



ENCORE Insights
Country Dashboard



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Methodology

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1. Introduction

The ENCORE Insights: Country Dashboard developed under the Horizon-funded Nature-3B project by Global Canopy enables regulators, policymakers, civil society and financial institutions to understand how European economies depend on nature and are exposed to nature loss as a result. It combines data about the extent of sectors' and subsectors' nature dependency with data on their monetary value to help identify the most critical parts of the economy in terms of exposure to nature degradation. Importantly, it quantifies those dependencies across countries' supply chains and differentiates between their domestic and foreign exposure to allow for more targeted policy responses.

The Country Dashboard is the first of the ENCORE Insights websites. These are satellite projects of ENCORE, produced by the ENCORE partners Global Canopy, United Nations Environment Programme World Conservation and Monitoring Centre (UNEP-WCMC) and United Nations Environment Programme Finance Initiative (UNEP FI). They combine the ENCORE knowledge base with other data to bring new insights about the economy's dependency on nature and its impact on it.

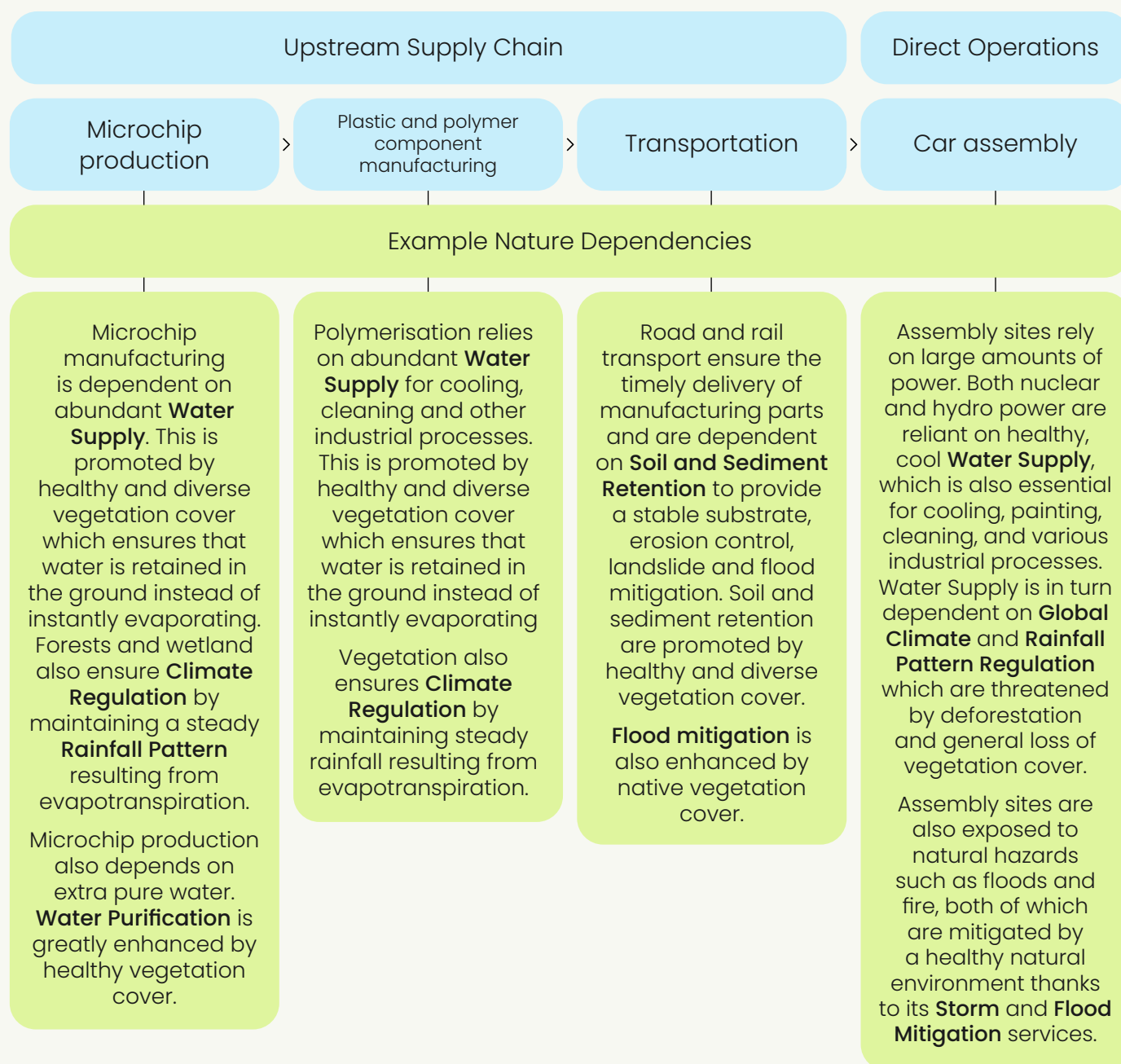
The Country Dashboard quantifies the exposure of European economies on ecosystem services in a visually engaging and accessible format. Additionally, it supports the advancement of open-source and transparent methodologies for nature-related economic risks, providing accountability and catalysing action. This document sets out the methodology used to calculate economies' exposure to nature loss for Version 3.0 of the Country Dashboard launched in October 2026, which for the first time introduces data not just on the exposure of countries' production, but also on their consumption, employment and exports.

