

# The Circularity Gap Report 2026

## The Value Gap

Methodology document

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## About Circle Economy

Circle Economy is a non-profit organisation founded in 2011 and based in Amsterdam. Our vision is an economic system that ensures the planet and all people can thrive. We work with partners worldwide, equipping them with the insights, strategies, and tools to accelerate the circular economy transition.

Our international team combines research, data analysis, advisory services, and capacity-building programmes across four focus areas: finance, cities, employment, and value chains. Circle Economy is the organisation behind the *Circularity Gap Report (CGR®)*, the leading global benchmark for measuring and tracking circularity.

# 1. Introduction

## Research goal

In a world of finite resources, the current economic model, often characterised as linear ('take-make-waste'), creates quantifiable value loss and can expose the global economy to systemic risks tied to resource volatility. Addressing the inefficiencies inherent in this model is important for building a more resilient economic future. Failure to address these challenges could lead to substantial economic consequences for the global economy, including significant financial losses that may not be fully anticipated within current planning frameworks. For example, it has been estimated that '*unchecked climate change alone could cost the global economy US\$178 trillion in net present value terms between 2021 and 2070*'.<sup>1</sup> Factors contributing to linear risk include the intensive utilisation of scarce and non-renewable resources, a predominant reliance on virgin material markets, and challenges in fostering collaboration, innovation, and adaptation within existing economic frameworks.<sup>2</sup>

In recent years, there has been a discernible shift among economic actors toward redefining risk profiles and reassessing corporate value by internalising environmental externalities—specifically, by monetising environmental impacts (or their associated risks) for integration into financial decision-making processes. Correspondingly, investments in circular economy strategies, business models, and infrastructure have increased, accompanied by numerous initiatives aimed at quantifying these economic efforts.<sup>3</sup> The 2025 *Circularity Gap Report Finance* estimated that, on average, €26 billion was invested each year globally between 2021 and 2023 in businesses engaging with the circular economy.<sup>4</sup>

Despite these advances in measurement and reporting, it remains unclear what proportion of value is lost across the global economy due to some market failures and inefficiencies such as avoidable deterioration, premature obsolescence, material wastage and environmental externalities—relative to the total value created and utilised. This study seeks to help address this knowledge gap by answering the following research question:

*What is the extent of avoidable economic value lost due to inefficient linear practices globally within a given accounting year?*

The following section defines the scope of this research question and outlines the general approach employed to estimate a metric this report terms the Value Gap (VG).

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<sup>1</sup> Deloitte Development LLC. (2022). *The turning point: A global summary*. Retrieved from: [Deloitte website](#)

<sup>2</sup> Circle Economy, PGGM, KPMG, WBCSD, & EBRD. (2018). *Linear Risks*. Circle Economy. Retrieved from: [Circle Economy website](#)

<sup>3</sup> Lawlor, E., & Spratt, S. (2021). *Circular investment: A review of global spending and barriers to increasing it* (Working Paper). Just Economics; Commissioned by Chatham House. Retrieved from: [Resource trade website](#)

<sup>4</sup> Circle Economy. (2025). *Circularity Gap Report Finance*. Retrieved from: [Circle Economy website](#)

# Theoretical background

What constitutes value? Numerous theories of value exist, each exhibiting varying degrees of compatibility with different interpretations of the circular economy paradigm. Conceptually, the theoretical foundation of this analysis draws on both receiver theories, which associate value with human demand, and donor theories, which attribute value to the objective resources required to produce a good or service.<sup>5</sup>

Within neoclassical economics, the theory of marginal utility posits that exchange value emerges at the intersection of utility—reflecting subjective individual preferences—and the cost of production, which is determined by scarcity. This foundational notion is complemented by perspectives from ecological economics, which link value and scarcity to thermodynamic principles. These perspectives introduce the concept of contributory value, which exists independently of a human valuer (such as ecological or shadow prices). Ecological economics complements this view by integrating considerations such as sustainable scale or efficient and equitable allocation. These principles encourage a broader assessment of value creation beyond traditional paradigms (such as growth-oriented and trickle-down economics) and metrics, highlighting new pathways for development.

Operationally, the definition of value adopted in this methodology is grounded in the notions of functional value and created value, as articulated by Vulsteke et al. (2024).<sup>6</sup> The anthropocentric concept of functional value is attributed to resources, materials, components, and products based on their capacity to provide functions to products or humans, thereby contributing to human well-being. Within the circular economy, the functional value of these elements is to be retained to the greatest extent possible.

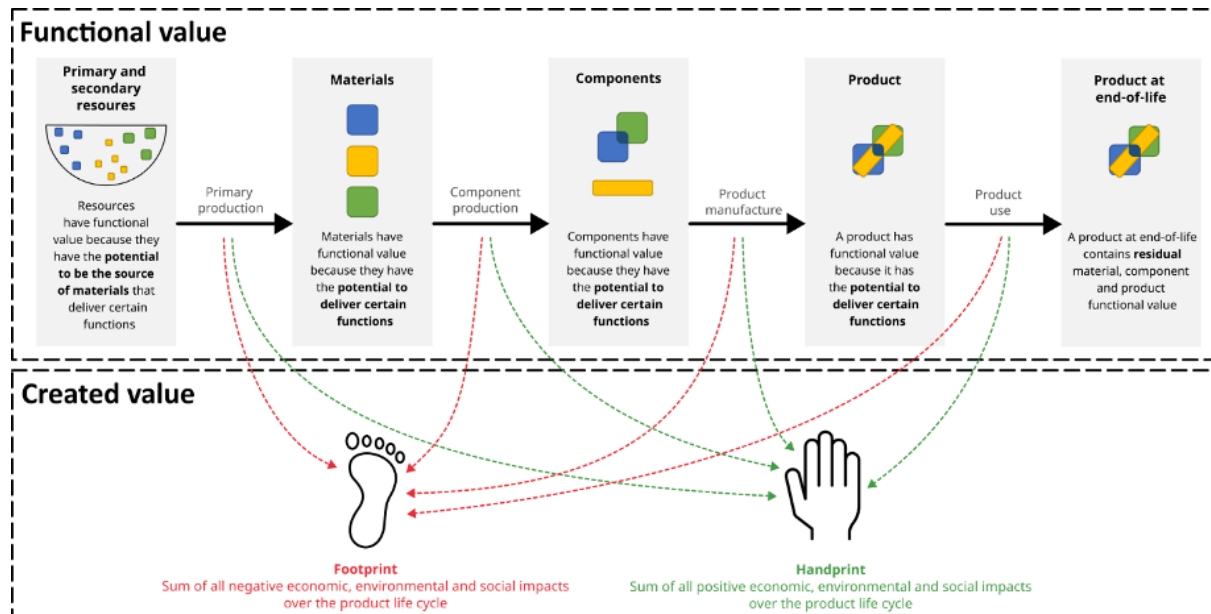
In the prevailing economic paradigm, both actual and perceived functional value are quantified in monetary terms and constitute the primary determinants of economic value creation, thus establishing the link between functional and created value. Created value is defined as the net balance of all positive and negative economic, social, and environmental impacts generated over a product's life cycle. It thereby serves as a bridge between the circular economy and sustainable development, with the maximisation of created value representing one of the key objectives of a sustainable circular economy.

Figure one and Figure two schematically illustrate both value types and how they are linked to a product's life cycle. In addition, they introduce the compositional structure of functional value used in this framework: a consumer product is the final good a consumer can buy, and typically consists of components (or semi-finished products). These components, in turn, are composed of specific (raw) materials, which can originate from either the natural environment or the technosphere. The former are referred to as primary natural resources, while the latter are secondary resources.

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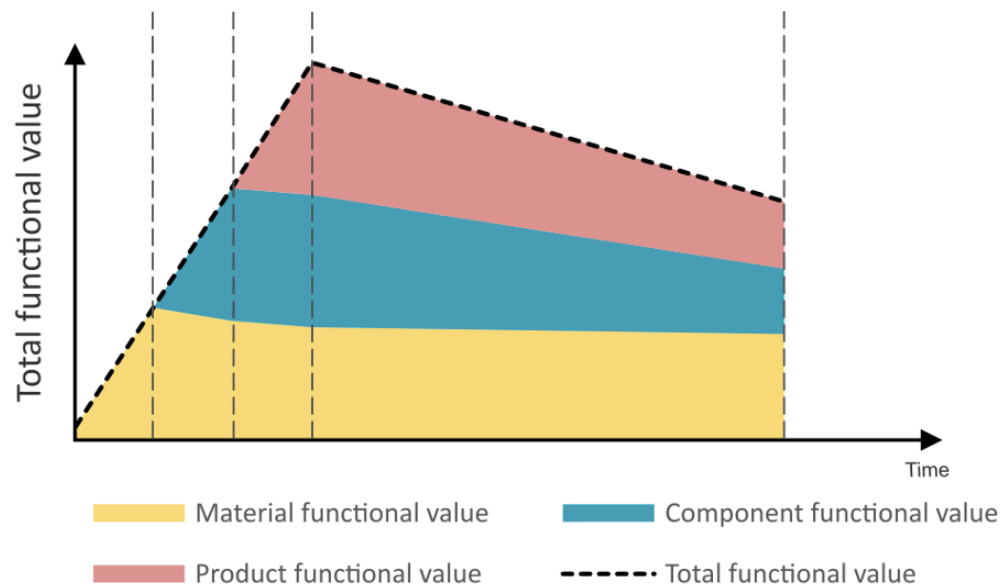
<sup>5</sup> Lowe, B. H., & Genovese, A. (2022). What theories of value (could) underpin our circular futures? *Ecological Economics*, 195, 107382. doi:10.1016/j.ecolecon.2022.107382

<sup>6</sup> Vulsteke, K., Huysveld, S., Thomassen, G., Beylot, A., Rechberger, H., & Dewulf, J. (2024). What is the meaning of value in a circular economy? A conceptual framework. *Resources, Conservation and Recycling*, 207. doi.org/10.1016/j.resconrec.2024.10768,7



**Figure one.** Schematic overview of the two value types relevant to the circular economy. The illustration is limited to the product life cycle until the end-of-life, providing a visual representation of the meaning and relation of both value types. Source: Vulsteke et al. (2024)

The concept of value associated with materials, components, and products—and its evolution across the life cycle—is typically divided into three stages: pre-use, use, and post-use. During the pre-use or manufacturing stage, materials and components are produced, and value is added to them. At the beginning of the use stage, value reaches its maximum, after which it gradually declines through use and post-use.<sup>7</sup> When visualised over the life-cycle, the rise, peak, and decline resemble a ‘value hill’.<sup>8</sup>



<sup>7</sup> Kumar, V., Shirodkar, P. S., Camelio, J. A., & Sutherland, J. W. (2007). Value flow characterization during product lifecycle to assist in recovery decisions. *International Journal of Production Research*, 45(18–19), 4555–4572. doi:10.1080/00207540701474633

<sup>8</sup> Achterberg, E., Hinfelaar, J., & Bocken, N. (2016). *Master circular business with the Value Hill* [Report]. Circle Economy; Sustainable Finance Lab; Nuovalente; TU Delft; Het Groene Brein. Retrieved from: [Circle Economy website](https://www.circleeconomy.nl/en/publications/master-circular-business-with-the-value-hill)

**Figure two.** Conceptual illustration of the estimated evolution of functional value of a durable product with a gradual decrease of product, component and material functional value throughout the use phase until the end-of-life (EOL). Source: Vulsteke et al. (2024).

Material functional value is the first constituent of total functional value. It persists throughout the product life cycle, as materials possess inherent properties that enable specific functions within components or products. For instance, copper is used in printed circuit boards for its conductivity, and indium in touch screens for its transparency and flexibility. The specific material functional value—defined per unit mass—depends on physical and chemical characteristics and closely aligns with what is often termed ‘material quality’ in the literature.<sup>9</sup>

When materials with distinct functions are combined, new component-level functionalities emerge. For example, lithium cobalt oxide, graphite, and electrolytes together form a lithium-ion battery capable of storing and supplying power to a laptop.<sup>10</sup> This defines the component functional value—the value of functionality embedded within a component, not directly experienced by the consumer. Similarly, product functional value arises when components are integrated into a final consumer product that delivers a direct function. For example, an electric vehicle provides mobility to users, and its range on a full charge contributes to its product’s functional value. In this framework, functional value is treated as an objective measure, particularly at the product level, where subjective perceptions of value often emerge. Differentiating between material, component, and product functional values enables for a clearer assessment of how functional value evolves throughout a product’s life cycle.

At the beginning of the product life cycle, when materials originate from the natural environment, there is only minimal material functional value. Through primary production processes such as mining and refining, this value increases as materials are extracted and purified. Material functional value typically peaks at the stage of pure primary raw materials, which possess high potential to deliver functions within components or products.

During component manufacturing, various raw materials are combined into specific configurations, often resulting in a decline in material functional value due to processing losses. More complex components, incorporating multiple materials, generally experience greater declines. Nonetheless, as components are produced to serve defined functions, component functional value emerges. Similarly, during product assembly, further decreases in material functional value may occur, and component functional value may also be affected by product design. In some cases, components are assembled in ways that prevent disassembly, eliminating both the functional value of the component and the material—an effect described as ‘loss by design’.

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<sup>9</sup> Tonini, D., Albizzati, P. F., Caro, D., De Meester, S., Garbarino, E., & Blengini, G. A. (2022). Quality of recycling: Urgent and undefined. *Waste Management*, 146, 11–19. doi:10.1016/j.wasman.2022.04.037

<sup>10</sup> Mossali, E., Picone, N., Gentilini, L., Rodriguez, O., Pérez, J. M., & Colledani, M. (2020). Lithium-ion batteries towards Circular Economy: A literature review of opportunities and issues of recycling treatments. *Journal of Environmental Management*, 264, 110500. doi:10.1016/j.jenvman.2020.110500

In the use phase, the type of product determines the trajectory of functional value.<sup>11</sup> Consumable products (such as food and personal care items) exhibit rapid declines as their materials are transformed or dispersed into the environment, leading to near-total loss of functional value. In contrast, durable products (like electronics, clothing, and furniture) retain their functional value over longer periods, although it gradually diminishes due to wear, deterioration, or damage.

Eventually, a product reaches the end of its first life cycle (end-of-life), defined as the point when the initial user ceases to use it. This may occur due to complete physical failure, resulting in a total loss of product functional value, although component and material functional value may remain. In other cases, premature obsolescence occurs—when the product is discarded before its functional value is exhausted—due to factors such as user dissatisfaction, performance decline, or regulatory restrictions. In all cases, the quantity and quality of the remaining functional value determine the feasible end-of-life strategy (see Textbox one).

**Textbox one.**

**End-of-Life strategies within the value framework**

To illustrate the relationship between the different value subtypes and the circular economy, a comparative qualitative analysis of end-of-life (EoL) strategies for a durable product was conducted. As a quantitative case study is not yet feasible, a qualitative example was deemed appropriate to examine the mechanisms underlying distinct EoL approaches. Four strategies are compared: landfilling, closed-loop recycling, remanufacturing, and reuse. Landfilling serves as the reference point for the linear economy, while closed-loop recycling preserves materials, remanufacturing preserves components, and reuse preserves the entire product in a circular economy. This framework enables the assessment of multiple EoL strategies within a circular economy context.

In reality, material cycles are highly interconnected—for example, crude oil functions as a primary resource for fuels, chemicals, and plastics. However, to reduce system complexity, the analysis focuses solely on the materials composing the product during its first life cycle. The functional value of natural resources is thus allocated to the materials contained within the studied product. When additional primary materials are introduced after the first life cycle to replace losses, their associated material functional value is excluded from the analysis. The resulting component and product functional values are allocated only to the materials within the defined system boundary.

Figure three presents the comparative results of the four EoL strategies. Because each scenario begins with the same product, functional value remains identical until the end of the first use phase. The analysis, therefore, concentrates on how the remaining functional value is preserved or recovered thereafter.

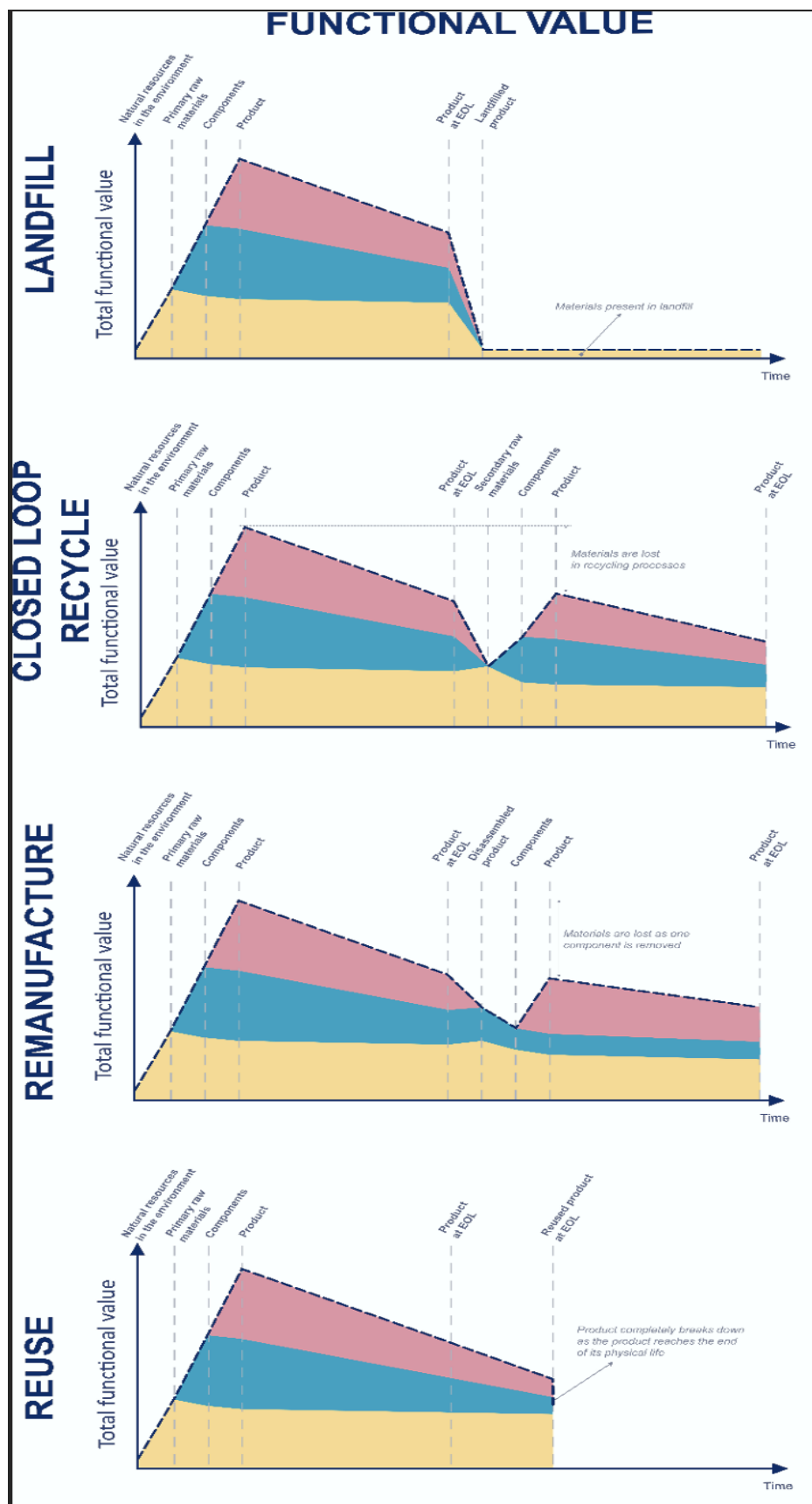
<sup>11</sup> Böckin, D., Willskytt, S., André, H., Tillman, A.-M., & Ljunggren Söderman, M. (2020). How product characteristics can guide measures for resource efficiency — a synthesis of assessment studies. *Resources, Conservation and Recycling*, 154, 104582. doi:10.1016/j.resconrec.2019.104582

Landfilling represents the baseline linear scenario, where discarded products lose nearly all product and component functional value, although some materials may theoretically retain residual value.

Closed-loop recycling aims to recover the functional value of materials for producing equivalent products, unlike open-loop recycling, which redirects materials to different uses. While product and component functional values are lost during recycling, material functional value often increases as secondary raw materials are purified and separated. These materials then re-enter production processes, partially reconstructing the functional value of components and products. However, because recycling efficiencies are below 100%, new primary materials are required to replace losses, resulting in a lower overall functional value than in the first life cycle.

Remanufacturing focuses on restoring the functional value of components and products, as well as the functional value of the embedded materials. The process involves disassembly, replacement of defective components, and reassembly into a 'like-new' product. Disassembly temporarily increases material functional value due to the separation of components, while the integration of new parts reinstates product functionality. As part of the value is attributed to the new components, the total functional value remains lower than in the initial life cycle.

Finally, in the reuse scenario, the product is transferred to a new user without modification once it reaches its first EoL point. The functional value remains unchanged at the start of the second life cycle and gradually declines over time due to continued use. Eventually, the product may reach its physical end of life, retaining only material—and in some cases, component—functional value. Reuse thus represents one of the simplest and most direct means of extending value creation within a circular economy.



**Figure three.** Estimated evolution of functional value for four different end-of-life strategies for a durable product. Source: Vulsteke et al. (2024)

## Research scope

In this approach, functional value loss is estimated with the aim of distinguishing between material and product value. The residual functional value of landfilled materials is assumed to be zero. The functional value of components is included, but not specifically quantified. The value of primary resources, in the form of natural reserves (capital), and their depletion are not included. Created value is only partially included in the form of the environmental and social costs (shadow cost) of unsorted<sup>12</sup> waste and GHG emissions. It is important to note that in the present approach, the created value of *negative impacts* is accounted for in the form of a *positive (shadow) cost* of dealing<sup>13</sup> with such impacts. As such, this positive monetary value (cost) can be considered as a form of value loss.

Five main pathways through which functional value is lost due to inefficient use are identified: deterioration through the consumption of fixed capital (in-use assets); premature obsolescence through residual value in EoL waste; mismanagement through manufacturing (or processing) losses; food losses and waste; and energy losses. Inefficient management also includes the cost of processing and EoL waste collection and treatment. Created value loss due to negative environmental and social impacts is partially included through the Social Cost of Carbon (SCC) for GHG emissions<sup>14</sup> and an eco-efficiency-based opportunity cost for unsorted waste.<sup>15</sup> In the current methodology, while internalisation through valuation of environmental and social impacts is acknowledged as one of the mechanisms to quantify value loss, it is not considered as an independent value loss pathway.

Each of these pathways, the methodology for investigating it, and the data used are elaborated in detail in the next section. Together, they provide an estimation of the scale of functional and created value lost (in trillion euros) in a specific year. The general approach to each pathway is based on three steps:

- *Quantification*: Material and energy flows related to the aforementioned pathways are quantified. These will include, for instance, the physical amount of manufacturing waste, End-of-Life waste or energy conversion and transformation losses.
- *Parametrisation*: Parameters that affect the amount of physical waste and losses created are identified and applied to the material and energy flows to distinguish between avoidable and unavoidable loss and waste fractions. These parameters will include, for instance, actual and maximum process efficiency, recoverable versus unrecoverable waste fractions and waste collection and treatment rates.

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<sup>12</sup> In this approach Circle Economy defines 'unsorted waste' as: "All unmanaged waste including open dumped, uncollected and unaccounted waste".

<sup>13</sup> The general term 'dealing' is used purposely to reflect the plurality of approaches through which valuation (costing) of externalities can be performed (see, for instance: Lee, S., Oh, D., & Lee, J. (2014). A new approach to measuring shadow price: Reconciling Engineering and economic perspectives. *Energy Economics*, 46, 66–77. doi:10.1016/j.eneco.2014.07.019)

<sup>14</sup> Estrada, F., Lupi, V., Botzen, W. J., & Tol, R. S. (2025). Urban and non-urban contributions to the social cost of carbon. *Nature Communications*, 16(1). doi:10.1038/s41467-025-59466-y

<sup>15</sup> Sala-Garrido, R., Mocholi-Arce, M., Molinos-Senante, M., & Maziotis, A. (2023). Monetary valuation of unsorted waste: A shadow price approach. *Journal of Environmental Management*, 325, 116668. doi:10.1016/j.jenvman.2022.116668

- *Valuation:* Market and shadow prices (that is, prices of environmental and social externalities) are applied to the avoidable losses and waste fractions to convert them into monetary values and relate them to Net Domestic Product (NDP).

The geographical scope of the analysis is global, and the temporal scope is 2021. All monetary values are expressed in 2021 prices. The currency unit of reference is millions of euros, and an average exchange rate of 0.846 euros per US dollar (€/US\$) was applied.<sup>16</sup>

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<sup>16</sup> European Central Bank (ECB). (2025). *US dollar (USD) — ECB euro reference exchange rate*. Retrieved from: [ECB website](#)

## 2. Methods and data

### The Value Gap metric

The VG metric represents the extent of economic loss due to resource and material inefficiencies. More specifically, this report defines the VG metric as:

*The amount of avoidable functional value that is lost through mismanagement and premature obsolescence of materials, products and assets—plus the shadow cost (created value) of negative environmental and social impacts— in an accounting year.*

Mathematically, this is expressed as:

$$\theta_{av} = \theta_{proc_{av}} + \theta_{food_{av}} + \theta_{en_{av}} + \theta_{EoL_{av}} + \theta_{cfc_{av}} \text{ (eq. 1)}$$

Where:

- **Processing losses** ( $\theta_{proc}$ ) represent the total loss of material functional value due to mismanagement at the fabrication and manufacturing stages (including the costs of waste treatment) plus the shadow cost<sup>17</sup> of unsorted processing losses;
- **Food losses and waste** ( $\theta_{food}$ ) represent the total loss of product functional value due to mismanagement at the manufacturing (food losses) and use (edible food waste) stages (excluding the cost of treatment).
- **Energy losses** ( $\theta_{en}$ ) represent the total loss of material and product functional value due to mismanagement across all stages of the supply chain, plus the shadow cost of GHG emissions;
- **End-of-Life waste** ( $\theta_{EoL}$ ) represents the total loss of product functional value due to premature obsolescence (expressed in terms of residual value in EoL waste and including the cost of waste treatment) plus the shadow cost of unsorted EoL waste;
- **Gross Domestic Product (GDP)** represents the total gross value generated by the economy in an accounting year;
- **Consumption of Fixed Capital** ( $\theta_{cfc}$ ) represents the total loss of product functional value due to avoidable physical deterioration of assets, expressed in monetary terms as depreciation;
- **“Avoidable” subscript (av)** represents only the share of total losses for each pathway that is technically avoidable through technological and behavioural changes related to circular interventions. Variables with this subscript exclude unavoidable losses;

The VG metric was developed as a stand-alone scale indicator (expressed in trillion euros), where the “gap” concept functions as a theoretical benchmark in a static system with a fixed target. Because the VG is composed solely of avoidable losses, the implicit theoretical target is

<sup>17</sup> Hereafter “shadow cost” is used as a synonym for “shadow price” and “environmental cost/price”. This is defined as “The loss of economic welfare that occurs when one additional kilo of a pollutant is released into the environment [...] or when non-material pollution, such as noise is created” (Delft, C. E. (2023). Environmental prices handbook 2024: EU27 version). In this report it is used as the measure of the created value of negative environmental impacts under the value framework by Vulsteke et al. (2024).

to eliminate 100% of the gap at any point in time (see the “Scale, rate and gap indicators” section for more details).

All pathways are divided into an avoidable and unavoidable fraction which represents the maximum potential for value retention achievable through efficiency and circularity measures. The criteria for distinguishing between avoidable and unavoidable losses are specific to each pathway, for instance recoverability for processing losses, edibility for food or maximum technological efficiency for energy. Food losses and End-of-Life waste are assumed to be fully avoidable due to lack of robust criteria or data (for more information on this refer to chapter 3). Next to this distinction, as mentioned in the “Research Scope” section, three components that make up total value losses for each pathway can be distinguished: Residual value of materials/products, shadow costs, and waste collection and treatment costs.

Results are provided in a range where the lower and upper bound values are dependent on some of the parameters used in the estimation of each variable, as listed in **Table two**. The median value is calculated as the arithmetic mean between the two.

