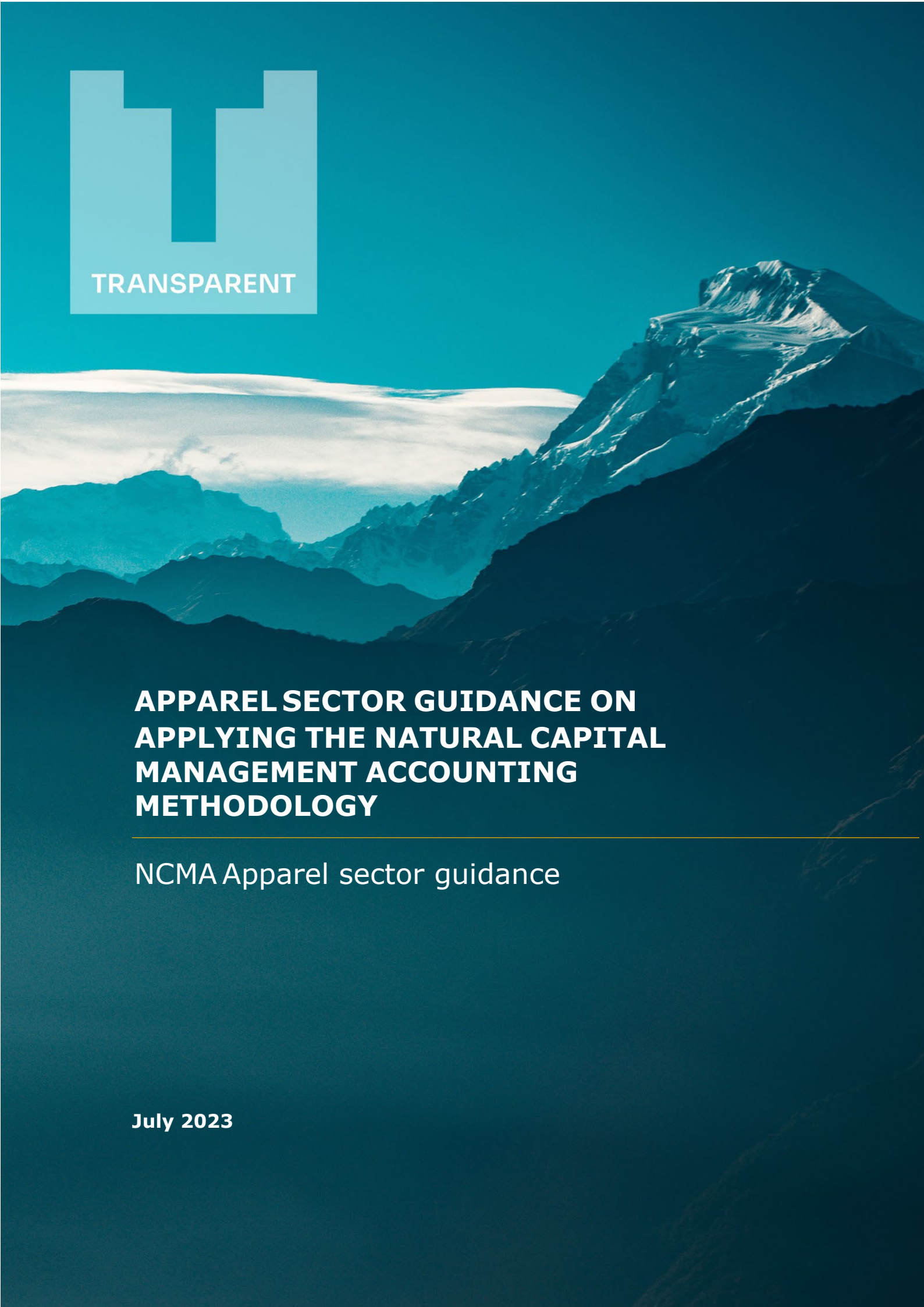

APPAREL SECTOR GUIDANCE ON APPLYING THE NATURAL CAPITAL MANAGEMENT ACCOUNTING METHODOLOGY

NCMA Apparel sector guidance

July 2023

TRANSPARENT

value balancing alliance

CAPITALS COALITION

World Business Council for Sustainable Development

About this document

This document was developed through the EU LIFE program by the Transparent Project.

The document is a work in progress. Detailed feedback from a number of experts has already helped to steer its development. Input from a consultation as well as a piloting process contributed to the presented standardized approach and this documentation.

Disclaimer

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The information and views set out in this material are those of the author(s) and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained herein.

ABOUT

The Value Balancing Alliance is a non-profit alliance of more than 25 multinational companies who share a common goal: to develop a standardized methodology of impact measurement and valuation for monetizing and disclosing positive and negative impacts of corporate activity. The objective of such a methodology is to provide guidance on how impacts can be integrated into business decision making to support greater sustainability and transparency in business. Member companies pilot the methodology to ensure feasibility, robustness, and relevance. The Alliance is supported by the four largest professional service networks – Deloitte, EY, KPMG, and PwC – and works in close collaboration with the International Foundation for Valuing Impacts (IFVI).

The Capitals Coalition is a global collaboration redefining value to transform decision making. It sits at the heart of an extensive global network which has united to advance the capitals approach to decision-making. The ambition of the Coalition is that by 2030 the majority of businesses, financial institutions and governments will include the value of natural capital, social capital and human capital in their decision making and that this will deliver a fairer, just and more sustainable world.

The World Business Council for Sustainable Development is the premier global, CEO-led community of over 200 of the world's leading sustainable businesses working collectively to accelerate the system transformations needed for a net-zero, nature-positive, and more equitable future. Since 1995, WBCSD has been uniquely positioned to work with member companies along and across value chains to deliver impactful business solutions to the most challenging sustainability issues.

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LIST OF ACRONYMS

CC – Capitals Coalition

CO_2 – carbon dioxide

EEIO – environmentally extended input-output model

EP&L – environmental profit and loss account

ENCORE – Exploring Natural Capital Opportunities, Risks and Exposure

GHG – greenhouse gas

GRI – Global Reporting Initiative

IO – input-output model

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization for Standardization

LCA – life cycle assessment

LCIA – life cycle impact assessment

MEA – Millennium Ecosystem Assessment

NCMA – Natural Capital Management Accounting

NOx – nitrogen oxides

PEF – Product Environmental Footprint

P&L – profit and loss

SASB – Sustainability Accounting Standards Board

SEEA – System of Environmental-Economic Accounting

UNEP-WCMC – United Nations Environment Program - World Conservation Monitoring Centre

VBA – Value Balancing Alliance

VOC – volatile organic compounds

WBCSD – World Business Council for Sustainable Development

1. BACKGROUND

1.1. About Transparent

In line with the ambition of the European Green Deal, Transparent is a public-private partnership to develop standardized natural capital accounting and valuation principles as a means of mobilizing the private sector in support of the green transition. In particular, the Transparent Project supports the call by the European Commission to support businesses and their stakeholders in their efforts to standardize natural capital accounting in the EU and globally.

The partners of the Transparent Project include the Value Balancing Alliance (VBA), the Capitals Coalition (CC), and the World Business Council for Sustainable Development (WBCSD).

Transparent partners successfully tendered for the EC grant for preparatory policy actions funded through the EU LIFE program. To promote the uptake of corporate natural capital accounting (and the insights such accounting brings to decision makers at the executive level), the tender called for the development of a standardized natural capital management accounting methodology that would result in the successful development of Environmental Profit and Loss Accounts. The expectation was that the methodology should cover both impacts and dependencies and should be suitable for integration in corporate strategic decision-making processes rather than focused on external reporting covered by other EU and global initiatives.