2. Context

Ecosystem services are the connections between nature and business. Each of these services represents a benefit that nature provides to enable or facilitate economic activities such as clean air and water, pollination for crops and the regulation of climate and fertile soil for food production (ENCORE Partners, 2026). All economic activities therefore fundamentally depend on nature to some extent as nature provides the raw materials, resources and essential processes necessary for the production of goods and services (**Figure 1**). This dependence exposes companies and national economies to significant risks as disruptions to natural systems can either affect production directly or propagate through supply chains. All industries are exposed to nature-related risk to some degree, with consequences for national economic stability and public health. To effectively address and mitigate this exposure, it is important to quantify these dependencies on nature at the national and sector level.

Figure 1

Simplified supply chain schematic showing how the production of cars is dependent on nature at multiple points in the supply chain.



Note: The ecosystem service dependencies are simplified for illustrative purposes and are not exhaustive.

3. Data

The analysis of nature dependencies combines two main datasets: ENCORE and EXIOBASE. ENCORE provides an indication of an economic activity's dependence on nature but it does not provide any data on the monetary value of this activity. EXIOBASE, on the other hand, is a global dataset based on national accounts that assigns a monetary value to economic sectors and subsectors in each country. By bringing these two datasets together, the Country Dashboard sheds light on sectors and subsectors' monetary exposure to nature loss. EXIOBASE also describes supply chain linkages within and between countries, which allows the Country Dashboard to quantify exposure across a country's international supply chain.

3.1 ENCORE

3.1.1 Data description

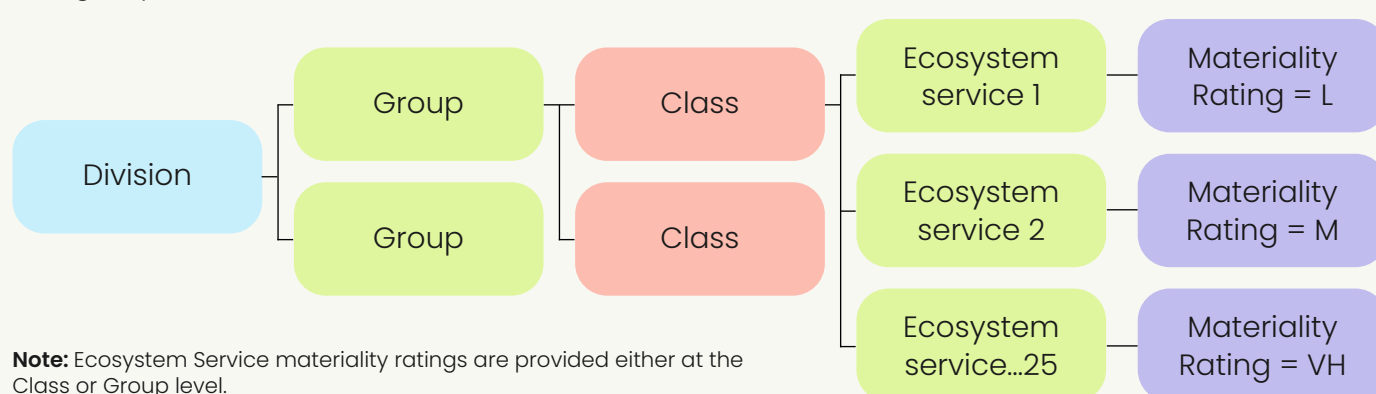
ENCORE was developed by Global Canopy, UNEP-FI and UNEP-WCMC with funding from the Swiss State Secretariat for Economic Affairs (SECO) and the MAVA Foundation. ENCORE was launched in 2018 with the original aim to support financial institutions and companies to understand how their activities rely on nature. The ENCORE knowledge base provides linkages between economic activities and the ecosystem services upon which they depend. In 2024, it was updated under the [SUSTAIN project](#). The 2024 updated version has been used in this analysis¹.

Footnote 1

For further information, see the [ENCORE update and methodology](#)

3.1.2 Economic activities classification

The ENCORE economic activities are categorised using the [UN's International Standard Industrial Classification of All Economic Activities](#) (ISIC Rev 4). ISIC divides economic activities into Sections, which are further broken down into Divisions, Groups and Classes (Figure 2 below). This provides materiality ratings for 271 economic activities based on either ISIC group or class level (levels 3 and 4).