**Table two.** Summary table of variables affecting the lower and upper bounds of the result range, by value loss pathway

| Item                                                   | Lower bound                                                                                                                                                                                                    | Upper bound                                                                                                                                                                                                               |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Consumption of fixed capital</b> ( $\theta_{cfc}$ ) | Assumed avoidable fraction of Consumption of Fixed Capital (CFC): <b>25%</b>                                                                                                                                   | Assumed avoidable fraction of Consumption of Fixed Capital (CFC): <b>50%</b>                                                                                                                                              |
| <b>Processing losses</b> ( $\theta_{proc}$ )           | Shadow price of uncollected waste - <b>346 \$/ton</b>                                                                                                                                                          | Shadow price of uncollected waste - <b>375 \$/ton</b>                                                                                                                                                                     |
| <b>End-of-Life waste</b> ( $\theta_{EoL}$ )            | <i>Treatment rates prices (\$/ton)*:</i><br>Collection: <b>20-30-50-85</b><br>Landfill: <b>10-15-20-40</b><br>Open dumping: <b>2-3-0-0</b><br>Waste to Energy: <b>0-40-60-40</b><br>Recycling: <b>0-5-5-30</b> | <i>Treatment rates prices (\$/ton)*:</i><br>Collection: <b>50-75-100-250</b><br>Landfill: <b>30-40-65-100</b><br>Open dumping: <b>8-10-0-0</b><br>Waste to Energy: <b>0-1-00-150-200</b><br>Recycling: <b>25-30-50-80</b> |
| <b>Food waste and losses</b> ( $\theta_{food}$ )       | Food waste edible shares: <b>25%</b>                                                                                                                                                                           | Food waste edible shares: <b>75%</b>                                                                                                                                                                                      |
| <b>Energy losses</b> ( $\theta_{en}$ )                 | Rebound effect: <b>25%</b>                                                                                                                                                                                     | Rebound effect: <b>50%</b>                                                                                                                                                                                                |

\*The different costs refer to Low, Low-Middle, Upper-Middle and Upper Income countries, respectively.

The VG can be categorised along the stages of the value chain: upstream (pre-use), use-phase, and downstream (post-use). **Table three** presents how each subcategory of the loss pathways was assigned to a specific stage of the value chain. The allocation logic is based on the point at which the losses or waste occur. For example, food waste and energy losses at end-use are linked to the consumption stage, and are therefore assigned to the use phase of the value chain (see **Table A4** in the Annexe).

**Table three.** Summary of value losses per supply chain stage, loss pathways and their components

| Supply chain stage | Loss pathway | Loss pathway | Value, € billion | Total € billion |
|--------------------|--------------|--------------|------------------|-----------------|
|--------------------|--------------|--------------|------------------|-----------------|

|            |                                     | components                      |              |               |
|------------|-------------------------------------|---------------------------------|--------------|---------------|
| Upstream   | Processing losses                   | Residual material value         | 482          | 5275 (±812)   |
|            |                                     | Cost of treatment               | 233 (±105)   |               |
|            |                                     | Shadow cost                     | 190 (±8)     |               |
|            | Food waste and losses               | Food losses                     | 595          |               |
|            | Energy losses                       | Fuel extraction                 | 163 (±24)    |               |
|            |                                     | Fuel extraction - Shadow cost   | 939 (±140)   |               |
|            |                                     | Power conversion                | 301 (±58)    |               |
|            |                                     | Power conversion - Shadow cost  | 2039 (±383)  |               |
|            |                                     | Transport                       | 61 (±18)     |               |
|            |                                     | Transport - Shadow cost         | 254 (±76)    |               |
| Use-Phase  | Food waste and losses               | Food waste                      | 56 (±28)     | 4973 (±944)   |
|            | Energy losses                       | End-Use                         | 1900 (±346)  |               |
|            |                                     | End-Use - Shadow cost           | 3017 (±570)  |               |
| Downstream | End-of-life waste (incl. treatment) | Residual material/product value | 6,479        | 9,989 (±1183) |
|            |                                     | Cost of treatment               | 2429 (±1139) |               |
|            |                                     | Shadow cost                     | 1,081 (±44)  |               |

## Gross Domestic Product, Net Domestic Product, and Consumption of Fixed Capital

GDP is derived from the concept of value added. Gross Value Added (GVA) is defined as the difference between output and intermediate consumption. Using the output method, GDP is calculated as the sum of the GVA of all resident producer units, plus taxes (in whole or in part) and minus subsidies on products, to the extent that these are not already included in the valuation of output. GDP can also be calculated using the income and expenditure methods, all of which yield the same result.<sup>18</sup>

<sup>18</sup> System of National Accounts (SNA). (2025). United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank (2025).

In principle, the concept of value added should exclude depreciation and depletion. Depreciation does not represent newly created value; rather, it reflects the reduction in value of previously created fixed assets as they are used in the production process. Similarly, depletion is treated as a cost of production, as it represents the decline in the value of natural resources due to their extraction in the production of goods. Value added is therefore, in theory, a net concept. This reasoning also applies to domestic product: theoretically, domestic product should be measured on a net basis. Net Domestic Product (NDP) is obtained by deducting depreciation—measured as Consumption of Fixed Capital (CFC)—and depletion from GDP:

$$NDP = GDP - CFC$$

Gross measures of product and income are commonly used for various reasons. The calculation of depreciation requires statisticians to estimate the present value of the stock of relevant assets, the lifetime of various types of assets, and patterns of depreciation, among other factors. Not all countries make such calculations, and when they do, there may be differences in the methodology used. There may be similar concerns regarding the estimation of depletion. However, these are not relevant to this analysis as depletion of natural resources is currently not within scope.<sup>19</sup> To overcome this limitation, this analysis employs two independent measures of macroeconomic depreciation—referred to as *Consumption of Fixed Capital (CFC)*—which are calculated consistently for all the countries covered:

- The ‘*Operating surplus: Consumption of fixed capital*’ item in the Exiobase v3.9.4<sup>20</sup> database. This item is provided per country, with disaggregation into 163 sectors, for the latest year 2021.
- The ‘*Capital consumption at current national prices*’ items in the Penn World Tables.<sup>21</sup> This item is provided per country, with disaggregation into four asset types, for the latest year 2019. Conversion into US\$ is based on exchange rates collected in the same dataset.

CFC is defined in general terms as:

*‘The decline, during the course of the accounting period, in the current value of the stock of fixed assets owned and used by a producer as a result of physical deterioration (or wear and tear), normal obsolescence or normal accidental damage’.*<sup>22</sup>

Typically, CFC is estimated by applying a depreciation function to the gross value of assets. Several depreciation functions are available, each implying a different rate at which the quantity of capital services declines over time (the age-efficiency profile). In this analysis, geometric depreciation is assumed; that is, the quantity of capital services declines at a constant rate over

<sup>19</sup> The OECD is currently developing extensions to the System of National Accounts (SNA) that incorporate the valuation of natural resources and account for resource depletion in the Net Domestic Product (NDP). [\[Source\]](#)

<sup>20</sup> Stadler, K., Wood, R., Bulavskaya, T., Södersten, C.-J., Simas, M., Schmidt, S., Usubiaga, A., Acosta-Fernández, J., Kuenen, J., Bruckner, M., Giljum, S., Lutter, S., Merciai, S., Schmidt, J. H., Theurl, M. C., Plutzar, C., Kastner, T., Eisenmenger, N., Erb, K.-H., Koning, A., & Tukker, A. (2020). EXIOBASE 3 (Version 3.8) [Dataset]. Zenodo. <https://zenodo.org/records/14614930>

<sup>21</sup> Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). *Penn World Table* (Version 11.0). Groningen Growth and Development Centre, University of Groningen. Retrieved from [University of Groningen website](#)

<sup>22</sup> OECD. (2009). *Measuring Capital - OECD Manual 2009: Second edition*. OECD Publishing, Paris. Retrieved from: [OECD website](#)

the asset's lifetime. This is a form of simple accounting depreciation which does not take into account influential complex economic factors. CFC represents the link between Gross and Net Capital Stock (NCS), which are key indicators in the calculations of the residual value in EoL waste (see End-of-Life waste section).

Avoidable and unavoidable fractions of CFC are then calculated as:

$$\theta_{cfc_{av}} = CFC * \alpha$$

$$\theta_{cfc_{uv}} = CFC * (1 - \alpha)$$

Where  $\alpha$  is a coefficient accounting for an assumed fraction of capital consumption that could be avoided through circular practices (25-50%).

Remarkably, in this analysis “avoidable functional value loss” ( $\theta_{cfc_{av}}$ ) is to be intended as a measure of avoidable economic depreciation rather than an adjustment to accounting depreciation. Financial depreciation allocates historical cost over time, whereas  $\theta_{cfc_{av}}$  captures the preventable loss of productive service potential caused by premature deterioration or suboptimal asset use. Valuing this lost service potential at current replacement cost aligns  $\theta_{cfc_{av}}$  methodologically with the monetisation of physical inefficiencies while keeping it conceptually distinct from accounting depreciation. This positioning preserves financial clarity and presents  $\theta_{cfc_{av}}$  as a forward-looking indicator of value at risk in the capital stock, rather than a reinterpretation of financial accounts.

The rationale underlying the selected range was developed through a structured assessment of plausible scenarios. Under conservative assumptions—where only currently feasible, low-regret measures such as improved maintenance, modest scaling of repair activities, and incremental policy interventions are implemented at scale—a substantial portion of technical depreciation remains unavoidable. This irreducible share stems from fundamental material fatigue, irreversible wear, and obsolescence linked to evolving standards or technological change that cannot be entirely mitigated. Within this baseline scenario, it was assumed that approximately 10% of total depreciation could be avoided, representing the lower bound of the range.

Conversely, the upper bound of 60% was derived from optimistic assumptions informed by empirical evidence from repair-success studies, the remanufacturing literature, and product-specific analyses in sectors characterised by premature disposal or design-for-disposability (such as fast fashion and certain consumer electronics). These cases, however, are not representative of capital-intensive assets such as heavy machinery or infrastructure, where depreciation is predominantly physical and thus less amenable to circular interventions.

The central estimate—ranging between 25% and 50%—was anchored in aggregated sectoral evidence. In this scenario, many manufactured goods exhibit substantial potential for repair and remanufacturing (such as electronics, furniture, and specific vehicle components), while building materials and structures demonstrate considerable scope for life extension through

maintenance and renovation. Behavioral and policy shifts could further reduce replacement rates. This mid-range estimate aligns with the findings of synthesis studies and circular economy modelling, which consistently indicate moderate material savings translating into significant avoidable fractions of replacement-driven CFC.<sup>23</sup>

The baseline is based on current depreciation at a constant rate and service prices accounted for in current prices. Against this, the counterfactual assumes a theoretical state in which circular practices (like life extension and refurbishment) reduce depreciation to the minimum levels technically feasible based on the same service prices. Indirect effects, such as changes in productivity impacts or macroeconomic adjustments, are not modelled. Because no transition or implementation costs are included, the avoidable share should be interpreted as an upper-bound estimate rather than a prediction of achievable reductions.

## Processing losses

Processing losses and their associated economic value are calculated for four income-level regions and 14 material categories. Losses are quantified using processing loss factors, which represent the global average proportion of total production lost during the fabrication (of semi-finished products) and the manufacturing (of final products) stage.<sup>24</sup> These losses are further disaggregated into recoverable and unrecoverable fractions (**Table four**).

The quantification of processing losses is carried out by applying processing loss factors to the final products' primary gross addition to stocks (GAS) as a proxy for the production output of semi-finished products. Processing loss factors for semi-finished products are applied to primary GAS plus losses at the manufacturing stage as a proxy for production output of raw products. This leads to a slight underestimation of losses at both the semi-finished and final product levels. Processing loss factors are disaggregated by material fractions using material composition data for Net Additions to Stock (NAS) as estimated by Wiedenhofer et al. (2019).<sup>25</sup> Material composition of NAS is assumed to remain constant at 2013 levels (**Table four**).

Processing losses are calculated as:

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<sup>23</sup> Research on the impact potentials of lifetime extension on depreciation and value is quite lacking. This range is determined as Circle Economy's conservative estimate based on expert judgment and information from studies looking at environmental and in particular material impacts:

- Russell, J. D., & Nasr, N. Z. (2022). Value-retained vs. impacts avoided: The differentiated contributions of remanufacturing, refurbishment, repair, and reuse within a circular economy. *Journal of Remanufacturing*, 13(1), 25–51. doi:10.1007/s13243-022-00119-4
- Material Economics. (2018). *The circular economy - A powerful force for climate mitigation*.
- Milford, R. L., Pauliuk, S., Allwood, J. M., & Müller, D. B. (2013). *The roles of energy and material efficiency in meeting steel industry CO2 targets*. *Environmental science & technology*, 47(7), 3455-3462. doi:10.1021/es3031424

<sup>24</sup> Plank, B., Streeck, J., Virág, D., Krausmann, F., Haberl, H., & Wiedenhofer, D. (2022). Compilation of an economy-wide material flow database for 14 stock-building materials in 177 countries from 1900 to 2016. *MethodsX*, 9, 101654. doi:10.1016/j.mex.2022.101654

<sup>25</sup> Wiedenhofer, D., Fishman, T., Lauk, C., Haas, W., & Krausmann, F. (2019). Integrating material stock dynamics into economy-wide Material Flow Accounting: Concepts, modelling, and global application for 1900–2050. *Ecological Economics*, 156, 121–133. doi:10.1016/j.ecolecon.2018.09.010

$$PLf_{ij} = GAS_{ij} * rf_i$$

$$PLs_{ij} = (GAS_{ij} + PLf_{ij}) * rs_i$$

Where:

- $PLf$  is the recoverable fraction of processing losses at the manufacturing stage,
- $PLs$  is the recoverable fraction of processing losses at the fabrication stage,
- $GAS$  are primary gross additions to stocks,
- $rf$  is the recoverable loss factor at the manufacturing stage,
- $rs$  is the recoverable loss factor at the fabrication stage,
- Subscripts  $i, j$  are the material fractions and income-level groups.

The valuation of recoverable processing losses is carried out using global average Free on Board (FOB) prices from the BACI database (version 202501,<sup>26,27</sup> see **Table A2** in the Annexe). A basket of detailed HS6 product codes is assembled to represent the average price of raw materials and semi-finished products for the 14 material categories (**Table four**). Average raw material prices are used for pricing recoverable losses at the fabrication stage (since they apply to the output of raw products), and semi-finished product prices are used for pricing recoverable losses at the manufacturing stage (since they apply to the output of semi-finished products). Value lost is calculated only for the recoverable waste fraction, excluding the share sent to recycling ( $1 - TR_{rec_j}$ ), on the basis that material functional value is partially retained through recycling (see Textbox one). The cost of recycling, which includes the additional cost of bringing material quality near its original levels and redeploying waste materials into the market, is included under treatment costs. The market value of secondary materials is thus assumed to be the value of virgin materials plus the costs of collection and recycling.

In addition to recycling costs, other treatment costs<sup>28,29</sup> (including the cost of collection) are calculated using treatment rates per region group.<sup>30</sup> Finally, for uncollected waste, the shadow price of 'unsorted' waste (here more broadly interpreted as 'not collected')<sup>31</sup> is applied to reflect the broader externalities associated with waste mismanagement (**Table five**). Open dumped, uncollected and unaccounted waste are all considered as forms of unmanaged waste. The overall value lost in processing losses is then expressed as:

$$\theta f_{ij} = (PLf_{ij} * (1 - TR_{rec_j}) * PRs_i)$$

$$\theta s_{ij} = (PLs_{ij} * (1 - TR_{rec_j}) * PRr_i)$$

$$\tau_{ij} = (PLf_{ij} + PLs_{ij}) * TR_{jl} * PT_{jl}$$

<sup>26</sup> Gaulier, G. and Zignago, S. (2010). BACI: International Trade Database at the Product-Level. The 1994-2007 Version. CEPII Working Paper, N°2010-23. Retrieved from: [CEPII website](#)

<sup>27</sup> Cotterlaz, P. (2025, January 30). *January 2025 BACI update: Release notes*. CEPII. Retrieved from: [CEPII website](#)

<sup>28</sup> Kaza, S., Yao, L. C., Bhada-Tata, P., & Van Woerden, F. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Washington, DC: World Bank. doi:10.1596/978-1-4648-1329-0

<sup>29</sup> United Nations Environment Programme (UNEP). (2024). *Global Waste Management Outlook 2024: Beyond an age of waste – Turning rubbish into a resource*. Nairobi. Retrieved from: [UNEP website](#)

<sup>30</sup> Circle Economy. (2025). CGR Engine. Technical Documentation. Retrieved from: [Circularity Gap website](#)

<sup>31</sup> Sala-Garrido, R., Mocholi-Arce, M., Molinos-Senante, M., & Maziotis, A. (2023a). Monetary valuation of unsorted waste: A shadow price approach. *Journal of Environmental Management*, 325, 116668. doi:10.1016/j.jenvman.2022.116668

$$\theta_{proc\_av} = \sum_{i=1}^n \sum_{j=1}^n (\theta f_{ij} + \theta s_{ij} + \tau_{ij})$$

Where:

- $\theta f$  and  $\theta s$  are the material value of recoverable processing losses at the manufacturing and fabrication stage,
- $TR_{rec}$  is the recycling rate (applied at both stages),
- $PRs$  and  $PRr$  are the prices of semi-finished products and raw materials,
- $\tau$  is the cost of waste treatment (incl. shadow price),
- $TR$  and  $PT$  are the treatment rates and costs of treatment (incl. shadow price)
- Subscripts  $i, j$  and  $l$  are the material fractions, income-level groups and treatment type.

The total value loss in processing losses  $\theta_{proc}$  is then given by the sum of the material value of disposed processing losses ( $\theta f_{ij}$  and  $\theta s_{ij}$ ), the cost of treatment (including recycling) and the shadow cost of all collected and uncollected processing losses, respectively ( $\tau_{ij}$ ).

**Table four.** Main variables used in the calculation of value loss from recoverable processing waste, by material group

| Material category      | Raw products price <sup>26,27</sup> (\$/kg) | Semi-finished products price <sup>26,27</sup> (\$/kg) | Unrec. process loss factor semifinished <sup>24</sup> (%) | Rec. process loss factor semifinished <sup>24</sup> (%) | Unrec. process loss factor final <sup>24</sup> (%) | Rec. process loss factor final <sup>24</sup> (%) | NAS composition <sup>25</sup> (%) | EoL waste composition <sup>25</sup> (%) |
|------------------------|---------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------|--------------------------------------------------|-----------------------------------|-----------------------------------------|
| Solidwood              | 0.13                                        | 0.68                                                  | -                                                         | -                                                       | -                                                  | 17.50                                            | 0.62                              | 2.55                                    |
| Paper                  | 0.13                                        | 1.01                                                  | -                                                         | -                                                       | -                                                  | 5.00                                             | 0.03                              | 3.83                                    |
| Plastics               | 2.19                                        | 4.42                                                  | -                                                         | 1.90                                                    | -                                                  | 7.10                                             | 0.43                              | 1.08                                    |
| Iron/steel             | 0.84                                        | 1.3                                                   | 1.00                                                      | 9.00                                                    | -                                                  | 14.20                                            | 2.82                              | 2.74                                    |
| Aluminum               | 2.55                                        | 3.47                                                  | -                                                         | 30.90                                                   | -                                                  | 15.20                                            | 0.15                              | 0.13                                    |
| Copper                 | 9.04                                        | 10.55                                                 | 0.50                                                      | 1.90                                                    | 0.50                                               | 18.00                                            | 0.03                              | 0.06                                    |
| Other metals/minerals  | 4.14                                        | 5.11                                                  | 0.70                                                      | 11.70                                                   | 1.00                                               | 15.20                                            | 0.19                              | 0.26                                    |
| Concrete               | 0.05                                        | 0.4                                                   | -                                                         | -                                                       | 5.50                                               | -                                                | 64.96                             | 48.31                                   |
| Asphalt                | 0.41                                        | 0.62                                                  | -                                                         | -                                                       | 3.00                                               | -                                                | 3.03                              | 8.42                                    |
| Bricks                 | 0.29                                        | 0.48                                                  | -                                                         | -                                                       | 6.80                                               | -                                                | 4.02                              | 11.81                                   |
| Aggregate - downcycled | 0.01                                        | 0.01                                                  | -                                                         | -                                                       | -                                                  | -                                                | 7.24                              | 1.47                                    |
| Aggregate - virgin     | 0.01                                        | 0.01                                                  | -                                                         | -                                                       | -                                                  | -                                                | 16.19                             | 18.95                                   |
| Flat glass             | 1.46                                        | 1.46                                                  | -                                                         | -                                                       | 1.50                                               | -                                                | 0.15                              | 0.13                                    |
| Container glass        | 1.46                                        | 2.73                                                  | -                                                         | -                                                       | 1.50                                               | -                                                | 0.12                              | 0.26                                    |

**Table five.** Waste treatment rates and cost of treatment per income group regions

| Income-group        | Variable                              | Landfill (incl. other disposal) | Open dumping | Recycling | Composting | Waste-to-Energy | Anaerobic digestion | Uncollected (incl. unaccounted) | Collection |
|---------------------|---------------------------------------|---------------------------------|--------------|-----------|------------|-----------------|---------------------|---------------------------------|------------|
| Low-income          | Low-end cost <sup>29,31</sup> (\$/t)  | 10                              | 2            | 0         | 5          | -               | -                   | 346                             | 20         |
|                     | High-end cost <sup>29,31</sup> (\$/t) | 30                              | 8            | 25        | 30         | -               | -                   | 375                             | 50         |
|                     | Rates <sup>28,30</sup> (%)            | 8                               | 18           | 5         | -          | 1               | -                   | 67                              | 33         |
| Lower-middle income | Low-end cost <sup>29,31</sup> (\$/t)  | 15                              | 3            | 5         | 10         | 40              | 20                  | 346                             | 30         |
|                     | High-end cost <sup>29,31</sup> (\$/t) | 40                              | 10           | 30        | 40         | 100             | 80                  | 375                             | 75         |
|                     | Rates <sup>28,30</sup> (%)            | 17                              | 17           | 16        | -          | 0               | -                   | 50                              | 50         |
| Upper-middle income | Low-end cost <sup>29,31</sup> (\$/t)  | 20                              | -            | 5         | 20         | 60              | 50                  | 346                             | 50         |
|                     | High-end cost <sup>29,31</sup> (\$/t) | 65                              | -            | 50        | 75         | 150             | 100                 | 375                             | 100        |
|                     | Rates <sup>28,30</sup> (%)            | 54                              | 5            | 30        | -          | 0               | -                   | 10                              | 90         |
| High income         | Low-end cost <sup>29,31</sup> (\$/t)  | 40                              | -            | 30        | 35         | 40              | 65                  | 346                             | 85         |
|                     | High-end cost <sup>29,31</sup> (\$/t) | 100                             | -            | 80        | 90         | 200             | 150                 | 375                             | 250        |
|                     | Rates <sup>28,30</sup> (%)            | 45                              | 1            | 39        | -          | 5               | -                   | 10                              | 90         |

Baseline estimates are based on current processing loss factors using average technologies. The counterfactual assumes that improvements in design, higher fabrication efficiency, improved process control, and enhanced material recovery can reduce the portion of losses that are technically recoverable at both the semi-finished and final manufacturing stages. Indirect effects such as shifts in production volumes, rebound from lower material costs, or changes in supply-chain efficiency are not captured; the avoidable share, therefore, should be interpreted strictly as a measure of technical potential. Transition costs are not included, so estimated reductions should be interpreted as 'up to' potential rather than guaranteed outcomes.

## End-of-Life waste

The estimation of value losses related to EoL waste in terms of residual value is based on a symmetric understanding of the relationship between capital assets and material stocks.

Capital assets are produced assets used as inputs into the production process. Three broad categories of capital assets exist: producible tangible fixed assets (such as dwellings, buildings, equipment and machinery), producible intangible fixed assets (such as exploration royalties, software) and non-produced tangible assets (such as energy resources, forest land, and water resources). *In this analysis, only producible tangible assets (excluding Cultivated assets such as breeding stock, dairy cattle, orchards, and vineyards) are considered.* National accounts are

primarily concerned with the wealth aspects of capital, namely *CFC* and *Net Capital Stocks (NCS)*. NCS is defined as:

*'The value at a point in time of assets at the prices for new assets of the same type (gross fixed capital formation) less the cumulative value of consumption of fixed capital accrued up to that point'.<sup>32</sup>*

The value of an asset primarily depends on the rental income it is expected to earn during its lifetime. Rentals are equal to the quantity of capital services produced by the asset, such as tonne-kilometres in the case of a truck or cubic metres of storage space in the case of a warehouse, multiplied by the unit price of those services. In general, the quantity of services will decline during the service life of the asset because wear and tear reduce the efficiency of assets as they age. The price of capital services, on the other hand, may move in either direction. For example, the price may rise in line with inflation, or it may fall, either absolutely or relatively to the prices of competing capital services, because of obsolescence. Rentals can be expressed in either current or constant prices, depending on whether inflation is to be considered. *In this analysis, service prices are accounted for in 2021 current prices.* The decline in the quantity of capital services, referred to as the age-efficiency profile, can take several patterns, including linear decline, decline at a constant rate (geometric), and 'hyperbolic' decline, meaning that capital services fall by small amounts initially and by larger amounts as the asset ages.

The *lifetime* of an asset, referred to as its service life, is the total period during which it is in productive use, from the moment it is first installed or constructed. Because rentals generated by an asset are received over several years, they must be discounted when calculating the asset's value at any point in time. The rentals expected in future periods are discounted using a *discount rate*. When an asset is discarded or scrapped at the end of its service life, it will have a *scrap value*. This will usually be a positive amount corresponding to the value of any parts or waste materials that can be recuperated from the asset, minus the cost of dismantling the asset or removing it from the site. In some cases, these costs may be so high that the scrap value becomes negative. It should be noted that when CFC is calculated over the entire time of an asset, the residual (scrap) value is subtracted from the initial value when determining how much of the asset's value is consumed. In each accounting period, the CFC record measures only the decline in net value of any expected residual value and omits the residual itself. Therefore, CFC excludes the residual (scrap) value—that portion of the asset's value is not considered consumed—and thus does not represent an instance of double counting.

For processing losses, the residual value is assumed to be equal to the functional value of materials (raw material output) or components (semi-finished product output). However, for final long-lived products (that is, capital assets), the residual value is often larger than just the functional material value, as it may include a share of the original functional product value that has not been fully used up due to, for instance, premature asset retirement. Therefore, the valuation of material embodied in long-lived products at the end of their service life needs to take these dynamics between lifetime, rentals and depreciation into account. In this methodology, the estimation of the residual value of retired assets (and EoL materials therein) is based on an assumed symmetric relationship between cumulated material stocks and NCS.

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<sup>32</sup> OECD. (2009). *Measuring Capital - OECD Manual 2009*. doi:10.1787/9789264068476-en

As previously mentioned,  $NCS^{33}$  represents the market value of fixed assets currently in use, adjusted for depreciation. Combined with data on the cumulative stock of materials embedded in assets<sup>34</sup> and under the assumption of a symmetric relationship between EoL materials from stocks and retired assets, it enables the estimation of a current-cost Net Capital Price (NCP), or the residual value per unit of mass of an asset type (**Table six**). EoL waste and its associated economic value are calculated for four income-level regions and 14 material categories embedded in four capital asset types,<sup>35</sup> under the assumption that material composition remains constant at 2013 levels (year of last available material composition dataset). Residual value of EoL waste can then be calculated as follows:

$$\begin{aligned}
 NCP_{zj} &= (NCS_{zj} / STK_{zj}) \\
 \theta EoL_{z,j} &= \sum_{z=1}^n \sum_{j=1}^n (EoL_{zj} * NCP_{zj}) - VM_{rec} \\
 \tau EoL_{z,j} &= \sum_{l=1}^n EoL_{zj} * TR_{jl} * PT_l \\
 \theta_{EoL_{av}} &= \sum_{z=1}^n \sum_{j=1}^n (\theta EoL + \tau EoL)
 \end{aligned}$$

Where:

- $NCP$  is the Current-cost net Capital Price
- $NCS$  is the Current-cost Net Capital Stock
- $STK$  is the physical quantity of cumulated stock
- $\theta EoL$  is the residual value of assets at their end-of-life
- $EoL$  is the physical quantity of EoL waste
- $VM_{rec}$  is the material value of the recycled fraction of EoL waste
- $\tau EoL$  is the total treatment cost of EoL waste
- Subscripts  $z, j$  and  $l$  represent the asset types, income region and treatment type, respectively

Due to limitations in the data, only two broad types of produced tangible fixed assets are considered: buildings (which include dwellings and infrastructure) and machinery (which includes machinery, equipment and vehicles). Other asset types and short-lived products are not considered in the residual value calculations. Note that since current-cost NCS data is only available up to 2019, the current-cost NCP is calculated for 2019 and applied to the EoL waste value for 2021.

