

The Circularity Gap Report 2026

The Value Gap

Methodology document

Version 1.0

22/12/2025

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About Circle Economy

Circle Economy is driving the transition to a new economy. In this circular economy, we help businesses, cities, and nations leverage business opportunities, reduce costs, create jobs, and inspire behavioural change. As a global impact organisation, our international team equips business leaders and policymakers with the insights, strategies, and tools to turn circular ambition into action.

Circle Economy has been at the forefront of the circular economy since 2011. Our annual Circularity Gap Report (CGR®) sets the standard for measuring progress, and we manage the world's largest circularity database, encompassing data from over 90 nations, 350 cities, and 1,000 businesses.

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*'.¹ 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.²

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.³ 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.⁴

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).

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

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

³ 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](#)

⁴ 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.⁵

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).⁶ 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.

⁵ 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

⁶ 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

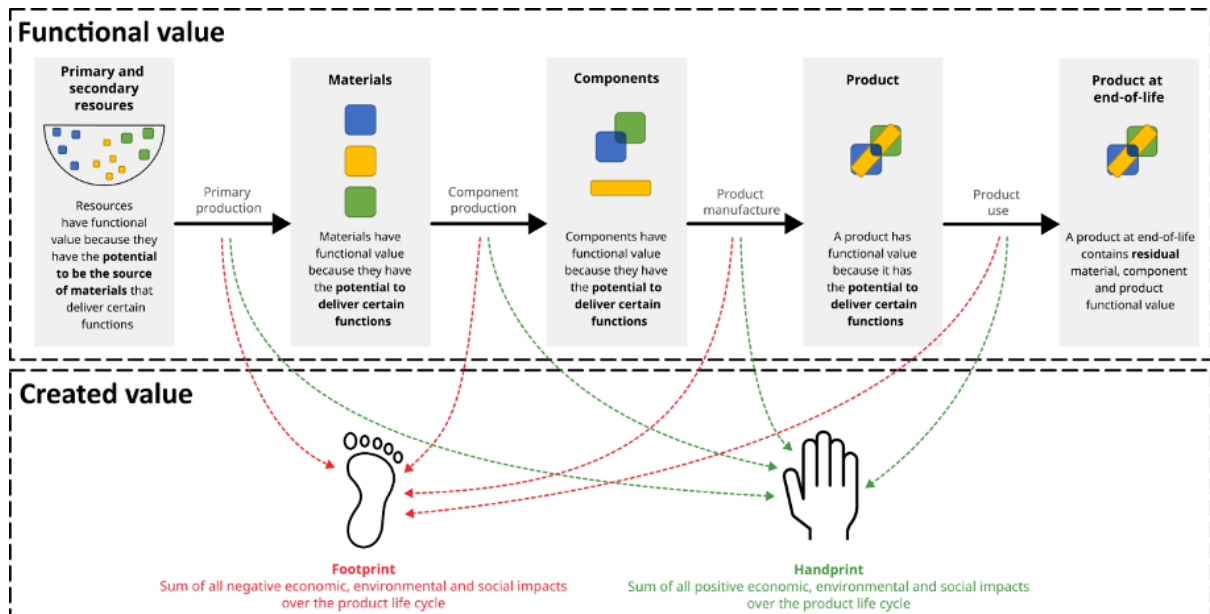
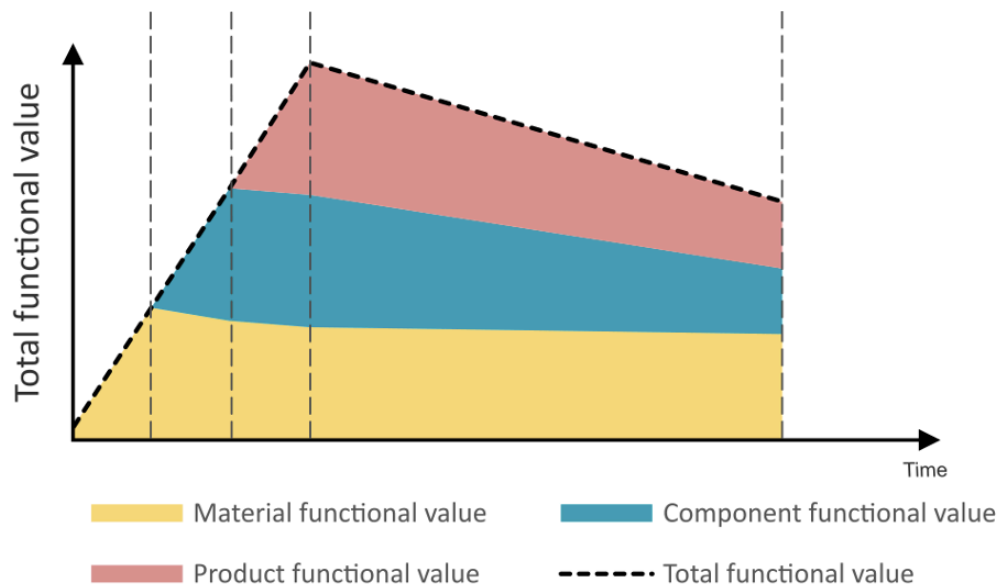