3.1.3 Ecosystem services

In ENCORE, ecosystem services are defined as the connections between nature and business with each ecosystem service representing a benefit that nature provides to enable or facilitate economic activities. Ecosystem services are classified according to the [UN System of Environmental Economic Accounting Ecosystem Accounting](#) categorisation of ecosystem services (ENCORE Partners, 2026). This comprises 25 ecosystem services² within three categories:

1. **Provisioning services** (i.e. those related to the supply of food, fibre, fuel and water).
2. **Regulating and maintenance services** (i.e. those related to activities of filtration, purification, regulation and maintenance of air, water, soil, habitat and climate).
3. **Cultural services** (i.e. the experiential and non-material services related to the perceived or realised qualities of ecosystems whose existence and functioning enables a range of cultural benefits to be derived by individuals).

For a full description of each of the 25 ecosystem services in ENCORE, see Appendix 6.1.

Figure 2

Schematic of the structure of ISIC economic activities, association to ecosystem services and allocation of materiality ratings. Ecosystem Service materiality ratings are provided either at the Class or Group level.

Footnote 2

Some ecosystem services are considered Final ecosystem services and other intermediate. For the purposes of this analysis, we have included all 25 ecosystem services, both final and intermediate.

3.1.4 ENCORE materiality ratings

In ENCORE, an ISIC economic activity's dependence on nature is assessed by assigning a materiality rating to each of the 25 ecosystem services on which it depends, so that each activity has 25 **ENCORE Materiality Ratings**. Materiality ratings provide an indication of the significance of an economic activity's potential nature-related dependencies at a typical global level. The term 'material' in this context refers to "*significant or important to consider in the decision-making process*" (ENCORE, 2024). Materiality ratings use a rating scale of Very High (VH), High (H), Medium (M), Low (L) and Very Low (VL). If an economic activity does not depend on a given ecosystem service, it is assigned Not Applicable (NA). It is assigned No Data (ND) where there is insufficient evidence to assign a rating. See Appendix 6.2 to understand these dependency ratings further.

3.1.5 Data limitations

The qualitative links between economic activities and ecosystem services in the ENCORE knowledge base are high-level, global links. Therefore, where there is a dependency link recorded for an economic activity, it does not mean that all production engaging in that activity has that dependency (you can read more about the limitations in the ENCORE knowledge base [here](#)).

ENCORE's materiality ratings represent a typical level of nature-related dependency at a global scale and are not location-specific. This means, for instance, that a sector's dependency rating on '*pollination services*' is the same everywhere, regardless of its geographical location. This spatial non-specificity becomes more limited for regulating services, for example, a sector's rating for material dependence on '*flood mitigation services*' will be the same everywhere, even though the actual exposure is highly localised.

Additionally, these ratings are not designed to be compared across different ecosystem services. Whilst they can be used to compare a single ecosystem dependency between sectors (e.g. comparing water use dependency between rice cultivation and plastic manufacturing), they should not be used to compare the materiality of different ecosystem services against each other (e.g. comparing the 'very high' materiality of a sector's '*water supply*' to its 'very low' materiality for '*pollination services*').

Finally, the materiality rating of a sector purely relates to the direct, physical exposure of its own *operations*. In the case of the financial and insurance industry, this means that the materiality of investments, loans or underwriting activities is not taken into account. As a result, indirect, financed exposure is excluded by this macro-economic assessment and should be calculated separately using financial portfolio data to trace exposure across the whole portfolio.

3.2 EXIOBASE

3.2.1 Data description

EXIOBASE⁴ is a global multi-regional input-output (MRIO) database that maps the complex economic flows within and between subsectors and

Footnote 3

<https://encorenature.org/resources/explanatory-note-on-the-updated-encore-knowledge-base-outlining-business-dependencies-and-impacts-on-nature>

Footnote 4

<https://exiobase.eu/>

countries to detail national production, global supply chains and final consumption patterns (Stadler et al., 2018). Data from national accounts – particularly Supply–Use Tables (SUTs) – is harmonised and linked with international trade data to enable analysis of the global production and interconnectedness of goods and services. Data is provided for 163 subsectors using the NACE categorisation system (Statistical Classification of Economic Activities in the European Community: NACE code, revision 1). Coverage is provided for 44 countries, which are located mostly in the EU and in the OECD, and 5 ‘rest of the world’ regions. For the Country Dashboard we aggregate the 163 subsectors into 25 sectors for each country using the groupings and sector mapping in Appendix 8.4.⁵

EXIOBASE version 3.9.6 (compiled 2020) has been used in the analysis.⁶ The core EXIOBASE 3.9 model uses SUTs up to 2020 and now-casted up to 2022 using global trade and macro-economic data.