As part of the Transparent Project, this sector guidance document provides an overview and additional resources in support of the steps needed for the application of natural capital management accounting that are specific to the apparel sector. Additional documents provide a standardized methodology for natural capital management accounting (the NCMA methodology), and the NCMA general guidance to support implementation of the methodology.

1.2. About Natural Capital Management Accounting

Natural capital is the stock of renewable and non-renewable natural resources, both biotic and abiotic (e.g., plants, animals, air, water, soils, minerals), that combine to yield a flow of benefits to people. This corresponds to "environmental assets" in the System of Environmental-Economic Accounting (SEEA) framework, which takes a (macro)economic perspective based on national accounts [1]. Changes to natural capital may affect the extent and condition of natural resources as well as the ecosystem services that natural capital provides. For the purposes of understanding, measuring, and valuing the impact of business activities on nature, the NCMA methodology and system of accounting does not attempt to estimate the overall state of natural capital. The focus is on the change in the flow of ecosystem services from one period to the next that affects society. It is only at a national accounts level and in assessing performance against the Sustainable Development Goals that it becomes meaningful and appropriate to consider the macro or total impact of human activities on nature.

Natural capital accounting is the compilation of consistent and comparable data on natural capital and the flow of services generated, using an accounting approach to show the contribution of the environment to the economy or business and the impact of the economy or business on the environment [2].

Natural capital management accounting refers to an internal management information system that combines data in support of corporate decision making. Unlike in statutory accounts, the form and content of management accounts are not determined by regulations and/or related to generally accepted accounting principles that are concerned with properly informing external stakeholders about the (financial) position and performance of an entity. Instead, the quality of

natural capital management accounting is ensured by applying best practice developed by the business community, and guided by academia and professional organizations such as IFAC, ICOS, and others.

Environmental profit & loss (EP&L) accounting The concept of a "profit and loss" (P&L) is a common business formulation to assess performance. In accounting terms, it is the difference between revenue generated by a business and the related costs incurred. It represents the change in the stock of financial capital for a business resulting from its operations. The calculation of P&L is based on transactions between market actors such as customers and suppliers. It ignores unpriced "transactions" with the environment which include impacts on natural capital. An EP&L is a means of extending the profit calculation to include both monetary value and the price of environmental impacts of business activities. An EP&L can be presented in different ways to help management understand and respond to the total impact of business activities. Some entities now publish such impact statements in various formats to help their stakeholders understand how the business's activities impact nature or lead to other externalities. In profit and loss calculation, caution needs to be taken when offsetting or netting amounts with different characteristics, to address concerns around additivity. For this reason, it is important to display gross amounts and not merely compute a net amount of externalities and other impacts.

Impacts and dependencies, for the purposes of this methodology, refer to relationships a business and its activities have with natural capital. An impact includes externalities or other unpriced effects of business activities on natural capital that result in the consumption or restoration of services provided by natural capital. Impacts are referred to as affecting the "value to society" that results from business activities. Looked at through this lens, business activities have brought about significant improvements in human well-being but often to the detriment of nature and both elements are relevant to understanding the overall performance of a business.

Dependencies refer to the set of relationships that describe the ways a business relies on nature and natural resources to create value. In market economies this "value to business" should be reflected in a business's overall market value (or enterprise value). The concepts of "value to society" and "value to business" are inextricably linked as one cannot exist without the other. Business models employed by business rely on natural, human, and social capital to generate wealth. Beyond market transactions and regulation of economic activity, these dependencies to extract value from the services provided by nature have largely been unaccounted for and taken for granted. It has been assumed that the problem of scarcity can be overcome through globalization and through shifting to new or different locations and methods to extract value from nature. The collapse of biodiversity requires a radical rethinking of the way in which the services provided by nature can continue to generate "value for business" while also safeguarding the possibility of a sustainable future.

2. INTRODUCTION

In addition to the NCMA general guidance document, the Transparent Project is developing sector-specific guidance documents based on the experience of piloting companies. Sector-specific guidance is currently available for the following sectors:

- Agri-food
- Apparel
- Chemicals

The NCMA general and sector-specific guidance documents set out the steps and actions to apply the methodology to measure and value business impacts on society.[1]

2.1. About the apparel sector guidance

The apparel sector guidance is intended to complement the NCMA methodology by providing additional detail and resources relevant to the apparel sector and illustrating the outcome of the methodology's use when applied in that sector. The guidance provides industry-specific considerations on:

- Objective of measuring and valuing impact
- Scoping and materiality
- Data availability
- Measuring and valuing impact drivers in monetary values

The guidance provides an example based on the apparel sector to assist in understanding the impact of sector-relevant business activities across the value chain. In applying the methodology, further breakdowns, changes, and specifications are needed to best reflect apparel sector business models.

2.2. About the intended users

Similar to the NCMA methodology, this guidance document is primarily intended for those responsible for preparing management information to support internal decision making at the corporate level (see NCMA methodology).

2.3. General management accounting principles

The NCMA methodology is based on general management accounting principles such as relevance, rigor, and replicability (see NCMA methodology). When applying the methodology, we advise following these principles to ensure that the methodology is applied in a sensible manner.

2.4. Basic impact management accounting concepts

Please refer to the NCMA methodology for further details on terminology such as "impact," "impact driver," "impact pathway," and "valuation techniques."

[1] The NCMA methodology is to be used in combination with regulatory sustainability requirements and disclosures to improve business decision making and strategy setting. The methodology is not intended to replace regulatory sustainability requirements and disclosures. At the time of developing this document, there is no legal obligation to publicly disclose the results of natural capital accounting focusing on impact measurement and valuation and it is left to the user of this document to make the decision regarding publicly sharing the results.

3. OBJECTIVE AND SCOPE

The focus of this section is to outline the steps and actions you will need to take to establish a set of corporate Environmental Profit & Loss accounts based on standardized NCMA methods and guidance developed under the Transparent Project. This section helps you to consider the intended use of your results to guide you in selecting and applying methods most appropriately. It is critical at this stage to make explicit the objective, scope, and assumptions that underpin your measurement and valuation of natural capital (see Figure 1).

Figure 1. Questions on the objective and scope of your accounting

What? to consider for natural capital accounting	**Objective** - What is the purpose?
	Scope - What should be the boundaries?
	Materiality - What are the minimum impact drivers that should be considered during the materiality analysis?

To set up your natural capital accounting we recommend the following phases:

- Define objective and scope
- Engage and train
- Measure and value
- Interpret and test the results
- Take action

For more details, see the NCMA general guidance.

3.1. Objective

While the main objective of the NCMA methodology is to develop an EP&L, you may also choose to apply the NCMA methodology to achieve a specific goal. It is essential to develop and clearly define the objective(s)/goal(s) of your natural capital accounting; for more details and examples, see the NCMA general guidance.

3.2. Scope

Defining the objective(s) of your natural capital accounting facilitates the process of defining/selecting the scope of your application. The focus of this guidance is on the selecting the scope with respect to the value chain boundaries and the impact drivers. For all other aspects to be considered, see the NCMA general guidance.