Figure one. Schematic overview of the two value types relevant to the circular economy. The illustration is limited to the product life cycle until the end-of-life, providing a visual representation of the meaning and relation of both value types. Source: Vulsteke et al. (2024)

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.⁷ When visualised over the life-cycle, the rise, peak, and decline resemble a 'value hill'.⁸



⁷ 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

⁸ 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.com/en/insights/reports/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.⁹

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.¹⁰ 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’.

⁹ 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

¹⁰ 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.¹¹ 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.

¹¹ 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.

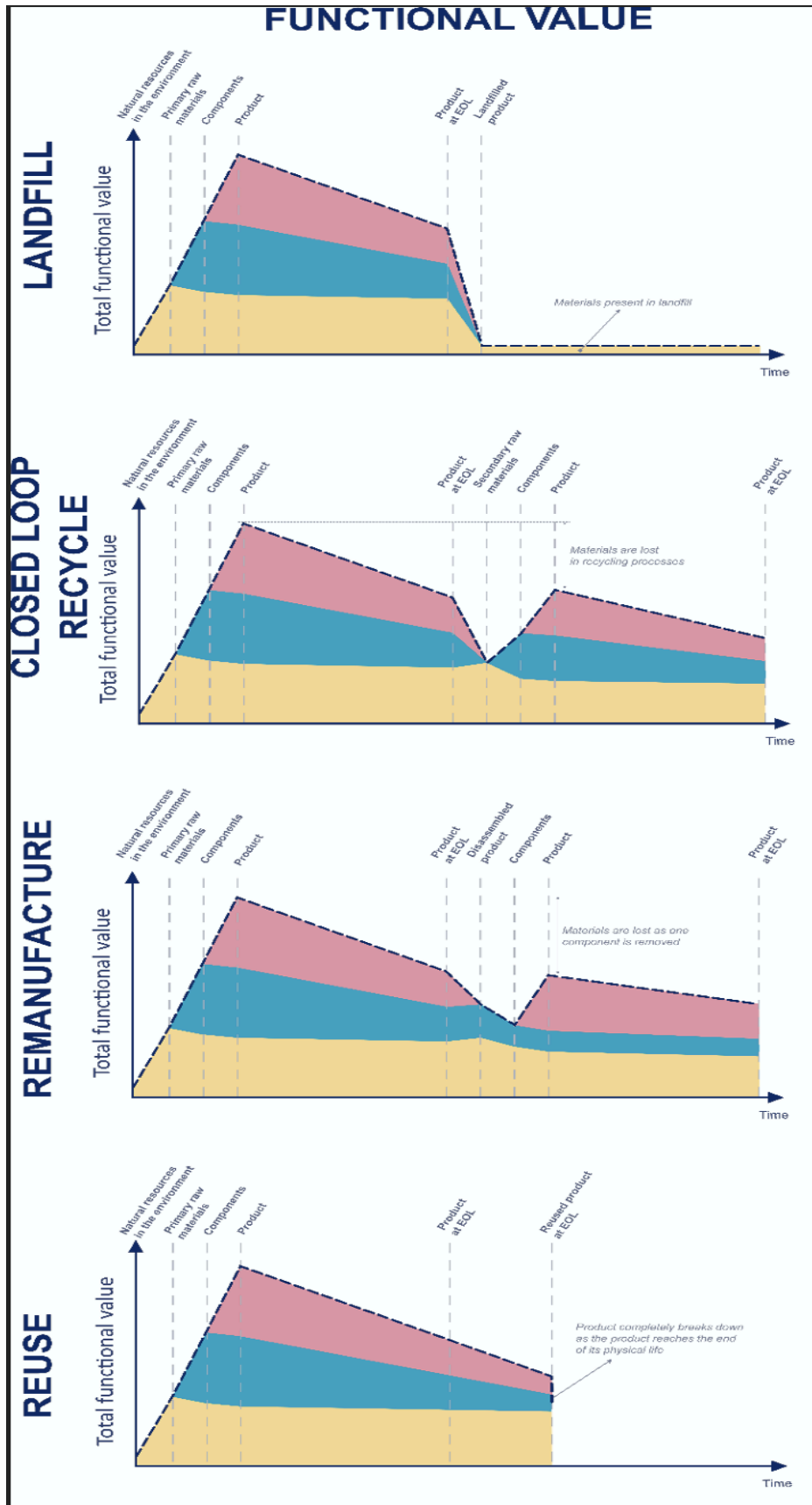


Figure three. Estimated evolution of functional value for four different end-of-life strategies for a durable product. Source: Vulsteke et al. (2024)

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 unsorted¹² 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 dealing¹³ 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 emissions¹⁴ and an eco-efficiency-based opportunity cost for unsorted waste.¹⁵ 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.

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

¹³ 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)

¹⁴ 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

¹⁵ 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.¹⁶

¹⁶ 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** (θ_{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 cost¹⁷ of unsorted processing losses;
- **Food losses and waste** (θ_{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** (θ_{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** (θ_{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** (θ_{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

¹⁷ 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
Consumption of fixed capital (θ_{cfc})	Assumed avoidable fraction of Consumption of Fixed Capital (CFC): 25%	Assumed avoidable fraction of Consumption of Fixed Capital (CFC): 50%
Processing losses (θ_{proc})	Shadow price of uncollected waste - 346 \$/ton	Shadow price of uncollected waste - 375 \$/ton
End-of-Life waste (θ_{EoL})	<i>Treatment rates prices (\$/ton)*:</i> Collection: 20-30-50-85 Landfill: 10-15-20-40 Open dumping: 2-3-0-0 Waste to Energy: 0-40-60-40 Recycling: 0-5-5-30	<i>Treatment rates prices (\$/ton)*:</i> Collection: 50-75-100-250 Landfill: 30-40-65-100 Open dumping: 8-10-0-0 Waste to Energy: 0-1-00-150-200 Recycling: 25-30-50-80
Food waste and losses (θ_{food})	Food waste edible shares: 25%	Food waste edible shares: 75%
Energy losses (θ_{en})	Rebound effect: 25%	Rebound effect: 50%

*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
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		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.¹⁸

¹⁸ 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.¹⁹ 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 v3.9.4²⁰ 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.²¹ 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.’²²