<sup>33</sup> This analysis employs the 'Current-cost net capital stock' (NCS) items taken from the Penn World Tables. This item is provided per country, with disaggregation into four asset types, for the latest year 2019. Conversion into US\$ is based on exchange rates collected in the same dataset.

<sup>34</sup> This analysis employs cumulated materials in assets taken from Wiedenhofer, D., Streeck, J., Wieland, H., Grammer, B., Baumgart, A., Plank, B., ... Krausmann, F. (2024). From extraction to end-uses and waste management: Modeling economy-wide material cycles and stock dynamics around the world. *Journal of Industrial Ecology*, 28(6), 1464–1480. doi:10.1111/jiec.13575

<sup>35</sup> This analysis employs End-of-Life waste figures by material, asset and country (aggregated to income-level brackets) derived from Wiedenhofer, D., Fishman, T., Lauk, C., Haas, W., & Krausmann, F. (2019). Integrating material stock dynamics into economy-wide Material Flow Accounting: Concepts, modelling, and global application for 1900–2050. *Ecological Economics*, 156, 121–133. doi:10.1016/j.ecolecon.2018.09.010

**Table six.** Residual value per unit of mass (NCP) of buildings and machinery for income brackets (Low, Low-Medium, Upper-Medium and High Income Countries)

| Income-group | LIC       |           | LMC       |           | UMC       |           | HIC       |           |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Asset type   | Buildings | Machinery | Buildings | Machinery | Buildings | Machinery | Buildings | Machinery |
| NCP (\$/t)   | 0.095     | 1.530     | 0.125     | 2.368     | 0.124     | 3.023     | 0.435     | 4.645     |

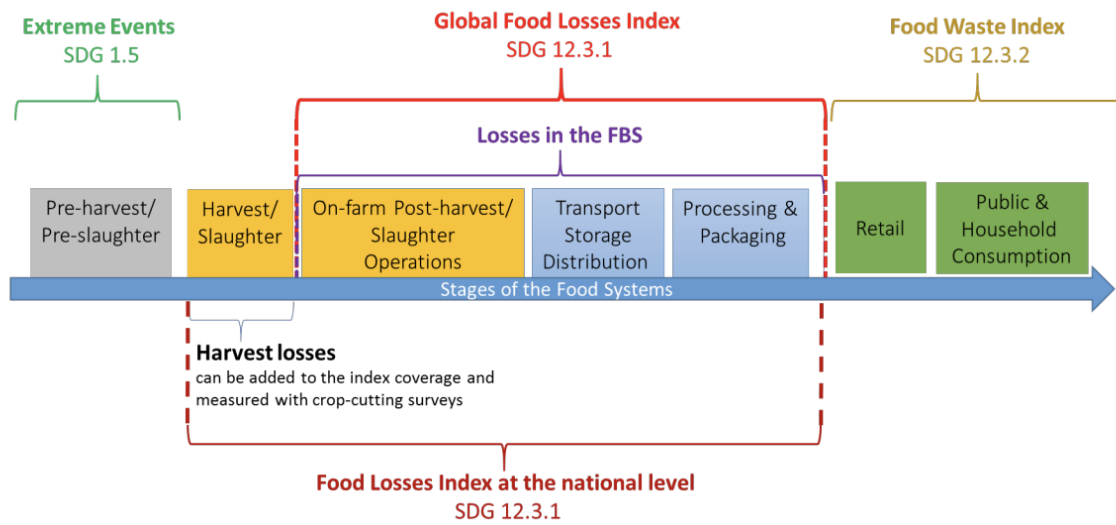
Different from processing losses, the calculation of the residual value of EoL waste includes the recycled fraction ( $EoL_{zj}$  is the total volume and is not multiplied by  $(1 - TR_{rec_j})$ , like with processing losses), as the product functional value of EoL assets sent to dismantling and recycling is lost (see Textbox one). To still account for the retention of material functional value for the fraction sent to recycling, the functional value of materials in EoL waste ( $VM_{rec}$ ) is subtracted from the functional product value. This makes  $\theta EoL$  a measure of product residual value, net of the value of recycled material. The assumptions and data regarding treatment rates and costs across income groups that are applied to processing losses remain consistent with those for processing losses (**Table five**). The category ‘short-lived products’ is excluded from the residual value calculations; however, it is included in the calculations of treatment costs.

The baseline reflects current waste flows, treatment rates, and the existing residual value of assets. The counterfactual represents a maximum-retention scenario in which design for disassembly, refurbishment, and efficient dismantling and sorting allow asset value to be preserved at the product or material level. System-level effects—such as secondary-market dynamics—are excluded, so the avoidable share represents a technical potential. Achieving this in practice would require investment in tracking technologies, standardisation for deconstruction, and supportive policy frameworks. These enabling conditions are assumed in the counterfactual, but their transition costs are not quantified.

## Food losses and waste

Food losses and waste are defined as all crop and livestock human-edible quantities that exit the supply chain and do not reenter the use phase in any other form (animal feed, industrial use, *et cetera*). Food losses occur at the processing, transportation and storage stages and apply to the food commodity as a whole, including its non-edible parts. Food waste, on the other hand, occurs from retail to the final consumption stages and enables a clear distinction between edible and non-edible fractions. For food waste, only the edible fractions are considered to be avoidable. Due to a lack of data, the collection and treatment costs of food losses and waste are not included. Harvest losses not covered by the Global Food Loss Index and feed waste are also excluded from the scope of the analysis.

Food losses data were obtained from FAOSTAT<sup>36</sup> for 81 different food products, expressed in kilotonnes per year and aggregated by region. To estimate their economic value, price data were sourced from the BACI database,<sup>37</sup> which records bilateral trade transactions in both physical and monetary units and enables the calculation of Free on Board (FOB) prices. BACI product categories were mapped to FAOSTAT items to generate a unique price for each item (see **Table A3** in the Annexe). Regional prices were then calculated using both import and export data. For example, all ‘Apples and products’ imported into country X and exported from country X were used to determine the representative price of ‘Apples and products’ for that country.



**Figure four.** Food supply boundaries, extracted from the Food Agriculture Organization of the United Nations (FBS: Food Balance Sheets).<sup>38</sup>

The economic value of food losses was calculated as the quantity lost (in kilotonnes) multiplied by the average price of the corresponding item in the region. To present results by income group, weighted average prices were computed, considering the magnitude of losses in each region. Specifically, if three countries in the High-Income group experience food losses of  $x$ ,  $y$ , and  $z$ , with respective prices  $p_1$ ,  $p_2$ , and  $p_3$ , the weighted price ( $W_p$ ) for the group is calculated as:

$$W_p = \frac{(p_1 \cdot x + p_2 \cdot y + p_3 \cdot z)}{p_1 + p_2 + p_3}$$

Food waste was estimated using data from the Food Waste Index,<sup>39</sup> which provides values for 233 regions. These estimates are categorised into food service, retail, and households; however, no distinction is made in this analysis. As with food losses, price data for food waste were derived from the BACI database. Because the food waste dataset does not provide item-level

<sup>36</sup> FAO. (2025). Food Balances (2010-). In: FAOSTAT. Rome. [Cited, September 2023]. Retrieved from: [FAO website](#)

<sup>37</sup> Gaulier, G. and Zignago, S. (2010) BACI: International Trade Database at the Product-Level. The 1994-2007 Version. CEPII Working Paper, N°2010-23. Retrieved from: [CEPII website](#)

<sup>38</sup> FAO. (2018). SDG 12.3.1: Global Food Loss Index (pp. 14, Rep.). Retrieved from: [FAO website](#)

<sup>39</sup> UNEP. (2021). Food Waste Index. [Data set]. Retrieved from: [UNEP website](#)

disaggregation, a single average price per region was applied. This regional price was calculated using both imports and exports to capture a representative value per ton of food. For regions where BACI data were not available, a global average price of US\$ 909 per tonne was used.

Total food waste is divided into edible and inedible fractions. Edible waste refers to food that could have been consumed, while inedible waste includes parts that are typically not eaten, such as bones, skins, and seeds. In many cases, edible waste can be considered avoidable food waste. Data on edible shares for some countries is available from the Food Waste Index report,<sup>40</sup> from which averages were calculated (**Table seven**). However, no data was available for LIC, so a conservative estimate of 25% edible share was applied.

**Table seven.** Edible shares estimates per Income-level country

| %                   | HIC | UMC | LMC | LIC |
|---------------------|-----|-----|-----|-----|
| <b>Edible share</b> | 59% | 31% | 34% | 25% |

The overall value loss related to food losses and waste is calculated as follows:

$$\theta_{food\_av} = \sum_{i=1}^n (p_{food,i} \cdot w_{food,i} \cdot ed_i + \sum_j p_{j,i} \cdot w_{losses,j,i})$$

Where:

$p_{food,i}$ : the average price per tonne of food in the country i,

$w_{food,i}$ : the estimated food waste in the country i (tonnes),

$ed_i$ : edible share of country i (%),

$p_{j,i}$ : the average price per tonne of item j in the country i,

$w_{losses,j,i}$ : the food losses of item j in the country i (tonnes).

The baseline reflects current inefficiencies across the supply chain, incorporating regional variations in spoilage. The counterfactual assumes that improvements in storage, processing, transportation, and consumer behaviour could reduce edible food losses and waste. Indirect effects such as price elasticity or demand shifts resulting from increased food availability are not modelled; the avoidable share represents a technical potential only. Achieving this would require enablers such as investment in cold chains and storage, improved logistics, consumer awareness, and supportive policies. Transition costs are not included, so results should be interpreted as ‘up to’ potential rather than assured outcomes.

## Energy losses

Energy losses and their associated economic value are calculated at the global level for 10 items across four stages. The journey of energy through the global system passes through five key stages. Initially, it is extracted as primary energy, such as coal and crude oil, from the earth. This energy is then processed into final energy that can be used more easily, such as gasoline and

<sup>40</sup> UNEP. (2024). *Food Waste Index Report 2024. Think Eat Save: Tracking progress to halve global food waste*. Nairobi. Retrieved from: [UNEP website](https://www.unep.org/foodwasteindex)

electricity, which are transported and sold to end-users. As an exception, energy from renewable sources (such as wind, solar and hydro) is not formally extracted, but directly converted into final energy in the form of electricity. These users convert this final energy into useful energy through devices like boilers and engines, turning the final energy captured in fuels into functional forms such as hot water or a moving vehicle. This useful energy delivers essential services across society, such as heating homes or transporting goods. Finally, energy services are used to create value and prosperity for consumers—providing comfort, mobility, and light—thereby transforming energy into an improvement in prosperity, quality of life, and human satisfaction and happiness.

The first step in quantifying losses along these stages was to assemble a dataset on the quantities and mixes for primary energy (Total Energy Supply - TES), final energy (Total Final Consumption - TFC) and energy losses (**Table eight** and **Table nine**). The primary sources for the compilation of this data were the IEA energy balances,<sup>41</sup> the IPCC 6AR,<sup>42</sup> and the Rocky Mountain Institute study on the inefficiency of the energy system.<sup>43</sup>

**Table eight.** Primary Energy Supply (TES) and Final Energy Consumption (TFC) by energy carrier

| Unit: EJ    | TES   | TFC   | TFC - Transport | TFC - Buildings | TFC - Industry and Other |
|-------------|-------|-------|-----------------|-----------------|--------------------------|
| Coal        | 168.8 | 38.1  | 0               | 8               | 30.1                     |
| Oil         | 183.2 | 163.5 | 108.6           | 24.1            | 30.8                     |
| Gas         | 145.6 | 71.6  | 4.9             | 20              | 46.7                     |
| Biomass     | 53.8  | 38.9  | 5.4             | 33.6            | 0.0                      |
| Electricity | 0     | 86.2  | 0               | 46.1            | 40.1                     |
| Other*      | 62.6  | 17.6  | 0               | 0               | 17.6                     |

\* Includes heat, renewables and nuclear energy

**Table nine.** Energy losses by energy carrier\*

| Unit: %                        | Coal ( $v_{coal}$ ) | Oil ( $v_{oil}$ ) | Gas ( $v_{gas}$ ) | Biomass ( $v_{bio}$ ) | Electricity ( $v_{el}$ ) |
|--------------------------------|---------------------|-------------------|-------------------|-----------------------|--------------------------|
| Fuel extraction and processing | 34%                 | 37%               | 29%               | -                     | -                        |
| Power conversion - gas         | -                   | -                 | 100%              | -                     | -                        |
| Power conversion - coal        | 100%                | -                 | -                 | -                     | -                        |
| Power conversion - other       | -                   | 61%               | -                 | 39%                   | -                        |
| Transport losses - wires       | -                   | -                 | -                 | -                     | 100%                     |
| Transport losses - pipes       | -                   | -                 | 100%              | -                     | -                        |

<sup>41</sup> International Energy Agency (IEA). (2025). *World Energy Balances* [Data set]. IEA. Retrieved from: [IEA website](#)

<sup>42</sup> Kikstra, J. S., Nicholls, Z. R., Smith, C. J., Lewis, J., Lamboll, R. D., Byers, E., ... & Riahi, K. (2022). The IPCC Sixth Assessment Report WGIII climate assessment of mitigation pathways: from emissions to global temperatures. *Geoscientific Model Development*, 15(24), 9075-9109. <https://doi.org/10.5194/gmd-15-9075-2022>

<sup>43</sup> Walter, D., Bond, K., Lovins, A., Speelman, L., Gulli, C., & Butler-Sloss, S. (2024). *The incredible inefficiency of the fossil energy system*. Rocky Mountain Institute (RMI). Retrieved from: [RMI website](#)

|                          |     |     |     |     |     |
|--------------------------|-----|-----|-----|-----|-----|
| Transport losses - ships | -   | 70% | 30% | -   | -   |
| End-use - transport      | -   | 91% | 4%  | 5%  | -   |
| End-use - buildings      | 6%  | 18% | 15% | 26% | 35% |
| End-use - industry       | 20% | 21% | 32% | 0%  | 27% |

*\*This table represents the composition in terms of energy carriers of the energy losses at each stage. It should be read as: 'At the fuel extraction and processing stage, losses are for the 34% coal, 37% oil and 29% natural gas'.*

In the second step, data on process efficiency and energy prices was assembled. Inefficiencies across the energy system were quantified for the production and transportation processes involved in the transition from primary to final energy, as well as for energy use losses related to end-use sectors (that is, transport, buildings, and industry) involved in the transition from final to useful energy. The three key drivers of energy waste in production processes are extraction (extracting raw fuels from the ground), fuel processing losses (converting raw extracted fuels into usable molecules), and power generation losses (converting molecules into usable energy). As raw fuels are upgraded into useful forms, they become more valuable. Hence, a unit of energy lost in production has a lower monetary value than a unit of final energy lost later or a unit of waste in useful energy. This is partially reflected in the use of different prices, specifically wholesale prices for losses up to the end-use stage and retail prices for losses at the end-use stage. The three key drivers of waste in transportation are energy losses in ships, pipes, and wires. Although in energy terms, pipes and wires lose a comparable amount of energy, the latter transport more valuable electricity, so the total wasted energy from wire losses is much higher. Most energy is used to provide one of three core energy services: producing heat (for water or air heating in buildings or heating in industry), doing work (mostly in transport—engines that power cars and buses—but also driving things like conveyor belts in factories), or generating light (to allow for activity after dark or in dark interiors). Heat and work production are the main drivers of waste—light generation is already largely electrified and less significant.

Actual and maximum technological process efficiencies were compiled from various sources and supplemented with assumptions (**Table ten**). Maximum technological efficiency is based on current Best Available Technologies (BATs) and is used to determine the fraction of energy losses that can be avoided versus the unavoidable.

**Table ten.** Actual and maximum technological potentials

| Unit: %                        | Baseline<br>( $\eta_{bas}$ ) | Maximum<br>( $\eta_{max}$ ) | Notes/Sources                                                                                              |
|--------------------------------|------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------|
| Fuel extraction and processing | 10%                          | 15%                         | Baseline: Back-calculated from RMI study<br>Maximum: Assumption                                            |
| Power conversion - gas         | 50%                          | 60%                         | Baseline: Offshore Combined Cycle Gas Turbine<br>Maximum: Onshore Combined Cycle Gas Turbine <sup>44</sup> |

<sup>44</sup> Ipieca. (2022). *Open-cycle gas turbines (2022)*. Ipieca. Retrieved from: [Ipieca website](#)

|                          |     |     |                                                                                                                                        |
|--------------------------|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------|
| Power conversion - coal  | 38% | 50% | Baseline: Sub-critical thermal plant<br>Maximum: Ultra Supercritical thermal plant <sup>45</sup>                                       |
| Power conversion - other | -   | -   | Not included due lack of reliable data                                                                                                 |
| Transport losses - wires | 93% | 98% | Baseline: Reported data <sup>46</sup><br>Maximum: Assumption based on IPIECA <sup>47</sup>                                             |
| Transport losses - pipes | 96% | 98% | Baseline: RMI study<br>Maximum: Assumption based on IPIECA                                                                             |
| Transport losses - ships | -   | -   | Not included due lack of reliable data                                                                                                 |
| End-use - transport      | 25% | 35% | Baseline: gasoline ICEVs <sup>48</sup><br>Maximum: Improved ICE or hybrids                                                             |
| End-use - buildings      | 60% | 90% | Baseline: Heating and insulation losses based on Circle Economy's calculations<br>Maximum: Assumption                                  |
| End-use - industry       | 70% | 75% | Baseline: Circle Economy's calculations based on research<br>Maximum: Circle Economy's calculations based on research <sup>49,50</sup> |
| End-use - other          | 53% | 60% | Baseline: Back-calculated from RMI study<br>Maximum: Assumption                                                                        |

Energy prices used for valuation of energy losses were gathered from the RMI appendix<sup>51</sup> and converted into a common unit of measure (GJ/\$) based on net calorific values from the *IEA Energy Statistics Manual*.<sup>52</sup> For oil, natural gas and electricity, a wholesale or retail price was applied to all stages up to end-use and the end-use stage, respectively. Next to standard market prices, shadow prices that internalise the cost of extreme weather externalities were estimated.

<sup>45</sup> Bhiogade, D. S. (2023). Ultra Supercritical Thermal Power Plant Material Advancements: A Review. *Journal of Alloys and Metallurgical Systems*, 3, 100024. doi:10.1016/j.jalms.2023.100024

<sup>46</sup> World Bank. (n.d.) *Electric power transmission and distribution losses (% of output)* [Data set]. *World Development Indicators*. Retrieved from: [World Bank website](#)

<sup>47</sup> Ipieca. (2023). *Flowlines and pipelines* (2023). Retrieved from: [Ipieca website](#)

<sup>48</sup> Ritchie, H. (2022). *Primary, secondary, final, and useful energy: Why are there different ways of measuring energy?*. *Our World in Data*. Retrieved from: [Our World in Data website](#)

<sup>49</sup> Bianchi, G., Panayiotou, G. P., Aresti, L., Kalogirou, S. A., Florides, G. A., Tsamos, K., ... Christodoulides, P. (2019). Estimating the waste heat recovery in the European Union Industry. *Energy, Ecology and Environment*, 4(5), 211–221. doi:10.1007/s40974-019-00132-7

<sup>50</sup> Forman, C., Muritala, I. K., Pardemann, R., & Meyer, B. (2016). Estimating the global waste heat potential. *Renewable and Sustainable Energy Reviews*, 57, 1568–1579. doi:10.1016/j.rser.2015.12.192

<sup>51</sup> Walter, D., Bond, K., Lovins, A., Speelman, L., Gulli, C., & Butler-Sloss, S. (2024). *Appendix: The incredible inefficiency of the fossil energy system*. Rocky Mountain Institute (RMI). Retrieved from: [RMI website](#)

<sup>52</sup> IEA. (2004). *Energy statistics manual*. Retrieved from: [OECD website](#)

This entailed the compilation of average emissions intensity factors for each energy carrier<sup>53 54 55</sup> (biomass was assumed to be carbon neutral) and a low-end and high-end value for the SCC<sup>56</sup> (**Table eleven**).

**Table eleven.** Energy losses valuation data

| Energy Carrier           | Market price (GJ/\$)<br>( $\rho_{mrk}$ ) | Emission factor<br>(kgCO <sub>2</sub> /GJ) | Shadow price<br>low-end (\$/GJ) ( $\rho_{shw}$ ) | Shadow price<br>high-end (\$/GJ) |
|--------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------------|----------------------------------|
| Oil                      | 10.2                                     | 73.3                                       | 13.7                                             | 35.9                             |
| Oil products             | 27.3                                     | 74.7                                       | 14.0                                             | 36.6                             |
| Gas wholesale            | 4.7                                      | 56.1                                       | 10.5                                             | 27.5                             |
| Gas retail               | 19.9                                     | 56.1                                       | 10.5                                             | 27.5                             |
| Biomass                  | 3.5                                      | 0.0                                        | 0.0                                              | 0.0                              |
| Coal                     | 4.2                                      | 100.6                                      | 18.8                                             | 49.3                             |
| Electricity<br>wholesale | 16.7                                     | 132.3                                      | 24.7                                             | 64.8                             |
| Electricity retail       | 33.3                                     | 132.3                                      | 24.7                                             | 64.8                             |

Based on this data and further assumptions detailed in **Table twelve**, energy losses were quantified as specified in **Table thirteen**.

**Table twelve.** Additional variables and values used in the calculation of value loss from avoidable energy losses (Circle Economy's assumptions)

| Unit: %  | Natural gas<br>in<br>power/heat<br>generation | Coal in<br>power/heat<br>generation | End-use -<br>transport in<br>TFC | End-use -<br>buildings in<br>TFC | End-use -<br>industry in<br>TFC | Heating/cool<br>ing in TFC of<br>buildings |
|----------|-----------------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------|--------------------------------------------|
| Variable | $\alpha_{gas}$                                | $\alpha_{coal}$                     | $\beta_{trs}$                    | $\beta_{bld}$                    | $\beta_{ind}$                   | $\sigma_{h/c}$                             |
| Share    | 35%                                           | 60%                                 | 29%                              | 32%                              | 34%                             | 75%                                        |

**Table thirteen.** Summary table of avoidable energy losses, including formulas

| Unit: EJ                          | Var            | Energy<br>productio<br>n losses | Energy<br>transpor<br>t losses | Final<br>energy | Energy<br>use<br>losses | Useful<br>energy | Source/Formula |
|-----------------------------------|----------------|---------------------------------|--------------------------------|-----------------|-------------------------|------------------|----------------|
| Fuel extraction<br>and processing | $\omega_{ext}$ | 51.0                            | -                              | -               | -                       | -                | RMI study      |

<sup>53</sup> IPCC – Emission Factor Database. (2023) – with minor processing by Our World in Data. (2025). *Carbon dioxide emissions factors*. Intergovernmental Panel on Climate Change, Emission Factor Database; Our World in Data. Retrieved from: [Our World in Data website](#)

<sup>54</sup> Ritchie, H., Rosado, P., & Roser, M. (2023). *Carbon intensity of electricity generation*. Our World in Data. Retrieved from: [Our World in Data website](#)

<sup>55</sup> Ritchie, H., Rosado, P., & Roser, M. (2023). *Energy use per person vs. GDP per capita*. Our World in Data. Retrieved from: [Our World in Data website](#)

<sup>56</sup> Estrada, F., Lupi, V., Botzen, W. J., & Tol, R. S. (2025). Urban and non-urban contributions to the social cost of carbon. *Nature Communications*, 16(1). doi:10.1038/s41467-025-59466-y

|                          |                 |      |     |       |      |      |                                                      |
|--------------------------|-----------------|------|-----|-------|------|------|------------------------------------------------------|
| Power conversion - gas   | $\omega_{gas}$  | 25.1 | -   | -     | -    | -    | $TPS_{gas} * \alpha_{gas} * (1 - \eta_{gas})$        |
| Power conversion - coal  | $\omega_{coal}$ | 62.3 | -   | -     | -    | -    | $TPS_{coal} * \alpha_{coal} * (1 - \eta_{coal})$     |
| Power conversion - other | $\omega_{conv}$ | 41.9 | -   | -     | -    | -    | $TPS - TFC - \sum \omega$                            |
| Transport losses - wires | $\omega_{wir}$  | -    | 6.0 | -     | -    | -    | $TFC_{el} * (1 - \eta_{wir,bas})$                    |
| Transport losses - pipes | $\omega_{pip}$  | -    | 5.8 | -     | -    | -    | $TPS_{gas} * (1 - \eta_{pip,bas})$                   |
| Transport losses - ships | $\omega_{shp}$  | -    | 6.0 | -     | -    | -    | RMI study                                            |
| End-use - transport      | $\omega_{trs}$  | -    | -   | 118.9 | 89.2 | 29.7 | $TFC * \beta_{trans} * (1 - \eta_{trs,bas})$         |
| End-use - buildings      | $\omega_{bld}$  | -    | -   | 131.8 | 39.6 | 92.3 | $TFC * \beta_{bld} * (1 - \eta_{bld,bas})$           |
| End-use - industry       | $\omega_{ind}$  | -    | -   | 141.4 | 42.4 | 99.0 | $TFC * \beta_{ind} * (1 - \eta_{ind,bas})$           |
| End-use - other          | $\omega_{oth}$  | -    | -   | 23.7  | 11   | 12.7 | $TFC - (\omega_{trs} + \omega_{bld} + \omega_{ind})$ |

Once losses at each step are calculated in energy units, a general equation to split them into avoidable and unavoidable fractions is applied:

$$\omega_{av,i} = \omega_i - ((\omega_i * \eta_{bas,i} / \eta_{max,i}) * (1 - \sigma))$$

$$\omega_{unav,i} = \omega_i - \omega_{av,i}$$

Where  $\omega$ ,  $\omega_{av}$  and  $\omega_{unav}$  are the total, avoidable and unavoidable losses at step  $i$ , while  $\sigma$  is a direct and indirect rebound effect coefficient assumed to range between 25%<sup>57</sup> and 50%.<sup>58</sup>

Finally, energy losses by energy carriers are monetised by applying both the market and shadow prices. These prices are considered additional since the SCC quantifies the unpriced, negative externalities of carbon emissions that impact society, which are not reflected in the market price.

$$\theta_{en_{av,i}} = \sum_{j=1}^n \omega_{av,i} * v_{i,j} * (\rho_{mrk,j} + \rho_{shw,j})$$

<sup>57</sup> Nadel, S. (2012). *The rebound effect: large or small?*. Washington, DC, USA: American Council for an Energy-Efficient Economy. ACEEE white paper. Retrieved from: [ACEEE website](https://www.aceee.org/publications/white-papers)

<sup>58</sup> Brockway, P. E., Sorrell, S., Semieniuk, G., Heun, M. K., & Court, V. (2021). Energy efficiency and economy-wide rebound effects: A review of the evidence and its implications. *Renewable and Sustainable Energy Reviews*, 141, 110781. doi:10.1016/j.rser.2021.110781

Where  $\theta_{en_{av},i}$  are the energy-related value losses at step  $i$ , calculated as the sum of value losses for each energy carrier  $j$  at the same step.

Baseline losses are estimated based on the current mix of generation technologies and their respective conversion efficiencies. The counterfactual assumes that adopting BAT, improving conversion and transmission efficiencies, and changing end-use consumer behaviour could reduce avoidable energy losses. Only rebound effects are included as a form of indirect effect—others, such as shifts in energy demand or price responses, are not captured, so the avoidable share reflects technical potential only. Achieving the counterfactual would require investment in advanced generation and transmission infrastructure, efficiency improvements in end-use devices, supportive policies, and behavioural change. Because the transition costs for these conditions are not included, the results represent the system's 'up to' technical potential rather than guaranteed outcomes.

# 3. Limitations and further research

## Limitations

The main limitations of this study can be grouped into four categories: scope, data, assumptions, and complexity and dynamics. These categories are interrelated—limitations in data availability constrain scope, which in turn shapes modelling assumptions and determines how systemic dynamics can be represented.