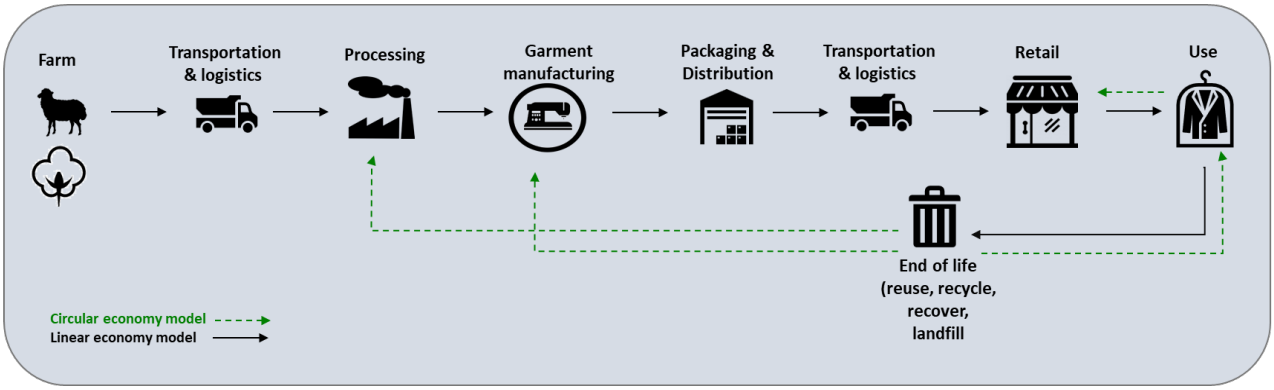
3.2.1. Value-chain boundaries

The apparel industry has a large variety of value chain configurations, dependent on factors such as the choice of materials used to create final products, amount of processing needed, supply chain locations, etc. Fibers used in textile product manufacturing in the apparel industry classify outputs into:

- Natural fibers: obtained from animals and plants, such as cotton, wool, linen, and silk
- Synthetic fibers: man-made fibers produced though chemical synthesis processes
- Combination fibers: fibers composed of a mix of natural fibers, synthetic fibers, or both

This guidance document covers textile and garment value-chain levels producing apparel comprised of *natural fibres,* focusing on agricultural and animal fibers. For synthetic fibers, please refer to the chemical sector guidance. For farm-level impacts please refer to the NCMA agri-food sector guidance.

Figure 2. Natural fibers apparel value chain, adapted from Trucost 2014 [3]



Allocating business activities into value-chain levels depends strongly on the type of raw materials and the manufacturing process. Due to this distinction, material impacts in the value chain are case specific.

Common stages in a natural fibers apparel value chain are defined as follows (see Figure 2):

1. **Farm**: All activities, such as agricultural processes and animal farming, related to sourcing raw materials (cotton, hemp, bamboo, flax, wool, alpaca, yak, etc.) used as key inputs to produce finished goods. This includes animal husbandry and rearing and crop planting and cultivation.
2. **Transportation & logistics**: All activities conducted throughout the value chain to transport materials and goods, e.g., from a farm to the production site.
3. **Processing**: All processes needed to transform raw materials into ready-to-use textiles for garment production, such as spinning, weaving, knitting, dyeing, and bleaching.
4. **Garment manufacturing**: All processes used in turning textiles into garments, such as cutting, sewing, and ironing.
5. **Packaging & distribution**: Includes folding, individual and stock packaging, and storage facilities.
6. **Retail**: Buying garments from manufacturers and selling to consumers.
7. **Use**: The use of garments by consumers.
8. **End of life:** Begins when the use phase of a product and its packaging ends and it is

discarded as waste to be finally disposed of or reintroduced within previous stages of the value chain, this includes:

- Reuse: Reusing the product.
- Recycle: Transforming discarded items into reusable raw material to reduce the production and use of virgin raw materials, covers also material recovery.
- Recover: Using disposed garments as fuel for energy production within the value chain.
- Landfill: Discarding garments and defining them as solid waste.

When defining your value-chain levels into upstream, own operations, and downstream levels please refer to the NCMA methodology and the general guidance.

3.2.2. Impact drivers

For first-time preparers, we recommend carrying out your natural capital accounting on all six impact drivers within the scope of the methodology (see NCMA general guidance for more details).

Material impacts should be included as defined by relevant frameworks, standard setters, and initiatives. To identify material environmental impact drivers for the apparel sector as established by existing initiatives, an analysis was conducted on apparel-specific sustainability requirements. The goal of this analysis is to provide you with:

- A basic understanding of the industry's sustainability obligations, sustainability goals, and commitments
- Additional sector-specific impact drivers to consider outside the scope of the NCMA methodology

Your material impacts highly depend on your business model. It is recommended that you look at your business model and activities (as a whole) to identify the most relevant impacts, and then review the various standards and initiatives to close any gaps in identifying your material impacts. When conducting your materiality assessment, it is important to assess the materiality of the impact drivers across the entire value chain. Furthermore, we recommend expanding your analysis to documents not considered here and monitoring developing initiatives not included in the analysis of this guidance document, to ensure that the goals of your company and its decision-making processes are aligned with disclosure requirements and sector commitments.

In preparing this document, an analysis was conducted for natural fiber apparel that was based on the SASB Apparel, Accessories & Footwear sustainability accounting standard, ENCORE, additional frameworks, and apparel companies' sustainability reports (for more details on these sources, see Annex I). A relative weight was assigned to each impact driver by value-chain level and phase. This relative weight was based on relevance as indicated in the reviewed documents, evidence (quantification) of impacts relative to others, and piloting experience. The results shown in Table 1 indicate the varying importance of impact drivers by value-chain level, and the importance of considering the entire value chain. Ultimately, the impacts of an entity strongly depend on the business model. Table 1 can provide guidance in potential material impacts.

Table 1. Materiality assessment across the apparel industry value chain

Impact drivers	**Upstream**			**Own operations**			**Downstream**	
	Farming machinery and inputs**	On-farm activities (irrigation)	On-farm activities (animal rearing)	Processing and production (textiles and garments)	Transportation and logistics***	Packaging	Retail	Use + end of life
GHG emissions	High	Low	High	High	High	High	High	High
Non-GHG air emissions	Medium	Low	High	High	High	Medium	Medium	High
Water consumption	High	High	High	High	Low	High	High	Low
Water pollution	High	High	High	High	Low	High	High	High
Land use	High	High	High	Low	Low	High	Low	High
Solid waste	High	Low	Medium	Medium	Low	High	Medium	High

*** Includes impacts created from manufacturing and use of farming machinery and other inputs (e.g., fertilizer or seed production)*

**** Accounts for all transportation throughout the value chain*

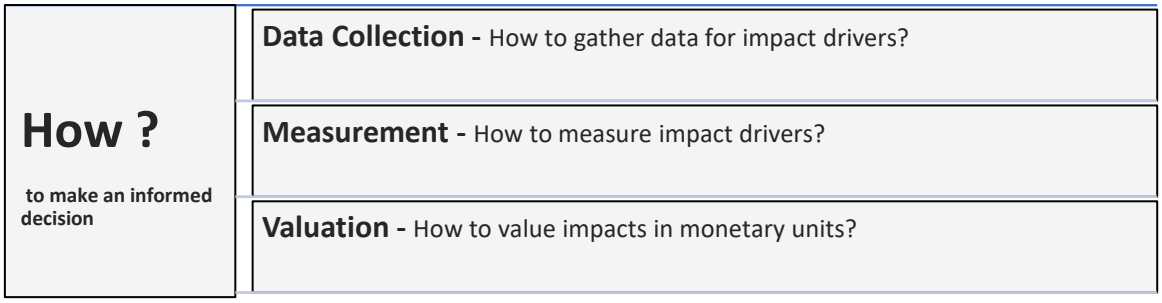
4. MEASURE AND VALUE

To measure and value the impacts of business activities in the apparel value chain, this document provides additional guidance for:

- Data collection needs
- Measuring the physical quantities for each impact driver
- Valuing your measured impacts in monetary terms

The following section provides support in applying the NCMA methodology (see Figure 3).