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

¹⁹ 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). [\[Source\]](#)

²⁰ 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>

²¹ 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](#)

²² 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 α 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.²³

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.²⁴ 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).²⁵ Material composition of NAS is assumed to remain constant at 2013 levels (**Table four**).

Processing losses are calculated as:

²³ 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

²⁴ 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

²⁵ 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,^{26,27} 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 ($1 - TR_{rec}$), 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^{28,29} (including the cost of collection) are calculated using treatment rates per region group.³⁰ Finally, for uncollected waste, the shadow price of 'unsorted' waste (here more broadly interpreted as 'not collected')³¹ 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:

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

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

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

²⁶ 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](#)

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

²⁸ 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

²⁹ 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](#)

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

³¹ 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:

- θf and θs 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,
- τ 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 θ_{proc} is then given by the sum of the material value of disposed processing losses (θf_{ij} and θs_{ij}), the cost of treatment (including recycling) and the shadow cost of all collected and uncollected processing losses, respectively (τ_{ij}).

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

Material category	Raw products price ^{26,27} (\$/kg)	Semi-finished products price ^{26,27} (\$/kg)	Unrec. process loss factor semifinished ²⁴ (%)	Rec. process loss factor semifinished ²⁴ (%)	Unrec. process loss factor final ²⁴ (%)	Rec. process loss factor final ²⁴ (%)	NAS composition ²⁵ (%)	EoL waste composition ²⁵ (%)
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 ^{29,31} (\$/t)	10	2	0	5	-	-	346	20
	High-end cost ^{29,31} (\$/t)	30	8	25	30	-	-	375	50
	Rates ^{28,30} (%)	8	18	5	-	1	-	67	33
Lower-middle income	Low-end cost ^{29,31} (\$/t)	15	3	5	10	40	20	346	30
	High-end cost ^{29,31} (\$/t)	40	10	30	40	100	80	375	75
	Rates ^{28,30} (%)	17	17	16	-	0	-	50	50
Upper-middle income	Low-end cost ^{29,31} (\$/t)	20	-	5	20	60	50	346	50
	High-end cost ^{29,31} (\$/t)	65	-	50	75	150	100	375	100
	Rates ^{28,30} (%)	54	5	30	-	0	-	10	90
High income	Low-end cost ^{29,31} (\$/t)	40	-	30	35	40	65	346	85
	High-end cost ^{29,31} (\$/t)	100	-	80	90	200	150	375	250
	Rates ^{28,30} (%)	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'.³²

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.