### Scope

- *Service-related value loss*: Estimating the ‘linear’ or ‘circular’ share of value added in the service sector is challenging due to the intangible nature of its outputs. Services such as finance, information technology, and insurance are inherently neutral; their contribution depends on the sectors they support. For example, the same financial or software service may assist either a mining company or a reverse logistics firm. Moreover, services are often exchanged within the service sector itself, complicating the attribution and quantification of service-related value that is ‘lost’.
- *Land (natural resources) and labour inputs*: The current approach focuses exclusively on produced capital—products, assets, and embedded materials—while excluding other forms of capital, such as natural and social capital. For natural capital, progress is expected through the integration of natural resource depletion as capital consumption in the System of National Accounts (SNA), enabling the calculation of an environmentally-adjusted Net Domestic Product (NDP).<sup>59</sup> Alternatively, the integration of GDP with another indicator capturing the unpriced value of ecosystem services such as the Gross Ecosystem Product (GEP)<sup>60</sup> represents another valid approach for the inclusion of natural capital. Regarding labour, no established method currently exists for quantifying value losses. One possible avenue would be to conceptualise employment-related value loss as the gap between actual and globally fair wages, extending the VG metric toward a more inclusive circular economy perspective.<sup>61</sup>
- *Environmental and social impacts*: The present analysis addresses only one environmental stressor (unsorted waste) and one impact category (global warming potential). Moreover, the valuation of unsorted waste—based on a custom methodology—is not harmonised with the SCC used for climate impacts. Future methodological refinements should expand coverage to a comprehensive set of environmental impact categories,

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<sup>59</sup> OECD. (2025). *Draft: Measuring natural resources in the national accounts: A compilation guide*. United Nations Statistics Division. Retrieved from: [UN Stats website](#)

<sup>60</sup> Zheng, H., Wu, T., Ouyang, Z., Polasky, S., Ruckelshaus, M., Wang, L., ... Daily, G. C. (2023). Gross ecosystem product (GEP): Quantifying nature for environmental and economic policy innovation. *Ambio*, 52(12), 1952–1967. doi:10.1007/s13280-023-01948-8

<sup>61</sup> Pansera, M., Barca, S., Martinez Alvarez, B., Leonardi, E., D’Alisa, G., Meira, T., & Guilibert, P. (2024). Toward a just circular economy: Conceptualizing environmental labor and Gender Justice in circularity studies. *Sustainability: Science, Practice and Policy*, 20(1). doi:10.1080/15487733.2024.2338592

such as those included in state-of-the-art Life Cycle Assessment (LCA),<sup>62,63</sup> using a consistent set of shadow prices.<sup>64</sup>

## Data

- *Partial inclusion of biomass-related value loss:* Material flow data for processing losses and EoL waste were sourced from the MISO2 model, whose scope is limited to stock-building materials. Similarly, treatment rates derived from the Global CGR database exclude biomass-related waste streams such as agricultural, food, and feed waste, as no data on anaerobic digestion or composting are included. Consequently, food losses and waste were quantified separately using FAOSTAT data. Future model improvements should aim to integrate both technical and chemical energy flows—and their associated waste—within the MISO2 model and CGR database, or alternatively, to expand data collection on waste treatment shares specific to the food and feed supply chain.
- *Absence of treatment rates for R4–R6 strategies:* The lack of data on the share of reused, remanufactured, or refurbished materials limits the comprehensive quantification of value retention achieved by circular strategies. Methodological refinement should first extend data coverage to track material flows in semi-manufactured products, enabling the distinction of component-level value as an intermediate step between materials and final products. Secondly, empirical data on reuse, remanufacturing, and refurbishment rates at the component or product level should be collected to operationalise the circular value framework fully (see Textbox one).
- *Pathway- and sector-specific rebound effects:* The influence of rebound effects on results underscores the need for more detailed and sector-specific data. In the current approach, rebound is considered only for the energy loss pathway; however, it can arise from any form of monetary savings, not solely those linked to energy consumption. Moreover, the magnitude of the rebound effect varies across industries and economic actors (such as households), necessitating sectoral differentiation in future datasets.<sup>65</sup>
- *Indicative estimates of ‘avoidable’ deterioration:* Current national accounting and depreciation measures rely on numerous asset-class assumptions (such as useful life and retirement profiles), while empirical evidence distinguishing curable (preventable) from incurable (unavoidable) depreciation remains limited. Both Organisation for Economic Development (OECD) and SNA literature highlight the sensitivity of consumption of fixed capital (CFC) estimates to outdated or weak empirical foundations.<sup>66</sup> As no global peer-reviewed estimates of the ‘per cent avoidable’ exist, this

<sup>62</sup> Bulle, C., Margni, M., Patouillard, L., Boulay, A.-M., Bourgault, G., De Bruille, V., ... Joliet, O. (2019). Impact world+: A globally regionalized life cycle impact assessment method. *The International Journal of Life Cycle Assessment*, 24(9), 1653–1674. doi:10.1007/s11367-019-01583-0

<sup>63</sup> Hardaker, A., Styles, D., Williams, P., Chadwick, D., & Dandy, N. (2022). A framework for Integrating Ecosystem Services as endpoint impacts in life cycle assessment. *Journal of Cleaner Production*, 370, 133450. doi:10.1016/j.jclepro.2022.133450

<sup>64</sup> CE Delft. (2023). Handboek milieuprijzen 2023. Methodische onderbouwing van kengetallen gebruikt voor waardering van emissies en milieu-impacts. Retrieved from: [CE Delft website](https://www.cedelft.nl/publicaties/handboek-milieuprijzen-2023)

<sup>65</sup> Matraeva, L., Vasiutina, E., Korolkova, N., Maloletko, A., & Kaurova, O. (2022). Identifying rebound effects and formulating more Sustainable Energy Efficiency Policy: A global review and Framework. *Energy Research & Social Science*, 85, 102402. doi:10.1016/j.erss.2021.102402

<sup>66</sup> Pionnier, P., M. Zinni and K. Baret. (2023). Sensitivity of capital and MFP measurement to asset depreciation patterns and initial capital stock estimates. (2023). *OECD Statistics Working Papers*. doi:10.1787/92498395-en. (Explains measurement limits and why single numbers are unreliable.)

analysis relies on sectoral studies and model syntheses addressing related themes, such as the potential of lifetime extension strategies to reduce material use and environmental impacts. While these studies do not directly quantify the effects of such strategies on depreciation, they provide a basis for expert-informed assumptions.

### Assumptions

- *Symmetric relationship between EoL waste flows and retired capital stocks:* This assumption, as the base to estimate residual value, imposes substantial simplifications on the dynamics of material and asset retirement. Physically measured EoL waste does not necessarily correspond in timing or composition to the economic retirement of assets: durable goods may be stored, reused, refurbished, or dismantled over varying lags before final disposal, leading to temporal and material mismatches between stock retirement and waste generation. In addition, recovery rates and informal recycling can cause significant portions of material to re-enter productive loops rather than becoming terminal waste, while data coverage and measurement inconsistencies distort the apparent mass of EoL materials relative to actual stock withdrawals. Consequently, applying a uniform Net Capital Price (NCP) per unit mass of EoL waste risks misestimating the true residual value embedded in retired assets, since the physical outflow of waste may not reflect the economic value realisation associated with asset retirement. A more accurate estimation of residual values in retired assets can be achieved by linking Dynamic Material Flow Analysis (dMFA) or Dynamic Stock Modelling (DSM) with Perpetual Inventory Methods (PIM) used in national accounts.<sup>67</sup> dMFA/DSM capture the evolution of in-use stocks and their retirements over time, using historical inflows and lifetime distributions, which provides a realistic basis for estimating end-of-life material outflows. When combined with PIM, which tracks the accumulation and depreciation of capital at current replacement cost, these models can align physical asset retirement with economic valuation. This integration enables estimation of residual values per asset cohort by connecting material outflows to remaining capital values, ensuring consistency between physical and monetary accounts. At the global level, harmonizing dMFA/DSM and PIM through common lifetime data, material compositions, and investment statistics offers a coherent framework for quantifying the material and economic dimensions of asset retirement.
- *Other minor assumptions included:* Landfilled materials were assumed to have no residual value, and the CFC value from both Exiobase and the PWTs was assumed to fully relate to produced tangible assets, thus excluding non-produced and non-tangible assets

### Complexity/dynamics

- *Current prices and inflation:* The analysis is conducted at current prices, meaning that inflation and changes in relative prices are not factored out. As a result, cross-temporal comparisons may be distorted by nominal price effects rather than reflecting real changes in value. Future research should employ constant prices to isolate the impact of inflation and enable more robust comparisons across time periods, sectors, and regions.

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<sup>67</sup> Pauliuk, S., Wood, R., & Hertwich, E. G. (2014). Dynamic models of fixed capital stocks and their application in Industrial Ecology. *Journal of Industrial Ecology*, 19(1), 104–116. doi:10.1111/jiec.12149

- *Transition costs, adoption dynamics, and lock-in effects:* The estimates presented are not net of transition or adoption costs and therefore represent potential ‘up-to’ values under ideal conditions rather than realised outcomes. Structural path dependencies, technological lock-ins, and premature scrappage or asset retirement may impede or delay the adoption of circular strategies. Similarly, waterbed effects—where efficiency gains in one area induce offsetting increases elsewhere—are not explicitly accounted for. The results should thus be interpreted as ‘what-if at the margin’ scenarios, assuming that all relevant enabling conditions (capital, infrastructure, and skills) are in place.
- *Underlying system changes:* The current framework does not capture broader systemic transformations that may accompany a large-scale transition toward circularity, such as shifts in industrial structure, consumption patterns, trade dynamics, or institutional arrangements. These changes could affect both the magnitude and distribution of value creation and loss, but fall outside the static boundaries of this study.
- *Price responses and macroeconomic linkages:* The model assumes fixed prices and linear relationships, without integrating general equilibrium feedbacks or macroeconomic linkages. Consequently, potential price adjustments, substitution effects, and cross-sectoral spillovers—typically captured in Computable General Equilibrium (CGE) or other macroeconomic models—are not represented. This limits the model’s capacity to assess dynamic interactions between sectors and global markets.
- *Sensitivity and uncertainty analysis:* Although the results are based on the available data and assumptions, a formal sensitivity or uncertainty analysis has not yet been performed. Given the inherent uncertainties in data quality, parameter selection, and modelling assumptions, the findings should be interpreted as indicative estimates rather than exact values. Future work could include systematic sensitivity testing and scenario-based or Monte Carlo analyses to evaluate the robustness of the Value Gap metric under varying conditions.

## Overconsumption

Undoubtedly, substantially greater value can be generated from the current levels of resource extraction. However, efficiency alone does not address the broader challenges that the concept of a circular economy seeks to resolve. Research indicates that the present scale of resource extraction is environmentally unsustainable.<sup>68,69</sup> Merely using existing resources more efficiently would therefore delay, rather than prevent, environmental degradation.

Moreover, the feasibility of achieving sustained absolute decoupling between material use (and environmental impacts more broadly) and economic growth—along with its assumed link to

<sup>68</sup> Schandl, H., Marcos-Martinez, R., West, J., Miatto, A., Lutter, S., Lieber, M., ... Fischer-Kowalski, M. (2024). Global material flows and resource productivity: The 2024 update. *Journal of Industrial Ecology*, 28(6), 2012–2031. doi:10.1111/jiec.13593

<sup>69</sup> Hickel, J., O'Neill, D. W., Fanning, A. L., & Zoomkawala, H. (2022). National responsibility for ecological breakdown: A Fair-shares assessment of Resource Use, 1970–2017. *The Lancet Planetary Health*, 6(4). doi:10.1016/s2542-5196(22)00044-4

higher and more equitable living standards—is increasingly being questioned.<sup>70,71</sup> For these reasons, in addition to improvements in resource efficiency, sufficiency measures are also required, including shifts in consumption patterns and reductions in overconsumption.

This analysis provides a preliminary estimate of the value associated with material overconsumption, conceptualising it as a form of misplaced value rather than an actual loss. Due to the distinct nature of this issue—as well as methodological uncertainties and the ethical considerations surrounding the definition of ‘sufficiency’—overconsumption is not included in the VG metric. Instead, it is treated as an optional analytical lens, rather than a normative prescription.

Overconsumption and its associated economic value are estimated for expenditure related to eight basic human needs. The Decent Living Standard (DLS) framework and related work by Milward-Hopkins et al. (2020)<sup>72</sup> and Vélez-Henao et al. (2023) provide the basis for determining the “basic” level for each human need.<sup>73</sup> Circle Economy defines overconsumption as the amount of material requirements and related monetary expenditure that exceeds the DLSs for each of the basic human needs. The starting point for this calculation is standard and actual service demands for each basic human need. While the DLS values are taken from Milward-Hopkins et al. (2020) and Vélez-Henao et al. (2023), the actuals (that is, current levels of service demands) were compiled through desktop research (**Table fourteen**). Note that waste management and clothing were excluded due to incomplete data.

**Table fourteen.** Values for Decent Living Standards versus actual, by basic human need (purple: overconsumption, blue: underconsumption)

| Item      | Unit           | Decent Living Standard | Actual | Source                                                                                                                                            |
|-----------|----------------|------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Shelter   | m2/(cap*yr)    | 15.0                   | 25.0   | Circle Economy's estimate based on Zhong et al. (2021) <sup>74</sup> and Global Status Report for Buildings and Construction (2024) <sup>75</sup> |
| Nutrition | kcal/(cap*day) | 2084.0                 | 2978.0 | FAOSTAT Food Balance Sheets <sup>76</sup>                                                                                                         |
| Mobility  | km/(cap*yr)    | 8274.0                 | 6800.0 | Circle Economy's estimate based on Our World in                                                                                                   |

<sup>70</sup> Guo, S., Cao, F., & Yang, Y. (2025). Material Footprint and economic growth decoupling toward green development: Comparative analysis of United States, the European Union and the BRICS countries. *Ecological Economics*, 238, 108733. doi:10.1016/j.ecolecon.2025.108733

<sup>71</sup> Groner, T., & Moradi, A. (2024). Sacrificing sustainability for a higher GDP growth rate. *Development and Sustainability in Economics and Finance*, 2–4, 100015. doi:10.1016/j.dsef.2024.100015

<sup>72</sup> Millward-Hopkins, J., Steinberger, J. K., Rao, N. D., & Oswald, Y. (2020). Providing decent living with minimum energy: A global scenario. *Global Environmental Change*, 65, 102168. doi:10.1016/j.gloenvcha.2020.102168

<sup>73</sup> Vélez-Henao, J. A., & Pauliuk, S. (2023). Material requirements of decent living standards. *Environmental Science & Technology*, 57(38), 14206–14217. doi:10.1021/acs.est.3c03957

<sup>74</sup> Zhong, X., Hu, M., Deetman, S., Steubing, B., Lin, H. X., Hernandez, G. A., ... Behrens, P. (2021). Global Greenhouse gas emissions from residential and commercial building materials and mitigation strategies to 2060. *Nature Communications*, 12(1). doi:10.1038/s41467-021-26212-z

<sup>75</sup> UNEP. (2024). (2024). *2023 Global Status Report for Buildings and Construction: Beyond Foundations - Mainstreaming Sustainable Solutions to Cut Emissions from the Buildings Sector*. doi:10.59117/20.500.11822/45095

<sup>76</sup> FAO. (2025). Food Balances (2010-). In: FAOSTAT. Rome. [Cited, September 2023]. Retrieved from: [FAO website](https://www.fao.org/faostat/en/#data/FS)

|                     |                      |      |      |                                                                                                                                         |
|---------------------|----------------------|------|------|-----------------------------------------------------------------------------------------------------------------------------------------|
|                     |                      |      |      | Data, <sup>77,78</sup> UIC, <sup>79</sup> ACI World-ICAO <sup>80</sup> and ITF (2023) <sup>81</sup>                                     |
| Hygiene             | L<br>water/(cap*day) | 50.0 | 70.4 | McCarton et al. (2022) <sup>82</sup>                                                                                                    |
| Education           | m2/(cap*yr)          | 2.5  | 1.3  | Circle Economy's estimate based on Global Status Report for Buildings and Construction (2024)                                           |
| Healthcare          | m2/(cap*yr)          | 1.6  | 0.6  | Circle Economy's estimate based on Sen-Crowe et al. (2021) <sup>83</sup> and Global Status Report for Buildings and Construction (2024) |
| Collective services | m2/(cap*yr)          | 4.7  | 3.5  | Circle Economy's estimate based on Global Status Report for Buildings and Construction (2024)                                           |
| Communication       | phone/(adult*yr)     | 0.8  | 1.2  | Circle Economy's estimate based on ITU <sup>84</sup> and GSMA <sup>85</sup>                                                             |
|                     | laptop/(adult*yr)    | 0.3  | 0.6  | Circle Economy's estimate based on Canalysis <sup>86</sup>                                                                              |
|                     | router/(adult*yr)    | 0.3  | 0.6  |                                                                                                                                         |

Circle Economy utilises the process-based Life Cycle Inventory compiled by Vélez-Henao et al. (2023), which employs ecoinvent 3.8 ('allocation, cut-off by classification'), to assign direct material requirements associated with each basic need service demand and map them to Exiobase 3.8.2 industries. For each industry, the ratio between actual and standard service demand is calculated across all basic human needs. For instance, the ecoinvent activity 'market for cement, Portland' is mapped to the Exiobase industries 'manufacturing of cement, lime and plaster', 'construction' and 'real estate activities' (see Table A1 in the Annexe). Construction and real estate activities are also included to account for indirect flows of services involved in the construction industry, not just the construction materials. Cement use, expressed in kilograms per capita, is summed across the different basic needs for both the inventories related to the standard and actual levels of service demand. The ratio between the overall cement use required to satisfy actual versus standard service demand is intended as the consumption multiplier for expenditures on cement products, construction, and real estate services. A multiplier larger than one means that actual expenditure is larger than the standard, and thus

<sup>77</sup> Our World in Data. (2025). *Passenger-kilometers by air* [Dataset]. Data adapted from International Civil Aviation Organization, International Transport Forum, and United Nations Conference on Trade and Development.

<sup>78</sup> Our World in Data. (2025). *Passenger-kilometers by rail* [Dataset]. Data processed by Our World in Data from International Union of Railways and OECD, via World Bank, *World Development Indicators* [Original data].

<sup>79</sup> International Union of Railways. (n.d.). RAIL Information System and Analyses (RAILISA) — UIC statistics platform [Statistical database]. Retrieved from: [Railisa website](#)

<sup>80</sup> Airports Council International (ACI) World and the International Civil Aviation Organization (ICAO). (2025). Joint Passenger Traffic Report, Trends, and Outlook. Retrieved from: [ACI website](#)

<sup>81</sup> OECD. (2023). *ITF Transport Outlook 2023*. OECD Publishing, Paris. doi:10.1787/b6cc9ad5-en

<sup>82</sup> McCarton, L., O'Hogain, S., & Nasr, A. (2022). Special issue: NBS for resilient cities and communities — how understanding the micro components of domestic water consumption can provide multiple water uses to facilitate a transition to a circular economy of water. *Nature-Based Solutions*, 2, 100028. doi:10.1016/j.nbsj.2022.100028

<sup>83</sup> Sen-Crowe, B., Sutherland, M., McKenney, M., & Elkbulli, A. (2021). A closer look into global hospital beds capacity and resource shortages during the COVID-19 pandemic. *Journal of Surgical Research*, 260, 56–63. doi:10.1016/j.jss.2020.11.062

<sup>84</sup> International Telecommunication Union (ITU). (2021). *Measuring digital development: Facts and figures 2021* (ISBN 978-92-61-35401-5). International Telecommunication Union. Retrieved from: [ITU website](#)

<sup>85</sup> GSMA. (2022). *The Mobile Economy 2022*. GSMA Intelligence. Retrieved from: [GSMA website](#)

<sup>86</sup> Canalis. (2022, January 12). *Global PC shipments pass 340 million in 2021 and 2022 is set to be even stronger*. Retrieved from: [Canalis website](#)

there is overconsumption and vice versa. The consumption multiplier is used to calculate the share of final demand that constitutes over- or under-consumption as follows:

$$\theta_{con} = \sum_{i=1}^n Y_i * (\alpha_{cons,i} - 1)$$

Where  $\theta_{con}$  is the value loss related to overconsumption,  $Y$  is the total final demand vector from Exiobase,  $\alpha_{cons}$  is the consumption multiplier, and subscript  $i$  represents each Exiobase industry.

According to this approach, overconsumption is valued at €7,022 million, corresponding to about 9% of global NDP. Underconsumption, occurring for material consumption related to mobility, education, healthcare and collective services, is estimated at €634 million. It should be noted that this is just a rough approximation of overconsumption, which is estimated at just a fraction (about one-third) of total final demand that relates to the material economy.

# Annexe

Table A1. Exiobase industries mapping table (Circle Economy's elaboration)

| Industry code | Industry name (Exiobase 3.9.4)                                                                      | Activity Name (Ecoinvent 3.8)                      |
|---------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| A_PARI        | Cultivation of paddy rice                                                                           | market for rice, basmati                           |
| A_WHEA        | Cultivation of wheat                                                                                | market for wheat grain, organic                    |
| A_OCER        | Cultivation of cereal grains nec                                                                    | market for lentil                                  |
| A_FVEG        | Cultivation of vegetables, fruit, nuts                                                              | market for tomato, fresh grade - market for potato |
| A_OILS        | Cultivation of oil seeds                                                                            | market for vegetable oil, refined                  |
| A_SUGB        | Cultivation of sugar cane, sugar beet                                                               | market for sugar, from sugarcane                   |
| A_FIBR        | Cultivation of plant-based fibers                                                                   |                                                    |
| A_OTCR        | Cultivation of crops nec                                                                            |                                                    |
| A_CATL        | Cattle farming                                                                                      | market for red meat, live weight                   |
| A_PIGS        | Pigs farming                                                                                        | market for red meat, live weight                   |
| A_PLTR        | Poultry farming                                                                                     | market for chicken for slaughtering, live weight   |
| A_OMEA        | Meat animals nec                                                                                    |                                                    |
| A_OANP        | Animal products nec                                                                                 |                                                    |
| A_MILK        | Raw milk                                                                                            | market for cow milk                                |
| A_WOOL        | Wool, silk-worm cocoons                                                                             |                                                    |
| A_MANC        | Manure treatment (conventional), storage and land application                                       |                                                    |
| A_MANB        | Manure treatment (biogas), storage and land application                                             |                                                    |
| A_FORE        | Forestry, logging and related service activities (02)                                               |                                                    |
| A_FISH        | Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05) |                                                    |
| A_COAL        | Mining of coal and lignite; extraction of peat (10)                                                 |                                                    |
| A_COIL        | Extraction of crude petroleum and services related to crude oil extraction, excluding surveying     |                                                    |
| A_GASE        | Extraction of natural gas and services related to natural gas extraction, excluding surveying       | market group for natural gas, high pressure        |
| A_OGPL        | Extraction, liquefaction, and regasification of other petroleum and gaseous materials               |                                                    |
| A_ORAN        | Mining of uranium and thorium ores (12)                                                             |                                                    |
| A_IRON        | Mining of iron ores                                                                                 |                                                    |
| A_COPO        | Mining of copper ores and concentrates                                                              |                                                    |

|        |                                                                                                                                      |                                                                                                                                                                                                                      |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A_NIKO | Mining of nickel ores and concentrates                                                                                               |                                                                                                                                                                                                                      |
| A_ALUO | Mining of aluminium ores and concentrates                                                                                            |                                                                                                                                                                                                                      |
| A_PREO | Mining of precious metal ores and concentrates                                                                                       |                                                                                                                                                                                                                      |
| A_LZTO | Mining of lead, zinc and tin ores and concentrates                                                                                   |                                                                                                                                                                                                                      |
| A_ONFO | Mining of other non-ferrous metal ores and concentrates                                                                              |                                                                                                                                                                                                                      |
| A_STON | Quarrying of stone                                                                                                                   |                                                                                                                                                                                                                      |
| A_SDCL | Quarrying of sand and clay                                                                                                           |                                                                                                                                                                                                                      |
| A_CHMF | Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c.                                    |                                                                                                                                                                                                                      |
| A_PCAT | Processing of meat cattle                                                                                                            | market for red meat, live weight                                                                                                                                                                                     |
| A_PPIG | Processing of meat pigs                                                                                                              | market for red meat, live weight                                                                                                                                                                                     |
| A_PPLT | Processing of meat poultry                                                                                                           | market for chicken for slaughtering, live weight                                                                                                                                                                     |
| A_POME | Production of meat products nec                                                                                                      | market for red meat, live weight                                                                                                                                                                                     |
| A_VOIL | Processing vegetable oils and fats                                                                                                   |                                                                                                                                                                                                                      |
| A_DAIR | Processing of dairy products                                                                                                         | market for cow milk                                                                                                                                                                                                  |
| A_RICE | Processed rice                                                                                                                       | market for rice, basmati                                                                                                                                                                                             |
| A_SUGR | Sugar refining                                                                                                                       |                                                                                                                                                                                                                      |
| A_OFOD | Processing of Food products nec                                                                                                      |                                                                                                                                                                                                                      |
| A_BEVR | Manufacture of beverages                                                                                                             |                                                                                                                                                                                                                      |
| A_FSHF | Manufacture of fish products                                                                                                         |                                                                                                                                                                                                                      |
| A_TOBC | Manufacture of tobacco products (16)                                                                                                 |                                                                                                                                                                                                                      |
| A_TEXT | Manufacture of textiles (17)                                                                                                         |                                                                                                                                                                                                                      |
| A_GARM | Manufacture of wearing apparel; dressing and dyeing of fur (18)                                                                      |                                                                                                                                                                                                                      |
| A_LETH | Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19)                               |                                                                                                                                                                                                                      |
| A_WOOD | Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20) | market for sawnwood, beam, softwood, raw, dried (u=10%)                                                                                                                                                              |
| A_WOOW | Re-processing of secondary wood material into new wood material                                                                      |                                                                                                                                                                                                                      |
| A_PULP | Pulp                                                                                                                                 |                                                                                                                                                                                                                      |
| A_PAPR | Re-processing of secondary paper into new pulp                                                                                       |                                                                                                                                                                                                                      |
| A_PAPE | Paper                                                                                                                                | market for kraft paper                                                                                                                                                                                               |
| A_MDIA | Publishing, printing and reproduction of recorded media (22)                                                                         |                                                                                                                                                                                                                      |
| A_COKE | Manufacture of coke oven products                                                                                                    |                                                                                                                                                                                                                      |
| A_REFN | Petroleum Refinery                                                                                                                   | market group for natural gas, high pressure<br>- market for transport, passenger, motor scooter - market for transport, passenger car, medium size, natural gas, EURO 5 - market for transport, regular bus - market |

|        |                                                                                       |                                                                                                                                                           |
|--------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |                                                                                       | for transport, passenger train - market for transport, passenger aircraft, medium haul                                                                    |
| A_NUCF | Processing of nuclear fuel                                                            |                                                                                                                                                           |
| A_PLAS | Plastics, basic                                                                       |                                                                                                                                                           |
| A_PLAW | Re-processing of secondary plastic into new plastic                                   |                                                                                                                                                           |
| A_NFER | N-fertiliser                                                                          |                                                                                                                                                           |
| A_PFER | P- and other fertiliser                                                               |                                                                                                                                                           |
| A_CHEM | Chemicals nec                                                                         |                                                                                                                                                           |
| A_RUBP | Manufacture of rubber and plastic products (25)                                       |                                                                                                                                                           |
| A_GLAS | Manufacture of glass and glass products                                               |                                                                                                                                                           |
| A_GLAW | Re-processing of secondary glass into new glass                                       |                                                                                                                                                           |
| A_CRMC | Manufacture of ceramic goods                                                          |                                                                                                                                                           |
| A_BRIK | Manufacture of bricks, tiles and construction products, in baked clay                 | market for clay brick                                                                                                                                     |
| A_CMNT | Manufacture of cement, lime and plaster                                               | market for cement, Portland - market for concrete, 30MPa                                                                                                  |
| A_ASHW | Re-processing of ash into clinker                                                     |                                                                                                                                                           |
| A_ONMM | Manufacture of other non-metallic mineral products n.e.c.                             |                                                                                                                                                           |
| A_STEL | Manufacture of basic iron and steel and of ferro-alloys and first products thereof    | market for steel, unalloyed                                                                                                                               |
| A_STEW | Re-processing of secondary steel into new steel                                       |                                                                                                                                                           |
| A_PREM | Precious metals production                                                            |                                                                                                                                                           |
| A_PREW | Re-processing of secondary precious metals into new precious metals                   |                                                                                                                                                           |
| A_ALUM | Aluminium production                                                                  |                                                                                                                                                           |
| A_ALUW | Re-processing of secondary aluminium into new aluminium                               |                                                                                                                                                           |
| A_LZTP | Lead, zinc and tin production                                                         |                                                                                                                                                           |
| A_LZTW | Re-processing of secondary lead into new lead, zinc and tin                           |                                                                                                                                                           |
| A_COPP | Copper production                                                                     |                                                                                                                                                           |
| A_COPW | Re-processing of secondary copper into new copper                                     |                                                                                                                                                           |
| A_ONFM | Other non-ferrous metal production                                                    |                                                                                                                                                           |
| A_ONFW | Re-processing of secondary other non-ferrous metals into new other non-ferrous metals |                                                                                                                                                           |
| A_METC | Casting of metals                                                                     |                                                                                                                                                           |
| A_FABM | Manufacture of fabricated metal products, except machinery and equipment (28)         |                                                                                                                                                           |
| A_MACH | Manufacture of machinery and equipment n.e.c. (29)                                    |                                                                                                                                                           |
| A_OFMA | Manufacture of office machinery and computers (30)                                    |                                                                                                                                                           |
| A_ELMA | Manufacture of electrical machinery and apparatus n.e.c. (31)                         | market for refrigerator - market for microwave oven - market for cookstove - market for washing machine - market for consumer electronics, mobile device, |

