MONETISATION FACTORS FOR TRUE PRICING

Version 3.0.0 (2023)

2023

True Price™

MONETISATION FACTORS FOR TRUE PRICING

Version 3.0.0 (2023) – June 2023

Authored by True Price Foundation

About True Price

True Price is a social enterprise with the mission of making sustainable products that are affordable to all a reality, by enabling consumers to see and voluntarily pay the true price of products they buy.

We envision a world where all products are sold for a "true price". If a product is sold for a true price, then no damage is done to people or to nature, and that product is fully sustainable. If all products were sold for a true price, then the global economy would be sustainable.

True Price was founded in 2012 and has subsequently developed into a world-leading expert in methods and tools to measure and monetise societal impact. It has calculated the true price of hundreds of products around the world, for global institutions, government agencies, supermarkets and cafés alike, and has seen a growing appreciation of the concept among companies, governments and consumers.

For more information visit: www.trueprice.org.

True Price
Haarlemmerplein 2
1013 HS Amsterdam
The Netherlands
Tel.: +31 202 403 440
info@trueprice.org

Version 3.0.0 – June 2023

Suggested citation: True Price Foundation, 2023: *Monetisation Factors for True Pricing* Version 3.0.0 (Authors: Galgani et al.). Amsterdam.

Lead Authors: Pietro Galgani, Dimitra Kanidou, Bart van Veen, Hans Westrik

(Contributing) Authors of this and previous versions: Adrian de Groot Ruiz, Reinier de Adelhart Toorop, Emmanouela Varoucha, Mats Hoppenbrouwers, Andrea Rusman, Floor van den Elzen, Roland van Keeken, Michel Scholte, Jude Bernard, Anne Mesguich, Valerius Vandru Hartanto, and Lewis Zwart.

Acknowledgements: This publication would not have been possible without the contributions of all current and past members of the True Price team and the partners of True Price.

Table of Contents

Change log

True Price aims for its monetisation factors to be the most representative approximation of external costs given the latest knowledge and available data. As such, when more representative methods of calculation or more accurate data are identified, the existent monetisation factors are updated accordingly.

Version log

1 (2020) First version

2.0.3 (2021) Second version

3.0.0 (2023) Current version

The current revision focused primarily on updating the social monetisation factors, with some changes made to certain environmental factors, regarding regional factors for air pollution. These changes do not affect the values of the global factors presented in section 4, but the accompanying explanation is updated.

Table 1 details the changes that have been made between the current and previous version of this work.

Table 1: Log of changes from previous to current version

#	Change	Description of change	Monetisation factor(s) affected
1	Removed indicator: POF	Monetisation factors for measuring the impact of photochemical oxidant formation based on kg NMVOC are no longer available.	• Photochemical Oxidant Formation
2	New indicators: POF: human health damage, POF: ecosystems damage	The indicator Photochemical Oxidant Formation (NOx) is split into two indicators. The new indicators represent the different effects deriving from emissions of NOx and NMVOC pollutants in the air – damage to human health and damage to ecosystems. Both indicators are expressed in NOx-eq.	• Photochemical Oxidant Formation (NOx)
3	Correction of valuation model of pollution (description)	The calculation of air, soil and water pollution is based on endpoint valuation based on ReCiPe 2016. In version 2.0.3, the explanation of the monetisation factors that fall under these impacts was stating that endpoint characterisation factors are used to derive the monetisation factors. However, Recipe 2016 midpoint to endpoint conversion factors are utilised to derive these. The explanation is corrected in this version.	• Toxic emissions to air / soil / water • Particulate matter (PM) formation[1] • Acidification[1] • Ozone layer depleting emissions • Photochemical Oxidant Formation[1]

[1] For these indicators an additional change on monetisation factors was realised in version 3.0.0. A different model is applied to account for the regional effects of PM formation, acidification and POF. However, this report focuses on global modelling and monetisation, so this change is left out of scope. To learn more about the alternative model to derive and use country-specific monetisation factors for these indicators see (Galgani, Woltjer, et al., 2023).

#	Change	Description of change	Monetisation factor(s) affected
4	Contribution to Climate Change factor increase	While all factors are simply inflated from one year to the next, for Contribution to Climate Change a higher increase of 3% each year is applied, following the so-called Hotelling Rule (Galgani, Woltjer, de Adelhart Toorop, de Groot Ruiz, et al., 2021a)	• Contribution to Climate change
5	Updated penalty values	For the impacts of Child Labour and Occupational Health & Safety, the penalty sources were revisited. For certain counties included in the penalty calculations, new values for fines were identified. The new values were incorporated in the calculations of these retribution costs.	• Underage workers below minimum age for light work (12 or 13) involved in non-hazardous economic work • Underage workers above minimum age for light work and below minimum age (12-14 or 13-15) involved in non-hazardous non-light economic work • Underage workers below minimum age (12 or 13) involved in hazardous work • Workers above minimum age (14 or 15) and below 18 involved in hazardous work • Occupational injuries with breach of H&S standards • Work performed in violation of H&S standards
6	Updated auditing cost values	For all social impacts, the source used to calculate the generic auditing set up cost was revisited. New data for the number of certified facilities and employees were found. The new values were incorporated in the calculations of the prevention costs.	• Labour force to be audited for child labour • Labour force to be audited for forced labour • Labour force to be audited for discrimination • Labour force to be audited for insufficient wages • Labour force to be audited for insufficient social security • Labour force to be audited for illegal overtime • Labour force to be audited for harassment • Labour force to be audited to be audited for denied freedom of association • Labour force to be audited for H&S
7	Replaced interest rate with inflation rate for income gaps	The calculation of certain compensation costs is corrected for an increase in consumer prices (annual inflation) due to delayed income. Previously, an interest rate was used for this correction.	• Value of denied maternity leave • Wage gap from gender discrimination • Wage gap from unequal opportunities • Wage gap of workers earning below minimum wage

#	Change	Description of change	Monetisation factor(s) affected
			• Wage gap of workers earning above minimum wage but below decent living wage • Value of denied paid leave • Overtime pay gap • Living income gap
8	Updated value for treatment cost of an injury	For the impacts of Occurrence of Harassment and Occupational Health & Safety, the sources used for to calculate treatment costs of an injury were revisited. New values were found and incorporated in the calculations of these compensation costs.	• Workers who experienced physical non-sexual harassment • Workers who experienced non-severe physical sexual harassment • Workers who experienced severe physical sexual harassment • Uninsured non-fatal occupational incidents
9	All factors inflated to 2022	Factors in this publication are at 2022 price levels.	• All factors

Abbreviations

1,4-DB	1,4-Dichlorobenzene
CFC11	Trichlorofluoromethane
CHRB	Corporate Human Rights Benchmark
CO_2	Carbon Dioxide
Cu	Copper
DALY	Disability Adjusted Life Year
eq	equivalent
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FTE	Full Time Equivalent
GHG	Greenhouse Gas
H&S	Health and Safety
ha	hectare
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IPEC	International Programme on the Elimination of Child Labour
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
m^3	cubic meters
MSA	Mean Species Abundance
N	Nitrogen
NH_3	Ammonia
NMVOC	Non Methane Volatile Organic Compounds
NO_x	Nitrogen Oxides
OECD	Organisation for Economic Cooperation and Development
OHCHR	Office of the High Commissioner for Human Rights
P	Phosphorus
PEF	Product Environmental Footprint
PM	Particulate Matter
$PM_{2.5}$	Fine particulate matter, particles that are 2.5 microns or less in diameter
PTSD	Post-Traumatic Stress Disorder
RIVM	The National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu
SAI	Social Accountability International
SOC	Soil Organic Carbon
SO_2	Sulphur Dioxide

TEEB	The Economics of Ecosystems and Biodiversity
tkm	tonne-kilometre
TPMD	True Price Monetization Database
TPS	True Price Standard
UN	United Nations
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
VSL	Value of a Statistical Life
WHO	World Health Organization
WWF	World Wildlife Fund

1 Introduction

1.1 Content of this publication

Current knowledge and technology enable us to account for external costs: We can determine the hidden costs of production and consumption of products, and we can remediate external costs at a local level. However, the infrastructure to measure and remediate external costs at a large scale does not yet exist. Nonetheless, many publications already exist on the monetisation of various environmental external costs at the product level, often in the context of a Life Cycle Assessment (LCA). This publication presents a database of monetisation factors for the accounting of both environmental and social external costs.

Over the past eleven years, True Price has developed the principles and methodology to monetise a wide set of social and environmental costs. The first Monetisation Factors for True Pricing document was published in 2020. It provided the first open access version of true pricing monetisation factors as a step towards an open access True Price Monetisation Database (TPMD). The aim of the original publication was to facilitate the adoption and application of true pricing, fill a gap in the literature and accelerate standardisation. This third edition serves the same purpose and provides improved and updated monetisation factors. A full overview of changes compared to the previous version can be found in the change log at the start of this document.

True Price is working towards a True Pricing Standard (TPS) consisting of open access principles, methodologies and guidance. In doing so, we promote a participatory process by inviting experts, stakeholders and practitioners to provide input and help to make both the TPS and accompanying TPMD scientifically and normatively sound, comprehensive and applicable.

Monetisation factors are estimates of the remediation cost of the social and environmental impacts that must be included to estimate the true price of a product. These impacts are measured by a set of footprint indicators[2] and every footprint indicator can be converted to a monetary unit using the corresponding monetisation factor. When all footprint indicators are measured and monetised for a product, the true price can be calculated.

This publication provides monetisation factors for ten environmental and ten social true price impacts and their footprint indicators and sub-indicators, along with an explanation of the interpretation and sources. The monetisation factors are all expressed in 2022 price levels. Ideally, monetisation factors should be regional, as an impact in one place may be different from the same impact elsewhere. In this publication, an global values are provided. Unless otherwise stated, these represent a global average of different countries or regions. Methodologies to derive regional/country-specific factors are available in other publications for 12 out of 20 true price impacts (see Section 2.7).

[2] The indicators are comparable to the impact category mid-point and end-point indicators of an LCA.