3.2.2 Data limitations

EXIOBASE, like all MRIO models, is built on Leontief input–output theory, which assumes:

- Fixed production relationships: each industry uses a fixed proportion of inputs to produce one unit of output with no substitution between inputs is allowed.
- Homogeneous products and producers: all firms within a subsector in a given country are assumed to produce a single, identical product mix using the same technology.
- No price or behavioral dynamics: changes in demand are met through proportional increases in production – there are no market adjustments, supply constraints, or feedback effects.

As a result, the model's estimated supply chain flows may be inaccurate.

Furthermore, as EXIOBASE relies heavily on ‘now-casting,’ the reliability of the data for more recent years is lower. The current analysis uses now-casted data to 2022 based on 2020 data. It should therefore be noted that the impact of the Coronavirus pandemic is not adequately captured in post-pandemic years as well as more recent changes in the geopolitical climate and global trade tariff impacts.

Footnote 5

This is aligned with the method used by the Joint Research Committee Hirschbuehl et al. (2025) and Evison et al. (2023) based on industry groups from the World Economic Forum (WEF) Strategic Intelligence.

Footnote 6

Now-casting in EXIOBASE is the process of updating the multi-regional input-output (MRIO) database to more recent years for which official, fully compiled data is not yet available. It uses macroeconomic data and bilateral trade statistics as proxies to estimate the current economic structure, bridging the time gap between the latest complete database (e.g., 2020) and the present.

4. Empirical approach

This analysis quantifies the nature dependencies of national economies. To assess the economic significance of different parts of the global supply chain, we combine direct and upstream dependencies with an ‘origin of trade’ perspective. This allows us to quantify dependencies based on the origin of production (domestic vs imported value-added), moving beyond a simple direct and indirect approach to nature loss exposure. It enables policymakers to identify which vulnerabilities from nature loss are through domestic production and which are embedded in imports, allowing for

a more targeted policy response adapted to national boundaries. To the best of our knowledge, this is the first nature dependency analysis differentiating between domestic and foreign dependencies.⁷

The analysis integrates the two key datasets: ENCORE for subsector-level direct nature dependency materiality ratings and EXIOBASE for monetary estimates of national subsector production through in-country exchanges and global trade flows.

The core of the approach involves the following steps:

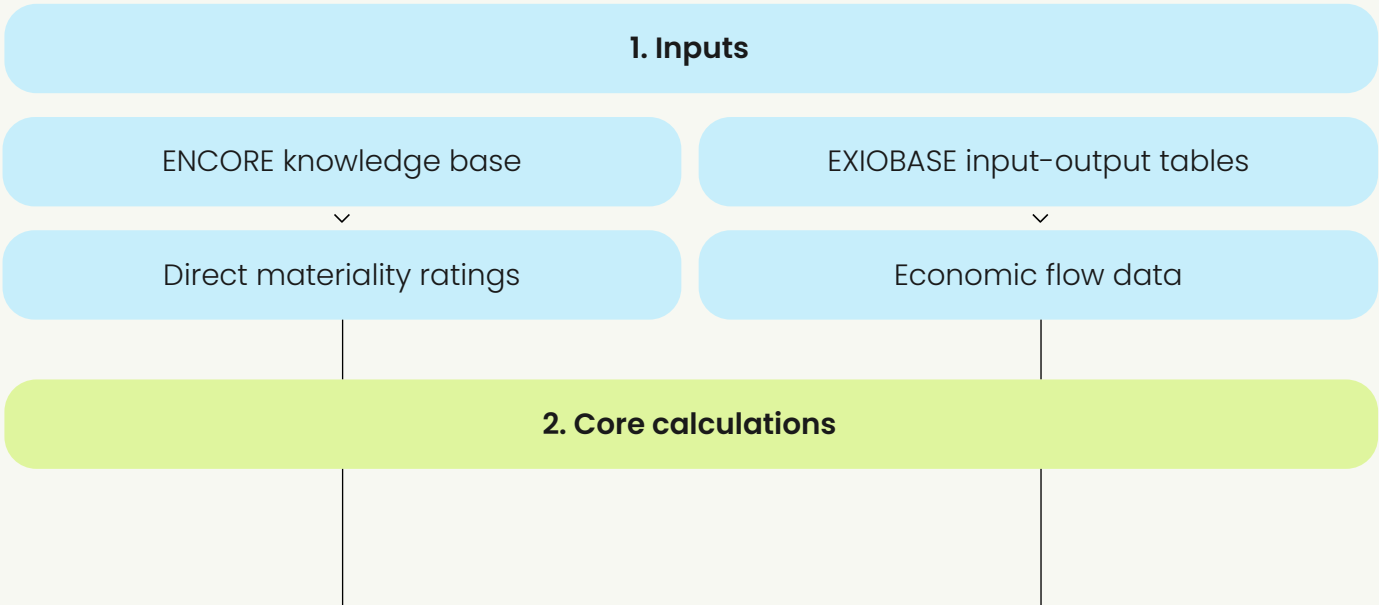
- 1. **Whole supply chain dependencies:** Calculating consolidated materiality ratings ‘from the ENCORE direct materiality ratings for relevant parts of the supply chain, at home and abroad (section 4.3.1).
- 2. **Monetary value decomposition:** Calculating value-added components (for both domestic and foreign supply chains) from EXIOBASE to represent the economic significance of different parts of the economy. In version 3.0 we further differentiate between four economic components: production, consumption, exports and employment.
- 3. **Derived metrics:** Combining the economic components with the materiality ratings to derive the monetary value, or proportion, of a subsector or country under high nature dependency.