|        |                                                                                    |                                                                                                                                                                                                                                               |
|--------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |                                                                                    | smartphone                                                                                                                                                                                                                                    |
| A_RATV | Manufacture of radio, television and communication equipment and apparatus (32)    | market for computer, laptop - market for router, internet                                                                                                                                                                                     |
| A_MEIN | Manufacture of medical, precision and optical instruments, watches and clocks (33) |                                                                                                                                                                                                                                               |
| A_MOTO | Manufacture of motor vehicles, trailers and semi-trailers (34)                     | market for transport, passenger, bicycle - market for transport, passenger, motor scooter - market for transport, passenger car, medium size, natural gas, EURO 5 - market for transport, regular bus - market for transport, passenger train |
| A_OTRE | Manufacture of other transport equipment (35)                                      | market for transport, passenger aircraft, medium haul                                                                                                                                                                                         |
| A_FURN | Manufacture of furniture; manufacturing n.e.c. (36)                                |                                                                                                                                                                                                                                               |
| A_RYMS | Recycling of waste and scrap                                                       |                                                                                                                                                                                                                                               |
| A_BOTW | Recycling of bottles by direct reuse                                               |                                                                                                                                                                                                                                               |
| A_POWC | Production of electricity by coal                                                  | market group for electricity, low voltage                                                                                                                                                                                                     |
| A_POWG | Production of electricity by gas                                                   |                                                                                                                                                                                                                                               |
| A_POWN | Production of electricity by nuclear                                               |                                                                                                                                                                                                                                               |
| A_POWH | Production of electricity by hydro                                                 |                                                                                                                                                                                                                                               |
| A_POWW | Production of electricity by wind                                                  |                                                                                                                                                                                                                                               |
| A_POWP | Production of electricity by petroleum and other oil derivatives                   |                                                                                                                                                                                                                                               |
| A_POWB | Production of electricity by biomass and waste                                     |                                                                                                                                                                                                                                               |
| A_POWS | Production of electricity by solar photovoltaic                                    |                                                                                                                                                                                                                                               |
| A_POWE | Production of electricity by solar thermal                                         |                                                                                                                                                                                                                                               |
| A_POWO | Production of electricity by tide, wave, ocean                                     |                                                                                                                                                                                                                                               |
| A_POWM | Production of electricity by Geothermal                                            |                                                                                                                                                                                                                                               |
| A_POWZ | Production of electricity nec                                                      |                                                                                                                                                                                                                                               |
| A_POWT | Transmission of electricity                                                        |                                                                                                                                                                                                                                               |
| A_POWD | Distribution and trade of electricity                                              |                                                                                                                                                                                                                                               |
| A_GASD | Manufacture of gas; distribution of gaseous fuels through mains                    | market group for natural gas, high pressure                                                                                                                                                                                                   |
| A_HWAT | Steam and hot water supply                                                         |                                                                                                                                                                                                                                               |
| A_WATR | Collection, purification and distribution of water (41)                            | market group for tap water                                                                                                                                                                                                                    |
| A_CONS | Construction (45)                                                                  | market for cement, Portland - market for kraft paper - market for sawnwood, beam, softwood, raw, dried (u=10%) - market for concrete, 30MPa - market for steel, unalloyed - market for clay brick                                             |
| A_CONW | Re-processing of secondary construction material into aggregates                   |                                                                                                                                                                                                                                               |
| A_TDMO | Sale, maintenance, repair of motor vehicles, motor vehicles                        |                                                                                                                                                                                                                                               |

|        |                                                                                                     |                                                                                                                                                                                                   |
|--------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | parts, motorcycles, motor cycles parts and accessories                                              |                                                                                                                                                                                                   |
| A_TDFU | Retail sale of automotive fuel                                                                      |                                                                                                                                                                                                   |
| A_TDWH | Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)                 |                                                                                                                                                                                                   |
| A_TDRT | Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52) |                                                                                                                                                                                                   |
| A_HORE | Hotels and restaurants (55)                                                                         |                                                                                                                                                                                                   |
| A_TRAI | Transport via railways                                                                              | market for transport, passenger train                                                                                                                                                             |
| A_TLND | Other land transport                                                                                | market for transport, regular bus                                                                                                                                                                 |
| A_TPIP | Transport via pipelines                                                                             |                                                                                                                                                                                                   |
| A_TWAS | Sea and coastal water transport                                                                     |                                                                                                                                                                                                   |
| A_TWAI | Inland water transport                                                                              |                                                                                                                                                                                                   |
| A_TAIR | Air transport (62)                                                                                  | market for transport, passenger aircraft, medium haul                                                                                                                                             |
| A_TAUX | Supporting and auxiliary transport activities; activities of travel agencies (63)                   |                                                                                                                                                                                                   |
| A_PTEL | Post and telecommunications (64)                                                                    |                                                                                                                                                                                                   |
| A_FINT | Financial intermediation, except insurance and pension funding (65)                                 |                                                                                                                                                                                                   |
| A_FINS | Insurance and pension funding, except compulsory social security (66)                               |                                                                                                                                                                                                   |
| A_FAUX | Activities auxiliary to financial intermediation (67)                                               |                                                                                                                                                                                                   |
| A_REAL | Real estate activities (70)                                                                         | market for cement, Portland - market for kraft paper - market for sawnwood, beam, softwood, raw, dried (u=10%) - market for concrete, 30MPa - market for steel, unalloyed - market for clay brick |
| A_MARE | Renting of machinery and equipment without operator and of personal and household goods (71)        |                                                                                                                                                                                                   |
| A_COMP | Computer and related activities (72)                                                                |                                                                                                                                                                                                   |
| A_RESD | Research and development (73)                                                                       |                                                                                                                                                                                                   |
| A_OBUS | Other business activities (74)                                                                      |                                                                                                                                                                                                   |
| A_PADF | Public administration and defence; compulsory social security (75)                                  |                                                                                                                                                                                                   |
| A_EDUC | Education (80)                                                                                      |                                                                                                                                                                                                   |
| A_HEAL | Health and social work (85)                                                                         |                                                                                                                                                                                                   |
| A_INCF | Incineration of waste: Food                                                                         |                                                                                                                                                                                                   |
| A_INCP | Incineration of waste: Paper                                                                        |                                                                                                                                                                                                   |
| A_INCL | Incineration of waste: Plastic                                                                      |                                                                                                                                                                                                   |
| A_INCM | Incineration of waste: Metals and Inert materials                                                   |                                                                                                                                                                                                   |
| A_INCT | Incineration of waste: Textiles                                                                     |                                                                                                                                                                                                   |
| A_INCW | Incineration of waste: Wood                                                                         |                                                                                                                                                                                                   |

|        |                                                          |  |
|--------|----------------------------------------------------------|--|
| A_INCO | Incineration of waste: Oil/Hazardous waste               |  |
| A_BIOF | Biogasification of food waste, incl. land application    |  |
| A_BIOP | Biogasification of paper, incl. land application         |  |
| A_BIOS | Biogasification of sewage sludge, incl. land application |  |
| A_COMF | Composting of food waste, incl. land application         |  |
| A_COMW | Composting of paper and wood, incl. land application     |  |
| A_WASF | Waste water treatment, food                              |  |
| A_WASO | Waste water treatment, other                             |  |
| A_LANF | Landfill of waste: Food                                  |  |
| A_LANP | Landfill of waste: Paper                                 |  |
| A_LANL | Landfill of waste: Plastic                               |  |
| A_LANI | Landfill of waste: Inert/metal/hazardous                 |  |
| A_LANT | Landfill of waste: Textiles                              |  |
| A_LANW | Landfill of waste: Wood                                  |  |
| A_ORGA | Activities of membership organisation n.e.c. (91)        |  |
| A_RECR | Recreational, cultural and sporting activities (92)      |  |
| A_OSER | Other service activities (93)                            |  |
| A_PRRH | Private households with employed persons (95)            |  |
| A_EXTO | Extra-territorial organizations and bodies               |  |

Table A2. HS6 codes for raw materials and semi-finished product prices (Circle Economy's elaboration)

| HS6 codes                                                                               | Material   | Stage         |
|-----------------------------------------------------------------------------------------|------------|---------------|
| 440311 - 440399                                                                         | Solidwood  | Raw material  |
| 440410 - 441300                                                                         | Solidwood  | Semi-finished |
| 440311 - 440399                                                                         | Paper      | Raw material  |
| 480210 - 481190 (excl. 480300)                                                          | Paper      | Semi-finished |
| 391211, 391212, 391610, 391620, 391690, 400110 - 400510 (excl. 400130), 540211 - 540600 | Plastics   | Raw material  |
| 391710 - 392190, 400520 - 401039                                                        | Plastics   | Semi-finished |
| 720510, 720529, 720610, 720690                                                          | Iron/Steel | Raw material  |
| 720711 - 732090 (excl. 730300, 730711, 731010)                                          | Iron/Steel | Semi-finished |
| 760110, 760120                                                                          | Aluminum   | Raw material  |
| 760421 - 760900                                                                         | Aluminum   | Semi-finished |

|                                            |                                   |               |
|--------------------------------------------|-----------------------------------|---------------|
| 740200 - 740500 (excl. 740400)             | Copper                            | Raw material  |
| 740710 - 741510                            | Copper                            | Semi-finished |
| Average of iron/steel, aluminum and copper | Other metals                      | Raw material  |
| Average of iron/steel, aluminum and copper | Other metals                      | Semi-finished |
| 252100, 252310 - 252390                    | Concrete                          | Raw material  |
| 681011 - 681099                            | Concrete                          | Semi-finished |
| 271320, 271490, 271500                     | Asphalt                           | Raw material  |
| 680710, 680790                             | Asphalt                           | Semi-finished |
| 690100                                     | Bricks                            | Raw material  |
| 690210, 690220, 690290, 690410, 690490     | Bricks                            | Semi-finished |
| 251710                                     | Aggregate - downcycled and virgin | Raw material  |
| 251710                                     | Aggregate - downcycled and virgin | Semi-finished |
| 700210 - 700800                            | Flat glass                        | Raw material  |
| 700210 - 700800                            | Flat glass                        | Semi-finished |
| 700210 - 700800                            | Container glass                   | Raw material  |
| 701333 - 701399                            | Container glass                   | Semi-finished |

**Table A3. BACI products, FAOSTAT Items mapping table  
(Circle Economy's elaboration)**

| <b>BACI code</b> | <b>BACI description</b>                                                                               | <b>Item FAOSTAT</b> |
|------------------|-------------------------------------------------------------------------------------------------------|---------------------|
| 020110           | Meat: of bovine animals, carcasses and half-carcasses, fresh or chilled                               | Bovine Meat         |
| 020120           | Meat: of bovine animals, cuts with bone in (excluding carcasses and half-carcasses), fresh or chilled | Bovine Meat         |
| 020130           | Meat: of bovine animals, boneless cuts, fresh or chilled                                              | Bovine Meat         |
| 020210           | Meat: of bovine animals, carcasses and half-carcasses, frozen                                         | Bovine Meat         |
| 020220           | Meat: of bovine animals, cuts with bone in (excluding carcasses and half-carcasses), frozen           | Bovine Meat         |
| 020230           | Meat: of bovine animals, boneless cuts, frozen                                                        | Bovine Meat         |
| 020311           | Meat: of swine, carcasses and half-carcasses, fresh or chilled                                        | Pigmeat             |
| 020312           | Meat: of swine, hams, shoulders and cuts thereof, with bone in, fresh or chilled                      | Pigmeat             |
| 020319           | Meat: of swine, n.e.c. in item no. 0203.1, fresh or chilled                                           | Pigmeat             |

| BACI code | BACI description                                                                                                | Item FAOSTAT       |
|-----------|-----------------------------------------------------------------------------------------------------------------|--------------------|
| 020321    | Meat: of swine, carcasses and half-carcasses, frozen                                                            | Pigmeat            |
| 020322    | Meat: of swine, hams, shoulders and cuts thereof, with bone in, frozen                                          | Pigmeat            |
| 020329    | Meat: of swine, n.e.c. in item no. 0203.2, frozen                                                               | Pigmeat            |
| 020410    | Meat: of sheep, lamb carcasses and half-carcasses, fresh or chilled                                             | Mutton & Goat Meat |
| 020421    | Meat: of sheep, carcasses and half-carcasses (excluding carcasses and half-carcasses of lamb), fresh or chilled | Mutton & Goat Meat |
| 020422    | Meat: of sheep (including lamb), cuts with bone in (excluding carcasses and half-carcasses), fresh or chilled   | Mutton & Goat Meat |
| 020423    | Meat: of sheep (including lamb), boneless cuts, fresh or chilled                                                | Mutton & Goat Meat |
| 020430    | Meat: of sheep, lamb carcasses and half-carcasses, frozen                                                       | Mutton & Goat Meat |
| 020441    | Meat: of sheep, carcasses and half-carcasses (excluding carcasses and half-carcasses of lamb), frozen           | Mutton & Goat Meat |
| 020442    | Meat: of sheep (including lamb), cuts with bone in (excluding carcasses and half-carcasses), frozen             | Mutton & Goat Meat |
| 020443    | Meat: of sheep (including lamb), boneless cuts, frozen                                                          | Mutton & Goat Meat |
| 020450    | Meat: of goats, fresh, chilled or frozen                                                                        | Mutton & Goat Meat |
| 020500    | Meat: of horses, asses, mules or hinnies, fresh, chilled or frozen                                              | Meat, Other        |
| 020610    | Offal, edible: of bovine animals, fresh or chilled                                                              | Bovine Meat        |
| 020621    | Offal, edible: of bovine animals, tongues, frozen                                                               | Bovine Meat        |
| 020622    | Offal, edible: of bovine animals, livers, frozen                                                                | Bovine Meat        |
| 020629    | Offal, edible: of bovine animals, (other than tongues and livers), frozen                                       | Bovine Meat        |
| 020680    | Offal, edible: of sheep, goats, horses, asses, mules or hinnies, fresh or chilled                               | Mutton & Goat Meat |
| 020690    | Offal, edible: of sheep, goats, horses, asses, mules or hinnies, frozen                                         | Mutton & Goat Meat |
| 020711    | Meat and edible offal: of fowls of the species Gallus domesticus, not cut in pieces, fresh or chilled           | Offals, Edible     |
| 020712    | Meat and edible offal: of fowls of the species Gallus domesticus, not cut in pieces, frozen                     | Offals, Edible     |
| 020713    | Meat and edible offal: of fowls of the species Gallus domesticus, cuts and offal, fresh or chilled              | Offals, Edible     |
| 020714    | Meat and edible offal: of fowls of the species Gallus domesticus, cuts and offal, frozen                        | Offals, Edible     |
| 020724    | Meat and edible offal: of turkeys, not cut in pieces, fresh or chilled                                          | Offals, Edible     |
| 020725    | Meat and edible offal: of turkeys, not cut in pieces, frozen                                                    | Offals, Edible     |
| 020726    | Meat and edible offal: of turkeys, cuts and offal, fresh or chilled                                             | Offals, Edible     |
| 020727    | Meat and edible offal: of turkeys, cuts and offal, frozen                                                       | Offals, Edible     |
| 020741    | Meat and edible offal: of ducks, not cut in pieces, fresh or chilled                                            | Offals, Edible     |

| BACI code | BACI description                                                                                                                                                                                                                                              | Item FAOSTAT          |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 020742    | Meat and edible offal: of ducks, not cut in pieces, frozen                                                                                                                                                                                                    | Offals, Edible        |
| 020743    | Meat and edible offal: of ducks, fatty livers (foie gras), fresh or chilled                                                                                                                                                                                   | Offals, Edible        |
| 020744    | Meat and edible offal: of ducks, cuts and offal, excluding fatty livers, fresh or chilled                                                                                                                                                                     | Offals, Edible        |
| 020745    | Meat and edible offal: of ducks, cuts and offal, excluding fatty livers, frozen                                                                                                                                                                               | Offals, Edible        |
| 020751    | Meat and edible offal: of geese, not cut in pieces, fresh or chilled                                                                                                                                                                                          | Offals, Edible        |
| 020752    | Meat and edible offal: of geese, not cut in pieces, frozen                                                                                                                                                                                                    | Offals, Edible        |
| 020753    | Meat and edible offal: of geese, fatty livers (foie gras), fresh or chilled                                                                                                                                                                                   | Offals, Edible        |
| 020754    | Meat and edible offal: of geese, cuts and offal, excluding fatty livers, fresh or chilled                                                                                                                                                                     | Offals, Edible        |
| 020755    | Meat and edible offal: of geese, cuts and offal, excluding fatty livers, frozen                                                                                                                                                                               | Offals, Edible        |
| 020760    | Meat and edible offal: of guinea fowls, fresh, chilled or frozen                                                                                                                                                                                              | Offals, Edible        |
| 020810    | Meat and edible meat offal: of rabbits or hares, fresh, chilled or frozen                                                                                                                                                                                     | Offals, Edible        |
| 020830    | Meat and edible meat offal: of primates, fresh, chilled or frozen                                                                                                                                                                                             | Offals, Edible        |
| 020840    | Meat and edible meat offal: of whales, dolphins and porpoises (mammals of the order Cetacea): of manatees and dugongs (mammals of the order Sirenia): of seals, sea lions and walruses (mammals of the suborder Pinnipedia), fresh, chilled or frozen         | Meat, Aquatic Mammals |
| 020850    | Meat and edible meat offal: of reptiles (including snakes and turtles), fresh, chilled or frozen                                                                                                                                                              | Offals, Edible        |
| 020860    | Meat and edible meat offal: of camels and other camelids (Camelidae), fresh, chilled or frozen                                                                                                                                                                | Offals, Edible        |
| 020890    | Meat and edible meat offal: n.e.c. in chapter 2, fresh, chilled or frozen                                                                                                                                                                                     | Offals, Edible        |
| 020910    | Fat: pig fat, free of lean meat, not rendered or otherwise extracted, fresh, chilled, frozen, salted, in brine, dried or smoked                                                                                                                               | Fats, Animals, Raw    |
| 020990    | Fat: poultry fat, not rendered or otherwise extracted, fresh, chilled, frozen, salted, in brine, dried or smoked                                                                                                                                              | Fats, Animals, Raw    |
| 021011    | Meat: salted, in brine, dried or smoked, of swine, hams, shoulders and cuts thereof, with bone in                                                                                                                                                             | Pigmeat               |
| 021012    | Meat: salted, in brine, dried or smoked, of swine, bellies (streaky) and cuts thereof                                                                                                                                                                         | Pigmeat               |
| 021019    | Meat: salted in brine, dried or smoked, of swine, n.e.c. in item no. 0210.1                                                                                                                                                                                   | Pigmeat               |
| 021020    | Meat: salted, in brine, dried or smoked, of bovine animals                                                                                                                                                                                                    | Bovine Meat           |
| 021091    | Meat and edible meat offal: salted, in brine, dried or smoked, and edible flours and meals of meat or meat offal, of primates                                                                                                                                 | Meat, Other           |
| 021092    | Meat and edible meat offal: salted, in brine, dried or smoked: edible flours, meals of meat or meat offal, of whales, dolphins, porpoises (of order Cetacea): manatees, dugongs (of order Sirenia): seals, sea lions, and walruses (of suborder Pinnipedia)   | Meat, Other           |
| 021093    | Meat and edible meat offal: salted, in brine, dried or smoked, and edible flours and meals of meat or meat offal, of reptiles (including snakes and turtles)                                                                                                  | Meat, Other           |
| 021099    | Meat and edible meat offal: salted, in brine, dried or smoked, and edible flours and meals of meat or meat offal, other than of primates, whales, dolphins, porpoises, manatees, dugongs, seals, sea lions, walruses, reptiles (including snakes and turtles) | Meat, Other           |

| BACI code | BACI description                                                                                                                                                                                                                                                                                                      | Item FAOSTAT    |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 030211    | Fish: fresh or chilled, trout ( <i>Salmo trutta</i> , <i>Oncorhynchus mykiss</i> , <i>Oncorhynchus clarki</i> , <i>Oncorhynchus aguabonita</i> , <i>Oncorhynchus gilae</i> , <i>Oncorhynchus apache</i> and <i>Oncorhynchus chrysogaster</i> ), excluding fillets, fish meat of 0304, and edible fish offal of 0302.9 | Freshwater Fish |
| 030213    | Fish: fresh or chilled, Pacific salmon ( <i>Oncorhynchus nerka</i> , <i>Oncorhynchus gorbusha</i> , <i>Oncorhynchus keta</i> , <i>Oncorhynchus tshawytscha</i> , <i>Oncorhynchus kisutch</i> , <i>Oncorhynchus masou</i> , <i>Oncorhynchus rhodurus</i> ), not fillets, meat of 0304, and edible fish offal of 0302.9 | Freshwater Fish |
| 030214    | Fish: fresh or chilled, Atlantic salmon ( <i>Salmo salar</i> ) and Danube salmon ( <i>Hucho hucho</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                | Freshwater Fish |
| 030219    | Fish: fresh or chilled, salmonidae, n.e.c. in item no. 0302.1, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                          | Freshwater Fish |
| 030221    | Fish: fresh or chilled, halibut ( <i>Reinhardtius hippoglossoides</i> , <i>Hippoglossus hippoglossus</i> , <i>Hippoglossus stenolepis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                            | Freshwater Fish |
| 030222    | Fish: fresh or chilled, plaice ( <i>Pleuronectes platessa</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                        | Demersal Fish   |
| 030223    | Fish: fresh or chilled, sole ( <i>Solea</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                                      | Demersal Fish   |
| 030224    | Fish: fresh or chilled, turbot ( <i>Psetta maxima</i> , <i>Scophthalmidae</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                        | Demersal Fish   |
| 030229    | Fish: fresh or chilled, flat fish, n.e.c. in item no. 0302.2, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                           | Demersal Fish   |
| 030231    | Fish: fresh or chilled, albacore or longfinned tunas ( <i>Thunnus alalunga</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                       | Demersal Fish   |
| 030232    | Fish: fresh or chilled, yellowfin tunas ( <i>Thunnus albacares</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                   | Pelagic Fish    |
| 030233    | Fish: fresh or chilled, skipjack tuna (stripe-bellied bonito) ( <i>Katsuwonus pelamis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                            | Pelagic Fish    |
| 030234    | Fish: fresh or chilled, bigeye tunas ( <i>Thunnus obesus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                         | Pelagic Fish    |
| 030235    | Fish: fresh or chilled, Atlantic and Pacific bluefin tunas ( <i>Thunnus thynnus</i> , <i>Thunnus orientalis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                      | Pelagic Fish    |
| 030236    | Fish: fresh or chilled, southern bluefin tunas ( <i>Thunnus maccoyii</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                             | Pelagic Fish    |
| 030239    | Fish: fresh or chilled, tuna, n.e.c. in item no. 0302.3, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                                | Pelagic Fish    |
| 030241    | Fish: fresh or chilled, herrings ( <i>Clupea harengus</i> , <i>Clupea pallasii</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                   | Pelagic Fish    |
| 030242    | Fish: fresh or chilled, anchovies ( <i>Engraulis</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                             | Pelagic Fish    |
| 030243    | Fish: fresh or chilled, sardines ( <i>Sardina pilchardus</i> , <i>Sardinops</i> spp.), sardinella ( <i>Sardinella</i> spp.), brisling or sprats ( <i>Sprattus sprattus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                           | Pelagic Fish    |

| BACI code | BACI description                                                                                                                                                                                                         | Item FAOSTAT       |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 030244    | Fish: fresh or chilled, mackerel ( <i>Scomber scombrus</i> , <i>Scomber australasicus</i> , <i>Scomber japonicus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99    | Pelagic Fish       |
| 030245    | Fish: fresh or chilled, jack and horse mackerel ( <i>Trachurus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                  | Pelagic Fish       |
| 030246    | Fish: fresh or chilled, cobia ( <i>Rachycentron canadum</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                             | Pelagic Fish       |
| 030247    | Fish: fresh or chilled, swordfish ( <i>Xiphias gladius</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                              | Pelagic Fish       |
| 030249    | Fish: fresh or chilled, n.e.c. in item no. 0302.4, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                         | Pelagic Fish       |
| 030251    | Fish: fresh or chilled, cod ( <i>Gadus morhua</i> , <i>Gadus ogac</i> , <i>Gadus macrocephalus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                      | Pelagic Fish       |
| 030252    | Fish: fresh or chilled, haddock ( <i>Melanogrammus aeglefinus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                       | Demersal Fish      |
| 030253    | Fish: fresh or chilled, coalfish ( <i>Pollachius virens</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                             | Demersal Fish      |
| 030254    | Fish: fresh or chilled, hake ( <i>Merluccius</i> spp., <i>Urophycis</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                             | Demersal Fish      |
| 030255    | Fish: fresh or chilled, Alaska pollock ( <i>Theragra chalcogramma</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                   | Demersal Fish      |
| 030256    | Fish: fresh or chilled, blue whittings ( <i>Micromesistius poutassou</i> , <i>Micromesistius australis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99              | Demersal Fish      |
| 030259    | Fish: fresh or chilled, n.e.c. in item no. 0302.5, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                         | Demersal Fish      |
| 030271    | Fish: fresh or chilled, tilapias ( <i>Oreochromis</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                               | Demersal Fish      |
| 030272    | Fish: fresh or chilled, catfish ( <i>Pangasius</i> spp., <i>Silurus</i> spp., <i>Clarias</i> spp., <i>Ictalurus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99 | Freshwater Fish    |
| 030273    | Fish: fresh or chilled, Carp (as specified by the WCO.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                   | Freshwater Fish    |
| 030274    | Fish: fresh or chilled, eels ( <i>Anguilla</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                      | Freshwater Fish    |
| 030279    | Fish: fresh or chilled, Nile perch ( <i>Lates niloticus</i> ) and snakeheads ( <i>Channa</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                        | Freshwater Fish    |
| 030281    | Fish: fresh or chilled, dogfish and other sharks, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                          | Freshwater Fish    |
| 030282    | Fish: fresh or chilled, rays and skates ( <i>Rajidae</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                | Marine Fish, Other |
| 030283    | Fish: fresh or chilled, toothfish ( <i>Dissostichus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                             | Marine Fish, Other |
| 030284    | Fish: fresh or chilled, seabass ( <i>Dicentrarchus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                              | Marine Fish, Other |