1.2 Methodological foundation

A brief overview of the methods used is given in Section 2. For an explanation of the principles and framework used to select the footprint indicators and monetisation factors, refer to the *Principles for True Pricing* (True Price Foundation, 2020). A detailed justification is available in separate *impact modules*, publications which also detail the Natural, Social and Human Capital methodologies underlying each of these factors. A *valuation framework* and an *true price assessment method* (Galgani, Woltjer, de Adelhart Toorop, & de Groot Ruiz, 2021b; Galgani, van Veen, et al., 2023) are also available.

More information and all the method documents can be found on www.trueprice.org and in section 2.7.

1.3 What the monetisation factors can be used for

The monetisation factors included in this publication are to be used primarily in the context of true pricing. They provide the key to expressing external costs (negative social and environmental impacts) in monetary terms.

True Price ultimately wants to enable everyone to calculate and publish true prices and worked towards sectoral guidelines that would allow anyone to get started. Such a publication is the *True Pricing Assessment Method for Agri-Food Products* (Galgani, van Veen, et al., 2023). This method and its complementary documents are aimed to enable practitioners to get started with true pricing and calculate the external costs of agri-food products.

Ultimately, the True Price Standard will detail in a univocal way how to determine the true price of a product, in a manner that allows full comparability of true prices of all products. This goes beyond the scope of the current method documents, which rather focus on providing data and the required steps to support a high-quality and transparent assessment. However, these steps on their own cannot fully prevent insufficiently sound claims on the true price of a product Therefore, if you are interested in calculating and disseminating true price calculations, please get in touch with True Price. Until a standard will be published, we propose the users of these monetisation factors refer to external costs calculated with these factors as "social and environmental costs calculated with the true price method", rather than "true prices" to safeguard consistency and comparability between true prices calculated by different organisations.

The monetisation factors can also be applied in various applications outside of true pricing, including (i) to monetise negative externalities in true cost accounting and impact assessments, (ii) to monetise impacts pertaining to the welfare dimension *respect of basic rights* for Integrated Profit & Loss statements, in line with the *Framework for Impact Statements* (Impact Institute, 2019), and (iii) as weighting factors for LCA.

The monetisation factors provided in this publication are a work in progress. We invite you to check regularly for updates on www.trueprice.org.

1.4 Who should use this publication

This publication is intended mainly for experts, researchers and practitioners who are active in the field of true pricing, impact assessment, impact-weighed accounts, true cost accounting or LCA.

1.5 Reader's guide

This publication consists of four sections: this section is an introduction; Section 2 briefly discusses the concept of true pricing and the methodology used to derive the monetisation factors; Section 3 provides an overview of the impacts relevant for true pricing, along with their definitions and footprint indicators; Section 4 provides the monetisation factors.

In addition, a glossary of key terms is included at the end of the publication and a change log to track changes from previous versions is included at the begin of the publication.

2 About the true pricing methodology

This section provides a brief discussion about true pricing methodology, focusing on the most important concepts to derive and apply monetisation factors. For more information on the principles and framework behind this methodology, see our method publications (illustrated in Section 2.7).

2.1 What is the true price?

The true price is a way to make the external costs of producing and consuming a product explicit. *External costs* are the costs associated with negative externalities. These are the negative effects on external stakeholders who did not participate in the production or consumption of that product (or, if they did, did not do so sufficiently freely). Externalities include effects on the environment, such as climate change and water pollution, and on people, such as health and safety accidents and child labour.

True pricing makes external costs explicit by assessing them on a per-unit basis and by monetising them—that is, expressing them in a monetary way (e.g., in euros or dollars), just as with conventional costs. The sum of all external costs assessed in this way is called the "true price gap". The true price gap can be compared directly to the market price of the product: the two are added together to get to the true price. The true price can be interpreted as how much the product *truly costs*. It includes costs to the buyer (the market price) and the costs to external stakeholders (the true price gap).

We believe true pricing—expressing externalities as discussed above—can contribute to the transformation towards a more sustainable economy (See *A roadmap for true pricing* (True Price Foundation, 2019)) for more on the applications of true pricing by businesses, consumers and governments).

2.2 How the true price is calculated

Calculating the true price of a product means calculating the true price gap and adding that to the market price. Calculating the true price gap in turn requires expressing all relevant externalities in monetary terms. This raises two questions: how to assess which externalities should be taken into account, and how to quantify and monetise them.

For the first question, the true price method takes a rights-based approach. Internationally accepted rights and agreements are taken as a starting point in determining which externalities should be included. The resulting subset of externalities—referred to as 'unsustainable externalities' or 'unsustainable impacts'—is the set of negative effects of producing and consuming products that should be factored into the true price gap.

Rights that are considered are the basic rights of all people as specified by international conventions, and include human rights, fundamental labour rights and environmental rights. True pricing is based on the normative idea that, to reach sustainability, the rights of all stakeholders, including future generations, should be respected by markets and the economy. For more details, refer to the *Principles for True Pricing*. (In particular, Chapter 1 presents the normative foundations, Annex A contains principles and definitions, and Annex C contains a (preliminary) list of all impacts that are to be included in a true price analysis, with a reference to which basic rights the impacts relate to.)

The second question is how to quantify and monetise these externalities. For each of the relevant impacts, the size of the impact in natural unit (or 'footprint') can be measured or estimated using primary or secondary sources (e.g., LCAs). Examples of footprints are the emission volumes of greenhouse gases per unit product (for determining the contribution to climate change), and hours of child labour per unit product. The impact expressed in its natural units (or footprint indicators) can then be multiplied by the monetisation factor for that impact.

The following section explains how this is done.

2.3 What monetisation factors are based on

Principles on what perspective to take are needed to determine the monetisation factor for an impact. For example: greenhouse gas emissions can result in climate change, which imposes large costs on society; the most disastrous effects of climate change could be prevented by taking a set of costly measures now. These two sets of costs are both associated to carbon emissions but are likely to be different. So, it is important to use a coherent framework to define the monetisation factors used in true pricing.

The *Principles for True Pricing* document defines the principle of remediation that monetisation can be based on. This is inspired by, among others, the *UN Guiding Principles on Business and Human Rights* (UN OHCHR, 2011) and links directly to the rights-based approach.

Article 22 in the *UN Guiding Principles* reads,

> Where business enterprises identify that they have caused or contributed to adverse impacts, they should provide for or cooperate in their remediation through legitimate processes.

What remediation entails is explained further in the commentary to Article 25:

> Remedy may include apologies, restitution, rehabilitation, financial or non-financial compensation and punitive sanctions (whether criminal or administrative, such as fines), as well as the prevention of harm through, for example, injunctions or guarantees of non-repetition.

The true price methodology implements the principles of remediation by identifying the following four types of costs that, when appropriately combined, form the remediation cost for an impact: 1) Restoration costs, 2) Compensation costs, 3) Prevention of re-occurrence costs and 4) Retribution costs.

1) Restoration costs

Restoration costs are the cost of bringing people's health, wealth, circumstances, capabilities, or environmental stocks and qualities to the state they would have been in the absence of the social and environmental damage associated with an impact (e.g., cost of ecosystem restoration). Restoration cost is applied for impacts where restoration is feasible, or feasible and more economically efficient than compensation, when the damage to people or communities is not severe.

2) Compensation costs

Compensation costs are the cost of compensating affected people for economic and/or non-economic damage caused by the social and environmental impacts of producing or consuming a product. In the valuation literature, this is also called "damage cost" (e.g., compensating for denied income, or the value of

lost human health). Non-economic damage can be assessed using the best available stated and revealed preference valuation techniques. Compensation costs are part of the remediation costs for impacts where restoration is not considered feasible.

3) Prevention of re-occurrence cost

Prevention of re-occurrence cost represents the upfront cost that should be incurred to avoid, avert or prevent the identified social and environmental impacts of a product from occurring again in the future (e.g., the cost of introducing human rights audits in a supply chain). Prevention of re-occurrence cost is part of the remediation costs, in addition to restoration or compensation, when the damage is considered more severe and irreversible. Whereas the other types of costs refer to realised damage, this cost relates to the *prevention* of future damage. It finds its basis in, among others, the *UN Guiding Principles* mentioned above that acknowledge a responsibility to prevent the re-occurrence of human rights breaches (UN OHCHR, 2011).

4) Retribution cost

Retribution costs are the cost associated with fines, sanctions or penalties imposed by governments for certain violations of legal or widely accepted obligations. They represent the damage to society caused by the breaking of laws. For impacts that correspond to the breach of a legal or a widely accepted obligation, retribution costs are part of remediation costs, over and above restoration, compensation and/or prevention of re-occurrence costs.

2.4 How monetisation factors are derived

To derive monetisation factors for a given impact, the following approach is followed:

1. The types of damage that are associated to the impact are determined based on existing literature.
    - Damage can be either damage to people or to the environment. In some cases, the damage has already occurred (i.e., damage in the past; it is irreversible).
    - In other cases, the future damage *might* occur unless it is prevented (namely, reversible future damage), or is *certain to occur* (namely, irreversible future damage).
    - The damage can also be assessed as severe or non-severe.
    - Which of the four types of remediation cost (i.e., Restoration, Compensation, Prevention cost of re-occurrence or Retribution) applies is assessed from the rules in Section 2.3.
    - More than one type of cost might be relevant (e.g., both Compensation costs and Prevention costs of re-occurrence). In some cases, the choice of cost may vary, depending on the country or region where the impacts take place, leading to different monetisation factors in different geographies.
2. The relevant costs are quantified, based on economic modelling and data available in the literature, in a way that can be attributed linearly to one unit of impact, as measured by the footprint indicators.
3. The quantified cost(s) are summed to form monetisation factors.

- For impacts that have only one footprint indicator, this is a single monetisation factor. For impacts that have a set of distinct footprint indicators, there are monetisation factors for each.

These steps are carried out for each of the social and environmental impacts considered, resulting in 86 monetisation factors. A few examples are presented in the following section. Sections 4.1 and 4.2 show the results of this procedure for the true price indicators that have been assessed so far.

2.5 Examples of the derivation of monetisation factors

This section provides two examples to show the process of identifying elements that contribute to the monetisation factors.