Figure 3. Questions on the measure and value step of your accounting



4.1. Principal accounting modules

4.1.1. Measure your impact driver

To measure the physical quantities of the impact drivers considered in scope, you will use primary data, secondary data, or a combination of both. You will most likely apply some allocation rules since multiple products might be produced on the same land (e.g., animal fibers as a by-product of animal rearing for meat, milk, and leather). For more details on typical data sources and additional guidance, see the NCMA general guidance.

In addition to the sources listed in the NCMA general guidance, the following data sources are available for the apparel sector (Annex II includes additional resources for the apparel industry).

Higg index [4]

Specifically for the apparel industry, the Higg Index developed by the Sustainable Apparel Coalition is a suite of sustainability measurement tools. Its application can be expanded to other industries such as outdoor, home goods, automotive, personal care, electronics, and toys.

The Higg index consists of five tools, four of which can be used to assess the environmental and social impacts of a company for different scopes:

- Higg Brand & Retail Module (BRM): to measure environmental and social risks and impacts along the global value chain.
- Higg Facility Environmental Module (FEM): to measure the environmental impacts of facilities within your supply chain.
- Higg Materials Sustainability Index (MSI): to measure the environmental impacts of materials for upstream and own operations value-chain levels (cradle-to-gate)
- Higg Product Module (PM): to measure the environmental impacts of a product through its entire life (cradle-to-grave)

The modeling in the Higg database is based on leading international standards including:

- GaBi Modeling Principles [5]
- Ecoinvent data quality guidelines [6]
- ISO 14043/14044 [7]
- Product Environmental Footprint (PEF) Guide [8]

When applying the NCMA methodology, we recommend reviewing and recording detailed information on each process in the database, including specific quantification approaches, allocation approaches, and other technical information to assess the need for data transformation processes such as merging, aggregating, filtering, enriching, or splitting and converting your data into a suitable format to link it to the valuation coefficients.

Additional LCA databases for the apparel sector

Table 2 presents LCA databases suitable for the apparel sector (in addition to those listed in the NCMA general guidance).

Table 2. LCA databases used by the apparel sector

Database	Developer	Paid/free	Link
GaBi textile finishing	Sphera	Paid/free	http://www.gabi-software.de/databases/gabi-databases/textile-finishing/
World Apparel and footwear Life Cycle Assessment Database (WALDB)	Quantis	Under development	https://quantis.com/who-we-guide/our-impact/sustainability-initiatives/waldb/

Additional sources to support measuring impact drivers using LCA include:

- Assessing the Environmental Impact of Textiles and the Clothing Supply Chain [9]: Provides an overview of the methods used to measure the environmental impacts affecting the textile value chain.
- Handbook of Life Cycle Assessment (LCA) of Textiles and Clothing [10]: Includes the evaluation of environmental impacts of textile products, from raw material extraction, through fiber processing, textile manufacture, distribution and use, to disposal or recycling.
- For a product scope: EU Product Environmental Footprints (PEF) [8] represent a reference product and Product Environmental Footprint Category Rules (PEFCR) set rules for calculating the impacts of a product. PEF and PEFCR are based on LCA.

4.1.2. Measure changes in the state of natural capital

Your quantified impact drivers will lead to changes in natural capital (air, water, land, and biodiversity) that will eventually impact society. For guidance, please see the NCMA general guidance.

4.1.3. Value your impacts on society

After measuring your impact drivers, you will calculate the monetary values of your impacts by multiplying the measured physical quantities (e.g., tons of CO_2) by a value factor (e.g., $/ton CO_2), which reflects the societal impact due to a change in natural capital and its ecosystem services as modeled in impact pathways. For guidance, please see the NCMA general guidance.

4.2. Specific accounting modules by impact driver

This section provides key considerations to take into account when measuring impacts for each impact driver and its related impact pathway when undertaking natural capital accounting using the methodology.

4.2.1. Greenhouse gas (GHG) emissions

The apparel and fashion industry accounted for about 2% of annual global CO_2 emissions in 2019 [11]. Following the current trajectory of the industry, the 1.5° C goal set by the Intergovernmental Panel on Climate Change (IPCC) [12] to limit climate change impacts will be exceeded.

Specific activities relevant for the apparel sector which are important to consider for the measurement of GHG emissions are:

- Agriculture and farming
- Energy and fuel consumption (manufacturing, processing, transportation, assembly, electricity in retail facilities, use phase, etc.)
- Land use and land-use change [13] (includes soil)
- Use phase [14] [15]

4.2.2. Non-GHG air emissions

The textile manufacturing process consumes large amounts of chemicals and resources, and the processing of textiles is highly polluting, emitting particulate matter, VOCs, NO_x, and SO_x through the entire value chain.

Specific activities which are important to consider for the measurement of non-GHG air emissions are:

- Agriculture and farming (e.g., dust, fuel combustion, machinery, fertilizers)
- Energy and fuel consumption (e.g., manufacturing, processing, transportation, assembly, electricity in retail facilities, use phase)
- Textile and garment manufacturing and processing (e.g., dyeing, bleaching, finishing, sizing, drying, chemical storage, wastewater treatment) [16]
- Use phase (energy use)
- End of life

4.2.3. Water consumption

The apparel industry is the second-largest consumer of water [17]. Water consumption is a material topic for the apparel industry and should be considered along the entire value chain. The amount of consumed water depends on the type of fibers used in the production of garments.

Specific activities which are important to consider for the measurement of water consumption are:

- Agriculture and farming
- Textile and garment manufacturing and processing (e.g., dyeing, bleaching, finishing, sizing, drying, chemical storage, wastewater treatment)
- Use phase

In the scope of the apparel sector, this includes water lost in evapotranspiration, water incorporated in the production process, polluted water that is not returned to its source, and untreated water.

4.2.4. Water pollution

Globally, the apparel industry accounts for one-third of industrial water pollution due to manufacturing processes, 20-35% of microplastics flowing to the ocean, 24% of insecticide use, and 10-20% of pesticide use [18].

Specific activities in the apparel sector which are important to consider for the measurement of water pollution are:

- Agriculture and farming (use of pesticides and insecticides)
- Textile and garment manufacturing and processing (e.g., dyeing, bleaching, finishing, sizing, drying, chemical storage, wastewater treatment)
- Use phase

4.2.5. Land use

The impacts related to the land use impact driver are particularly significantly for the apparel industry, especially when considering apparel made from natural fibers. Cultivation of natural fibers is frequently linked to monoculture agricultural practices and animal rearing, which use large quantities of fertilizers, pesticides, and insecticides, altering the land and leading to loss of biodiversity, soil degradation and environmental pollution. [19]

Specific activities which are important to consider for the measurement of land use are:

- Agriculture and farming (use of pesticides and insecticides)
- Own operations land-use footprint
- End of life

4.2.6. Solid waste

The apparel industry is highly criticized for the amount of waste it generates as a result of the introduction of fast fashion practices, changing the behavior of individuals in terms of owned quantities, frequency of purchase, and duration of garment ownership. Sixty-four percent of produced garments are sent to landfill annually [20].