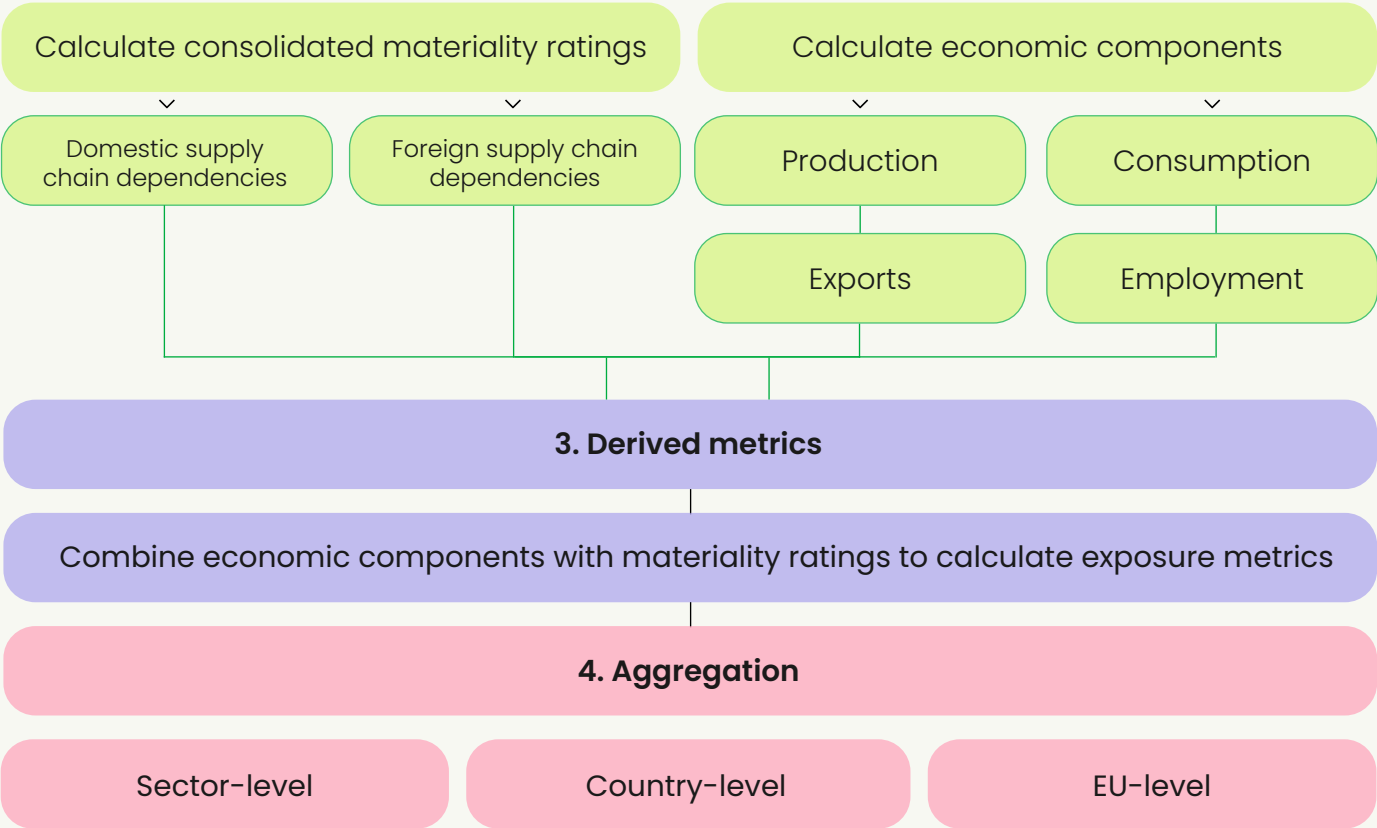
Decomposing dependencies and economic value into domestic and foreign terms allows users to query nature dependencies along multiple dimensions to answer questions such as: How does a country’s reliance on nature through domestic production compare with its reliance on nature through imports? In addition, in this most recent version the Country Dashboard provides users with the ability to view exposures across multiple socio-economic dimensions, such as consumption and employment, for a more comprehensive assessment.