Contribution to climate change

Greenhouse gas emissions have been shown to change climate patterns globally. Anthropogenic activities increasingly disrupt climatological patterns, which has long-lasting impacts on human and natural environments. Climate-related risks include extreme temperatures and increases in the frequency, intensity, or amount of heavy precipitation, or droughts and precipitation deficits in other regions. Ultimately, climate change results in severe economic damage and damage to human health (e.g., malnutrition or increased risk of diseases) and ecosystems (for example, see IPCC (2018) for more information).

It is not yet too late to curb emissions and limit temperature increases to the *2-degree scenario* as specified in the Paris Agreement. However, measures to do so come with costs. Marginal abatement costs for the 2-degree scenario can be seen as the carbon price required to restore greenhouse gas levels in the atmosphere to a safe level. As a result, the monetisation factor for climate change has only one element: a restoration element that follows from a meta-study of marginal abatement cost models (Kuik et al., 2009). Compensation cost, prevention-of-recurrence and retribution costs do not apply in this case.

Child labour

Child labour refers to work done by children beyond what is allowed by law: in most countries, children above a certain age are allowed to do light and non-hazardous work for a specified number of hours per day or week.

Child labour severely damages children. The damage includes missed education and lower future earnings (if the children were not able to attend school), and, in some cases, physical and psychological damage (mostly for the more severe forms of child labour) (ILO, n.d.-b; IPEC & ILO, 2004).

For severe damage to people that is reversible, the cost of restoration is included in the remediation cost (see Section 2.3). For example, restoration can occur through provision of quality education for underage workers not attending school, or through reintegration programmes for children involved in hazardous child labour. The monetisation factor contains the costs associated with these restoration activities.

For types of damage that cannot be restored, the compensation cost is taken into account. This includes compensation for the loss of future earnings due to lost years of education during childhood that cannot

be regained. As the damage is severe, and not fully restorable, the cost of measures to guarantee non-reoccurrence should be factored in. The cost of an audit that verifies that child labour is not present in a supply chain is also included.

Finally, retribution also applies, as there is always a breach of the law. Retribution costs are estimated from a weighted average of penalties for forms of child labour that are derived from various countries.[3]

2.6 Key limitations

The monetisation factors contained in this publication and the true price methodology are a work-in-progress.

There are various limitations associated with the current factors that should be mentioned:

- The list of monetisation factors included here is not complete with respect to all impacts mentioned in the *Principles for True Pricing*. The coverage of the current impacts is more complete for impacts related to environmental rights and worker rights. Impacts related to rights of local and indigenous communities and society at large have not yet been covered. There are also some gaps for environmental impacts, particularly for impacts not commonly assessed in LCA, such as biodiversity loss (other than that related to land use change or pollution). Furthermore, as mentioned, many factors are local and this publication addresses only global factors.
- The methodology is new and contains various normative assumptions. Translating principles into measurable targets and remediation categories thus requires interpretation.
- Significant model and data uncertainties exist regarding the estimates of restoration, compensation (damage), prevention and retribution costs. In particular, retribution cost is an innovation in valuation and damage cost is not always available. In many cases, a best estimate based on proxy data was used, although there may be some impacts that have not been modelled. This leads to a possible underestimate of the remediation cost.
- This database depends on datapoints from a very large variety of sources for social and environmental impact measurement and valuation. Even though significant effort has been put into standardizing assumptions and modelling choices used across indicators, including exchange rates, inflation rates, discount rates and valuation coefficients of human health and biodiversity, the presence of inconsistencies cannot be excluded.
- Alignment with the many existing standards and methods for sustainability reporting and impact measurement would be desirable, when developing a method that aims to be useful to many types of businesses and is applied to many types of products. As much as possible efforts have been made to work towards this end. However, this alignment is demanding and it has not been reached fully in this version.

[3] A global average is used instead of a local value in each country to negate the idea that the health of a child is worth more in some countries than in others.

While care was taken to come to the present version of monetisation factors, these can and will, no doubt, be improved. True Price and its partners are committed to developing these standards and methods.

2.7 Other publications relating to monetisation factors

In collaboration with our partners, True Price is continuously refining the monetisation factors and developing the methodology further. We invite you to check regularly on www.trueprice.org for more new publications, such as more detailed description of the methodology, including guidelines on how to apply it in practical cases and background papers on the methods, data and reasoning behind these monetisation factors.

Within the public-private partnership True and Fair Price for Sustainable Products with *Bionext, Wageningen Economic Research* impact-specific modules, covered in the current publication, were published. These modules contain the specific methods, to measure and value six natural and five social and human capital impacts. More background on how the monetisation factors are developed, as well as methods to derive country-specific factors when applicable, can be found in these documents. The natural impact modules (published at the time of writing) are:

- Contribution to climate change (Galgani, Woltjer, de Adelhart Toorop, de Groot Ruiz, et al., 2021a)
- Land use, land use change, biodiversity and ecosystem services (Galgani, Woltjer, de Adelhart Toorop, de Groot Ruiz, et al., 2021b)
- Soil degradation (Galgani, Woltjer, de Adelhart Toorop, Varoucha, et al., 2021)
- Scarce water use (Galgani, Woltjer, Kanidou, de Adelhart Toorop, et al., 2021)
- Air, soil and water pollution (Galgani, Woltjer, et al., 2023)
- Fossil fuel and other non-renewable material depletion (Galgani, Woltjer, de Adelhart Toorop, & de Groot Ruiz, 2021a)

The social and human capital modules that have already been published and are expected to be published within the project:

- Occupational Health and Safety (Galgani et al., 2022)
- Living Income (van Veen & Galgani, 2022)

We welcome feedback from valuation and true cost accounting specialists and users. We would be grateful for you to send your input to info@trueprice.org.

3 Impacts and indicators for true pricing

3.1 Environmental impacts

Table 2 provides an overview of all true pricing environmental impacts that are in scope of this publication. A total of 10 impacts is provided, along with their definition, footprint indicator(s) and sub-indicator(s) used to quantify them and corresponding unit. This list is not exhaustive, and more impacts, indicators and sub-indicators may be added in the future. Environmental indicators are largely based on the ReCiPe life cycle assessment methodology (Huijbregts et al., 2016).

Table 2: Overview of environmental impacts in true pricing.

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Contribution to climate change	Contribution to climate change	Contribution to climate change from emissions of greenhouse gases (carbon dioxide, methane, nitrous oxide and others). Emissions of greenhouse gases increase their atmospheric concentration (ppb), which increases the radiative forcing capacity and consequently increases the global mean temperature. Ultimately, extreme weather patterns, reduced agricultural yields and increased frequency of natural disasters can result in damage to the economy, human health – e.g., increased risk of diseases, natural disasters - and ecosystems (Huijbregts et al., 2016).	Greenhouse gas (GHG) emissions		kg CO_2-eq
Pollution of the living environment	Air pollution	Impacts caused by emissions to air other than climate change, including acidification, photochemical oxidant formation, particulate matter formation, nitrogen	Toxic emissions to air	Human toxicity	DALY[4]
				Terrestrial ecotoxicity	kg 1,4-DB emitted to industrial soil eq

[4] DALY, Disability Adjusted Life Year (WHO, 2019).

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
		deposition from emissions to air, ozone layer depletion, terrestrial and aquatic ecotoxicity and human toxicity from toxic emissions to air. Pollutants related to the first four impacts are sulphur dioxide (SO2), fine particulate matter (PM2.5), ammonia (NH3), nitrogen oxides (NOx) and Non Methane Volatile Organic Compounds (NMVOC). An extensive number of pollutants contributes to ozone layer depletion, ecotoxicity and human toxicity		Freshwater ecotoxicity	kg 1,4-DB emitted to freshwater eq
				Marine ecotoxicity	kg 1,4-DB emitted to seawater eq
			Particulate matter (PM) formation		kg PM2.5 eq
			Photochemical oxidant formation (POF)	Photochemical oxidant formation (POF): human health damage	kg NO_x eq
				Photochemical oxidant formation (POF): ecosystems damage	kg NO_x eq
			Acidification		kg SO_2-eq
			Ozone layer depleting emissions		kg CFC11-eq
			Nitrogen deposition NH_3	NH_3 from animal husbandry (in stables)	kg NH_3
				NH_3 from use of manure	kg NH_3
				NH_3 from other sources	kg NH_3
			Nitrogen deposition NO_x	NO_x from use of machines and vehicles	kg NO_x
				NO_x from other sources	kg NO_x
Pollution of the living environment	Water pollution	Emissions to water contributing to ecotoxicity and human toxicity, as well as eutrophication of marine- and freshwater. Eutrophication occurs due to the runoff and discharge of nutrients, for example from leaching of plant nutrients into soil, marine and freshwater bodies	Toxic emissions to water	Human toxicity	DALY
				Terrestrial ecotoxicity	kg 1,4-DB emitted to industrial soil eq
				Freshwater ecotoxicity	kg 1,4-DB emitted to freshwater eq

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
		and the subsequent rise in nutrient levels, i.e., of phosphorus (P) and nitrogen (N).		Marine ecotoxicity	kg 1,4-DB emitted to seawater eq
			Freshwater eutrophication		kg P-eq to freshwater
			Marine eutrophication		kg N-eq to marine water
Pollution of the living environment	Soil pollution	Eco- and human toxicity caused by emissions to soil. Soil pollution occurs due to the runoff and discharge of contaminants, for example heavy metals and pesticides.	Toxic emissions to soil	Human toxicity	DALY
				Terrestrial ecotoxicity	kg 1,4-DB emitted to industrial soil eq
				Freshwater ecotoxicity	kg 1,4-DB emitted to freshwater eq
				Marine ecotoxicity	kg 1,4-DB emitted to seawater eq
Degradation of land, biodiversity and ecosystems	Land occupation	The decreased availability of land for purposes other than the current one, through land occupancy. Land occupation by agriculture displaces habitats and ecosystems and therefore leads to biodiversity loss and loss of ecosystem services (Alkemade et al., 2009; de Groot et al., 2012; Milà i Canals et al., 2007)	Land occupation	Tropical forest	MSA*ha*yr
				Other forest	
				Woodland/shrubland	
				Grassland/savannah	
				Inland/wetland	
				Coastal wetland	
Degradation of land, biodiversity and ecosystems	Land transformation	Changes in land-cover that can affect ecosystem services and the climate system. This impact includes the number of natural ecosystems – i.e. (tropical) forest, woodland, grassland, and (inland and coastal) wetland - that are transformed in a certain period of time. Land transformation reduces the size of habitats and ecosystems and therefore leads to biodiversity loss and loss of ecosystem services.	Land transformation	Tropical forest	MSA*ha
				Other forest	
				Woodland/shrubland	
				Grassland/savannah	
				Inland/wetland	
				Coastal wetland	