Specific activities which are important to consider for the measurement of solid waste are:

- Waste generated during production and retail processes (pre-consumption)
- Used garments (post consumption) [21]

Specifically in the apparel industry we recommend keeping internal reports of your different natural capital accounting results, to facilitate future decision making in terms of selecting locations for material sourcing, different processing and manufacturing options, textiles composition, etc. With time these results can be expanded to create internal standards and manuals leading to streamlined sustainable business activities.

5. DEPENDENCIES AND VALUE TO BUSINESS

The scope of this document is to provide guidance on how to assess the impact of business activities on society, based on the piloting experience by companies. Dependencies and value to business are therefore out of scope for this document and left for future development.

6. USING THE RESULTS

After generating your results, you will need to interpret and test them and take appropriate action. You may also report results externally. This step is highly case-specific yet does not differ between sectors. Therefore, please refer to the general guidance for more information.

7. CALCULATION EXAMPLE

In the following, an example of a manufacturer of golf shirts in the apparel sector is described to illustrate the steps necessary to perform natural capital management accounting. For ease of understanding, we consider a small company with one factory in Portugal, producing a single type of golf shirt, including cutting and sewing of the shirts. Suppliers of the golf shirt manufacturer are located in the US, India, and China. This is a strongly simplified example and does not reflect the large product portfolio or full depth of the supply chain of most companies in the apparel sector.

The produced golf shirts are made from knit, 100% cotton fabric and weigh 313 grams each. The factory produces 3,600 golf shirts per day and operates 260 days per year, resulting in an annual output of 936,000 golf shirts.

Impact from the following activities were excluded in the example for reasons of simplification[2]:

- Construction and materials used for equipment, buildings, and other auxiliary facilities
- Maintenance and operation of support equipment
- Production and transport of packaging

7.1. Step one: Objective and scope

The company's objective is to monitor their impacts along their supply chain to identify hot spots and prioritize actions in reducing their environmental impacts in their upstream activities.

In this example, the environmental impacts of one golf shirt as a functional unit have been calculated and scaled up linearly to calculate damages for assumed production capacity which can be roughly assumed as the environmental impact of the upstream activities of the company.

[2] in line with underlying LCA study [23]

7.2. Step two: Measure and value

In the next step, the company estimates its impact drivers for the upstream activities to evaluate impacts to society through purchasing decisions. Estimations for impacts to society from own operations and downstream activities are out of scope for this example. The value chain activities of the manufacturer of golf shirts can be described as followed:

1) Upstream

A. Cotton fiber production:

- Fertilizer production
- Seed production
- Pesticide production
- Transportation from production sides to farms (fertilizer, seeds, pesticides, fuel, etc.)
- Crop rotation
- Irrigation
- Field fuel use (by field operations, including sowing and harvesting)
- Field emissions (through fertilizer and pesticides)
- Post harvest (e.g., transport to and processing at cotton gin, packaging, etc.)

B. Textile manufacturing (knit cotton fabric):

- Transportation (e.g., energy use for moving bales from warehouse to mill)
- Bale opening and spinning (e.g., energy use for cleaning, carding, drawing, or spinning fiber to cotton yarn)
- Knitting (knitting yarn into fabric)
- Batch dyeing (including energy and chemical use, emissions to water, wastewater treatment, etc.)
- Finishing (wet finishing, drying, curing of knit cotton fabric)
- Compaction (energy use to reduce length shrinkage)

2) Own operations (out of scope)

- Transportation (of materials to production side)
- Processing (cutting and sewing)
- Packaging

3) Downstream (out of scope)

- Transportation (to retailer)
- Retailing
- Product use (washing)
- End of life

[Note – All numerical values used below have been approximated. None of these values should be taken as standard values in any practical scenario.]

Based on this information, the company calculates the amounts of manufacturing inputs (cotton fiber, knit cotton fabric) needed, to assess their upstream activities (overview in Figure 4).

1. Total weight of annual golf shirt production:
   Assuming that the weight of a golf shirt is 313 grams, the weight of golf shirts produced annually is (in kg):

   $$313 * 936{,}000/1{,}000 = 293{,}009$$

2. Amount of cotton fabric needed annually to produce golf shirts:
   To estimate the amount of fabric needed from supplier/s to produce the garment, Better Cotton Initiative (BCI) multipliers were applied [22]. For knit fabric the multiplier is 1.15 to translate the weight of the end-product golf shirt into required cotton fabric [22]. In this case, the production of one golf shirt requires 0.36 kg of knit cotton fabric [23].

   The total amount of cotton fabric needed is calculated as followed (in kg of fabric):

   $$\text{End-Product-to-Fabric multiplier} * \text{weight of annual golf shirt production}$$

   $$= 1.15 * 293{,}009 = 336{,}960$$

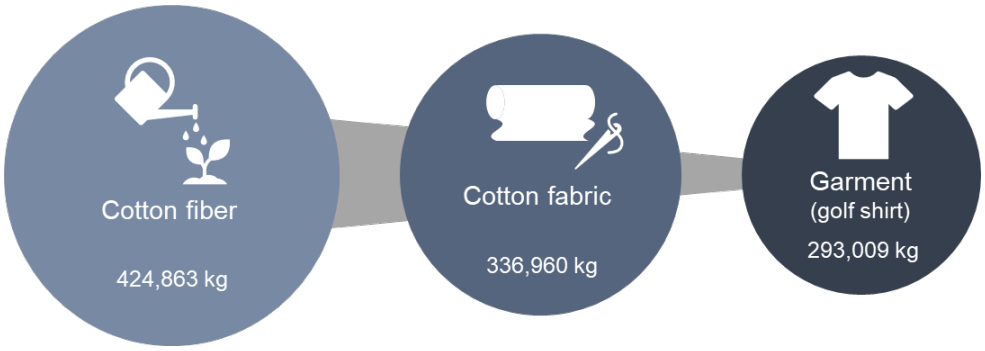
3. The amount of cotton fiber needed to produce the annual amount of golf shirts:
   The amount of cotton fiber required for annual production is calculated analogously. The BCI multiplier to estimate required cotton fiber based on the weight of the end product is 1.45 [22].

   The total amount of needed cotton fiber is calculated as follows (in kg of cotton fiber):

   $$\text{End-Product-to-Fiber multiplier} * \text{weight of annual golf shirt production}$$

   $$= 1.45 * 293{,}009 = 424{,}863$$

Figure 4. Manufacturing inputs needed for annual golf shirt production



Starting from manufacturing inputs, indicators per impact driver can be estimated. See calculations for each impact driver below.

GHG emissions

To estimate CO_2 equivalents for upstream activities, all emissions related to (A) cotton fiber production and (B) textile manufacturing need to be considered. The Global Warming Potential (GWP) at the farm level is quantified at 1,812 kg CO_2 eq./1,000 kg of cotton fiber[3] [23]. For knit cotton fabric, the GWP is quantified at 9,070 kg CO_2 eq./1,000 kg of cotton fabric [23].

Therefore, the quantified GHG emissions are:

A. Cotton fiber production:

$$1{,}812 \text{ kg CO2 eq./1,000 kg of cotton fiber} * 424{,}863 \text{ kg of cotton fiber}$$

$$= 769{,}851.8 \text{ kg } CO_2 \text{ eq.}$$

B. Textile manufacturing (knit cotton fabric):

$$9{,}070 \text{ kg CO2 eq./1,000 kg of cotton fabric} * 336{,}960 \text{ kg of cotton fabric}$$

$$= 3{,}056{,}227.2 \text{ kg } CO_2 \text{ eq.}$$

The total amount of GHG emissions for the upstream activities is quantified at 3,826,079 kg CO_2 eq.