³² 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 assets³⁴ 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,³⁵ 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:

$$NCP_{zj} = (NCS_{zj} / STK_{zj})$$

$$\theta EoL_{z,j} = \sum_{z=1}^n \sum_{j=1}^n (EoL_{zj} * NCP_{zj}) - VM_{rec}$$

$$\tau EoL_{z,j} = \sum_{l=1}^n EoL_{zj} * TR_{jl} * PT_l$$

$$\theta_{EoL_{av}} = \sum_{z=1}^n \sum_{j=1}^n (\theta EoL + \tau EoL)$$

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
- θEoL 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
- τEoL 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.

³³ 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.

³⁴ 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

³⁵ 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_{z_j} 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 θEoL 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 FAOSTAT³⁶ 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,³⁷ 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 Annex). 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.

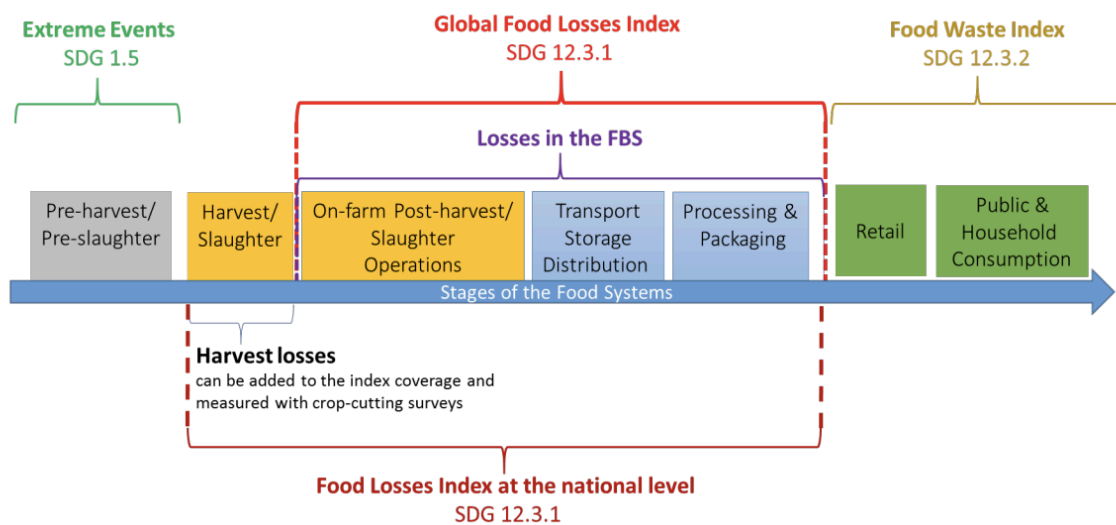


Figure four. Food supply boundaries, extracted from the Food Agriculture Organization of the United Nations (FBS: Food Balance Sheets).³⁸

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,³⁹ 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

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

³⁷ 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](#)

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

³⁹ 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,⁴⁰ 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
Edible share	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

⁴⁰ UNEP. (2024). *Food Waste Index Report 2024. Think Eat Save: Tracking progress to halve global food waste*. Nairobi. Retrieved from: [UNEP website](#)

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,⁴¹ the IPCC 6AR,⁴² and the Rocky Mountain Institute study on the inefficiency of the energy system.⁴³

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%	-	-

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

⁴² 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>

⁴³ 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 (η_{bas})	Maximum (η_{max})	Notes/Sources
Fuel extraction and processing	10%	15%	Baseline: Back-calculated from RMI study Maximum: Assumption
Power conversion - gas	50%	60%	Baseline: Offshore Combined Cycle Gas Turbine Maximum: Onshore Combined Cycle Gas Turbine ⁴⁴

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

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

Energy prices used for valuation of energy losses were gathered from the RMI appendix⁵¹ and converted into a common unit of measure (GJ/\$) based on net calorific values from the *IEA Energy Statistics Manual*.⁵² 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.