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Depletion of scare abiotic resources	Fossil fuel depletion	The consequence of the primary extraction of fossil fuels linked to fuel use, energy use and to produce other inputs, such as mineral fertilizer. Extraction of crude oil, hard coal and natural gas bears external societal costs because the stock of these materials is reduced for present and future generations (Huijbregts et al., 2016). In this method, fossil fuel depletion is considered separately from the depletion of other non-renewable materials in line with LCA methodologies.	Fossil fuel depletion		kg oil-eq
Depletion of scarce abiotic resources	(Other) non-renewable material depletion	The consequence of the primary extraction of scarce, non-renewable resources besides fossil fuels, such as minerals. These bear external societal costs because the stock of these materials is reduced for present and future generations.	(Other) non-renewable material depletion		kg Cu-eq
Depletion of scarce abiotic resources	Scarce water use	Concerns the use of blue water in such a way that the water is evaporated, incorporated into products, transferred to other watersheds or disposed into the sea, in areas where water is scarce (Falkenmark & Rockström, 2004). Water that is used as such is not available anymore in the watershed of origin for humans nor for ecosystems (Huijbregts et al., 2016). Scarcity of water depends on the watershed of origin and the geographical context (WWF, n.d.) .	Scarce blue water use		m^3 scarce water
Degradation of land, biodiversity and ecosystems	Soil degradation	Soil degradation is defined as the physical, chemical and biological decline in soil quality driven by productive activities, like excessive use of irrigation or unbalanced use of fertilisers, and it can manifest itself in multiple ways, for example as loss of nutrients, loss of organic matter, increased soil erosion (from water or wind), soil	Soil organic carbon (SOC) loss		kg SOC
			Soil loss from wind erosion		kg soil lost
			Soil loss from water erosion		kg soil lost

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
		compaction, waterlogging and salinisation (Lal, 2009). Soil quality is the capacity of a soil to have the desired soil functions sufficiently available under varying conditions for a combination of objectives such as food production, an efficient nutrient cycle and the preservation of biodiversity (Hanegraaf et al., 2019).	Soil compaction		corrected tkm

3.2 Social impacts

Table 3 provides an overview of all true pricing social impacts that are in scope of this publication. A total of 10 impacts is provided, along with their definitions, indicator(s) and sub-indicator(s) used to quantify them and corresponding unit. This list is not exhaustive, and more impacts, indicators and sub-indicators may be added in the future. The set of social impacts is based on the *Principles for True Pricing* (True Price Foundation, 2020, Annex C) and largely in line with labour rights, Human Rights and corporate responsibility standards for business and existing social LCA frameworks (Benoit-Norris et al., 2012; CHRB, 2018; Croes & Vermeulen, 2015; ISO, 2010; SAI, 2014; UNEP, 2009; van der Velden & Vogtländer, 2017). The set of social footprint indicators is developed by True Price.

Table 3: Overview of social impacts in true pricing.

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Child labour	Child labour	Child labour is work that deprives children of their childhood, their potential and their dignity, and is harmful to physical and mental development and/or interferes with their schooling. Work can interfere with children's schooling by depriving them of the opportunity to attend school; obliging them to leave school prematurely; or requiring them to attempt to combine school attendance with excessively long and heavy work (ILO, n.d.-b). Worst forms of child labour involve children being enslaved, separated from their families, exposed to serious hazards and illnesses and/or left to fend for themselves on the streets of large cities – often at a very early age (ILO, n.d.-b). One of the worst forms of child labour is hazardous child labour. Whether participation of children in work is deemed child labour depends on age, local regulation on minimum working	Underage workers	Underage workers below minimum age for light work (12 or 13) involved in non-hazardous economic work	child FTE[5]
				Underage workers above minimum age for light work and below minimum age (12-14 or 13-15) involved in non-hazardous non-light economic work	child FTE
				Underage workers below minimum age (12 or 13) involved in hazardous work	child FTE
				Workers above minimum age (14 or 15) and below 18 involved in hazardous work	FTE

[5] Full Time Equivalent adapted for legal working hours for underage workers.

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
		age and minimum age for light work, nature of the work and the work relation, as specified by international institutions such as the ILO (ILO, 1973, 1999) and UNICEF (UNICEF, 2014).	Underage workers that are not attending school		children
			Labour force to be audited for child labour		FTE
Forced labour	Forced labour	Forced labour concerns all physical and psychological damage from work or service that is claimed under threat of punishment and for which the person concerned is not autonomously participating. Forced labour includes practices such as the use of compulsory prison labour by private business entities, debt bondage, indentured servitude and human trafficking (ILO, 2019).	Forced workers (least severe)		FTE
			Forced workers (medium severe)		FTE
			Forced workers (most severe)		FTE
			Forced workers who are in debt bondage		FTE
			Forced workers who are victims of abuse		FTE
			Labour force to be audited for forced labour		FTE
Discrimination	Gender discrimination	Gender discrimination concerns the effect of discriminating, nullifying or impairing equality of opportunity or treatment based on gender and/or sex. Gender discrimination includes insufficient provision of maternity leave and benefits, different pay for the same work between employees of different genders/sexes and different opportunities to access higher pay job based on gender and/or sex.	Female workers without maternity leave provision		FTE
			Value of denied maternity leave		EUR
			Wage gap from gender discrimination		EUR
			Wage gap from unequal opportunities		EUR
			Labour force to be audited for discrimination		FTE

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Non-guarantee of a decent living standard	Underpayment in the value chain	Underpayment occurs when the actual wages of employees over standard working hours, including financial wages and some forms of in-kind compensation, lie below the legal minimum wage or a decent living wage. Underpayment in the value chain can also include underpayment of child labourers and forced labourers. It excludes underpaid overtime, which is included under 'Excessive and underpaid overtime'.	Wage gap of workers earning below minimum wage		EUR
			Wage gap of workers earning above minimum wage but below decent living wage		EUR
			Labour force to be audited for insufficient wages		FTE
Non-guarantee of a decent living standard	Lack of social security	Negative effects of lack of social security (where this is obliged by law). Social security includes protection against certain life risks and social needs, such as guaranteed income security and health protection. It is provisioned through cash or in-kind transfers, intended to ensure access to medical care and health services as well as income security through one's life, particularly in the event of illness, unemployment, employment injury, maternity, family responsibilities, invalidity, loss of the family breadwinner, as well as during retirement and old age (ILO, n.d.-a).	Workers without legal social security		FTE
			Value of denied paid leave		EUR
			Labour force to be audited for insufficient social security		FTE
Non-guarantee of a decent living standard	Excessive and underpaid overtime	Overtime hours worked by employees that are carried out in violation of legal regulations or compensated below legal requirements. It does not include underpayment, the gap between liveable and actual wages, for standard working hours.	Workers performing illegal overtime		FTE
			Workers performing underpaid overtime		FTE
			Overtime wage gap		EUR
			Labour force to be audited for illegal overtime		FTE

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Non-guarantee of a decent living standard	Insufficient income	Concerns smallholder farmers and other small entrepreneurs in the value chain that have an income below the so-called living income. Living income is "the net annual income required for a household in a particular place to afford a decent standard of living for all members of that household." (The Living Income Community of Practice, n.d.). A decent standard of living means "being able to afford food, water, decent housing, education, healthcare, transportation, clothing, and other essential needs including provision for unexpected events." (The Living Income Community of Practice, n.d.).	Living income gap		EUR
Occupational health and safety risks	Occurrence of harassment	Negative effects of workplace harassment, including verbal and non-verbal, sexual and non-sexual. The term of "harassment" encompasses any act, conduct, statement or request which is unwelcome and could, in all the circumstances, reasonably be regarded as harassing behaviour of a discriminatory, offensive, humiliating, intimidating or violent nature or an intrusion of privacy. This impact includes bullying/mobbing and sexual harassment (ILO, 2013).	Workers who experienced harassment	Workers who experienced non-physical non-sexual harassment	workers
				Workers who experienced non-physical sexual harassment	workers
				Workers who experienced physical non-sexual harassment	workers
				Workers who experienced non-severe physical sexual harassment	workers
				Workers who experienced severe physical sexual harassment	workers
			Labour force to be audited for harassment		FTE

Impact category	Impact	Definition	Footprint indicator	Footprint sub-indicator	Unit
Lack of union rights	Lack of freedom of association	Workers that are not given the right of freedom of association: the extent to which workers have the right to establish and to join organisations of their choice without prior authorisation, to promote and defend their interests, and to negotiate collectively with other parties. They should be able to do this freely, without interference by other parties or the state, and should not be discriminated against as a result of union membership. The right to organise includes the right of workers to strike and the rights of organisations to draw up constitutions and rules, to freely elect representatives, to organise activities without restriction and to formulate programmes (UNEP, 2009).	Instances of denied freedom of association		violations
			Labour force to be audited for denied freedom of association		FTE
Occupational health and safety risks	Negative effects of employee health & safety	Negative effects on workers' health and safety at work, specifically the extent to which working in the value chain negatively affects the safety and overall health status of the workers. The term health, in relation to work, indicates not merely the incidence of occupational disease or infirmity, but also includes the physical and mental elements affecting health, which are directly related to safety and hygiene at work (Goedkoop et al., 2018; ISO, 2010). Safety is understood as the extent to which working can lead to fatal and non-fatal injuries, as well as the application of prevention measures and management practices to reduce their incidence.	Non-fatal occupational incidents	Insured non-fatal occupational incidents	Incidents
				Uninsured non-fatal occupational incidents	Incidents
			Fatal occupational incidents		Incidents
			Occupational incidents with breach of H&S standards		Incidents
			Work performed in violation of H&S standards		FTE
			Labour force to be audited for H&S		FTE

4 Monetisation factors for true pricing

4.1 Environmental impacts

Table 4 provides the monetisation factors for all environmental impacts and corresponding footprint indicators in true pricing. Each monetisation factor represents a restoration, compensation, prevention or retribution cost, or a combination of those, as explained in Section 2.3. An explanation of the types of costs and sources is also provided. All values are expressed in euro 2022 and International $ 2022 and rounded.