Non-GHG air emissions

The example focuses on the non-GHG air emission impacts of the indicator SO_2 to illustrate application of the methodology.

To assess the acidification potential for the described upstream activities, SO_2 emissions from (A) cotton fiber production and (B) textile manufacturing have to be accounted for. The acidification potential at the farm level (cotton fiber production) is quantified at 18.7 kg SO_2 eq./1,000 kg of cotton fiber [23]. SO_2 emissions from activities related to textile manufacturing are at 61.4 kg SO_2 eq./1,000 kg of cotton fabric [23]

Therefore, the quantified non-GHG air emissions are:

A. Cotton fiber production:

$$18.7 \text{ kg } SO_2 \text{ eq./1,000 kg of cotton fiber} * 424{,}863 \text{ kg of cotton fiber}$$

$$= 7{,}944.9 \text{ kg } SO_2 \text{ eq.}$$

B. Textile manufacturing (knit cotton fabric):

$$61.4 \text{ kg } SO_2 \text{ eq./1,000 kg of cotton fabric} * 336{,}960 \text{ kg of cotton fabric}$$

$$= 20{,}689.3 \text{ kg } SO_2 \text{ eq.}$$

Thus, the total non-GHG air emissions amount to 28,634.2 kg SO_2 eq.

[3] Carbon stored in the fiber is not taken into account.

Water consumption

The water consumption of upstream activities can be estimated as follows: Water consumption through farming activities (cotton fiber production) is quantified at 2,120 m^3/1,000 kg of cotton fiber [23]. For textile manufacturing, water consumption can be estimated at 49.4 m^3/1,000 kg of cotton fabric [23].

A. Cotton fiber production:

$$2{,}120\ m^3/1{,}000\ kg\ of\ cotton\ fiber * 424{,}863\ kg\ of\ cotton\ fiber$$

$$= 900{,}709.6\ m^3$$

B. Textile manufacturing (knit cotton fabric):

$$49.4\ m^3/1{,}000\ kg\ of\ cotton\ fabric * 336{,}960\ kg\ of\ cotton\ fabric$$

$$= 16{,}645.8\ m^3$$

Thus, the total amount of water consumption for all upstream activities is 917,355.4 m^3.

Water pollution

Water pollution is calculated from eutrophication potential of upstream activities. For cotton fiber production, the eutrophication potential is 3.84 kg phosphate eq./1,000 kg of cotton fiber [23]. The eutrophication potential for the manufacturing of cotton fabric amounts to 0.002 kg phosphate eq./1,000 kg of cotton fabric [23].

Therefore, the quantified water pollution is:

A. Cotton fiber production:

$$3.84\ kg\ phosphate\ eq./1{,}000\ kg\ of\ cotton\ fiber * 424{,}863\ kg\ of\ cotton\ fiber$$

$$= 1{,}631.5\ kg\ phosphate\ eq.$$

B. Textile manufacturing (knit cotton fabric):

$$0.002\ kg\ phosphate\ eq./1{,}000\ kg\ of\ cotton\ fabric * 336{,}960\ kg\ of\ cotton\ fabric$$

$$= 0.7\ kg\ phosphate\ eq.$$

Considering both components above, the total water pollution for all upstream activities can be quantified at 1,632.2 kg phosphate eq.

Land use

For land use, the agricultural land needed for cotton fiber production is considered. Land use due to textile manufacturing is excluded from the assessment. Average land use for the production of 1,000 kg of cotton fiber is estimated at 3.27 ha [24].[4]

[4] Unweighted average value for the considered countries US, China, and India.

Therefore, the quantified land use for cotton fiber production is:

$$3.27 \text{ ha}/1{,}000 \text{ kg of cotton fiber} * 424{,}863 \text{ kg of cotton fiber} = 1{,}389.3 \text{ ha}$$

$$= 13{,}893{,}000 \text{ m}^2.$$

Quantified land-use impacts, by impact pathway using the LANCA methodology[5] are [25]:

a. Erosion potential: $9.64 \text{ kg}/\text{m}^2 * 13{,}893{,}000 \text{ m}^2 = 133{,}928{,}520 \text{ kg}$
b. Infiltration reduction potential: $44.10 \text{ m}^3/\text{m}^2 * 13{,}893{,}000 \text{ m}^2 = 612{,}681{,}300 \text{ m}^3$
c. Groundwater regeneration reduction potential**:** $0.03 \text{ m}^3/\text{m}^2 * 13{,}893{,}000 \text{ m}^2 = 416{,}790 \text{ m}^3$
d. Biotic production loss potential: $0.45 \text{ kg}/\text{ m}^2 * 13{,}893{,}000 \text{ m}^2 = 6{,}251{,}850 \text{ kg}$

Solid waste

The solid waste production from upstream activities of the golf shirt manufacturer can be estimated by building on the BCI multipliers that translate manufacturing inputs into the processed output. The assumption is made that weight differences indicate solid waste production from spinning and knitting. For reasons of simplification, it is assumed that all solid waste produced during the upstream activities will end up in landfills.

Thus, the amount of fabric sent to landfill is calculated as follows:

$$\text{Total weight of cotton fiber} - \text{total weight of knit cotton fabric}$$

$$= 424{,}863 \text{ kg} - 336{,}960 \text{ kg} = 87{,}903 \text{ kg}$$

In this example, only indirect effects due to GHG emissions released from landfills are considered. An estimate of 1.5 kg CO_2 eq./1 kg of cotton waste is applied [26]. Thus, the indirect effects from GHG emissions due to solid waste production can be computed as:

$$1.5 \text{ kg } CO_2 \text{ eq.}/1 \text{ kg of solid waste to landfills} * 87{,}903 \text{ kg of cotton waste to landfills}$$

$$= 131{,}854.5 \text{ kg } CO_2 \text{ eq.}$$

To perform the monetary valuation, the apparel company multiplies the computed quantified impact drivers with the respective valuation coefficients. See Table 3 for value factors used in this example. Due to the US and European context, the value factors of True price and CE Delft are used to in this example.

[5] Unweighted average values for characterization factors for the considered countries US, China, and India.

Table 3. List of monetary valuation coefficients by impact driver

Impact driver	Value factor	Unit	Reference year	In 2022 values (inflation-adjusted[6])	Source
GHG emissions	152	USD per metric ton of CO_2	2020	174	[27]
Non-GHG air emissions	17.9	€/kg SO_2	2015	19.7	[28]
Water consumption	1.5	USD/m^3	2021	1.6	[29]
Water pollution	0.226	€/kg phosphate	2015	0.261	[28]
Land use: Erosion potential	0.06	USD/kg	2020	0.07	[30]
Land use: Infiltration reduction potential	0.000156	USD/m^3	2015	0.000193	[31]
Land use: Groundwater regeneration reduction potential	0.072	USD/m^3	2020	0.0824	[32]
Land use: Biotic production loss potential	1.38	USD/kg	2020	1.58	[33]
Solid waste*	152 for GHG emissions	USD per metric ton of CO_2	2020	174	[27]

* *Direct impacts due to leachate and disamenity are out of scope for this example.*

[6] Inflation adjustments for Europe based on Destatis [58], and for the US based on the Bureau of Labor statistics [59].