⁴⁵ 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.jalmes.2023.100024

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

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

⁴⁸ 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](#)

⁴⁹ 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

⁵⁰ 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

⁵¹ 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](#)

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

This entailed the compilation of average emissions intensity factors for each energy carrier^{53 54 55} (biomass was assumed to be carbon neutral) and a low-end and high-end value for the SCC⁵⁶ (**Table eleven**).

Table eleven. Energy losses valuation data

Energy Carrier	Market price (GJ/\$) (ρ_{mrk})	Emission factor (kgCO2/GJ)	Shadow price low-end (\$/GJ) (ρ_{shw})	Shadow price 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 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 in power/heat generation	Coal in power/heat generation	End-use - transport in TFC	End-use - buildings in TFC	End-use - industry in TFC	Heating/cooling in TFC of buildings
Variable	α_{gas}	α_{coal}	β_{trs}	β_{bld}	β_{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 production losses	Energy transport losses	Final energy	Energy use losses	Useful energy	Source/Formula
Fuel extraction and processing	ω_{ext}	51.0	-	-	-	-	RMI study

⁵³ 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](#)

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

⁵⁵ 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](#)

⁵⁶ 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	ω_{gas}	25.1	-	-	-	-	$TPS_{gas} * \alpha_{gas} * (1 - \eta_{gas})$
Power conversion - coal	ω_{coal}	62.3	-	-	-	-	$TPS_{coal} * \alpha_{coal} * (1 - \eta_{coal})$
Power conversion - other	ω_{conv}	41.9	-	-	-	-	$TPS - TFC - \sum \omega$
Transport losses - wires	ω_{wir}	-	6.0	-	-	-	$TFC_{el} * (1 - \eta_{wir,bas})$
Transport losses - pipes	ω_{pip}	-	5.8	-	-	-	$TPS_{gas} * (1 - \eta_{pip,bas})$
Transport losses - ships	ω_{shp}	-	6.0	-	-	-	RMI study
End-use - transport	ω_{trs}	-	-	118.9	89.2	29.7	$TFC * \beta_{trans} * (1 - \eta_{trs,bas})$
End-use - buildings	ω_{bld}	-	-	131.8	39.6	92.3	$TFC * \beta_{bld} * (1 - \eta_{bld,bas})$
End-use - industry	ω_{ind}	-	-	141.4	42.4	99.0	$TFC * \beta_{ind} * (1 - \eta_{ind,bas})$
End-use - other	ω_{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 ω , ω_{av} and ω_{unav} are the total, avoidable and unavoidable losses at step i , while σ is a direct and indirect rebound effect coefficient assumed to range between 25%⁵⁷ and 50%.⁵⁸

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.

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

⁵⁷ 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/whitepapers/the-rebound-effect-large-or-small/)

⁵⁸ 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).⁵⁹ Alternatively, the integration of GDP with another indicator capturing the unpriced value of ecosystem services such as the Gross Ecosystem Product (GEP)⁶⁰ 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.⁶¹
- *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,

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

⁶⁰ 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

⁶¹ Pansera, M., Barca, S., Martinez Alvarez, B., Leonardi, E., D’Alisa, G., Meira, T., & Guillibert, 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),^{62,63} using a consistent set of shadow prices.⁶⁴

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.⁶⁵
- *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.⁶⁶ As no global peer-reviewed estimates of the ‘per cent avoidable’ exist, this

⁶² Bulle, C., Margni, M., Patouillard, L., Boulay, A.-M., Bourgault, G., De Bruille, V., ... Jolliet, 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

⁶³ 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

⁶⁴ CE Delft. (2023). Handboek milieuprijzen 2023. Methodische onderbouwing van kengetallen gebruikt voor waardering van emissies en milieu-impacts. Retrieved from: [CE Delft website](#)

⁶⁵ 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

⁶⁶ 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.⁶⁷ 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.

⁶⁷ 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 scrapping 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.^{68,69} 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

⁶⁸ 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

⁶⁹ 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.^{70,71} 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)⁷² and Vélez-Henao et al. (2023) provide the basis for determining the “basic” level for each human need.⁷³ 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) ⁷⁴ and Global Status Report for Buildings and Construction (2024) ⁷⁵
Nutrition	kcal/(cap*day)	2084.0	2978.0	FAOSTAT Food Balance Sheets ⁷⁶
Mobility	km/(cap*yr)	8274.0	6800.0	Circle Economy's estimate based on Our World in