Table 4: Monetisation factors for environmental impacts in true pricing. CO: compensation cost, RS: restoration cost, PR: prevention cost, RT: retribution cost.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
Contribution to climate change	Greenhouse gas (GHG) emissions[RS]		0.163 EUR/kgCO2eq	0.236 Int.$/kgCO2eq	A restoration cost which expresses the abatement cost for achieving the policy targets of reducing greenhouse gas emissions to meet the 2-degree target as set in the Paris Agreement, based on a meta-study of 62 marginal abatement cost estimates (Kuik et al., 2009).
Air pollution	Toxic emissions to air	Human toxicity[CO]	106,000 EUR/DALY	125,000 Int.$/DALY	A compensation cost which expresses the value of a Disability Adjusted Life Year (DALY) based on a meta-analysis of the Value of Statistical Life (VSL) from 92 willingness-to-pay studies, carried out by the OECD (Biausque, 2012). This global value is applicable to all countries.
		Terrestrial ecotoxicity[CO]	0.0003 EUR/kg 1,4-DB emitted to industrial soil eq	0.0004 Int.$/kg 1,4-DB emitted to industrial soil eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at ecosystems damage. Ecosystems damage is valued looking at the value of ecosystems services lost. The endpoint valuation of ecosystem damage represents the annual value of ecosystem services (ESS) of one hectare of nature, based on the median annual value per hectare of ecosystem services of six terrestrial
		Freshwater ecotoxicity[CO]	0.0417 EUR/kg 1,4-DB emitted to freshwater eq	0.0606 Int.$/kg 1,4-DB emitted to freshwater eq	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
		Marine ecotoxicity[CO]	0.0019 EUR/kg 1,4-DB emitted to seawater eq	0.0028 Int.$/kg 1,4-DB emitted to seawater eq	biomes. These values are based on a published meta-analysis of the TEEB database (de Groot et al., 2012). Recipe 2016 midpoint to endpoint conversion factors for terrestrial, marine and freshwater ecotoxicity are utilised to derive the monetisation factors (Huijbregts et al., 2016). A global value for endpoint valuation is used rather than location specific values, due to the high uncertainty and the fact that the quantification of ecosystems damage from Recipe is not location specific (e.g., it is not specified where the damage occurs, only the size of the damage).
	Nitrogen deposition NH_3[6]	Animal Husbandry (in stables)[RS]	13.00 EUR/kg NH_3 eq	18.90 Int.$/kg NH_3 eq	A marginal cost of the abatement measures needed to reach the regulatory target of nitrogen deposition in nature areas. Types and magnitude of emissions that contribute to nitrogen deposition in the Netherlands are based on (van der Maas, 2020). The costs to prevent the deposition of 1 mol of Nitrogen per hectare per year from 1 kg of NOx and NH_3 emissions from various sources are derived from (van den Born et al., 2020). Adjusted values for nitrogen deposition in other European countries are provided based on PEF characterisation factors and data on the average accumulate exceedance per hectare (Manfredi et al., 2012). Country-specific values are provided in (Galgani, Woltjer, et al., 2023)
		Use of manure[RS]	8.32 EUR/kg NH_3 eq	12.10 Int.$/kg NH_3 eq	
		Other sources[RS]	7.28 EUR/kg NH_3 eq	10.60 Int.$/kg NH_3 eq	
	Nitrogen deposition NO_x[7]	Use of machines and vehicles[RS]	1.27 EUR/kg NO_x eq	1.84 Int.$/kg NO_x eq	
		Other sources[RS]	2.40 EUR/kg NO_x eq	3.49 Int.$/kg NO_x eq	
	Particulate matter (PM) formation[CO]		66.80 EUR/kg PM2.5 eq	78.50 Int.$/kg PM2.5 eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare

[6] Values represent a European average, rather than a global one.

[7] Values represent a European average, rather than a global one.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Photochemical oxidant formation (POF)	Photochemical oxidant formation (POF): human health damage[CO]	0.0966 EUR/ kg NO_x eq	0.114 Int.$/ kg NO_x eq	when pollutants are emitted to the environment, looking at human health damage (morbidity, i.e., sickness and disease, and premature mortality). The endpoint valuation of human health is based on valuation of a DALY (Disability Adjusted Life Year) as described above for Human Toxicity. Recipe 2016 midpoint to endpoint conversion factors for PM formation are utilised to derive the monetisation factors (Huijbregts et al., 2016). At midpoint level, the indicator has only global monetisation. Country-specific conversion factors can be derived for individual gases (NOx, SOx, NMVOC), with the method described in (Galgani, Woltjer, et al., 2023).
		Photochemical oxidant formation (POF): ecosystems damage[CO]	2.93 EUR/kg NO_x eq	4.27 Int$/kg NO_x eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at ecosystems damage. Ecosystems damage is valued looking at the value of ecosystems services lost,as described for ecotoxicity. Recipe 2016 midpoint to endpoint conversion factors for ecosystem damage due to ozone formation are utilised to derive the monetisation factors (Huijbregts et al., 2016).. At midpoint level, the indicator has only global monetisation. Country-specific conversion factors can be used for individual gases (NOx, SOx, NMVOC), with the method described in (Galgani, Woltjer, et al., 2023).
	Acidification[CO]		4.82 EUR/kg SO2 eq	7.02 Int.$/kg SO2 eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at ecosystems damage. Ecosystems damage is valued looking at the value of ecosystems services lost, as described above for ecotoxicity. Recipe 2016 midpoint to endpoint conversion

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
					factors for acidification are utilised to derive the monetisation factors (Huijbregts et al., 2016). At midpoint level, the indicator has only global monetisation. Country-specific conversion factors can be used for individual gases (NH3, SOx, NOx), with the method described in (Galgani, Woltjer, et al., 2023)..
	Ozone layer depleting emissions[CO]		57.90 EUR/kg CFC-11 eq	68.50 Int.$/kg CFC-11 eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at human health damage (morbidity, i.e., sickness and disease, and premature mortality). The endpoint valuation of human health is based on valuation of a DALY (Disability Adjusted Life Year). The global Recipe 2016 midpoint to endpoint conversion factor for Ozone layer depleting emissions is utilised to derive the monetisation factor (Huijbregts et al., 2016). The monetisation factor for ozone layer depleting emissions also includes the cost of damage to agricultural crops taken from CE Delft (De Bruyn et al., 2018). The cost of damage to agricultural crops represents average damage costs for ozone depletion for an average emission source in the Netherlands. Although the damage could be different in different geographies, for example because of different thickness of the ozone layer, at the moment the value is used without adjustments for different countries due to the lack of an appropriate coefficient for regional adjustments.
Water pollution	Toxic emissions to water	Human toxicity[CO]	106,000 EUR/DALY	125,000 Int.$/DALY	A compensation cost which expresses the Value of Statistical Life (VSL) based on a meta-analysis of the Value of Statistical Life (VSL) from 92 willingness-to-pay studies, carried out by the OECD (Biausque, 2012). This global value is applicable to all countries.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
		Terrestrial ecotoxicity[CO]	0.0003 EUR/kg 1,4-DB emitted to industrial soil eq	0.0004 Int.$/kg 1,4-DB emitted to industrial soil eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at ecosystems damage. Ecosystems damage is valued looking at the value of ecosystems services lost. The endpoint valuation of ecosystem damage represents the annual value of ecosystem services (ESS) of one hectare of nature, based on the median annual value per hectare of ecosystem services of six terrestrial biomes. These values are based on a published meta-analysis of the TEEB database (de Groot et al., 2012). Recipe 2016 midpoint to endpoint conversion factors for terrestrial, marine and freshwater ecotoxicity are utilised to derive the monetisation factors (Huijbregts et al., 2016). A global value for endpoint valuation is used rather than location specific values, due to the high uncertainty and the fact that the quantification of ecosystems damage from Recipe is not location specific (e.g., it is not specified where the damage occurs, only the size of the damage).
		Freshwater ecotoxicity[CO]	0.0417 EUR/kg 1,4-DB emitted to freshwater eq	0.0606 Int.$/kg 1,4-DB emitted to freshwater eq	
		Marine Ecotoxicity[CO]	0.0019 EUR/kg 1,4-DB emitted to seawater eq	0.0028 Int.$/kg 1,4-DB emitted to seawater eq	
	Freshwater eutrophication[CO,RS]		209 EUR/kg P eq to freshwater	304 Int.$/kg P eq to freshwater	A combination of restoration and compensation costs based on a literature review on the costs of eutrophication. Restoration costs express average abatement cost for bringing nutrient levels to a regulatory target, for the impacts that are reversible. Compensation costs express other damage (economic damage, damage to human health and biodiversity loss), for residual impacts after restoration has taken place. Country specific factors can be derived based on water basin-level risk of eutrophication.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Marine eutrophication[CO,RS]		14.50 EUR/kg N eq to marine water	21.10 Int.$/kg N eq to marine water	A combination of restoration and compensation costs based on a literature review on the costs of eutrophication. Restoration costs express average abatement cost for bringing nutrient levels to a regulatory target, for the impacts that are reversible. Compensation costs express other damage (economic damage, damage to human health and biodiversity loss), for residual impacts after restoration has taken place.
Soil pollution	Toxic emissions to soil	Human toxicity[CO]	106,000 EUR/DALY	125,000 Int.$/DALY	A compensation cost which expresses the value of a Disability Adjusted Life Year (DALY) based on a meta-analysis of the Value of Statistical Life (VSL) from 92 willingness-to-pay studies, carried out by the OECD (Biausque, 2012).
		Terrestrial ecotoxicity[CO]	0.0003 EUR/kg 1,4-DB emitted to industrial soil eq	0.0004 Int.$/kg 1,4-DB emitted to industrial soil eq	A compensation cost which expresses the social cost of pollution and indicates the occurring loss of economic welfare when pollutants are emitted to the environment, looking at ecosystems damage. Ecosystems damage is valued looking at the value of ecosystems services lost. The endpoint valuation of ecosystem damage represents the annual value of ecosystem services (ESS) of one hectare of nature, based on the median annual value per hectare of ecosystem services of six terrestrial biomes. These values are based on a published meta-analysis of the TEEB database (de Groot et al., 2012). Recipe 2016 midpoint to endpoint conversion factors for terrestrial, marine and freshwater ecotoxicity are utilised to derive the monetisation factors (Huijbregts et al., 2016). A global value for endpoint valuation is used rather than location specific values, due to the high uncertainty and the fact that the quantification of ecosystems damage from Recipe is not location specific (e.g., it is not specified where the damage occurs, only the size of the damage).
		Freshwater ecotoxicity[CO]	0.0417 EUR/kg 1,4-DB emitted to freshwater eq	0.0606 Int.$/kg 1,4-DB emitted to freshwater eq	
		Marine Ecotoxicity[CO]	0.0019 EUR/kg 1,4-DB emitted to seawater eq	0.0028 Int.$/kg 1,4-DB emitted to seawater eq	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
Land occupation	Land occupation	Tropical forest[CO]	2,180 EUR/(MSA*ha*yr)	3,170 Int.$/(MSA*ha*yr)	A compensation cost which expresses the opportunity cost of land occupation based on the value of ecosystem services for main biomes based on a meta-analysis from TEEB (de Groot et al., 2012). Country-specific factors can be derived based on biome cover per country.
		Other forest[CO]	1,040 EUR/(MSA*ha*yr)	1,520 Int.$/(MSA*ha*yr)	
		Woodland/shrubland[CO]	1,410 EUR/(MSA*ha*yr)	2,050 Int.$/(MSA*ha*yr)	
		Grassland/savannah[CO]	2,500 EUR/(MSA*ha*yr)	3,640 Int.$/(MSA*ha*yr)	
		Inland wetland[CO]	15,300 EUR/(MSA*ha*yr)	22,300 Int.$/(MSA*ha*yr)	
		Coastal wetland[CO]	11,300 EUR/(MSA*ha*yr)	16,400 Int.$/(MSA*ha*yr)	
Land transformation	Land transformation	Tropical forest[CO]	3,700 EUR/(MSA*ha)	4,350 Int.$/(MSA*ha)	A restoration cost which expresses the average cost of ecosystem restoration projects in different biomes based on a review of case studies (TEEB, 2009). Costs include capital investment and maintenance of the restoration project.
		Other forest[CO]	2,570 EUR/(MSA*ha)	3,020 Int.$/(MSA*ha)	
		Woodland/shrubland[CO]	1,060 EUR/(MSA*ha)	1,250 Int.$/(MSA*ha)	
		Grassland/savannah[CO]	279 EUR/(MSA*ha)	328 Int.$/(MSA*ha)	
		Inland wetland[CO]	35,400 EUR/(MSA*ha)	41,600 Int.$/(MSA*ha)	
		Coastal wetland[CO]	3,090 EUR/(MSA*ha)	3,630 Int.$/(MSA*ha)	
Fossil fuel depletion	Fossil fuel depletion[CO]		0.460 EUR/kg oil eq	0.540 Int.$/kg oil eq	A compensation cost which expresses the future loss of economic welfare due to increased extraction costs of fossil fuels in the future (Huijbregts et al., 2016).