7.3. Step three: Using the results

To use the results, the company creates an overview for internal steering (see Table 7). To report all values in USD, the company applies a currency exchange rate of 1.02 USD/EUR.

Table 4. Overview of valued impacts for upstream activities

Impact driver	**Monetarily valued impacts of supply chain level (in USD)**		**Total per impact driver in USD**
	A. Cotton fiber production	B. Textile production (cotton fabric)	
GHG emissions	133,954,213.20	531,783,532.80	665,737,746.00
Non-GHG air emissions	159,644.82	415,730.79	575,375.61
Water consumption	1,441,135.36	26,633.28	1,467,768.64
Water pollution	434.34	0.19	434.52
Land use	19,405,510.39	—	19,405,510.39
Solid waste*	—	22,942,683.00	22,942,683.00

* *Direct impacts due to leachate and disamenity are out of scope for this example.*

ANNEX I: SOURCES IN SCOPE OF MATERIALITY STUDY

In the following, the sources used in the materiality study described in section 3.2 are briefly presented.

SASB, Apparel, Accessories & Footwear: Sustainability accounting standard

SASB standards are designed to identify a minimum set of sustainability issues most likely to impact the operating performance or financial condition of the typical company in an industry, regardless of location.

The SASB standard describes the reporting requirements for the apparel industry using the predominant business model and industry segments. It includes the disclosure topics, accounting metrics, technical protocols, and activity metrics required for use in communications to investors regarding sustainability issues impacting a corporation's ability to achieve long-term value creation.

The natural capital topics prioritized by the SASB standard sustainability disclosure topics and accounting metrics are:

- Management of chemicals in products
- Environmental impacts in the supply chain
- Raw materials sourcing

Table A-1. Matching the SASB apparel accounting metrics and NCMA impact drivers

SASB apparel accounting metrics	**Match with NCMA impact drivers**
Greenhouse Gas Emissions	GHG emissions
Air Quality	Non-GHG air emissions
Energy Management	GHG emissions + non-GHG air emissions (for estimation)
Water Management	Water consumption + Water pollution (for estimation)
Hazardous Waste Management	Solid waste

Disclosure on SASB topics requires entities to provide quantitative impacts supported by an analysis and discussion of the impact. By applying the methodology, companies can move beyond quantitative impacts to monetarily valued impacts on society to support the process of setting their management strategy.

It is suggested that you use the SASB materiality finder which provides users with an overview of the material sustainability topics identified by publicly listed companies within the sector. [34]

ENCORE, Natural Capital Finance Alliance

Alongside the SASB standards, ENCORE [35] (Exploring Natural Capital Opportunities, Risks and Exposure)[7] provides a comprehensive overview of industry material topics and a ranking of their materiality (high, medium, low).

ENCORE is a tool to help users better understand and visualize the impact of environmental change on the economy. By focusing on the goods and services that nature provides to enable economic production, it guides users in understanding how businesses across all sectors of the economy potentially depend and impact on nature, and how these potential dependencies and impacts might represent a business risk, using Extended Environmental Input-Output models.

Using ENCORE, the prioritized impacts for the apparel sector can be translated into monetarily valued impacts using the NCMA methodology as demonstrated in Table 6:

Table A-2. Matching ENCORE and NCMA impact drivers

ENCORE Impact drivers	Materiality rating	NCMA impact drivers
Non-GHG air pollutants	Medium	Non-GHG air emissions
Water use	High	Water consumption
Water pollutants	High	Water pollution
Soil pollutants [35]	High	Land use

Additional recommendations for standards, initiatives, and frameworks to review

The list below introduces some sources commonly used by the apparel sector for transitioning to a more sustainable sector. These include but are not limited to the following:

- Aid by Trade Foundation – Good Cashmere Standard: The standard was created to enhance the wellbeing of cashmere goats by specifying a clear set of criteria for sustainable cashmere production. The standard also promotes the economic, social, and ecological welfare of farmers and related communities in Mongolia. [36]
- American Apparel and Footwear Association (AAFA) – Restricted Substances List (RSL): The list provides companies with information on laws and regulations that restrict the use of certain chemicals and substances in finished home textiles, apparel, and footwear products around the globe. [37]
- BioRe Sustainable Textiles & BioRe Sustainable Cotton: Quality labels that seek to ensure highest possible standards wherein a user can trace each product as far back as source farms. [38]
- Global Fibre Impact Explorer [39]: Currently under development.
- Global Organic Textile Standard (GOTS): The standard aims to define worldwide requirements for environmentally and socially responsible manufacturing practices for organic textiles. [40]
- Green Button Label: A German government-run certification label for sustainable textiles that evaluates if companies are taking responsibility for respecting human rights and environmental standards in their supply chains. [41]
- GRI sector standards: Textile and Apparel (under development).

[7] ENCORE was developed by the Natural Capital Finance Alliance in partnership with UNEP-WCMC and was financed by the Swiss State Secretariat for Economic Affairs (SECO) and the MAVA Foundation.

- Natural Capital Protocol, Apparel Sector Guide [42]
- Science based Targets Guidance: Apparel and footwear sector [14]: The guidance focuses on climate change reduction and provides steps and considerations for a user to set reduction targets.
- Textile Exchange standards and industry tools [43]: Provides information to positively impact climate, soil health, water, and biodiversity through certifications and specified tools.

ANNEX II: ADDITIONAL RESOURCES FOR THE APPAREL INDUSTRY

In the following, additional sources are listed that can support assessing natural capital in the apparel industry.

Apparel market and impacts:

- Accessing Markets, Technology, Experience: Role of Global Value Chains.
  Available from: http://dx.doi.org/10.13140/2.1.3558.0484
- Environmental impact of apparel supply chain and textile products.
  Available from: https://link.springer.com/article/10.1007/s10668-021-01873-4
- Analysis of the polyester clothing value chain to identify key intervention points for sustainability.
  Available from: https://enveurope.springeropen.com/articles/10.1186/s12302-020-00447-x
- Practical solutions for circular business models in the fashion industry.
  Available from: https://doi.org/10.1016/j.clscn.2022.100040

LCA:

- Life Cycle Gap Analysis for Product Circularity and Sustainability - a Case Study with Three Different Products.
  Available from: https://link.springer.com/content/pdf/10.1007/s42824-022-00055-5.pdf
- A review: life cycle assessment of cotton textiles.
  Available from: http://www.revistaindustriatextila.ro/images/2021/1/03%20FANGLI%20CHEN%20Industria%20Textila%201_2021.pdf
- Life Cycle Assessment (LCA) of MWool® Recycled Wool Fibers.
  Available from: https://www.mdpi.com/2079-9276/11/5/41/html
- LCA on Recycling cotton.
  Available from: http://dx.doi.org/10.13140/RG.2.2.22598.57927
- LCA benchmarking study on textiles made of cotton, polyester, nylon, acryl, or elastane.
  Available from: https://link.springer.com/content/pdf/10.1007/s11367-013-0626-9.pdf
- Life Cycle Assessment of Apparel Consumption in Australia.
  Available from: https://www.researchgate.net/publication/350730874_Life_Cycle_Assessment_of_Apparel_Consumption_in_Australia