The subsequent sections detail each step of the analytical process (summarised in **Figure 3** below), from data preparation, core calculations to the final derivation of dependency scores and their use in the Country Dashboard. The whole analysis is implemented in Python v3.13.2.

Footnote 7
Svartzman et al. (2021), Ranger et al. (2024) and Ceglar et al. (2025) differentiate between direct and indirect exposure, with indirect exposure potentially including both domestic and foreign exposure.

Figure 3
Summary of analysis workflow showing input data, core calculations, derived metrics and aggregation.





Note: Ecosystem Service materiality ratings are provided either at the Class or Group level.

5. Nature dependency

5.1 Direct materiality ratings

As EXIOBASE subsectors and ENCORE activities use different classification systems, an ENCORE-provided crosswalk table is used to map the 271 ISIC economic activities of ENCORE to the 163 EXIOBASE NACE subsectors.⁸ Firstly, ENCORE’s categorical materiality ratings are converted to numerical ratings as per Table 1. Then the data on ENCORE materiality ratings is merged with the EXIOBASE subsector data using the crosswalk table. Matches are made using the ‘ISIC level used for analysis’ column in the ENCORE knowledge base, specifically at class- and group- level data. After the merge, the data is grouped by EXIOBASE subsector and the mean materiality rating calculated where multiple ISIC activities map to a single EXIOBASE subsector.

Footnote 8
This concordance table is provided as part of the ENCORE knowledge base data download.

ENCORE Materiality Rating	Assigned Numerical Score
Very High (VH)	1
High (H)	0.8
Medium (M)	0.6

Table 1
Values applied when converting the categorical ENCORE materiality ratings to numerical ratings

Low (L)	0.4
Very Low (VL)	0.2
No Data (ND)	0
Not Applicable (NA)	NaN

This sector concordance approach means we lose the granularity of ecosystem service ratings at the ISIC sector level. However, this approach was selected to meet the requirements of users expressing a preference for NACE sectors. It also ensures that the granularity of EXIOBASE data is retained, as mapping EXIOBASE onto ENCORE would require splitting the EXIOBASE values between ENCORE ISIC sectors.

As ENCORE materiality ratings do not have a geographical component (e.g. the subsector '*Manufacture of electrical machinery and apparatus*' in Country A has the same materiality rating for each ecosystem service as '*Manufacture of electrical machinery and apparatus*' in Country B), a matrix representing **direct materiality ratings**, D_{direct} , was generated to reformat the data into a country-sector format for subsequent calculations. This results in a matrix with the 25 ecosystem services on the rows and EXIOBASE country-subsectors on columns with materiality ratings for each ecosystem service duplicated across each country-subsector pair. Therefore, the 25 ratings assigned to any given subsector are identical across all countries in the matrix.

5.2 Consolidated materiality rating

As a subsector has materiality ratings for each 25 ecosystem services, a single **consolidated materiality rating** is calculated to summarise its overall dependency. This consolidated rating is derived from aggregating **direct materiality ratings** from the D_{direct} matrix using the method defined by Hirschbuehl et al. (2025) to integrate three key aspects of dependency. This gives a more comprehensive score compared to a simple average or maximum:

- i. **Breadth of dependency** (score 1): Measures the diversity of a subsector's reliance on nature by counting the number of different ecosystem services it depends on normalised by the total number of ecosystem services. A high score here indicates a subsector is exposed to a wide range of potential physical dependencies.
- ii. **Average intensity of dependency** (score 2): Captures the typical level of reliance across all services, preventing the score from being skewed by a few low- or high-impact services.
- iii. **Peak dependency** (score 3): Highlights the single most critical exposure. It captures the assumption that a high dependency on a single ecosystem service poses a significant, concentrated risk, even if other dependencies are low. This ensures that the most significant dependency is not understated.

The equation used for the **consolidated materiality rating** is:

$$D_{\text{consolidated}} = \frac{1}{3} \text{Score}_1 + \frac{1}{3} \text{Score}_2 + \frac{1}{3} \text{Score}_3$$

Where:

$Score_1$ = Normalised number of different sector ecosystem dependencies

$Score_2$ = Mean materiality rating of all ecosystem service dependencies

$Score_3$ = Maximum strength of any individual dependency

The 'water supply' ecosystem service is excluded from this calculation to avoid double counting. As a final ecosystem service, 'water supply' reflects the combined contributions of other ecosystem services—including water flow regulation and water purification—which are already separately included in the ENCORE knowledge base (United Nations et al, 2021).