⁷⁰ 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

⁷¹ 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

⁷² 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

⁷³ 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

⁷⁴ 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

⁷⁵ 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

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

				Data, ^{77,78} UIC, ⁷⁹ ACI World-ICAO ⁸⁰ and ITF (2023) ⁸¹
Hygiene	L water/(cap*day)	50.0	70.4	McCarton et al. (2022) ⁸²
Education	m ² /(cap*yr)	2.5	1.3	Circle Economy's estimate based on Global Status Report for Buildings and Construction (2024)
Healthcare	m ² /(cap*yr)	1.6	0.6	Circle Economy's estimate based on Sen-Crowe et al. (2021) ⁸³ and Global Status Report for Buildings and Construction (2024)
Collective services	m ² /(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 ⁸⁴ and GSMA ⁸⁵
	laptop/(adult*yr)	0.3	0.6	Circle Economy's estimate based on Canalysis ⁸⁶
	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

⁷⁷ 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.

⁷⁸ 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].

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

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

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

⁸² 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

⁸³ Sen-Crowe, B., Sutherland, M., McKenney, M., & Elkbuli, 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

⁸⁴ 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](#)

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

⁸⁶ 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 θ_{con} is the value loss related to overconsumption, Y is the total final demand vector from Exiobase, α_{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_FSHP	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 - 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	
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 slugde, 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_PRHH	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)**

BACI code	BACI description	Item FAOSTAT
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 gorboscha</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 (<i>Dissostichus</i> spp.), excluding fillets, livers, roes, and edible fish offal of subheadings 0303.91 to 0303.99	Marine Fish, Other
030384	Fish: frozen, seabass (<i>Dicentrarchus</i> 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 (<i>Oreochromis</i> spp.)	Aquatic Animals, Others
030432	Fish fillets: fresh or chilled, catfish (<i>Pangasius</i> spp., <i>Silurus</i> spp., <i>Clarias</i> spp., <i>Ictalurus</i> spp.)	Freshwater Fish
030433	Fish fillets: fresh or chilled, Nile perch (<i>Lates niloticus</i>)	Freshwater Fish
030439	Fish fillets: fresh or chilled, carp (as specified by the WCO), eels (<i>Anguilla</i> spp.), and snakeheads (<i>Channa</i> spp.)	Freshwater Fish
030441	Fish fillets: fresh or chilled, salmon, Pacific (<i>Oncorhynchus nerka</i> , <i>Oncorhynchus gorboscha</i> , <i>Oncorhynchus keta</i> , <i>Oncorhynchus tshawytscha</i> , <i>Oncorhynchus kisutch</i> , <i>Oncorhynchus masou</i> and <i>Oncorhynchus rhodurus</i>), Atlantic (<i>Salmo salar</i>), Danube (<i>Hucho hucho</i>)	Freshwater Fish
030442	Fish fillets: 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>)	Freshwater Fish
030443	Fish fillets: fresh or chilled, flat fish (<i>Pleuronectidae</i> , <i>Bothidae</i> , <i>Cynoglossidae</i> , <i>Soleidae</i> , <i>Scophthalmidae</i> and <i>Citharidae</i>)	Freshwater Fish
030444	Fish fillets: fresh or chilled, of the families <i>Bregmacerotidae</i> , <i>Euclichthyidae</i> , <i>Gadidae</i> , <i>Macrouridae</i> , <i>Melanonidae</i> , <i>Merlucciidae</i> , <i>Moridae</i> , and <i>Muraenolepididae</i>	Demersal Fish
030445	Fish fillets: fresh or chilled, swordfish (<i>Xiphias gladius</i>)	Demersal Fish
030446	Fish fillets: fresh or chilled, toothfish (<i>Dissostichus</i> 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 (<i>Rajidae</i>)	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 <i>Bregmacerotidae</i> , <i>Euclichthyidae</i> , <i>Gadidae</i> , <i>Macrouridae</i> , <i>Melanonidae</i> , <i>Merlucciidae</i> , <i>Moridae</i> , and <i>Muraenolepididae</i>	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, Eulichthyidae, 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
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

BACI code	BACI description	Item FAOSTAT
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

BACI code	BACI description	Item FAOSTAT
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

BACI code	BACI description	Item FAOSTAT
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

BACI code	BACI description	Item FAOSTAT
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

BACI code	BACI description	Item FAOSTAT
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

BACI code	BACI description	Item FAOSTAT
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 (<i>Sarda</i> 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

BACI code	BACI description	Item FAOSTAT
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	

Acknowledgements

Circle Economy would like to thank the funders, authors and contributors for their contribution to the preparation of this edition of the Circularity Gap Report 2026. Authors have contributed in their individual capacities.

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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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