GLOSSARY

Baseline	In the Natural Capital Protocol [44], the starting point or benchmark against which changes in natural capital attributed to your business's activities can be compared.
Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems [45].
Business application	In the Natural Capital Protocol [44], the intended use of the results of your natural capital assessment, to help inform decision making.
Counterfactual	A form of scenario that describes a plausible alternative situation, and the environmental conditions that would result if the activity or operation did not proceed (adapted from [46]).
Economic value	The importance, worth, or usefulness of something to people—including all relevant market and non-market values. In more technical terms, the sum of individual preferences for a given level of provision of that good or service. Economic values are usually expressed in terms of marginal/incremental changes in the supply of a good or service, using money as the metric (e.g., $/unit).
Ecosystem	A dynamic complex of plants, animals, and microorganisms, and their non-living environment, interacting as a functional unit. Examples include deserts, coral reefs, wetlands, and rainforests [47]. Ecosystems are part of natural capital.
Ecosystem services	The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment [48]: "the benefits people obtain from ecosystems." The MEA further categorized ecosystem services into four categories: • Provisioning: Material outputs from nature (e.g., seafood, water, fiber, genetic material). • Regulating: Indirect benefits from nature generated through regulation of ecosystem processes (e.g., mitigation of climate change through carbon sequestration, water filtration by wetlands, erosion control and protection from storm surges by vegetation, crop pollination by insects). • Cultural: Non-material benefits from nature (e.g., spiritual, aesthetic, recreational, and others). • Supporting: Fundamental ecological processes that support the delivery of other ecosystem services (e.g., nutrient cycling, primary production, soil formation).
Environmentally extended input-output models (EEIO)	Traditional input-output (IO) tables summarize the exchanges between major sectors of an economy [49]. For example, output from the footwear manufacturing sector results in economic activity in associated sectors, from cattle ranching to accounting services. Environmentally extended input-output models (EEIOs) integrate information on the environmental impacts of each sector within IO tables [50] [51].

Externality	A consequence of an action that affects someone other than the agent undertaking that action, and for which the agent is neither compensated nor penalized. Externalities can be either positive or negative [52].
Impact	See "natural capital impact."
Impact driver	In the Natural Capital Protocol [44], an impact driver is a measurable quantity of a natural resource that is used as an input to production (e.g., volume of sand and gravel used in construction) or a measurable non-product output of business activity (e.g., a kilogram of NO_x emissions released into the atmosphere by a manufacturing facility).
Impact pathway	An impact pathway describes how, as a result of a specific business activity, a particular impact driver results in changes in natural capital and how these changes in natural capital affect different stakeholders.
Life cycle assessment	Also known as life cycle analysis. A technique used to assess the environmental impacts of a product or service through all stages of its life cycle, from material extraction to end of life (disposal, recycling, or reuse). The International Organization for Standardization (ISO) has standardized the LCA approach under ISO 14040 [53]. Several life cycle impact assessment (LCIA) databases provide a useful library of published estimates for different products and processes.
Materiality	In the Natural Capital Protocol, an impact or dependency on natural capital is material if consideration of its value, as part of the set of information used for decision making, has the potential to alter that decision [54] [55].
Materiality assessment	In the Natural Capital Protocol [44], the process that involves identifying what is (or is potentially) material in relation to the natural capital assessment's objective and application.
Measurement	In the Natural Capital Protocol [44] , the process of determining the amounts, extent, and condition of natural capital and associated ecosystem and/or abiotic services, in physical terms.
Monetary valuation	Valuation that uses money (e.g., $, €, ¥) as the common unit to assess the values of natural capital impacts or dependencies.
Natural capital	The stock of renewable and non-renewable natural resources (e.g., plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people [56] [57](adapted from [56]).
Natural capital assessment	The process of measuring and valuing relevant ("material") natural capital impacts and/or dependencies, using appropriate methods.
Natural capital dependency	A business reliance on or use of natural capital.
Natural capital impact	The negative or positive effect of business activity on natural capital.
Natural Capital Protocol	A standardized framework to identify, measure, and value direct and indirect impacts (positive and negative) and/or dependencies on natural capital.
Organizational	In the Natural Capital Protocol [44], the part or parts of the business

focus	to be assessed (e.g., the company as a whole, a business unit, or a product, project, process, site, or incident). For simplicity, these are grouped under three general headings as below: • Corporate: assessment of a corporation or group, including all subsidiaries, business units, divisions, different geographies or markets, etc. • Project: assessment of a planned undertaking or initiative for a specific purpose, and including all related sites, activities, processes, and incidents. • Product: assessment of particular goods and/or services, including the materials and services used to produce these products.
Price	The amount of money expected, required, or given in payment for something (normally requiring the presence of a market).
Primary data	Data collected specifically for the assessment being undertaken.
Qualitative valuation	Valuation that describes natural capital impacts or dependencies and may rank them into categories such as high, medium, or low.
Quantitative valuation	Valuation that uses non-monetary units such as numbers (e.g., in a composite index), area, mass, or volume to assess the magnitude of natural capital impacts or dependencies.
Scenario	A storyline describing a possible future. Scenarios explore aspects of, and choices about, the future that are uncertain, such as alternative project options, business as usual, and alternative visions.
Scoping	In the Natural Capital Protocol [44], the process of determining the objective, boundaries, and material focus of a natural capital assessment.
Secondary data	Data that were originally collected and published for another purpose or a different assessment.
Spatial boundary	The geographic area covered by an assessment, for example, a site, watershed, landscape, country, or global level. The spatial boundary may vary for different impacts and dependencies and will also depend on the organizational focus, value-chain boundary, value perspective, and other factors.
Stakeholder	Any individual, organization, sector, or community with an interest or "stake" in the outcome of a decision or process.
Temporal boundary	The time horizon of an assessment. This could be a current "snapshot", a 1-year period, a 3-year period, a 25-year period, or longer.
Validation	Internal or external process to check the quality of an assessment, including technical credibility, the appropriateness of key assumptions, and the strength of your results. This process may be more or less formal and often relies on self-assessment.
Valuation	In the Natural Capital Protocol [44], the process of estimating the relative importance, worth, or usefulness of natural capital to people (or to a business), in a particular context. Valuation may involve qualitative, quantitative, or monetary approaches, or a combination of

	these.
Valuation technique	The specific method used to determine the importance, worth, or usefulness of something in a particular context.
Value (noun)	The importance, worth, or usefulness of something.
Value perspective	In the Natural Capital Protocol [44], the perspective or point of view from which value is assessed; this largely determines which costs or benefits are included in an assessment. • Business value: The costs and benefits to the business, also referred to as internal, private, financial, or shareholder value. • Societal values: The costs and benefits to wider society, also referred to as external, public, or stakeholder value (or externalities).
Value transfer	A technique that takes a value determined in one context and applies it to another context. If contexts are similar or appropriate adjustments can be made to account for differences, value transfer can provide reasonable estimates of value.
Value-chain boundary	The part or parts of the business value chain to be included in a natural capital assessment. For simplicity, the Natural Capital Protocol [44] identifies three generic parts of the value chain: upstream, direct operations, and downstream. An assessment of the full lifecycle of a product would encompass all three parts. • Upstream (cradle-to-gate): covers the activities of suppliers, including purchased energy. • Direct operations (gate-to-gate): covers activities over which the business has direct operational control, including majority-owned subsidiaries. • Downstream (gate-to-grave): covers activities linked to the purchase, use, reuse, recovery, recycling, and final disposal of the business's products and services.
Verification	Independent process involving expert assessment to check that the documentation of the assessment is complete and accurate and gives a true representation of the process and results. "Verification" is used interchangeably with terms such as "audit" or "assurance."

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