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
(Other) non-renewable material depletion	(Other) non-renewable material depletion[CO]		0.223 EUR/kg Cu eq	0.273 Int.$/kg Cu eq	A compensation cost which expresses the future loss of economic welfare due to increased extraction costs of non-renewable materials in the future (Huijbregts et al., 2016).
Scarce water use	Scarce blue water use[RS]		1.330 EUR/m^3	1.560 Int.$/$m^3$	A restoration cost which expresses the annualized cost of desalination, including the cost of operation and maintenance, electrical and thermal energy, as well as the cost of covering and repaying initial capital and operational costs of desalination (World Bank, 2012).
Soil degradation	Soil organic carbon (SOC) loss[CO]		0.0310 EUR/kg SOC loss	0.0450 Int.$/kg SOC loss	A compensation cost which expresses the damage cost for the chemical, physical, biological and ecological decline of soil due to loss of SOC, based on a study on the shadow prices of soil quality by TNO and Wageningen University (Ligthart & van Harmelen, 2019).
	Soil loss from wind erosion[CO]		0.0281 EUR/kg soil loss	0.0331 Int.$/kg soil loss	A compensation cost which expresses the cost of soil erosion based on an extensive review on the costs of soil erosion by (FAO, 2014). The costs include on-site damage such as loss of nutrients, reduced harvests and reduced value of the land, and off-site damage such as the silting up of waterways, flooding and repairing public and private property.
	Soil loss from water erosion[CO]		0.0220 EUR/kg soil loss	0.0259 Int.$/ kg soil loss	
	Soil compaction[8][CO]		0.570 EUR/corrected tkm	0.830 Int.$/corrected tkm	A damage cost based on lost future crop yields. Other off-site costs such as flooding, water pollution and increased GHG emissions, associated with subsoil compaction, are not included in the monetisation factor. The damage cost from soil compaction is calculated based on the average gross revenue of crop production lost due to irreversible subsoil compaction. This

[8] Values represent a European average, rather than a global one.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
					is quantified as the present value future crop yield losses (over 100 years) that are due to one year of machinery use. Average yearly loss (%) of crop yield per corrected tkm per ha over 100 years of production is provided in Stoessel et al. (2018), with country- and region-specific factors. Average value of annual gross production per hectare (in euro/ha) is estimated from data collected from FAOSTAT for all crops produced in each country (FAOSTAT, n.d.). Since the average yearly loss is given for 100 years of production, future crop production losses (0.12 eur/corrected tkm) are discounted to determine the present value, with a discount rate equal to 3% (Werkgroep discontovoet, 2015) and summed over 100 years.

4.2 Social impacts

Table 5 provides the monetisation factors for all social impacts and corresponding footprint indicators in true pricing. Each monetisation factor represents a restoration, compensation, prevention or retribution cost, or a combination of those, as explained in Section 2.3. An explanation of the types of costs and sources is also provided. All values are expressed in euro and International $ 2022 and rounded.

Table 5: Monetisation factors for social impacts in true pricing. CO: compensation cost, RS: restoration cost, PR: prevention cost, RT: retribution cost.

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
Child labour	Underage workers	Underage workers below minimum age for light work (12 or 13) involved in non-hazardous economic work[RT]	9,910 EUR/child FTE	14,400 Int.$/child FTE	A combination of restoration, compensation, prevention and retribution cost. The restoration cost expresses the costs of providing quality education for children not attending school and the costs of implementing additional components of reintegration programmes for children involved in hazardous child labour (IPEC & ILO, 2004). The compensation cost expresses the loss of future earnings when a child is prevented from attending school during youth (IPEC & ILO, 2004). The prevention cost expresses the cost of generic auditing setup, to prevent future instances. Finally, the retribution cost represents a penalty for instances of child labour based on the weighted average of penalties from various countries that expresses a global penalty.
		Underage workers above minimum age for light work and below minimum age (12-14 or 13-15) involved in non-hazardous non-light economic work[RT]	2,380 EUR/child FTE	3,470 Int.$/child FTE	
		Underage workers below minimum age (12 or 13) involved in hazardous work[RS,RT]	25,100 EUR/child FTE	36,600 Int.$/child FTE	
		Workers above minimum age (14 or 15) and below 18 involved in hazardous work[RS,RT]	11,000 EUR/FTE	15,900 Int.$/FTE	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Underage workers that are not attending school[CO,RS]		22,400 EUR/children	26,400 Int.$/children	
	Labour force to be audited for child labour[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Forced Labour	Forced workers (least severe) [RS,RT]		12,300 EUR/FTE	18,000 Int.$/FTE	A combination of restoration, compensation, prevention and retribution costs. The restoration cost expresses the restitution of past economic losses of forced workers in debt bondage, as well as other costs for reintegration (ILO, 2009; Kara, 2012). The compensation cost expresses the cost of lost health valued using DALY for forced workers victims of abuse (Biausque, 2012). The prevention cost expresses the cost of generic auditing setup, to prevent future instances. Finally, the retribution cost represents a penalty for instances of forced labour based on the weighted average of penalties from various countries that expresses a global penalty. Restoration, retribution, and compensation costs for harassment may also be included, if abuse exists in the specific case.
	Forced workers (medium severe) [RS,RT]		67,600 EUR/FTE	98,300 Int.$/FTE	
	Forced workers (most severe) [RS,RT]		123,000 EUR/FTE	179,000 Int.$/FTE	
	Forced workers who are in debt bondage[RS]		16,900 EUR/FTE	19,900 Int.$/FTE	
	Forced workers who are victims of abuse[CO,RS,RT]		35,800 EUR/FTE	43,000 Int.$/FTE	
	Labour force to be audited for forced labour[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Discrimination	Female workers without maternity leave provision[RT]		1,760 EUR/FTE	2,560 Int.$/FTE	A combination of restoration, prevention, and retribution costs. The restoration cost represents the restitution of wage lost due to denied maternity leave, gender discrimination and unequal opportunities, corrected for an increase in consumer prices (annual inflation) due to delayed income. The prevention cost expresses the cost of generic auditing setup, to prevent future
	Value of denied maternity leave[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	
	Wage gap from gender discrimination[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Wage gap from unequal opportunities[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	instances of discrimination. The retribution cost represents a penalty for the violation of denied maternity leave.
	Labour force to be audited for discrimination[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Underpayment in the value chain	Wage gap of workers earning below minimum wage[CO,RT]		1.59 EUR/EUR	1.59 Int.$/Int.$	A combination of compensation, prevention, and retribution costs. The compensation cost expresses the gap to a decent living wage, corrected for an increase in consumer prices (annual inflation) due to delayed income. The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution cost represents a penalty for the amount of the wage gap that is below the legal minimum wage, based on the weighted average of penalties from various countries that expresses a global penalty.
	Wage gap of workers earning above minimum wage but below decent living wage[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	
	Labour force to be audited for insufficient wages[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Lack of social security	Workers without legal social security[RT]		2,340 EUR/FTE	3,400 Int.$/FTE	A combination of compensation, prevention, and retribution costs. The compensation cost represents the restitution of the denied paid leave, corrected for an increase in consumer prices (annual inflation) due to delayed income. The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution cost represents a penalty for the workers without social security, in the case of a legal requirement by law, based on the weighted average of penalties from various countries that expresses a global penalty.
	Value of denied paid leave[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	
	Labour force to be audited for insufficient social security[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Excessive and underpaid overtime	Workers performing illegal overtime[RT]		110 EUR/FTE	160 Int.$/FTE	A combination of compensation, prevention, and retribution costs. The compensation cost represents the wage gap due to