| BACI code | BACI description                                                                                                                                                                                                                                                                                                   | Item FAOSTAT            |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 030285    | Fish: fresh or chilled, seabream (Sparidae), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                                         | Marine Fish, Other      |
| 030289    | Fish: fresh or chilled, n.e.c. in heading 0302, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0302.91 to 0302.99                                                                                                                                                                      | Marine Fish, Other      |
| 030291    | Fish: fresh or chilled, livers, roes and milt                                                                                                                                                                                                                                                                      | Marine Fish, Other      |
| 030292    | Fish: fresh or chilled, shark fins                                                                                                                                                                                                                                                                                 | Aquatic Animals, Others |
| 030299    | Fish: fresh or chilled, fish fins (other than shark fins), heads, tails, maws and other edible fish offal                                                                                                                                                                                                          | Aquatic Animals, Others |
| 030311    | Fish: frozen, Pacific salmon, sockeye salmon (red salmon) ( <i>Oncorhynchus nerka</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                             | Aquatic Animals, Others |
| 030312    | Fish: frozen, Pacific salmon ( <i>Oncorhynchus gorbuscha/keta/tschawytscha/kisutch/masou/rhodurus</i> ) other than sockeye salmon ( <i>Oncorhynchus nerka</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                     | Freshwater Fish         |
| 030313    | Fish: frozen, Atlantic salmon ( <i>Salmo salar</i> ) and Danube salmon ( <i>Hucho hucho</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                       | Freshwater Fish         |
| 030314    | Fish: frozen, trout ( <i>Salmo trutta</i> , <i>Oncorhynchus mykiss</i> , <i>Oncorhynchus clarki</i> , <i>Oncorhynchus aguabonita</i> , <i>Oncorhynchus gilae</i> , <i>Oncorhynchus apache</i> and <i>Oncorhynchus chrysogaster</i> ), excluding fillets, meat of 0304, and edible fish offal of 0303.91 to 0303.99 | Freshwater Fish         |
| 030319    | Fish: frozen, salmonidae, n.e.c. in item no. 0303.1, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                 | Freshwater Fish         |
| 030323    | Fish: frozen, tilapias ( <i>Oreochromis</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                   | Freshwater Fish         |
| 030324    | Fish: frozen, catfish ( <i>Pangasius</i> spp., <i>Silurus</i> spp., <i>Clarias</i> spp., <i>Ictalurus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                     | Freshwater Fish         |
| 030325    | Fish: frozen, carp (as specified by the WCO), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                        | Freshwater Fish         |
| 030326    | Fish: frozen, eels ( <i>Anguilla</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                          | Freshwater Fish         |
| 030329    | Fish: frozen, Nile perch ( <i>Lates niloticus</i> ) and snakeheads ( <i>Channa</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                            | Freshwater Fish         |
| 030331    | Fish: frozen, halibut ( <i>Reinhardtius hippoglossoides</i> , <i>Hippoglossus hippoglossus</i> , <i>Hippoglossus stenolepis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                   | Freshwater Fish         |
| 030332    | Fish: frozen, plaice ( <i>Pleuronectes platessa</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                               | Demersal Fish           |
| 030333    | Fish: frozen, sole ( <i>Solea</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                             | Demersal Fish           |
| 030334    | Fish: frozen, turbot ( <i>Psetta maxima</i> , <i>Scophthalmidae</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                               | Demersal Fish           |
| 030339    | Fish: frozen, flat fish, n.e.c. in item no. 0303.3, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                                                  | Demersal Fish           |
| 030341    | Fish: frozen, albacore or longfinned tunas ( <i>Thunnus alalunga</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                                              | Demersal Fish           |

| BACI code | BACI description                                                                                                                                                                                                                                                  | Item FAOSTAT  |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 030342    | Fish: frozen, yellowfin tunas ( <i>Thunnus albacares</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                         | Pelagic Fish  |
| 030343    | Fish: frozen, skipjack tuna (stripe-bellied bonito) ( <i>Katsuwonus pelamis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                  | Pelagic Fish  |
| 030344    | Fish: frozen, bigeye tunas ( <i>Thunnus obesus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                               | Pelagic Fish  |
| 030345    | Fish: frozen, Atlantic and Pacific bluefin tunas ( <i>Thunnus thynnus</i> , <i>Thunnus orientalis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                            | Pelagic Fish  |
| 030346    | Fish: frozen, southern bluefin tunas ( <i>Thunnus maccoyii</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                   | Pelagic Fish  |
| 030349    | Fish: frozen, tuna, n.e.c. in item no. 0303.4, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                      | Pelagic Fish  |
| 030351    | Fish: frozen, herrings ( <i>Clupea harengus</i> , <i>Clupea pallasii</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                         | Pelagic Fish  |
| 030353    | Fish: frozen, sardines ( <i>Sardina pilchardus</i> , <i>Sardinops</i> spp.), sardinella ( <i>Sardinella</i> spp.), brisling or sprats ( <i>Sprattus sprattus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99 | Pelagic Fish  |
| 030354    | Fish: frozen, mackerel ( <i>Scomber scombrus</i> , <i>Scomber australasicus</i> , <i>Scomber japonicus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                       | Pelagic Fish  |
| 030355    | Fish: frozen, jack and horse mackerel ( <i>Trachurus</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                     | Pelagic Fish  |
| 030356    | Fish: frozen, cobia ( <i>Rachycentron canadum</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                | Pelagic Fish  |
| 030357    | Fish: frozen, swordfish ( <i>Xiphias gladius</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                 | Pelagic Fish  |
| 030359    | Fish: frozen, n.e.c. in item no. 0303.5, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                            | Pelagic Fish  |
| 030363    | Fish: frozen, cod ( <i>Gadus morhua</i> , <i>Gadus ogac</i> , <i>Gadus macrocephalus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                         | Pelagic Fish  |
| 030364    | Fish: frozen, haddock ( <i>Melanogrammus aeglefinus</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                          | Demersal Fish |
| 030365    | Fish: frozen, coalfish ( <i>Pollachius virens</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                | Demersal Fish |
| 030366    | Fish: frozen, hake ( <i>Merluccius</i> spp., <i>Urophycis</i> spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                | Demersal Fish |
| 030367    | Fish: frozen, Alaska pollock ( <i>Theragra chalcogramma</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                      | Demersal Fish |
| 030368    | Fish: frozen, blue whittings ( <i>Micromesistius poutassou</i> , <i>Micromesistius australis</i> ), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                 | Demersal Fish |
| 030369    | Fish: frozen, of Bregmacerotidae, Eulichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae, Muraenolepididae, other than cod, haddock, coalfish, hake, Alaska pollack, blue whittings, not fillets, meat of 0304, and edible offal of 0303.9       | Demersal Fish |
| 030381    | Fish: frozen, dogfish and other sharks, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                             | Demersal Fish |

| BACI code | BACI description                                                                                                                                                                                                                                            | Item FAOSTAT            |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 030382    | Fish: frozen, rays and skates (Rajidae), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                      | Marine Fish, Other      |
| 030383    | Fish: frozen, toothfish (Dissostichus spp.), excluding fillets, livers, roes, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                       | Marine Fish, Other      |
| 030384    | Fish: frozen, seabass (Dicentrarchus spp.), excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                   | Marine Fish, Other      |
| 030389    | Fish: frozen, n.e.c. in heading 0303, excluding fillets, fish meat of 0304, and edible fish offal of subheadings 0303.91 to 0303.99                                                                                                                         | Marine Fish, Other      |
| 030391    | Fish: frozen, livers, roes and milt                                                                                                                                                                                                                         | Marine Fish, Other      |
| 030392    | Fish: frozen, shark fins                                                                                                                                                                                                                                    | Aquatic Animals, Others |
| 030399    | Fish: frozen, fish fins (other than shark fins), heads, tails, maws and other edible fish offal                                                                                                                                                             | Aquatic Animals, Others |
| 030431    | Fish fillets: fresh or chilled, tilapias (Oreochromis spp.)                                                                                                                                                                                                 | Aquatic Animals, Others |
| 030432    | Fish fillets: fresh or chilled, catfish (Pangasius spp., Silurus spp., Clarias spp., Ictalurus spp.)                                                                                                                                                        | Freshwater Fish         |
| 030433    | Fish fillets: fresh or chilled, Nile perch (Lates niloticus)                                                                                                                                                                                                | Freshwater Fish         |
| 030439    | Fish fillets: fresh or chilled, carp (as specified by the WCO), eels (Anguilla spp.), and snakeheads (Channa spp.)                                                                                                                                          | Freshwater Fish         |
| 030441    | Fish fillets: fresh or chilled, salmon, Pacific (Oncorhynchus nerka, Oncorhynchus gorbuscha, Oncorhynchus keta, Oncorhynchus tshawytscha, Oncorhynchus kisutch, Oncorhynchus masou and Oncorhynchus rhodurus), Atlantic (Salmo salar), Danube (Hucho hucho) | Freshwater Fish         |
| 030442    | Fish fillets: fresh or chilled, trout (Salmo trutta, Oncorhynchus mykiss, Oncorhynchus clarki, Oncorhynchus aguabonita, Oncorhynchus gilae, Oncorhynchus apache and Oncorhynchus chrysogaster)                                                              | Freshwater Fish         |
| 030443    | Fish fillets: fresh or chilled, flat fish (Pleuronectidae, Bothidae, Cynoglossidae, Soleidae, Scophthalmidae and Citharidae)                                                                                                                                | Freshwater Fish         |
| 030444    | Fish fillets: fresh or chilled, of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae, and Muraenolepididae                                                                                             | Demersal Fish           |
| 030445    | Fish fillets: fresh or chilled, swordfish (Xiphias gladius)                                                                                                                                                                                                 | Demersal Fish           |
| 030446    | Fish fillets: fresh or chilled, toothfish (Dissostichus spp.)                                                                                                                                                                                               | Pelagic Fish            |
| 030447    | Fish fillets: fresh or chilled, dogfish and other sharks                                                                                                                                                                                                    | Marine Fish, Other      |
| 030448    | Fish fillets: fresh or chilled, rays and skates (Rajidae)                                                                                                                                                                                                   | Marine Fish, Other      |
| 030449    | Fish fillets: fresh or chilled, other than fish of heading 0304.4                                                                                                                                                                                           | Marine Fish, Other      |
| 030451    | Fish meat, excluding fillets, whether or not minced: fresh or chilled, tilapias, catfish, carp, eels, Nile perch, and snakeheads                                                                                                                            | Marine Fish, Other      |
| 030452    | Fish meat, excluding fillets, whether or not minced: fresh or chilled, salmonidae                                                                                                                                                                           | Freshwater Fish         |
| 030453    | Fish meat, excluding fillets, whether or not minced: fresh or chilled, of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae, and Muraenolepididae                                                      | Freshwater Fish         |

| BACI code | BACI description                                                                                                                                                                                                                                                                                                              | Item FAOSTAT       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 030454    | Fish meat, excluding fillets, whether or not minced: fresh or chilled, swordfish ( <i>Xiphias gladius</i> )                                                                                                                                                                                                                   | Demersal Fish      |
| 030455    | Fish meat, excluding fillets, whether or not minced: fresh or chilled, toothfish ( <i>Dissostichus</i> spp.)                                                                                                                                                                                                                  | Pelagic Fish       |
| 030456    | Fish meat: excluding fillets, whether or not minced: fresh or chilled, dogfish and other sharks                                                                                                                                                                                                                               | Marine Fish, Other |
| 030457    | Fish meat: excluding fillets, whether or not minced: fresh or chilled, rays and skates ( <i>Rajidae</i> )                                                                                                                                                                                                                     | Marine Fish, Other |
| 030459    | Fish meat: excluding fillets, whether or not minced: fresh or chilled, of fish n.e.c. in item no. 0304.5                                                                                                                                                                                                                      | Marine Fish, Other |
| 030461    | Fish fillets: frozen, tilapias ( <i>Oreochromis</i> spp.)                                                                                                                                                                                                                                                                     | Marine Fish, Other |
| 030462    | Fish fillets: frozen, catfish ( <i>Pangasius</i> spp., <i>Silurus</i> spp., <i>Clarias</i> spp., <i>Ictalurus</i> spp.)                                                                                                                                                                                                       | Freshwater Fish    |
| 030463    | Fish fillets: frozen, Nile Perch ( <i>Lates niloticus</i> )                                                                                                                                                                                                                                                                   | Freshwater Fish    |
| 030469    | Fish fillets: frozen, carp ( <i>Cyprinus/Carassius/Ctenopharyngodon idellus/Hypophthalmichthys/Cirrhinus/Mylopharyngodon piceus/Catla catla/Labeo/Osteochilus hasselti/Leptobarbus hoeveni/Megalobrama</i> ), eels ( <i>Anguilla</i> ) and snakeheads ( <i>Channa</i> )                                                       | Freshwater Fish    |
| 030471    | Fish fillets: frozen, cod ( <i>Gadus morhua</i> , <i>Gadus ogac</i> , <i>Gadus macrocephalus</i> )                                                                                                                                                                                                                            | Freshwater Fish    |
| 030472    | Fish fillets: frozen, haddock ( <i>Melanogrammus aeglefinus</i> )                                                                                                                                                                                                                                                             | Demersal Fish      |
| 030473    | Fish fillets: frozen, coalfish ( <i>Pollachius virens</i> )                                                                                                                                                                                                                                                                   | Demersal Fish      |
| 030474    | Fish fillets: frozen, hake ( <i>Merluccius</i> spp., <i>Urophycis</i> spp.)                                                                                                                                                                                                                                                   | Demersal Fish      |
| 030475    | Fish fillets: frozen, Alaska pollock ( <i>Theragra chalcogramma</i> )                                                                                                                                                                                                                                                         | Demersal Fish      |
| 030479    | Fish fillets: frozen, of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae and Muraenolepididae other than cod, haddock, coalfish, hake, and Alaska pollock                                                                                                              | Demersal Fish      |
| 030481    | Fish fillets: frozen, salmon, Pacific ( <i>Oncorhynchus nerka</i> , <i>Oncorhynchus gorbuscha</i> , <i>Oncorhynchus keta</i> , <i>Oncorhynchus tshawytscha</i> , <i>Oncorhynchus kisutch</i> , <i>Oncorhynchus masou</i> , <i>Oncorhynchus rhodurus</i> ), Atlantic ( <i>Salmo salar</i> ), and Danube ( <i>Hucho hucho</i> ) | Demersal Fish      |
| 030482    | Fish fillets: frozen, trout ( <i>Salmo trutta</i> , <i>Oncorhynchus mykiss</i> , <i>Oncorhynchus clarki</i> , <i>Oncorhynchus aguabonita</i> , <i>Oncorhynchus gilae</i> , <i>Oncorhynchus apache</i> and <i>Oncorhynchus chrysogaster</i> )                                                                                  | Freshwater Fish    |
| 030483    | Fish fillets: frozen, flat fish ( <i>Pleuronectidae</i> , <i>Bothidae</i> , <i>Cynoglossidae</i> , <i>Soleidae</i> , <i>Scophthalmidae</i> and <i>Citharidae</i> )                                                                                                                                                            | Freshwater Fish    |
| 030484    | Fish fillets: frozen, swordfish ( <i>Xiphias gladius</i> )                                                                                                                                                                                                                                                                    | Demersal Fish      |
| 030485    | Fish fillets: frozen, toothfish ( <i>Dissostichus</i> spp.)                                                                                                                                                                                                                                                                   | Pelagic Fish       |
| 030486    | Fish fillets: frozen, herrings ( <i>Clupea harengus</i> , <i>Clupea pallasii</i> )                                                                                                                                                                                                                                            | Marine Fish, Other |
| 030487    | Fish fillets: frozen, tunas (of the genus <i>Thunnus</i> ), skipjack tuna (stripe-bellied bonito) ( <i>Katsuwonus pelamis</i> )                                                                                                                                                                                               | Pelagic Fish       |
| 030488    | Fish fillets: frozen, dogfish, other sharks, rays and skates ( <i>Rajidae</i> )                                                                                                                                                                                                                                               | Pelagic Fish       |
| 030489    | Fish fillets: frozen, of fish n.e.c. in heading 0304.8                                                                                                                                                                                                                                                                        | Marine Fish, Other |

| BACI code | BACI description                                                                                                                                                                                                                                                                                                                          | Item FAOSTAT            |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 030491    | Fish meat, excluding fillets, whether or not minced: frozen, swordfish ( <i>Xiphias gladius</i> )                                                                                                                                                                                                                                         | Marine Fish, Other      |
| 030492    | Fish meat, excluding fillets, whether or not minced: frozen, toothfish ( <i>Dissostichus</i> spp.)                                                                                                                                                                                                                                        | Pelagic Fish            |
| 030493    | Fish meat, excluding fillets, whether or not minced: frozen, tilapias, catfish, carp, eels, Nile perch, and snakeheads                                                                                                                                                                                                                    | Marine Fish, Other      |
| 030494    | Fish meat, excluding fillets, whether or not minced: frozen, Alaska Pollock ( <i>Theragra chalcogramma</i> )                                                                                                                                                                                                                              | Freshwater Fish         |
| 030495    | Fish meat, excluding fillets, whether or not minced: frozen, of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae and Muraenolepididae, other than Alaska Pollock ( <i>Theragra chalcogramma</i> )                                                                                   | Demersal Fish           |
| 030496    | Fish meat, excluding fillets, whether or not minced: frozen, dogfish and other sharks                                                                                                                                                                                                                                                     | Demersal Fish           |
| 030497    | Fish meat, excluding fillets, whether or not minced: frozen, rays and skates ( <i>Rajidae</i> )                                                                                                                                                                                                                                           | Marine Fish, Other      |
| 030499    | Fish meat, excluding fillets, whether or not minced: frozen, n.e.c. in item no. 0304.9                                                                                                                                                                                                                                                    | Marine Fish, Other      |
| 030520    | Fish: livers, roes and milt of fish, dried, smoked, salted or in brine                                                                                                                                                                                                                                                                    | Marine Fish, Other      |
| 030531    | Fish fillets: dried, salted or in brine, but not smoked, tilapias, catfish, carp, eels, Nile perch, and snakeheads                                                                                                                                                                                                                        | Aquatic Animals, Others |
| 030532    | Fish fillets: dried, salted or in brine, but not smoked, of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae and Muraenolepididae                                                                                                                                                   | Freshwater Fish         |
| 030539    | Fish fillets: dried, salted or in brine, but not smoked, n.e.c. in item no. 0305.3                                                                                                                                                                                                                                                        | Demersal Fish           |
| 030541    | Fish: smoked, whether or not cooked before or during smoking, salmon, Pacific ( <i>Oncorhynchus nerka</i> , <i>gorbuscha</i> , <i>keta</i> , <i>tschawytscha</i> , <i>kisutch</i> , <i>masou</i> , <i>rhodurus</i> ), Atlantic ( <i>Salmo salar</i> ) and Danube ( <i>Hucho hucho</i> ), includes fillets, but excludes edible fish offal | Marine Fish, Other      |
| 030542    | Fish: smoked, whether or not cooked before or during smoking, herrings ( <i>Clupea harengus</i> , <i>Clupea pallasii</i> ), includes fillets, but excludes edible fish offal                                                                                                                                                              | Freshwater Fish         |
| 030543    | Fish: smoked, whether or not cooked before or during smoking, trout ( <i>Salmo trutta</i> , <i>Oncorhynchus mykiss/clarki/aguabonita/gilae/apache/chrysogaster</i> ), includes fillets, but excludes edible fish offal                                                                                                                    | Pelagic Fish            |
| 030544    | Fish: smoked, whether or not cooked before or during smoking, tilapias, catfish, carp, eels, Nile perch, and snakeheads, includes fillets, but excludes edible fish offal                                                                                                                                                                 | Freshwater Fish         |
| 030549    | Fish: smoked, whether or not cooked before or during smoking, n.e.c. in item no. 0305.4, includes fillets, but excludes edible fish offal                                                                                                                                                                                                 | Freshwater Fish         |
| 030551    | Fish: dried, whether or not salted but not smoked, other than edible fish offal, cod ( <i>Gadus morhua</i> , <i>Gadus ogac</i> , <i>Gadus macrocephalus</i> )                                                                                                                                                                             | Marine Fish, Other      |
| 030552    | Fish: dried, whether or not salted but not smoked, tilapias, catfish, carp, eels, Nile perch, and snakeheads                                                                                                                                                                                                                              | Demersal Fish           |
| 030553    | Fish: dried, whether or not salted but not smoked, fish of the families Bregmacerotidae, Euclichthyidae, Gadidae, Macrouridae, Melanonidae, Merlucciidae, Moridae and Muraenolepididae, other than cod                                                                                                                                    | Freshwater Fish         |
| 030554    | Dried herrings, anchovies, sardines, sardinella, brisling or sprats, mackerel (incl Indian, jack, or horse), seerfishes, jacks, crevalles, cobia, silver pomfrets, Pacific saury, scads, capelin, swordfish, Kawakawa, bonitos, marlins, sailfishes, spearfish                                                                            | Demersal Fish           |
| 030559    | Fish: dried, whether or not salted but not smoked, other than edible fish offal, n.e.c. in item no. 0305.5                                                                                                                                                                                                                                | Pelagic Fish            |

| BACI code | BACI description                                                                                                                                                                                                                                     | Item FAOSTAT            |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 030561    | Fish: salted or in brine, not dried or smoked, other than edible fish offal, herrings ( <i>Clupea harengas</i> , <i>Clupea pallasii</i> )                                                                                                            | Marine Fish, Other      |
| 030562    | Fish: salted or in brine, not dried or smoked, other than edible fish offal, cod ( <i>Gadus morhua</i> , <i>Gadus ogac</i> , <i>Gadus macrocephalus</i> )                                                                                            | Pelagic Fish            |
| 030563    | Fish: salted or in brine, not dried or smoked, other than edible fish offal, anchovies ( <i>Engrails</i> spp.)                                                                                                                                       | Demersal Fish           |
| 030564    | Fish: salted or in brine, not dried or smoked, other than edible fish offal, tilapias, catfish, carp, eels, Nile perch, and snakeheads                                                                                                               | Pelagic Fish            |
| 030569    | Fish: salted or in brine, not dried or smoked, other than edible fish offal, n.e.c. in item no. 0305.6                                                                                                                                               | Freshwater Fish         |
| 030571    | Fish: edible offal, shark fins                                                                                                                                                                                                                       | Offals, Edible          |
| 030572    | Fish: edible offal, fish heads, tails and maws                                                                                                                                                                                                       | Offals, Edible          |
| 030579    | Fish: edible offal, other than shark fins, fish heads, tails and maws                                                                                                                                                                                | Offals, Edible          |
| 030611    | Crustaceans: frozen, rock lobsters and other sea crawfish ( <i>Palinurus</i> spp., <i>Panulirus</i> spp., <i>Jasus</i> spp.), in shell or not, smoked, cooked or not before or during smoking: in shell, cooked by steaming or by boiling in water   | Crustaceans             |
| 030631    | Crustaceans: live, fresh or chilled, rock lobsters and other sea crawfish ( <i>Palinurus</i> spp., <i>Panulirus</i> spp., <i>Jasus</i> spp.), in shell or not                                                                                        | Crustaceans             |
| 030691    | Crustaceans: rock lobsters and other sea crawfish ( <i>Palinurus</i> spp., <i>Panulirus</i> spp., <i>Jasus</i> spp.), smoked, cooked or not, whether in shell or not, whether or not cooked before or during smoking                                 | Crustaceans             |
| 030742    | Molluscs: cuttle fish and squid, whether in shell or not, live, fresh or chilled                                                                                                                                                                     | Molluscs, Other         |
| 030743    | Molluscs: cuttle fish and squid, whether in shell or not, frozen                                                                                                                                                                                     | Molluscs, Other         |
| 030749    | Molluscs: cuttle fish and squid, whether in shell or not, dried, salted, in brine, or smoked, cooked or not before or during the smoking process                                                                                                     | Molluscs, Other         |
| 030811    | Aquatic invertebrates: sea cucumbers ( <i>Stichopus japonicus</i> , <i>Holothuroidea</i> ), live, fresh or chilled                                                                                                                                   | Cephalopods             |
| 030812    | Aquatic invertebrates: sea cucumbers ( <i>Stichopus japonicus</i> , <i>Holothuroidea</i> ), frozen                                                                                                                                                   | Cephalopods             |
| 030819    | Aquatic invertebrates: sea cucumbers ( <i>Stichopus japonicus</i> , <i>Holothuroidea</i> ), dried, salted or in brine, smoked, whether or not cooked before or during the smoking process                                                            | Cephalopods             |
| 030821    | Aquatic invertebrates: sea urchins ( <i>Strongylocentrotus</i> spp., <i>Paracentrotus lividus</i> , <i>Loxechinus albus</i> , <i>Echinus esculentus</i> ), live, fresh or chilled                                                                    | Cephalopods             |
| 030822    | Aquatic invertebrates: sea urchins ( <i>Strongylocentrotus</i> spp., <i>Paracentrotus lividus</i> , <i>Loxechinus albus</i> , <i>Echinus esculentus</i> ), frozen                                                                                    | Cephalopods             |
| 030829    | Aquatic invertebrates: sea urchins ( <i>Strongylocentrotus</i> spp., <i>Paracentrotus lividus</i> , <i>Loxechinus albus</i> , <i>Echinus esculentus</i> ), dried, salted or in brine, smoked, whether or not cooked before or during smoking process | Cephalopods             |
| 030830    | Aquatic invertebrates: jellyfish ( <i>Rhopilema</i> spp.), live, fresh, chilled, frozen, dried, salted or in brine, smoked, whether or not cooked before or during smoking                                                                           | Cephalopods             |
| 030890    | Aquatic invertebrates: other than crustaceans, molluscs, sea urchins, sea cucumbers and jellyfish, live, fresh, chilled, frozen, dried, salted or in brine, smoked, cooked or not before or during smoking                                           | Cephalopods             |
| 040110    | Dairy produce: milk and cream, not concentrated, not containing added sugar or other sweetening matter, of a fat content, by weight, not exceeding 1%                                                                                                | Milk - Excluding Butter |

| BACI code | BACI description                                                                                                                                                                                                 | Item FAOSTAT            |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 040120    | Dairy produce: milk and cream, not concentrated, not containing added sugar or other sweetening matter, of a fat content, by weight, exceeding 1% but not exceeding 6%                                           | Milk - Excluding Butter |
| 040140    | Dairy produce: milk and cream, not concentrated, not containing added sugar or other sweetening matter, of a fat content, by weight, exceeding 6% but not exceeding 10%                                          | Cream                   |
| 040150    | Dairy produce: milk and cream, not concentrated, not containing added sugar or other sweetening matter, of a fat content, by weight, exceeding 10%                                                               | Cream                   |
| 040210    | Dairy produce: milk and cream, concentrated or containing added sugar or other sweetening matter, in powder, granules or other solid forms, of a fat content not exceeding 1.5% (by weight)                      | Cream                   |
| 040221    | Dairy produce: milk and cream, concentrated, not containing added sugar or other sweetening matter, in powder, granules or other solid forms, of a fat content exceeding 1.5% (by weight)                        | Cream                   |
| 040229    | Dairy produce: milk and cream, containing added sugar or other sweetening matter, in powder, granules or other solid forms, of a fat content exceeding 1.5% (by weight)                                          | Cream                   |
| 040291    | Dairy produce: milk and cream, concentrated, not containing added sugar or other sweetening matter, other than in powder, granules or other solid forms                                                          | Cream                   |
| 040299    | Dairy produce: milk and cream, containing added sugar or other sweetening matter, other than in powder, granules or other solid forms                                                                            | Cream                   |
| 040390    | Dairy produce: buttermilk, curdled milk or cream, kephir, fermented or acidified milk or cream, whether or not concentrated or containing added sweetening, flavouring, fruit, nuts or cocoa (excluding yoghurt) | Butter, Ghee            |
| 040490    | Dairy produce: natural milk constituents (excluding whey), whether or not containing added sugar or other sweetening matter, n.e.c. in chapter 04                                                                | Milk - Excluding Butter |
| 040510    | Dairy produce: derived from milk, butter                                                                                                                                                                         | Butter, Ghee            |
| 040590    | Dairy produce: fats and oils derived from milk (other than butter or dairy spreads)                                                                                                                              | Butter, Ghee            |
| 040721    | Birds' eggs, in shell: fresh, not for incubation, of fowls of the species Gallus domesticus (domestic hens)                                                                                                      | Eggs                    |
| 040729    | Birds' eggs, in shell: fresh, not for incubation, other than fowls of the species Gallus domesticus (domestic hens)                                                                                              | Eggs                    |
| 040790    | Birds' eggs, in shell: preserved or cooked                                                                                                                                                                       | Eggs                    |
| 040811    | Eggs: birds' eggs, yolks, dried, whether or not containing added sugar or other sweetening matter                                                                                                                | Eggs                    |
| 040819    | Eggs: birds' eggs, yolks, fresh, cooked by steaming or by boiling in water, moulded, frozen or otherwise preserved, whether or not containing added sugar or other sweetening matter                             | Eggs                    |
| 040891    | Eggs: birds' eggs (not in shell, excluding yolks only), dried, whether or not containing added sugar or other sweetening matter                                                                                  | Eggs                    |
| 040899    | Eggs: birds' eggs (not in shell, excluding yolks only), fresh, cooked by steaming or boiling in water, moulded, frozen, otherwise preserved, whether or not containing added sugar or other sweetening matter    | Eggs                    |
| 040900    | Honey: natural                                                                                                                                                                                                   | Honey                   |
| 051191    | Animal products: of fish or crustaceans, molluscs or other aquatic invertebrates: dead animals of chapter 03, unfit for human consumption                                                                        | Cephalopods             |
| 070110    | Vegetables: seed potatoes, fresh or chilled                                                                                                                                                                      | Potatoes and products   |