5.3 Nature dependencies

5.3.1 Nature dependency

The **direct materiality rating** provides a measure of a subsector's *direct* physical dependencies on ecosystem services. But policy makers attempting to tackle nature degradation and its effects on the economy will need to know a subsector's mean weighted dependency across a subsector's supply chain. This provides a measure of supply chain dependency across the domestic supply chain and foreign supply chain. The mean weighted **nature dependency** is calculated by weighting the subsector and each supplier by their economic size in the supply chain using each supplier's share of inputs from the Leontief Inverse matrix (B) (including suppliers from other sectors).⁹ This captures the importance of a supplier within the supply chain as well as their dependency on nature, giving more weight to a larger supplier than a smaller one.

The **nature dependencies** are calculated along two dimensions for a subsector (normalised to a scale between 0 and 1):

- Domestic **nature dependency** ($D_{domestic}$) is the mean weighted **consolidated materiality rating** of the producer and all its upstream domestic suppliers, including suppliers from other subsectors, representing the mean dependency embodied in goods and services sourced from within the same country;
- Foreign **nature dependency** ($D_{foreign}$) is the mean weighted **consolidated materiality rating** of all its foreign suppliers, including suppliers from other subsectors, representing the mean dependency embodied in goods and services sourced from other countries.
- Total **nature dependency** is the mean weighted **consolidated materiality rating** of all its upstream domestic and foreign suppliers, including suppliers from other sectors.

Specifically:

$$D_j^{supply\ chain} = \frac{\sum_i D_i B_{ij}^{comp}}{\sum_i B_{ij}^{comp}}$$

where

D_i is the **consolidated materiality rating** from the $D_{consolidated}$ matrix of the supplier subsector i ,

B_{ij}^{comp} is the total output required from supplier i to satisfy demand from j from the Leontief Inverse, filtered for either domestic or foreign suppliers,

$\sum_i B_{ij}^{comp}$ is the total Leontief Inverse coefficients from all supplier subsectors i , filtered for either domestic or foreign suppliers.

Footnote 9

This calculation logic for upstream dependencies is aligned with the method by Swartzman et al, 2021.

While **direct materiality ratings** (D_{direct}) do not vary geographically, **nature dependencies** ($D_{domestic}$) and ($D_{foreign}$) are influenced by the country location and mix of suppliers within a subsector's supply chain. This results in varying upstream nature dependencies for the same subsector in different countries, reflecting regional variations in economic structures. Using a mean weighting for calculating supply chain nature dependencies can dilute the influence of highly dependent subsectors and smooths the overall dependency profile. Therefore, the results from this analysis provide an indicative comparative assessment of exposure between subsectors within countries and further analysis would be required to identify critical single dependencies within supply chains.

Note that **nature dependencies** are averaged across subsectors to obtain their corresponding sector-level **nature dependency**.

5.3.2 Ecosystem service-specific nature dependency

We also calculate a subsector's **nature dependency** on each specific **ecosystem service** to produce the ecosystem service dependency heatmap. These are calculated in the same way as the **nature dependency** but uses the **direct materiality rating** (instead of the consolidated materiality rating) to produce a supply chain dependency value for each of the 25 ecosystem services. Therefore:

- **Domestic Ecosystem services nature dependency** is the mean weighted materiality rating of its producer and all its upstream domestic suppliers, representing the mean dependency embodied in goods and services sourced from within the same country;
- The **Foreign Ecosystem services nature dependency rating** is the mean weighted materiality rating of its producer and all its upstream foreign suppliers, representing the mean dependency embodied in goods and services sourced from other countries.

The current methodology does not provide figures for the imported employment exposure as they are less relevant to a country's exposure.

6. Economic size

To evaluate national economies' exposure to nature loss, one cannot rely simply on nature dependencies. It is also necessary to understand the value of a country's – or specific sector or subsector's – economic output, including across the supply chain. This can further help target action to specific subsectors or sectors at home or abroad. In this Version 3.0 of the Country Dashboard we also extend the initial, production-focused analysis developed in Version 1 to three other key socio-economic components: consumption, exports, and employment (the latter with a breakdown by gender and skill level).

To map economic value across global value chains, we distinguish between a country's domestic economic activity and its foreign supply

chain linkages. EXIOBASE represents the global economy as a matrix where diagonal blocks capture transactions within a country and off-diagonal blocks record international trade. Following established value-added trade decomposition frameworks (e.g. Koopman et al, 2014; Aslam et al, 2017), a Value-Added Content Matrix (VB) is created to represent the total direct and indirect value added generated by each upstream producing sector to deliver one unit of final demand or export. By applying regional block-diagonal selector matrices (I_{block}) to the Value-Added Content Matrix and trade vectors, we isolate value generated within a country's own borders from foreign value added imported through global value chains. This allows us to split monetary values across local production, international trade and final consumer demand.