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Workers performing underpaid overtime[RT]		110 EUR/FTE	160 Int.$/FTE	underpaid overtime, corrected for an increase in consumer prices (annual inflation) due to delayed income. The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution cost represents a penalty cost for overtime work above the maximum legal limit or paid under legal requirements based on the weighted average of penalties from various countries that expresses a global penalty.
	Overtime pay gap[CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	
	Labour force to be audited for illegal overtime[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Insufficient income	Living income gap [CO]		1.09 EUR/EUR	1.09 Int.$/Int.$	A compensation cost that represents the restitution of the income gap, corrected for an increase in consumer prices (annual inflation) due to delayed income.
Occurrence of harassment	Workers who experienced harassment	Workers who experienced non-physical non-sexual harassment[CO,RS,RT]	29,300 EUR/worker	34,500 Int.$/worker	A combination of restoration, compensation, prevention, and retribution costs. The restoration cost represents average medical costs for injuries, anxiety, depression, and PTSD resulting from workplace harassment estimated for the Netherlands and adapted to other countries using value transfer (Chappell & Di Martino, 2006; RIVM, 2022; Stam, C. & Blatter, B., 2020; WHO, 2021). The compensation cost represents the cost of loss of future well-being due to long-term mental health impact of victims of harassment. The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution cost represents a penalty for instances of physical non-sexual and sexual harassment based on the weighted average of penalties from various countries that expresses a global penalty.
		Workers who experienced non-physical sexual harassment[CO,RS,RT]	31,200 EUR/worker	37,300 Int.$/worker	
		Workers who experienced physical non-sexual harassment[CO,RS,RT]	56,500 EUR/worker	67,300 Int.$/worker	
		Workers who experienced non-severe physical sexual harassment[CO,RS,RT]	63,800 EUR/worker	77,900 Int.$/worker	
		Workers who experienced severe	71,900 EUR/worker	89,700 Int.$/worker	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
		physical sexual harassment[CO,RS,RT]			
	Labour force to be audited for harassment[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Lack of freedom of association	Instances of denied freedom of association[RT]		379 EUR/violation	551 Int.$/violation	A combination of prevention and retribution cost. The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution cost expresses a penalty for denied freedom of association based on a review of penalties from five different legal systems and adjusted based on the square root of the corresponding countries' population to express a global penalty. Restoration and compensation are not included so as not to double count the impact of freedom of association with the other social impacts.
	Labour force to be audited to be audited for denied freedom of association[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	
Negative effects on employee health and safety	Non-fatal occupational incidents	Insured non-fatal occupational incidents[CO]	3,710 EUR/incident	4,360 Int.$/incident	A combination of compensation, prevention, and retribution costs. The compensation cost represents the average cost of medical expenses for occupational injuries not covered by the employer estimated from Dutch data and adapted to other countries using value transfer (RIVM, 2022; Stam, C. & Blatter, B., 2020; WHO, 2021), the value of health (DALY) loss in the case of non-fatal incidents and the VSL in the cause of fatal incidents as a compensation to the family of the victim (Biausque, 2012). The prevention cost expresses the cost of generic auditing setup, to prevent future instances. The retribution costs represent a penalty for the cases in which workers perform their duties in conditions which violate Health and Safety regulations, which is based on the weighted average of penalties from various countries that expresses a global penalty.
		Uninsured non-fatal occupational incidents[CO]	3,840 EUR/incident	4,550 Int.$/incident	
	Fatal occupational incidents[CO]		3,150,000 EUR/incident	3,700,000 Int.$/incident	
	Occupational injuries with breach of H&S standards[RT]		4,230 EUR/incident	6,150 Int.$/incident	
	Work performed in violation of H&S standards[RT]		1,910 EUR/FTE	2,780 Int.$/FTE	

Impact	Footprint indicator	Footprint sub-indicator	Monetisation factor (EUR)	Monetisation factor (Int.$)	Explanation
	Labour force to be audited for H&S[PR]		8.55 EUR/FTE	9.47 Int.$/FTE	

Glossary

True price	The true price of a product is the sum of the market price and the true price gap of a product. It reflects the price a buyer would have to pay for a product if the cost of remediating its unsustainable impacts would be added on top of its price.
True price gap	The true price gap of a product is the sum of all the remediation costs of all unsustainable impacts caused by the production and consumption of that product.
Unsustainable impact	An unsustainable impact is a realised or expected harm to the Natural, Financial, Social, Human, Manufactured or Intellectual Capital flow or experienced well-being of people or communities due to a breach of one or more generally accepted universal rights. Can also be referred to as unsustainable externality.
Externality	A societal cost or benefit that affects a party who did not choose to incur this cost or benefit. A societal cost is a negative externality while a societal benefit is a positive externality.
Social impacts	Impact on people and communities caused by production and consumption. In the context of a true price gap assessment, social impacts are unsustainable externalities related to breaches of human rights and labour rights.
Environmental impacts	Impacts on the environment, people and communities caused by production and consumption. In the context of a true price gap assessment, environmental impacts are unsustainable externalities related to the breaches of environmental rights.
Footprint indicators	Variables that quantify the actual social and environmental impacts that are in scope to calculate the true price of a product. Footprint indicators can be monetized and compared meaningfully across different life cycle steps.
Monetisation factor	Estimate of the remediation cost of the impacts measured by the footprint indicators. In some cases, different monetisation factors may be country-dependent and be different for the same impact for different parts of the product life cycle (for example, if some damage cost coefficients are proportional to local income levels and the damage occurs in different countries).

List of references

Alkemade, R., van Oorschot, M., Miles, L., Nellemann, C., Bakkenes, M., & ten Brink, B. (2009). GLOBIO3: A Framework to Investigate Options for Reducing Global Terrestrial Biodiversity Loss. *Ecosystems*, *12*(3), 374–390. https://doi.org/10.1007/s10021-009-9229-5

Benoit-Norris, C., Cavan, D. A., & Norris, G. (2012). Identifying Social Impacts in Product Supply Chains:Overview and Application of the Social Hotspot Database. *Sustainability*, *4*(9), 1946–1965. https://doi.org/10.3390/su4091946

Biausque, V. (2012). *The Value of Statistical Life: A Meta-Analysis*. OECD. https://one.oecd.org/document/ENV/EPOC/WPNEP(2010)9/FINAL/en/pdf

Chappell, D., & Di Martino, V. (2006). *Violence at work* (3rd ed). International Labour Office.

CHRB. (2018). *Corporate Human Rights Benchmark Methodology 2018: For the Agricultural Products, Apparel and Extractives Industries.* https://assets.worldbenchmarkingalliance.org/app/uploads/2021/04/CHRB2018MethodologyAGAPEX.pdf

Croes, P. R., & Vermeulen, W. J. V. (2015). Comprehensive life cycle assessment by transferring of preventative costs in the supply chain of products. A first draft of the Oiconomy system. *Journal of Cleaner Production*, *102*, 177–187. https://doi.org/10.1016/j.jclepro.2015.04.040

De Bruyn, S., Bijleveld, M., de Graaff, L., Schep, E., Schroten, A., Vergeer, R., & Ahdour, S. (2018). *Environmental Prices Handbook EU28 version*. CE Delft. https://cedelft.eu/publications/environmental-prices-handbook-eu28-version/

de Groot, R., Brander, L., van der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L., Hussain, S., Kumar, P., McVittie, A., Portela, R., Rodriguez, L. C., ten Brink, P., & van Beukering, P. (2012). Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services*, *1*(1), 50–61. https://doi.org/10.1016/j.ecoser.2012.07.005

Falkenmark, M., & Rockström, J. (2004). *Balancing water for humans and nature: The new approach in ecohydrology*. Earthscan.