| BACI code | BACI description                                                                                                                                                                                              | Item FAOSTAT               |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 070190    | Vegetables: potatoes (other than seed), fresh or chilled                                                                                                                                                      | Potatoes and products      |
| 070200    | Vegetables: tomatoes, fresh or chilled                                                                                                                                                                        | Tomatoes and products      |
| 070310    | Vegetables, alliaceous: onions and shallots, fresh or chilled                                                                                                                                                 | Onions                     |
| 070320    | Vegetables, alliaceous: garlic, fresh or chilled                                                                                                                                                              | Vegetables, other          |
| 070390    | Vegetables, alliaceous: leeks and other kinds n.e.c. in heading no. 0703, fresh or chilled                                                                                                                    | Vegetables, other          |
| 070410    | Vegetables, brassica: cauliflowers and broccoli, fresh or chilled                                                                                                                                             | Vegetables, other          |
| 070420    | Vegetables, brassica: brussel sprouts, fresh or chilled                                                                                                                                                       | Vegetables, other          |
| 070490    | Vegetables, brassica: edible, n.e.c. in heading no. 0704, fresh or chilled                                                                                                                                    | Vegetables, other          |
| 070511    | Vegetables: cabbage (head) lettuce ( <i>lactuca sativa</i> ), fresh or chilled                                                                                                                                | Vegetables, other          |
| 070519    | Vegetables: lettuce ( <i>lactuca sativa</i> ), (other than cabbage lettuce), fresh or chilled                                                                                                                 | Vegetables, other          |
| 070521    | Vegetables: witloof chicory ( <i>cichorium intybus</i> var. <i>foliosum</i> ), fresh or chilled                                                                                                               | Vegetables, other          |
| 070529    | Vegetables: chicory ( <i>cichorium</i> spp.), (other than witloof chicory), fresh or chilled                                                                                                                  | Vegetables, other          |
| 070610    | Vegetables, root: carrots and turnips, fresh or chilled                                                                                                                                                       | Roots, Other               |
| 070690    | Vegetables, root: salad beetroot, salsify, celeriac, radishes and similar edible roots, fresh or chilled                                                                                                      | Roots, Other               |
| 070700    | Vegetables: cucumbers and gherkins, fresh or chilled                                                                                                                                                          | Vegetables, other          |
| 070810    | Vegetables, leguminous: peas ( <i>pisum sativum</i> ), shelled or unshelled, fresh or chilled                                                                                                                 | Peas                       |
| 070820    | Vegetables, leguminous: beans ( <i>vigna</i> spp., <i>phaseolus</i> spp.), shelled or unshelled, fresh or chilled                                                                                             | Beans                      |
| 070890    | Vegetables, leguminous: (other than peas and beans), shelled or unshelled, fresh or chilled                                                                                                                   | Pulses, Other and products |
| 070920    | Vegetables: asparagus, fresh or chilled                                                                                                                                                                       | Vegetables, other          |
| 070930    | Vegetables: aubergines, (e.g. plants), fresh or chilled                                                                                                                                                       | Vegetables, other          |
| 070940    | Vegetables: celery (other than celeriac), fresh or chilled                                                                                                                                                    | Vegetables, other          |
| 070951    | Vegetables: mushrooms of the genus <i>Agaricus</i> , fresh or chilled                                                                                                                                         | Vegetables, other          |
| 070952    | Vegetables: mushrooms of the genus <i>Boletus</i> , fresh or chilled                                                                                                                                          | Vegetables, other          |
| 070953    | Vegetables: mushrooms of the genus <i>Cantharellus</i> , fresh or chilled                                                                                                                                     | Vegetables, other          |
| 070954    | Vegetables: shiitake mushrooms ( <i>Lentinus edodes</i> ), fresh or chilled                                                                                                                                   | Vegetables, other          |
| 070955    | Vegetables: matsutake mushrooms ( <i>Tricholoma matsutake</i> , <i>Tricholoma magnivelare</i> , <i>Tricholoma anatolicum</i> , <i>Tricholoma dulciolens</i> , <i>Tricholoma caligatum</i> ), fresh or chilled | Vegetables, other          |
| 070956    | Vegetables: truffles ( <i>Tuber</i> spp.), fresh or chilled                                                                                                                                                   | Vegetables, other          |
| 070959    | Vegetables: truffles and mushrooms n.e.c. in heading 0709, fresh or chilled                                                                                                                                   | Vegetables, other          |

| BACI code | BACI description                                                                                                                             | Item FAOSTAT                 |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 070960    | Vegetables: fruits of the genus capsicum or of the genus pimenta, fresh or chilled                                                           | Vegetables, other            |
| 070970    | Vegetables: spinach, New Zealand spinach and orache spinach (garden spinach), fresh or chilled                                               | Vegetables, other            |
| 070991    | Vegetables: globe artichokes, fresh or chilled                                                                                               | Vegetables, other            |
| 070992    | Vegetables: olives, fresh or chilled                                                                                                         | Olives (including preserved) |
| 070993    | Vegetables: pumpkins, squash and gourds (Cucurbita spp.), fresh or chilled                                                                   | Vegetables, other            |
| 070999    | Vegetables: edible, n.e.c. in chapter 07, fresh or chilled                                                                                   | Vegetables, other            |
| 071010    | Vegetables: potatoes, uncooked or cooked by steaming or boiling in water, frozen                                                             | Potatoes and products        |
| 071021    | Vegetables, leguminous: peas (pisum sativum), shelled or unshelled, uncooked or cooked by steaming or boiling in water, frozen               | Peas                         |
| 071022    | Vegetables, leguminous: beans (vigna spp., phaseolus spp.), shelled or unshelled, uncooked or cooked by steaming or boiling in water, frozen | Beans                        |
| 071029    | Vegetables, leguminous: (other than peas or beans), shelled or unshelled, uncooked or cooked by steaming or boiling in water, frozen         | Pulses, Other and products   |
| 071030    | Vegetables: spinach, New Zealand spinach and orache spinach (garden spinach), uncooked or cooked by steaming or boiling in water, frozen     | Vegetables, other            |
| 071040    | Vegetables: sweetcorn, uncooked or cooked by steaming or boiling in water, frozen                                                            | Vegetables, other            |
| 071080    | Vegetables: uncooked or cooked by steaming or boiling in water, n.e.c. in heading no. 0710, frozen                                           | Vegetables, other            |
| 071120    | Vegetables: olives, provisionally preserved but unsuitable in that state for immediate consumption                                           | Olives (including preserved) |
| 071140    | Vegetables: cucumbers and gherkins, provisionally preserved but unsuitable in that state for immediate consumption                           | Vegetables, other            |
| 071151    | Vegetables: mushrooms of the genus Agaricus, provisionally preserved but unsuitable in that state for immediate consumption                  | Vegetables, other            |
| 071159    | Vegetables: mushrooms other than of the genus Agaricus, provisionally preserved but unsuitable in that state for immediate consumption       | Vegetables, other            |
| 071190    | Vegetables and mixed vegetables: n.e.c. in heading no. 0711, provisionally preserved but unsuitable in that state for immediate consumption  | Vegetables, other            |
| 071220    | Vegetables: onions, whole, cut, sliced, broken or in powder but not further prepared, dried                                                  | Onions                       |
| 071231    | Vegetables: mushrooms of the genus Agaricus, whole, cut, sliced, broken or in powder but not further prepared, dried                         | Vegetables, other            |
| 071232    | Vegetables: wood ears (Auricularia spp), whole, cut, sliced, broken or in powder but not further prepared, dried                             | Vegetables, other            |
| 071233    | Vegetables: jelly fungi (Tremella spp)), whole, cut, sliced, broken or in powder but not further prepared, dried                             | Vegetables, other            |
| 071234    | Vegetables: shiitake mushrooms (Lentinus edodes), whole, cut, sliced, broken or in powder but not further prepared, dried                    | Vegetables, other            |
| 071239    | Vegetables: mushrooms and truffles n.e.c. in item 0712.3, whole, cut, sliced, broken or in powder but not further prepared, dried            | Vegetables, other            |

| BACI code | BACI description                                                                                                                                                                                                                                              | Item FAOSTAT               |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 071290    | Vegetables: mixtures of vegetables n.e.c. in heading no. 0712, whole, cut, sliced, broken or in powder but not further prepared, dried                                                                                                                        | Vegetables, other          |
| 071310    | Vegetables, leguminous: peas ( <i>pisum sativum</i> ), shelled, whether or not skinned or split, dried                                                                                                                                                        | Peas                       |
| 071320    | Vegetables, leguminous: chickpeas ( <i>garbanzos</i> ), shelled, whether or not skinned or split, dried                                                                                                                                                       | Peas                       |
| 071331    | Vegetables, leguminous: beans of the species <i>vigna mungo</i> (l.) hepper or <i>vigna radiata</i> (l.) wilczek, shelled, whether or not skinned or split, dried                                                                                             | Beans                      |
| 071332    | Vegetables, leguminous: small red ( <i>adzuki</i> ) beans ( <i>phaseolus</i> or <i>vigna angularis</i> ), shelled, whether or not skinned or split, dried                                                                                                     | Beans                      |
| 071333    | Vegetables, leguminous: kidney beans, including white pea beans ( <i>phaseolus vulgaris</i> ), shelled, whether or not skinned or split, dried                                                                                                                | Beans                      |
| 071334    | Vegetables, leguminous: bambara beans ( <i>Vigna subterranea</i> or <i>Voandzeia subterranea</i> ), shelled, whether or not skinned or split, dried                                                                                                           | Beans                      |
| 071335    | Vegetables, leguminous: cow peas ( <i>Vigna unguiculata</i> ), shelled, whether or not skinned or split, dried                                                                                                                                                | Peas                       |
| 071339    | Vegetables, leguminous: n.e.c. in item no. 0713.3, shelled, whether or not skinned or split, dried                                                                                                                                                            | Pulses, Other and products |
| 071340    | Vegetables, leguminous: lentils, shelled, whether or not skinned or split, dried                                                                                                                                                                              | Pulses, Other and products |
| 071350    | Vegetables, leguminous: broad beans ( <i>vicia faba</i> var. <i>major</i> ) and horse beans ( <i>vicia faba</i> var. <i>equina</i> , <i>vicia faba</i> var. <i>minor</i> ), shelled, whether or not skinned or split, dried                                   | Beans                      |
| 071360    | Vegetables, leguminous: pigeon peas ( <i>Cajanus cajan</i> ), shelled, whether or not skinned or split, dried                                                                                                                                                 | Peas                       |
| 071390    | Vegetables, leguminous: n.e.c. in heading no. 0713, shelled, whether or not skinned or split, dried                                                                                                                                                           | Pulses, Other and products |
| 071410    | Vegetable roots and tubers: manioc ( <i>cassava</i> ), with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets                                                                                   | Cassava and products       |
| 071420    | Vegetable roots and tubers: sweet potatoes, with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets                                                                                              | Sweet potatoes             |
| 071430    | Vegetable roots and tubers: yams ( <i>Dioscorea</i> spp.) with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets                                                                                | Yams                       |
| 071440    | Vegetable roots and tubers: taro ( <i>Colocasia</i> spp.) with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets                                                                                | Roots, Other               |
| 071450    | Vegetable roots and tubers: yautia ( <i>Xanthosoma</i> spp.) with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets                                                                             | Roots, Other               |
| 071490    | Vegetable roots and tubers: arrowroot, salep, Jerusalem artichokes and similar roots and tubers (not manioc, sweet potatoes, yams, taro or yautia), high starch or inulin content, fresh, chilled, frozen, dried, sliced or not, or in pellet form: sago pith | Roots, Other               |
| 080111    | Nuts, edible: coconuts, desiccated                                                                                                                                                                                                                            | Coconuts - Incl Copra      |
| 080112    | Nuts, edible: coconuts, in the inner shell (endocarp)                                                                                                                                                                                                         | Coconuts - Incl Copra      |
| 080119    | Nuts, edible: coconuts, fresh or dried, other than desiccated or in the inner shell (endocarp)                                                                                                                                                                | Coconuts - Incl Copra      |
| 080121    | Nuts, edible: brazil nuts, fresh or dried, in shell                                                                                                                                                                                                           | Nuts and products          |
| 080122    | Nuts, edible: brazil nuts, fresh or dried, shelled                                                                                                                                                                                                            | Nuts and products          |

| BACI code | BACI description                                                                                | Item FAOSTAT            |
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| 080131    | Nuts, edible: cashew nuts, fresh or dried, in shell                                             | Nuts and products       |
| 080132    | Nuts, edible: cashew nuts, fresh or dried, shelled                                              | Nuts and products       |
| 080211    | Nuts, edible: almonds, fresh or dried, in shell                                                 | Nuts and products       |
| 080212    | Nuts, edible: almonds, fresh or dried, shelled                                                  | Nuts and products       |
| 080221    | Nuts, edible: hazelnuts or filberts (corylus spp.), fresh or dried, in shell                    | Nuts and products       |
| 080222    | Nuts, edible: hazelnuts or filberts (corylus spp.), fresh or dried, shelled                     | Nuts and products       |
| 080231    | Nuts, edible: walnuts, fresh or dried, in shell                                                 | Nuts and products       |
| 080232    | Nuts, edible: walnuts, fresh or dried, shelled                                                  | Nuts and products       |
| 080241    | Nuts, edible: chestnuts (Castanea spp.), fresh or dried, in shell                               | Nuts and products       |
| 080242    | Nuts, edible: chestnuts (Castanea spp.), fresh or dried, shelled                                | Nuts and products       |
| 080251    | Nuts, edible: pistachios, fresh or dried, in shell                                              | Nuts and products       |
| 080252    | Nuts, edible: pistachios, fresh or dried, shelled                                               | Nuts and products       |
| 080261    | Nuts, edible: macadamia, fresh or dried, in shell                                               | Nuts and products       |
| 080262    | Nuts, edible: macadamia, fresh or dried, shelled                                                | Nuts and products       |
| 080270    | Nuts, edible: kola nuts (Cola spp.), fresh or dried, whether or not shelled or peeled           | Nuts and products       |
| 080280    | Nuts, edible: areca nuts, fresh or dried, whether or not shelled or peeled                      | Nuts and products       |
| 080291    | Nuts, edible: pine nuts, fresh or dried, in shell                                               | Nuts and products       |
| 080292    | Nuts, edible: pine nuts, fresh or dried, shelled                                                | Nuts and products       |
| 080299    | Nuts, edible: n.e.c. in heading 0801 and 0802, fresh or dried, whether or not shelled or peeled | Nuts and products       |
| 080310    | Fruit, edible: plantains, fresh or dried                                                        | Plantains               |
| 080390    | Fruit, edible: bananas, other than plantains, fresh or dried                                    | Bananas                 |
| 080410    | Fruit, edible: dates, fresh or dried                                                            | Dates                   |
| 080420    | Fruit, edible: figs, fresh or dried                                                             | Fruits, other           |
| 080430    | Fruit, edible: pineapples, fresh or dried                                                       | Pineapples and products |
| 080440    | Fruit, edible: avocados, fresh or dried                                                         | Fruits, other           |
| 080450    | Fruit, edible: guavas, mangoes and mangosteens, fresh or dried                                  | Fruits, other           |
| 080510    | Fruit, edible: oranges, fresh or dried                                                          | Oranges, Mandarines     |
| 080521    | Fruit, edible: mandarins (including tangerines and satsumas), fresh or dried                    | Oranges, Mandarines     |
| 080522    | Fruit, edible: clementines, fresh or dried                                                      | Fruits, other           |
| 080529    | Fruit, edible: tangelos, wilkings and similar citrus hybrid, fresh or dried                     | Fruits, other           |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                                                                 | <b>Item FAOSTAT</b>             |
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| 080540           | Fruit, edible: grapefruit and pomelos, fresh or dried                                                                                                                                                   | Grapefruit and products         |
| 080550           | Fruit, edible: lemons (Citrus limon, Citrus limonum), limes (Citrus aurantifolia, Citrus latifolia), fresh or dried                                                                                     | Lemons, Limes and products      |
| 080590           | Fruit, edible: citrus fruit n.e.c. in heading no. 0805, fresh or dried                                                                                                                                  | Citrus, Other                   |
| 080610           | Fruit, edible: grapes, fresh                                                                                                                                                                            | Grapes and products (excl wine) |
| 080620           | Fruit, edible: grapes, dried                                                                                                                                                                            | Grapes and products (excl wine) |
| 080711           | Fruit, edible: watermelons, fresh                                                                                                                                                                       | Fruits, other                   |
| 080719           | Fruit, edible: melons, other than watermelons, fresh                                                                                                                                                    | Fruits, other                   |
| 080720           | Fruit, edible: papaws (papayas), fresh                                                                                                                                                                  | Fruits, other                   |
| 080810           | Fruit, edible: apples, fresh                                                                                                                                                                            | Apples and products             |
| 080830           | Fruit, edible: pears, fresh                                                                                                                                                                             | Fruits, other                   |
| 080840           | Fruit, edible: quinces, fresh                                                                                                                                                                           | Fruits, other                   |
| 080910           | Fruit, edible: apricots, fresh                                                                                                                                                                          | Fruits, other                   |
| 080921           | Fruit, edible: sour cherries (Prunus cerasus), fresh                                                                                                                                                    | Fruits, other                   |
| 080929           | Fruit, edible: cherries, other than sour cherries (Prunus cerasus), fresh                                                                                                                               | Fruits, other                   |
| 080930           | Fruit, edible: peaches, including nectarines, fresh                                                                                                                                                     | Fruits, other                   |
| 080940           | Fruit, edible: plums and sloes, fresh                                                                                                                                                                   | Fruits, other                   |
| 081010           | Fruit, edible: strawberries, fresh                                                                                                                                                                      | Fruits, other                   |
| 081020           | Fruit, edible: raspberries, blackberries, mulberries, and loganberries, fresh                                                                                                                           | Fruits, other                   |
| 081030           | Fruit, edible: black, white or red currants and gooseberries, fresh                                                                                                                                     | Fruits, other                   |
| 081040           | Fruit, edible: cranberries, bilberries and other fruits of the genus vaccinium, fresh                                                                                                                   | Fruits, other                   |
| 081050           | Fruit, edible: kiwifruit, fresh                                                                                                                                                                         | Fruits, other                   |
| 081060           | Fruit, edible: durians, fresh                                                                                                                                                                           | Fruits, other                   |
| 081070           | Fruit, edible: persimmons, fresh                                                                                                                                                                        | Fruits, other                   |
| 081090           | Fruit, edible: fruits n.e.c. in heading no. 0801 to 0810, fresh                                                                                                                                         | Fruits, other                   |
| 081110           | Fruit, edible: strawberries, uncooked or cooked by steaming or boiling in water, frozen, whether or not containing added sugar or other sweetening matter                                               | Fruits, other                   |
| 081120           | Fruit, edible: raspberries, blackberries, mulberries, loganberries, black, white or red currants and gooseberries, uncooked or cooked, whether or not containing added sugar or other sweetening matter | Fruits, other                   |
| 081190           | Fruit, edible: fruit and nuts n.e.c. in heading no. 0811, uncooked or cooked, frozen whether or not containing added sugar or other sweetening matter                                                   | Fruits, other                   |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                              | <b>Item FAOSTAT</b>  |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 081210           | Fruit, edible: cherries, provisionally preserved, but unsuitable in that state for immediate consumption                                                             | Fruits, other        |
| 081290           | Fruit, edible: fruit and nuts n.e.c. in heading no. 0812, provisionally preserved, but unsuitable in that state for immediate consumption                            | Fruits, other        |
| 081310           | Fruit, edible: apricots, dried                                                                                                                                       | Fruits, other        |
| 081320           | Fruit, edible: prunes, dried                                                                                                                                         | Fruits, other        |
| 081330           | Fruit, edible: apples, dried                                                                                                                                         | Apples and products  |
| 081340           | Fruit, edible: fruit n.e.c. in heading no. 0812, dried                                                                                                               | Fruits, other        |
| 081350           | Nuts, edible: mixtures of nuts or dried fruits of chapter 08                                                                                                         | Nuts and products    |
| 081400           | Peel: of citrus fruit or melons (including watermelons), fresh, frozen, dried or provisionally preserved in brine, in sulphur water and other preservative solutions | Citrus, Other        |
| 090111           | Coffee: not roasted or decaffeinated                                                                                                                                 | Coffee and products  |
| 090112           | Coffee: decaffeinated, not roasted                                                                                                                                   | Coffee and products  |
| 090121           | Coffee: roasted, not decaffeinated                                                                                                                                   | Coffee and products  |
| 090122           | Coffee: roasted, decaffeinated                                                                                                                                       | Coffee and products  |
| 090190           | Coffee: husks and skins, coffee substitutes containing coffee in any proportion                                                                                      | Coffee and products  |
| 090210           | Tea, green: (not fermented), in immediate packings of a content not exceeding 3kg                                                                                    | Tea (including mate) |
| 090220           | Tea, green: (not fermented), in immediate packings of a content exceeding 3kg                                                                                        | Tea (including mate) |
| 090230           | Tea, black: (fermented) and partly fermented tea, in immediate packings of a content not exceeding 3kg                                                               | Tea (including mate) |
| 090240           | Tea, black: (fermented) and partly fermented tea, in immediate packings of a content exceeding 3kg                                                                   | Tea (including mate) |
| 090411           | Spices: pepper (of the genus piper), neither crushed nor ground                                                                                                      | Pepper               |
| 090412           | Spices: pepper (of the genus piper), crushed or ground                                                                                                               | Pepper               |
| 090421           | Spices: fruits of the genus Capsicum or Pimenta, dried, neither crushed nor ground                                                                                   | Pimento              |
| 090422           | Spices: fruits of the genus Capsicum or Pimenta, crushed or ground                                                                                                   | Pimento              |
| 090510           | Spices: vanilla, neither crushed nor ground                                                                                                                          | Spices, Other        |
| 090520           | Spices: vanilla, crushed or ground                                                                                                                                   | Spices, Other        |
| 090611           | Spices: cinnamon (Cinnamomum zeylanicum Blume), neither crushed nor ground                                                                                           | Spices, Other        |
| 090619           | Spices: cinnamon and cinnamon-tree flowers, other than cinnamon (Cinnamomum zeylanicum Blume), neither crushed nor ground                                            | Spices, Other        |
| 090620           | Spices: cinnamon and cinnamon-tree flowers, crushed or ground                                                                                                        | Spices, Other        |
| 090710           | Spices: cloves (whole fruit, cloves and stems), neither crushed nor ground                                                                                           | Cloves               |
| 090720           | Spices: cloves (whole fruit, cloves and stems), crushed or ground                                                                                                    | Cloves               |

| <b>BACI code</b> | <b>BACI description</b>                                                                        | <b>Item FAOSTAT</b> |
|------------------|------------------------------------------------------------------------------------------------|---------------------|
| 090811           | Spices: nutmeg, neither crushed nor ground                                                     | Spices, Other       |
| 090812           | Spices: nutmeg, crushed or ground                                                              | Spices, Other       |
| 090821           | Spices: mace, neither crushed nor ground                                                       | Spices, Other       |
| 090822           | Spices: mace, crushed or ground                                                                | Spices, Other       |
| 090831           | Spices: cardamoms, neither crushed nor ground                                                  | Spices, Other       |
| 090832           | Spices: cardamoms, crushed or ground                                                           | Spices, Other       |
| 090921           | Spices: coriander seeds, neither crushed nor ground                                            | Spices, Other       |
| 090922           | Spices: coriander seeds, crushed or ground                                                     | Spices, Other       |
| 090931           | Spices: cumin seeds, neither crushed nor ground                                                | Spices, Other       |
| 090932           | Spices: cumin seeds, crushed or ground                                                         | Spices, Other       |
| 090961           | Spices: seeds of anise, badian, caraway or fennel: juniper berries, neither crushed nor ground | Spices, Other       |
| 090962           | Spices: seeds of anise, badian, caraway or fennel: juniper berries, crushed or ground          | Spices, Other       |
| 091011           | Spices: ginger, neither crushed nor ground                                                     | Spices, Other       |
| 091012           | Spices: ginger, crushed or ground                                                              | Spices, Other       |
| 091020           | Spices: saffron                                                                                | Spices, Other       |
| 091030           | Spices: turmeric (curcuma)                                                                     | Spices, Other       |
| 091091           | Spices: mixtures of 2 or more products of different headings                                   | Spices, Other       |
| 091099           | Spices: n.e.c. in heading no. 0910                                                             | Spices, Other       |
| 100111           | Cereals: wheat and meslin, durum wheat, seed                                                   | Wheat and products  |
| 100119           | Cereals: wheat and meslin, durum wheat, other than seed                                        | Wheat and products  |
| 100191           | Cereals: wheat and meslin, other than durum wheat, seed                                        | Wheat and products  |
| 100199           | Cereals: wheat and meslin, other than durum wheat, other than seed                             | Wheat and products  |
| 100210           | Cereals: rye, seed                                                                             | Rye and products    |
| 100290           | Cereals: rye, other than seed                                                                  | Rye and products    |
| 100310           | Cereals: barley, seed                                                                          | Barley and products |
| 100390           | Cereals: barley, other than seed                                                               | Barley and products |
| 100410           | Cereals: oats, seeds                                                                           | Oats                |
| 100490           | Cereals: oats, other than seed                                                                 | Oats                |
| 100510           | Cereals: maize (corn), seed                                                                    | Maize and products  |
| 100590           | Cereals: maize (corn), other than seed                                                         | Maize and products  |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                        | <b>Item FAOSTAT</b>        |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 100610           | Cereals: rice in the husk (paddy or rough)                                                                                                                     | Rice and products          |
| 100620           | Cereals: husked (brown) rice                                                                                                                                   | Rice and products          |
| 100630           | Cereals: rice, semi-milled or wholly milled, whether or not polished or glazed                                                                                 | Rice and products          |
| 100640           | Cereals: rice, broken                                                                                                                                          | Rice and products          |
| 100710           | Cereals: grain sorghum, seed                                                                                                                                   | Sorghum and products       |
| 100790           | Cereals: grain sorghum, other than seed                                                                                                                        | Sorghum and products       |
| 100810           | Cereals: buckwheat                                                                                                                                             | Wheat and products         |
| 100821           | Cereals: millet, seed                                                                                                                                          | Millet and products        |
| 100829           | Cereals: millet, other than seed                                                                                                                               | Millet and products        |
| 100830           | Cereals: canary seeds                                                                                                                                          | Cereals, other             |
| 100840           | Cereals: fonio ( <i>Digitaria</i> spp.)                                                                                                                        | Cereals, other             |
| 100850           | Cereals: quinoa ( <i>Chenopodium quinoa</i> )                                                                                                                  | Cereals, other             |
| 100860           | Cereals: triticale                                                                                                                                             | Cereals, other             |
| 100890           | Cereals: n.e.c. in chapter 10                                                                                                                                  | Cereals, other             |
| 110100           | Wheat or meslin flour                                                                                                                                          | Wheat and products         |
| 110220           | Cereal flour: of maize (corn)                                                                                                                                  | Maize and products         |
| 110311           | Cereal groats and meal: of wheat                                                                                                                               | Wheat and products         |
| 110313           | Cereal groats and meal: of maize (corn)                                                                                                                        | Maize and products         |
| 110412           | Cereal grains: rolled or flaked, of oats                                                                                                                       | Oats                       |
| 110422           | Cereal grains: worked (e.g. hulled, pearled, sliced or kibbled) of oats                                                                                        | Oats                       |
| 110423           | Cereal grains: worked (e.g. hulled, pearled, sliced or kibbled) of maize (corn)                                                                                | Maize and products         |
| 110429           | Cereal grains: worked, other than rolled or flaked (e.g. Hulled, pearled, sliced or kibbled) of cereals, excluding oats and maize, and rice of heading no.1006 | Cereals, other             |
| 110430           | Cereal: germ of cereals, whole, rolled, flaked or ground                                                                                                       | Cereals, other             |
| 110510           | Flour, meal and powder: of potatoes                                                                                                                            | Potatoes and products      |
| 110520           | Flakes, granules and pellets: of potatoes                                                                                                                      | Potatoes and products      |
| 110610           | Flour, meal and powder: of the dried leguminous vegetables of heading no. 0713                                                                                 | Pulses, Other and products |
| 110811           | Starch: wheat                                                                                                                                                  | Wheat and products         |
| 110812           | Starch: maize (corn) starch                                                                                                                                    | Maize and products         |