FAO. (2014). *Food wastage footprint full-cost accounting: Final report*. Food Wastage Footprint. https://www.fao.org/3/i3991e/i3991e.pdf

FAOSTAT. (n.d.). *Value of Agricultural Production*. Retrieved 8 March 2023, from https://www.fao.org/faostat/en/#data/QV

Galgani, P., Kanidou, D., & van Veen, B. (2022). *Occupational Health and Safety—True pricing method for agri-food products*. True Price and Wageningen Economic Research. https://edepot.wur.nl/580504

Galgani, P., van Veen, B., de Adelhart Toorop, R., & Woltjer, G. (2023). *True Pricing Assessment Method for Agri-food Products*. https://edepot.wur.nl/585906

Galgani, P., Woltjer, G., de Adelhart Toorop, R., & de Groot Ruiz, A. (2021a). *Fossil fuel and other non-renewable material depletion—True pricing method for agri-food products* (p. 18). True Price and Wageningen Economic Research. https://edepot.wur.nl/558072

Galgani, P., Woltjer, G., de Adelhart Toorop, R., & de Groot Ruiz, A. (2021b). *Valuation Framework for True Price Assessment of Agri-food Products*. https://www.wur.nl/nl/show/Valuation-Framework-for-True-Price-Assessment-of-Agri-food-Products.htm

Galgani, P., Woltjer, G., de Adelhart Toorop, R., de Groot Ruiz, A., & Varoucha, E. (2021a). *Contribution to climate change—True pricing method for agri-food products*. True Price and Wageningen Economic Research. https://edepot.wur.nl/556017

Galgani, P., Woltjer, G., de Adelhart Toorop, R., de Groot Ruiz, A., & Varoucha, E. (2021b). *Land use, Land use change, Biodiversity and Ecosystem Services—True pricing method for agri-food product* (p. 24). True Price and Wageningen Economic Research. https://edepot.wur.nl/555581

Galgani, P., Woltjer, G., de Adelhart Toorop, R., Varoucha, E., & Kanidou, D. (2021). *Soil degradation—True pricing method for agri-food products* (p. 31). True Price and Wageningen Economic Research. https://edepot.wur.nl/557712

Galgani, P., Woltjer, G., Kanidou, D., de Adelhart Toorop, R., & de Groot Ruiz, A. (2021). *Scarce water use—True pricing method for agri-food products* (p. 21). True Price and Wageningen Economic Research. https://edepot.wur.nl/558073

Galgani, P., Woltjer, G., Kanidou, D., Varoucha, E., & de Adelhart Toorop, R. (2023). *Air, soil and water pollution—True pricing method for agri-food products*. https://edepot.wur.nl/589965

Goedkoop, M., Indrane, D., & Beer, I. D. (2018). *Handbook for Product Social Impact Assessment 2018*. https://doi.org/10.13140/RG.2.2.33455.79523

Hanegraaf, M., van den Elsen, E., de Haan, J., & Visser, S. (2019). *Bodemkwaliteitsbeoordeling van landbouwgronden in Nederland—Indicatorset en systematiek, versie 1.0*. Stichting Wageningen Research (WR). https://doi.org/10.18174/498307

Huijbregts, M. A. J., Steinmann, Z. J. N., Elshout, P. M. F., Stam, G., Verones, F., Vieira, M., Zijp, M., Hollander, A., & Zelm, R. van. (2016). *ReCiPe2016: A harmonised life cycle impact assessment method at midpoint and endpoint level*. *22*(2), 138–147. https://doi.org/10.1007/s11367-016-1246-y

ILO. (n.d.-a). *International Labour Standards on Social security*. Retrieved 8 March 2023, from https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/social-security/lang--en/index.htm

ILO. (n.d.-b). *What is child labour (IPEC)*. Retrieved 15 July 2022, from https://www.ilo.org/ipec/facts/lang--en/index.htm

ILO. (1973). *C138—Minimum Age Convention, 1973*. International Labour Organization. https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO:12100:P12100_INSTRUMENT_ID:312283:NO

ILO. (1999). *C182—Worst Forms of Child Labour Convention, 1999*. International Labour Organization. https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C182

ILO. (2009). *The cost of coercion—Global Report on Forced Labour 2009* [Report]. http://www.ilo.org/global/topics/forced-labour/publications/WCMS_106268/lang--en/index.htm

ILO. (2019). *Eliminating Forced Labour: Handbook for Parliamentarians No. 30* [Report]. http://www.ilo.org/global/topics/forced-labour/publications/WCMS_723507/lang--en/index.htm

ILO. (2013). *Code of conduct and guidelines to prevent and address sexual harassment in workplace* [Publication]. http://www.ilo.org/colombo/whatwedo/publications/WCMS_525537/lang--en/index.htm

Impact Institute. (2019). *Framework for Impact Statements—Beta version (FIS Beta)*. http://www.impactinstitute.com/framework-for-impact-statements/

IPCC. (2018). *Global Warming of 1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-industrial Levels in Context of Strengthening Response to Climate Change, Sustainable*

Development, and Efforts to Eradicate Poverty (V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield, Eds.). Cambridge University Press. https://doi.org/10.1017/9781009157940

IPEC & ILO. (2004). *Investing in every child: An economic study of the costs and benefits of eliminating child labour*. International Programme on the Elimination of Child Labour (IPEC) and International Labour Organization (ILO). https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_071311/lang--en/index.htm

ISO. (2010). *ISO 26000:2010 Guidance on social responsibility*. ISO. https://www.iso.org/cms/render/live/en/sites/isoorg/contents/data/standard/04/25/42546.html

Kara, S. (2012). *Bonded Labor: Tackling the System of Slavery in South Asia* (p. 336 Pages). Columbia University Press.

Kuik, O., Brander, L., & Tol, R. S. J. (2009). Marginal abatement costs of greenhouse gas emissions: A meta-analysis. *Energy Policy*, *37*(4), 1395–1403. https://doi.org/10.1016/j.enpol.2008.11.040

Lal, R. (2009). Soils and world food security. *Soil and Tillage Research*, *102*(1), 1–4. https://doi.org/10.1016/j.still.2008.08.001

Ligthart, T. N., & van Harmelen, T. (2019). Estimation of shadow prices of soil organic carbon depletion and freshwater depletion for use in LCA. *The International Journal of Life Cycle Assessment*, *24*(9), 1602–1619. https://doi.org/10.1007/s11367-019-01589-8

Manfredi, S., Allacker, K., Chomkhamsri, K., Pelletier, N., & de Souza, D. M. (2012). *Product Environmental Footprint (PEF) Guide. Deliverable 2 and 4A of the Administrative Arrangement between DG Environment and the Joint Research Centre No. N 070307/2009/552517, Including Amendment No. 1 from December 2010*. European Commission, Joint Research Centre & Institute for Environment and Sustainability. https://ec.europa.eu/environment/eussd/pdf/footprint/PEF%20methodology%20final%20draft.pdf

Milà i Canals, L., Romanyà, J., & Cowell, S. J. (2007). Method for assessing impacts on life support functions (LSF) related to the use of 'fertile land' in Life Cycle Assessment (LCA). *Journal of Cleaner Production*, *15*(15), 1426–1440. https://doi.org/10.1016/j.jclepro.2006.05.005

RIVM. (2022). *Kosten van ziekten 2019*. https://statline.rivm.nl/#/RIVM/nl/dataset/50091NED/table?ts=1660223783679

SAI. (2014). *Social Accountability 8000 International Standard*. https://sa-intl.org/resources/sa8000-standard/

Stam, C. & Blatter, B. (2020). *Letsels 2019 Kerncijfers LIS*. https://www.veiligheid.nl/kennisaanbod/cijferrapportage/kerncijfers-letsels-nederland

Stoessel, F., Sonderegger, T., Bayer, P., & Hellweg, S. (2018). Assessing the environmental impacts of soil compaction in Life Cycle Assessment. *Science of The Total Environment*, *630*, 913–921. https://doi.org/10.1016/j.scitotenv.2018.02.222

TEEB. (2009). *TEEB Climate Issues Update*. https://www.teebweb.org/media/2009/09/TEEB-Climate-Issues-Update.pdf

The Living Income Community of Practice. (n.d.). *The Concept*. Retrieved 31 March 2022, from https://www.living-income.com/the-concept

True Price Foundation. (2019). *A roadmap for true pricing*. https://trueprice.org/vision-paper-a-roadmap-for-true-pricing/

True Price Foundation. (2020). *Principles for True Pricing*. https://trueprice.org/principles-for-true-pricing/

UN OHCHR. (2011). *Guiding principles on business and human rights: Implementing the United Nations 'Protect, respect and remedy' framework*. Office of the United Nations High Commissioner for Human Rights. https://www.ohchr.org/sites/default/files/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf

UNEP. (2009). *Guidelines for social life cycle assessment of products*. UNEP - UN Environment Programme. http://www.unep.org/resources/report/guidelines-social-life-cycle-assessment-products

UNICEF. (2014). *Child Labour and UNICEF in Action: Children at the Centre*. United Nations Children's Fund. https://www.unicef.nl/media/2535977/child_labour_and_unicef_in_action.pdf

van den Born, G. J., Couvreur, L., van Dam, J., Geilenkirchen, G., 't Hoen, M., Koelemeijer, R., van Schijndel, M., Vink, M., & van der Zanden, E. (2020). *Analyse Stikstofbronmaatregelen—Analyse op verzoek van het kabinet van zestien maatregelen om de uitstoot van stikstofoxiden en ammoniak in Nederland te beperken*. PBL, TNO, CE Delft and RIVM.

van der Maas, W. (2020). *De effectiviteit van bronmaatregelen: Van nationale emissiereducties naar depositie in de natuur*. RIVM. https://www.rivm.nl/documenten/notitie-van-emissie-naar-depositie

van der Velden, N. M., & Vogtländer, J. G. (2017). Monetisation of external socio-economic costs of industrial production: A social-LCA-based case of clothing production. *Journal of Cleaner Production*, *153*, 320–330. https://doi.org/10.1016/j.jclepro.2017.03.161

van Veen, B., & Galgani, P. (2022). *Living income—True pricing method for agri-food products*. True Price and Wageningen Economic Research. https://edepot.wur.nl/580503

Werkgroep discontovoet. (2015). *Rapport werkgroep discontovoet 2015*. https://www.mkba-informatie.nl/mkba-voor-gevorderden/richtlijnen/rapport-werkgroep-discontovoet-2015/

WHO. (2019). *Health statistics and information systems, Metrics: Disability-Adjusted Life Year (DALY)*. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates

WHO. (2021). *WHO-CHOICE estimates of cost for inpatient and outpatient health service delivery*. https://www.who.int/publications/m/item/who-choice-estimates-of-cost-for-inpatient-and-outpatient-health-service-delivery

World Bank. (2012). *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa*. Washington, DC: World Bank. https://doi.org/10.1596/978-0-8213-8838-9

WWF. (n.d.). *WWF Water Risk Filter/Country profiles*. Retrieved 17 December 2021, from https://waterriskfilter.org/explore/countryprofiles

True Price
Haarlemmerplein 2
1013 HS Amsterdam
The Netherlands
Tel.: +31 202 403 440
info@trueprice.org