| BACI code | BACI description                                                                                                               | Item FAOSTAT          |
|-----------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 110813    | Starch: potato                                                                                                                 | Potatoes and products |
| 110814    | Starch: manioc (cassava)                                                                                                       | Cassava and products  |
| 110900    | Wheat gluten: whether or not dried                                                                                             | Wheat and products    |
| 120110    | Soya beans: seed, whether or not broken                                                                                        | Soyabeans             |
| 120190    | Soya beans: other than seed, whether or not broken                                                                             | Soyabeans             |
| 120230    | Ground-nuts: seed, not roasted or otherwise cooked, whether or not shelled or broken                                           | Groundnuts            |
| 120241    | Ground-nuts: other than seed, not roasted or otherwise cooked, in shell                                                        | Groundnuts            |
| 120242    | Ground-nuts: other than seed, not roasted or otherwise cooked, shelled, whether or not broken,                                 | Groundnuts            |
| 120400    | Oil seeds: linseed, whether or not broken                                                                                      | Oilcrops, Other       |
| 120510    | Oil seeds: low erucic acid rape or colza seeds, whether or not broken                                                          | Rape and Mustardseed  |
| 120590    | Oil seeds: rape or colza seeds, other than low erucic, whether or not broken                                                   | Rape and Mustardseed  |
| 120600    | Oil seeds: sunflower seeds, whether or not broken                                                                              | Sunflower seed        |
| 120710    | Oil seeds: palm nuts and kernels, whether or not broken                                                                        | Palm kernels          |
| 120721    | Oil seeds: cotton seeds, seed, whether or not broken                                                                           | Cottonseed            |
| 120729    | Oil seeds: cotton seeds, other than seed, whether or not broken                                                                | Cottonseed            |
| 120730    | Oil seeds: castor oil seeds, whether or not broken                                                                             | Oilcrops, Other       |
| 120740    | Oil seeds: sesamum seeds, whether or not broken                                                                                | Sesame seed           |
| 120750    | Oil seeds: mustard seeds, whether or not broken                                                                                | Rape and Mustardseed  |
| 120760    | Oil seeds: safflower ( <i>Carthamus tinctorius</i> ) seeds, whether or not broken                                              | Oilcrops, Other       |
| 120770    | Oil seeds: melon seeds, whether or not broken                                                                                  | Oilcrops, Other       |
| 120791    | Oil seeds: poppy seeds, whether or not broken                                                                                  | Oilcrops, Other       |
| 120799    | Oil seeds and oleaginous fruits: n.e.c. in heading no. 1207, whether or not broken                                             | Oilcrops, Other       |
| 120810    | Flours and meals: of soya beans                                                                                                | Soyabeans             |
| 120890    | Flours and meals of oil seeds or oleaginous fruits: excluding soya beans and mustard seeds                                     | Soyabeans             |
| 120910    | Seed: sugar beet seeds, of a kind used for sowing                                                                              | Sugar beet            |
| 120925    | Seeds of forage plants: rye grass ( <i>Lolium multiflorum</i> Lam., <i>Lolium perenne</i> L.) seeds, of a kind used for sowing | Rye and products      |
| 121291    | Sugar beet: fit for human consumption, fresh, chilled, frozen or dried, whether or not ground                                  | Sugar beet            |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                                                                                                   | <b>Item FAOSTAT</b>          |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 121292           | Locust beans (carob): fit for human consumption, fresh, chilled, frozen or dried, whether or not ground                                                                                                                                   | Beans                        |
| 121293           | Sugar cane: fit for human consumption, fresh, chilled, frozen or dried, whether or not ground                                                                                                                                             | Sugar cane                   |
| 150110           | Pig fat: lard, other than that of heading 0209 and 1503                                                                                                                                                                                   | Fats, Animals, Raw           |
| 150120           | Pig fat: not lard, other than that of heading 0209 or 1503                                                                                                                                                                                | Fats, Animals, Raw           |
| 150190           | Poultry fat: other than that of heading 0209 or 1503                                                                                                                                                                                      | Fats, Animals, Raw           |
| 150290           | Fats of bovine animals, sheep or goats: excluding tallow, and other than those of heading 1503                                                                                                                                            | Fats, Animals, Raw           |
| 150410           | Oils of fish: fish-liver oils and their fractions, whether or not refined, but not chemically modified                                                                                                                                    | Fish, Liver Oil              |
| 150420           | Fats and oils and their fractions: of fish, (excluding liver-oils)                                                                                                                                                                        | Fats, Animals, Raw           |
| 150430           | Fats and oils and their fractions: of marine mammals                                                                                                                                                                                      | Fats, Animals, Raw           |
| 150600           | Animal fats and oils and their fractions: whether or not refined, but not chemically modified, n.e.c. in chapter 15                                                                                                                       | Fats, Animals, Raw           |
| 150710           | Vegetable oils: soya-bean oil and its fractions, crude, whether or not degummed, not chemically modified                                                                                                                                  | Soyabean Oil                 |
| 150790           | Vegetable oils: soya-bean oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                                                                                    | Soyabean Oil                 |
| 150810           | Vegetable oils: ground-nut oil and its fractions, crude, not chemically modified                                                                                                                                                          | Groundnut Oil                |
| 150890           | Vegetable oils: ground-nut oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                                                                                   | Groundnut Oil                |
| 150920           | Vegetable oils: olive oil and its fractions, extra virgin olive oil, whether or not refined, but not chemically modified                                                                                                                  | Olive Oil                    |
| 150930           | Vegetable oils: olive oil and its fractions, virgin olive oil, whether or not refined, but not chemically modified                                                                                                                        | Olive Oil                    |
| 150940           | Vegetable oils: olive oil and its fractions, virgin olive oils n.e.c. in heading 1509, whether or not refined, but not chemically modified                                                                                                | Olive Oil                    |
| 150990           | Vegetable oils: olive oil and its fractions, other than virgin, whether or not refined, but not chemically modified                                                                                                                       | Olive Oil                    |
| 151010           | Vegetable oils: crude olive pomace oil and their fractions, obtained solely from olives, whether or not refined, but not chemically modified                                                                                              | Olives (including preserved) |
| 151090           | Vegetable oils: oils and their fractions n.e.c. in heading 1510, obtained solely from olives, whether or not refined, but not chemically modified, including blends of these oils or fractions with oils or fractions of heading no. 1509 | Olive Oil                    |
| 151110           | Vegetable oils: palm oil and its fractions, crude, not chemically modified                                                                                                                                                                | Palmkernel Oil               |
| 151190           | Vegetable oils: palm oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                                                                                         | Palmkernel Oil               |
| 151211           | Vegetable oils: sunflower seed or safflower oil and their fractions, crude, not chemically modified                                                                                                                                       | Sunflowerseed Oil            |
| 151219           | Vegetable oils: sunflower seed or safflower oil and their fractions, other than crude, whether or not refined, but not chemically modified                                                                                                | Sunflower seed               |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                                   | <b>Item FAOSTAT</b>  |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 151221           | Vegetable oils: cotton-seed oil and its fractions: crude, whether or not gossypol has been removed, not chemically modified                                               | Cottonseed Oil       |
| 151229           | Vegetable oils: cotton-seed oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                  | Cottonseed Oil       |
| 151311           | Vegetable oils: coconut (copra) oil and its fractions, crude, not chemically modified                                                                                     | Coconut Oil          |
| 151319           | Vegetable oils: coconut (copra) oil and its fractions, other than crude, whether or not refined, but not chemically modified                                              | Coconut Oil          |
| 151321           | Vegetable oils: palm kernel or babassu oil and their fractions, crude, not chemically modified                                                                            | Palmkernel Oil       |
| 151329           | Vegetable oils: palm kernel or babassu oil and their fractions, other than crude, whether or not refined, but not chemically modified                                     | Palmkernel Oil       |
| 151411           | Vegetable oils: low erucic acid rape or colza oil and its fractions, crude                                                                                                | Rape and Mustard Oil |
| 151419           | Vegetable oils: low erucic acid rape or colza oil and its fractions, other than crude, but not chemically modified                                                        | Rape and Mustard Oil |
| 151491           | Vegetable oils: excluding low erucic acid rape or colza oil and its fractions, crude                                                                                      | Oilcrops Oil, Other  |
| 151499           | Vegetable oils: excluding low erucic acid rape or colza oil and its fractions, other than crude, but not chemically modified                                              | Oilcrops Oil, Other  |
| 151511           | Vegetable oils: linseed oil and its fractions, crude, not chemically modified                                                                                             | Oilcrops Oil, Other  |
| 151519           | Vegetable oils: linseed oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                      | Oilcrops Oil, Other  |
| 151521           | Vegetable oils: maize (corn) oil and its fractions, crude, not chemically modified                                                                                        | Maize Germ Oil       |
| 151529           | Vegetable oils: maize (corn) oil and its fractions, other than crude, whether or not refined, but not chemically modified                                                 | Maize Germ Oil       |
| 151530           | Vegetable oils: castor oil and its fractions, whether or not refined, but not chemically modified                                                                         | Oilcrops Oil, Other  |
| 151550           | Vegetable oils: sesame oil and its fractions, whether or not refined, but not chemically modified                                                                         | Sesameseed Oil       |
| 151560           | Vegetable oils: microbial fats and oils and their fractions, whether or not refined, but not chemically modified                                                          | Oilcrops Oil, Other  |
| 151610           | Animal fats and oils and their fractions: partly or wholly hydrogenated, inter-esterified, re-esterified or elaidinised, whether or not refined, but not further prepared | Fats, Animals, Raw   |
| 160100           | Meat preparations: sausages and similar products, of meat, meat offal, blood or insects, and food preparations based on these products                                    | Meat, Other          |
| 160210           | Meat preparations: homogenised preparations of meat, meat offal blood or insects                                                                                          | Meat, Other          |
| 160220           | Meat preparations: of the prepared or preserved liver of any animal (excluding homogenised preparations)                                                                  | Meat, Other          |
| 160231           | Meat preparations: of turkeys, prepared or preserved meat or meat offal (excluding livers and homogenised preparations)                                                   | Poultry Meat         |
| 160232           | Meat preparations: of the poultry of heading no. 0105, (i.e. of fowls of the species Gallus domesticus)                                                                   | Poultry Meat         |
| 160239           | Meat preparations: of poultry (excluding turkeys), prepared or preserved meat or meat offal (excluding livers and homogenised preparations)                               | Poultry Meat         |

| BACI code | BACI description                                                                                                                                          | Item FAOSTAT            |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 160241    | Meat preparations: of swine, hams and cuts thereof, prepared or preserved (excluding homogenised preparations)                                            | Pigmeat                 |
| 160242    | Meat preparations: of swine, shoulders and cuts thereof, prepared or preserved (excluding homogenised preparations)                                       | Pigmeat                 |
| 160249    | Meat preparations: of swine, meat or meat offal (including mixtures), prepared or preserved, n.e.c. in heading no. 1602                                   | Pigmeat                 |
| 160250    | Meat preparations: of bovine animals, meat or meat offal, prepared or preserved (excluding livers and homogenised preparations)                           | Bovine Meat             |
| 160290    | Meat preparations: of meat, meat offal or the blood of any animal, n.e.c. in heading no. 1602                                                             | Meat, Other             |
| 160411    | Fish preparations: salmon, prepared or preserved, whole or in pieces (but not minced)                                                                     | Freshwater Fish         |
| 160412    | Fish preparations: herrings, prepared or preserved, whole or in pieces (but not minced)                                                                   | Pelagic Fish            |
| 160413    | Fish preparations: sardines, sardinella and brisling or sprats, prepared or preserved, whole or in pieces (but not minced)                                | Pelagic Fish            |
| 160414    | Fish preparations: tunas, skipjack tuna and bonito (Sarda spp.), prepared or preserved, whole or in pieces (but not minced)                               | Pelagic Fish            |
| 160415    | Fish preparations: mackerel, prepared or preserved, whole or in pieces (but not minced)                                                                   | Pelagic Fish            |
| 160416    | Fish preparations: anchovies, prepared or preserved, whole or in pieces (but not minced)                                                                  | Pelagic Fish            |
| 160417    | Fish preparations: eels, prepared or preserved, whole or in pieces (but not minced)                                                                       | Freshwater Fish         |
| 160418    | Fish preparations: shark fins, prepared or preserved, whole or in pieces (but not minced)                                                                 | Aquatic Animals, Others |
| 160419    | Fish preparations: fish prepared or preserved, whole or in pieces (but not minced), n.e.c. in heading no. 1604                                            | Aquatic Animals, Others |
| 160420    | Fish preparations: fish minced or in forms n.e.c. in heading no. 1604, prepared or preserved                                                              | Aquatic Animals, Others |
| 160431    | Fish preparations: caviar                                                                                                                                 | Aquatic Animals, Others |
| 160432    | Fish preparations: caviar substitutes, prepared from fish eggs                                                                                            | Aquatic Animals, Others |
| 160554    | Mollusc preparations: cuttle fish and squid, prepared or preserved                                                                                        | Molluscs, Other         |
| 160561    | Aquatic invertebrates: sea cucumbers, prepared or preserved                                                                                               | Cephalopods             |
| 160562    | Aquatic invertebrates: sea urchins, prepared or preserved                                                                                                 | Cephalopods             |
| 160563    | Aquatic invertebrates: jellyfish, prepared or preserved                                                                                                   | Cephalopods             |
| 160569    | Aquatic invertebrates: other than crustaceans, molluscs, sea cucumbers, sea urchins, and jellyfish, prepared or preserved                                 | Cephalopods             |
| 170112    | Sugars: beet sugar, raw, in solid form, not containing added flavouring or colouring matter                                                               | Sugar beet              |
| 170113    | Sugars: cane sugar, raw, in solid form, as specified in Subheading Note 2 to this chapter, not containing added flavouring or colouring matter            | Sugar cane              |
| 170114    | Sugars: cane sugar, raw, in solid form, other than as specified in Subheading Note 2 to this chapter, not containing added flavouring or colouring matter | Sugar cane              |

| <b>BACI code</b> | <b>BACI description</b>                                                                                                                                                                                                   | <b>Item FAOSTAT</b>      |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 170191           | Sugars: sucrose, chemically pure, in solid form, containing added flavouring or colouring matter                                                                                                                          | Sugar (Raw Equivalent)   |
| 170199           | Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter                                                                                                                      | Sugar (Raw Equivalent)   |
| 170310           | Sugars: molasses, from sugar cane, resulting from the extraction or refining of sugar                                                                                                                                     | Sugar cane               |
| 170390           | Sugars: molasses, from sugar beet, resulting from the extraction or refining of sugar                                                                                                                                     | Sugar beet               |
| 180100           | Cocoa beans: whole or broken, raw or roasted                                                                                                                                                                              | Cocoa Beans and products |
| 180200           | Cocoa: shells, husks, skins and other cocoa waste                                                                                                                                                                         | Cocoa Beans and products |
| 180310           | Cocoa: paste, not defatted                                                                                                                                                                                                | Cocoa Beans and products |
| 180320           | Cocoa: paste, wholly or partly defatted                                                                                                                                                                                   | Cocoa Beans and products |
| 180400           | Cocoa: butter, fat and oil                                                                                                                                                                                                | Cocoa Beans and products |
| 180500           | Cocoa: powder, not containing added sugar or other sweetening matter                                                                                                                                                      | Cocoa Beans and products |
| 180610           | Cocoa: powder, containing added sugar or other sweetening matter                                                                                                                                                          | Cocoa Beans and products |
| 180620           | Chocolate & other food preparations containing cocoa: in blocks, slabs or bars weighing more than 2kg or in liquid, paste, powder, granular or other bulk form in containers or immediate packings, content exceeding 2kg | Cocoa Beans and products |
| 180631           | Chocolate and other food preparations containing cocoa: in blocks, slabs or bars, filled, weighing 2kg or less                                                                                                            | Cocoa Beans and products |
| 180632           | Chocolate and other food preparations containing cocoa: in blocks, slabs or bars, (not filled), weighing 2kg or less                                                                                                      | Cocoa Beans and products |
| 180690           | Chocolate and other food preparations containing cocoa: n.e.c. in chapter 18                                                                                                                                              | Cocoa Beans and products |
| 190110           | Food preparations: of flour, meal, starch, malt extract or milk products, suitable for infants or young children, put up for retail sale                                                                                  | Infant food              |
| 200190           | Vegetable preparations: vegetables, fruit, nuts and other edible parts of plants, prepared or preserved by vinegar or acetic acid (excluding cucumbers and gherkins)                                                      | Vegetables, other        |
| 200210           | Vegetable preparations: tomatoes, whole or in pieces, prepared or preserved otherwise than by vinegar or acetic acid                                                                                                      | Tomatoes and products    |
| 200290           | Vegetable preparations: tomatoes, (other than whole or in pieces), prepared or preserved otherwise than by vinegar or acetic acid                                                                                         | Tomatoes and products    |
| 200410           | Vegetable preparations: potatoes, prepared or preserved otherwise than by vinegar or acetic acid, frozen                                                                                                                  | Potatoes and products    |
| 200490           | Vegetable preparations: vegetables and mixtures of vegetables (excluding potatoes), prepared or preserved otherwise than by vinegar or acetic acid, frozen                                                                | Vegetables, other        |
| 200510           | Vegetable preparations: homogenised vegetables, prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                | Vegetables, other        |
| 200520           | Vegetable preparations: potatoes, prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                              | Potatoes and products    |

| BACI code | BACI description                                                                                                                                                                                                                                        | Item FAOSTAT                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 200540    | Vegetable preparations: peas ( <i>pisum sativum</i> ), prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                                       | Peas                         |
| 200551    | Vegetable preparations: beans, shelled, prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                                                      | Beans                        |
| 200559    | Vegetable preparations: beans, (not shelled), prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                                                | Beans                        |
| 200570    | Vegetable preparations: olives, prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                                                                              | Olives (including preserved) |
| 200599    | Vegetable preparations: vegetables and mixtures of vegetables n.e.c. in heading no. 2005, prepared or preserved otherwise than by vinegar or acetic acid, not frozen                                                                                    | Vegetables, other            |
| 200600    | Vegetables, fruit, nuts, fruit-peel and other parts of plants, preserved by sugar (drained, glaze or crystallised)                                                                                                                                      | Vegetables, other            |
| 200791    | Jams, jellies, marmalades, purees and pastes: of citrus fruit, being cooked preparations (excluding homogenised), whether or not containing added sugar or other sweetening matter                                                                      | Citrus, Other                |
| 200820    | Fruit: pineapples, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                   | Pineapples and products      |
| 200830    | Fruit: citrus, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                       | Citrus, Other                |
| 200840    | Fruit: pears, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                        | Fruits, other                |
| 200850    | Fruit: apricots, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                     | Fruits, other                |
| 200860    | Fruit: cherries, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                     | Fruits, other                |
| 200870    | Fruit: peaches, including nectarines, prepared or preserved in ways n.e.c. in heading no. 2007 and 2008, whether or not containing added sugar, other sweetening matter or spirit                                                                       | Fruits, other                |
| 200880    | Fruit: strawberries, prepared or preserved in ways n.e.c. in heading no. 2007, whether or not containing added sugar, other sweetening matter or spirit                                                                                                 | Fruits, other                |
| 200891    | Fruit, palm hearts: prepared or preserved, whether or not containing added sugar, other sweetening matter or spirit                                                                                                                                     | Fruits, other                |
| 200893    | Fruit: cranberries ( <i>Vaccinium macrocarpon</i> , <i>Vaccinium oxycoccos</i> ): Iignonberries ( <i>Vaccinium vitis-idaea</i> ), prepared or preserved, whether or not containing added sugar, other sweetening matter or spirit                       | Fruits, other                |
| 200897    | Fruit, nuts and other edible parts of plants: mixtures (other than those of subheading no 2008.19): prepared or preserved in ways n.e.c. in headings 2007 and 2008, whether or not containing added sugar, or other sweetening matter or spirit, n.e.c. | Fruits, other                |
| 200899    | Fruit, nuts and other edible parts of plants: prepared or preserved, whether or not containing added sugar, other sweetening matter or spirit, n.e.c. in heading no. 2008                                                                               | Fruits, other                |
| 200921    | Juice: grapefruit or pomelo, of a Brix value not exceeding 20, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter                                                                             | Grapefruit and products      |
| 200929    | Juice: grapefruit or pomelo, of a Brix value exceeding 20, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                                                                                   | Grapefruit and products      |
| 200931    | Juice: of single citrus fruit (excluding orange, grapefruit or pomelo), of a Brix value not exceeding 20, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                                    | Citrus, Other                |

| BACI code | BACI description                                                                                                                                                                                                 | Item FAOSTAT                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 200939    | Juice: of single citrus fruit (excluding orange, grapefruit or pomelo), of a Brix value exceeding 20, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter | Citrus, Other                   |
| 200950    | Juice: tomato, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                                                                                        | Tomatoes and products           |
| 200961    | Juice: grape, of a Brix value not exceeding 30, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter                                                     | Grapes and products (excl wine) |
| 200969    | Juice: grape, of a Brix value exceeding 30, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                                                           | Grapes and products (excl wine) |
| 200989    | Juice: of any single fruit, nut or vegetable n.e.c. in heading no. 2009, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                              | Fruits, other                   |
| 200990    | Juices: mixtures of fruits or vegetables (but not nut juice), unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter                                         | Vegetables, other               |
| 210111    | Extracts, essences and concentrates: of coffee, and preparations with a basis of these extracts, essences or concentrates or with a basis of coffee                                                              | Coffee and products             |
| 210112    | Preparations with a basis of extracts, essences or concentrates or with a basis of coffee                                                                                                                        | Coffee and products             |
| 210130    | Chicory, roasted and other roasted coffee substitutes: extracts, essences and concentrates thereof                                                                                                               | Coffee and products             |
| 210310    | Sauces: soya                                                                                                                                                                                                     | Soyabeans                       |
| 210320    | Sauces: tomato ketchup and other tomato sauces                                                                                                                                                                   | Tomatoes and products           |
| 210330    | Mustard flour and meal and prepared mustard                                                                                                                                                                      | Rape and Mustardseed            |
| 220291    | Non-alcoholic beverages: non-alcoholic beer                                                                                                                                                                      | Beer                            |
| 220300    | Beer: made from malt                                                                                                                                                                                             | Beer                            |
| 220410    | Wine: sparkling                                                                                                                                                                                                  | Wine                            |
| 220421    | Wine: still, in containers holding 2 litres or less                                                                                                                                                              | Wine                            |
| 220422    | Wine: still, in containers holding more than 2 litres but not more than 10 litres                                                                                                                                | Wine                            |
| 220429    | Wine: still, in containers holding more than 10 litres                                                                                                                                                           | Wine                            |
| 220430    | Grape must: n.e.c. in heading no. 2009, n.e.c. in item no. 2204.2                                                                                                                                                | Grapes and products (excl wine) |
| 220510    | Vermouth and other wine of fresh grapes, flavoured with plants or aromatic substances, in containers holding 2 litres or less                                                                                    | Wine                            |
| 220590    | Vermouth and other wine of fresh grapes, flavoured with plants or aromatic substances, in containers holding more than 2 litres                                                                                  | Wine                            |
| 220600    | Beverages, fermented: (e.g. cider, perry, mead, sake)                                                                                                                                                            | Beverages, Fermented            |
| 220820    | Spirits obtained by distilling grape wine or grape marc                                                                                                                                                          | Wine                            |
| 220830    | Whiskies                                                                                                                                                                                                         | Beverages, Alcoholic            |
| 220840    | Rum and other spirits obtained by distilling fermented sugar-cane products                                                                                                                                       | Beverages, Alcoholic            |

| BACI code | BACI description                                                                                                                                                                                                                                  | Item FAOSTAT               |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 220850    | Gin and geneva                                                                                                                                                                                                                                    | Beverages, Alcoholic       |
| 220860    | Vodka                                                                                                                                                                                                                                             | Beverages, Alcoholic       |
| 220890    | Spirits, liqueurs and other spirituous beverages: n.e.c. in heading no. 2208                                                                                                                                                                      | Beverages, Alcoholic       |
| 230210    | Bran, sharps and other residues: of maize (corn), whether or not in the form of pellets, derived from the sifting, milling or other workings thereof                                                                                              | Maize and products         |
| 230400    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil                                                                                                                | Soyabean Oil               |
| 230500    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of ground-nut oil                                                                                                               | Groundnut Oil              |
| 230610    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of cotton seed oils                                                                                                             | Cottonseed Oil             |
| 230620    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of linseed oils                                                                                                                 | Oilcrops Oil, Other        |
| 230630    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of sunflower seed oils                                                                                                          | Sunflowerseed Oil          |
| 230641    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of low erucic acid rape or colza seed oils                                                                                      | Rape and Mustard Oil       |
| 230649    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of rape seed oils (other than low erucic acid rape or colza)                                                                    | Rape and Mustard Oil       |
| 230650    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of coconut or copra seed oils                                                                                                   | Coconut Oil                |
| 230660    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of palm nuts or kernels oils                                                                                                    | Palmkernel Oil             |
| 230690    | Oil-cake and other solid residues: whether or not ground or in the form of pellets, resulting from the extraction of oils, n.e.c. in heading no. 2306                                                                                             | Oilcrops Oil, Other        |
| 230700    | Wine lees: argol                                                                                                                                                                                                                                  | Wine                       |
| 330113    | Oils, essential: of lemon (terpeneless or not), including concretes and absolutes                                                                                                                                                                 | Lemons, Limes and products |
| 330119    | Oils, essential: of citrus fruits n.e.c. in heading no. 3301 (terpeneless or not), including concretes and absolutes                                                                                                                              | Citrus, Other              |
| 410120    | Raw hides and skins: whole, unsplit, of bovine or equine animals, of a weight per skin not exceeding 8kg when simply dried, 10kg when dry-salted or 16kg when fresh, wet-salted or otherwise preserved                                            | Bovine Meat                |
| 410150    | Hides and skins: raw, whole, of bovine or equine animals, of a weight per skin exceeding 16 kg                                                                                                                                                    | Bovine Meat                |
| 410190    | Hides and skins: other than whole, but including butts, bends and bellies, of bovine (including. buffalo) and equine animals, fresh, salted or preserved, but not tanned, parchment dressed or further prepared, whether or not dehaired or split | Bovine Meat                |

Table A4. Mapping table on allocation of pathway losses to value chain stage (Circle Economy's elaboration)

| Item                         | Subcomponent                   | Upstream                    | Use phase | Downstream                                          |
|------------------------------|--------------------------------|-----------------------------|-----------|-----------------------------------------------------|
| Consumption of fixed capital | Consumption of fixed capital   |                             | x         |                                                     |
| Processing losses            | Processing losses              | x (residual material value) |           | x (waste treatment cost)                            |
| End-of-Life waste            | End-of-Life waste              |                             |           | x (residual product value and waste treatment cost) |
| Food waste and losses        | Food waste                     |                             | x         |                                                     |
|                              | Food losses                    | x                           |           |                                                     |
| Energy losses                | Fuel extraction and processing | x                           |           |                                                     |
|                              | Power conversion - gas         | x                           |           |                                                     |
|                              | Power conversion - coal        | x                           |           |                                                     |
|                              | Power conversion - other       | x                           |           |                                                     |
|                              | Transport losses - wires       | x                           |           |                                                     |
|                              | Transport losses - pipes       | x                           |           |                                                     |
|                              | Transport losses - ships       | x                           |           |                                                     |
|                              | End-use - transport            |                             | x         |                                                     |
|                              | End-use - buildings            |                             | x         |                                                     |
|                              | End-use - industry             |                             | x         |                                                     |
|                              | End-use - other                |                             | x         |                                                     |

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## External methodology review

The methodology was reviewed by the following independent subject-matter specialists with experience in macroeconomics, environmental economics and related fields. These specialists provided feedback on the conceptual and methodological soundness of the approach. Their feedback informed refinements to the methodology where relevant. Responsibility for the final methodology remains with the authors. Affiliations are listed for identification purposes only.

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