Table 2 below provides short descriptions of each component, in value added terms, at the subsector level. We refer to a subsector's value under each component as its economic size. Economic size can be aggregated up to the sector level by summing the economic size of a sector's subsectors. It varies across components and across a country's domestic and imported parts of the supply chain. For employment, it is expressed in the number of people in jobs or payroll amount contributed by that sector or subsector. For each component, the domestic and imported part can be summed to obtain a total value.

Table 2
(Sub-)sector economic size definition, by component and supply chain origin

	Domestic	Imported	Total
Production economic size	The value added by the domestic producers of a specific (sub-) sector serving either domestic consumption or exports. Also commonly referred to as a subsector's Gross Value Added or GVA.	The imported value added (by any foreign (sub-)sector)) used by the domestic producers of a specific (sub-)sector, either for domestic consumption or exports. We refer to this as a subsector's Imported Value Added or IVA.	The sum of domestic production economic size and imported production economic size.
Consumption economic size	The value added by the domestic producers of a specific (sub-)sector serving domestic consumption only.	The imported value added (by any foreign (sub-)sector)), either used by the domestic producers of a specific (sub-)sector for domestic consumption, or directly consumed domestically.	The sum of domestic consumption economic size and imported consumption economic size.
Exports economic size	The value added by the domestic producers of a specific (sub-)sector serving domestic exports only.	The imported value added (by any foreign (sub-)sector)) used by the domestic producers of a specific	The sum of domestic exports economic size and imported exports economic size.

(sub-)sector for exports only. Also includes re-exports.

Employment economic size	The number of jobs or amount of wages associated with the domestic production of a (sub-)sector.	N/A	N/A
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Section 6.1 below provides details on the calculation of each component's **economic size**. The economic value of each component is extracted from EXIOBASE, initially at the subsector level for each country and subsequently aggregated up at sector and eventually country level.

Specifically, these monetary decompositions are calculated using the following core input-output matrices and vectors:

- *Direct Requirements Matrix (A)*: Inputs required per unit of gross output;
- *Leontief Inverse matrix (L)*: Computed as $L = (I - A)^{-1}$, capturing total direct and indirect output required across global supply chains to satisfy one unit of final demand;
- *Intermediate Transactions Matrix (Z)*: Captures the monetary flows of intermediate goods and services traded between all producing sectors and regions (before reaching final consumers). Each element $Z_{(r,i),(s,j)}$ represents inputs purchased by sector j in region s from sector i in region r to support its production.
- *Direct Value-Added Coefficients ($\hat{V}$)*: A diagonalised vector of direct value-added shares per unit of output, derived as $v_{(r,i)} = 1 - \sum_{(s,j)} a_{(s,j),(r,i)}$;
- *Value-Added Content Matrix (VB)*: Derived as $VB = \hat{V} L$, linking primary value creation directly to final demand and trade flows across all producing and consuming regions.

The core VB matrix (or $\hat{V}$) is multiplied by the corresponding economic flow vector to generate the relevant accounting footprint:

- *Gross Output (x)*: Captures the total monetary volume of production generated by each sector. Direct value-added coefficients ($\hat{V}$) are applied to Gross Output (x) to evaluate domestic production (GVA).
- *Final Demand (Y)*: Captures end-user expenditure by households, governments and capital investment. It is multiplied by the *VB matrix* to map global value creation to final consumption.
- *Gross Exports (E)*: Derived by summing all intermediate sales (from the intermediate matrix Z) and final demand sales (from matrix Y) that originate in country r and are delivered to foreign countries ($s \neq r$).

To isolate domestic from imported flows, regional partitioning is performed using element-wise multiplication with a block-diagonal selector matrix (I_{block}) containing $N \times N$ blocks of ones along the diagonal for each region r . In addition to monetary value added, employment metrics (jobs and wages) are extracted directly from EXIOBASE satellite extension (F) accounts.

6.1 Components' economic size calculations

Here we provide more information on the calculation of production, consumption, exports and employment. Further detail is provided in Appendix 8.3.

6.1.1 Production

We capture a country-subsector's reliance on domestic production by calculating the value added by its domestic producers serving either domestic consumption or exports. This is commonly referred to as a country-subsector's **Gross Value Added (GVA)**, for each country-subsector is calculated from EXIOBASE by multiplying the diagonal matrix of direct value-added coefficients ($\hat{V}$) by the total output vector (x)¹⁰:

$$GVA = \hat{V}x$$

To capture the reliance of a domestic downstream subsector on foreign production, we calculate the value added by any foreign downstream subsector processed by it, either for domestic consumption or exports. We refer to this as **Imported Value Added (IVA)**, and compute it as follows:

$$IVA = FVA_{fd} + FC$$

where:

- *Foreign Value Added in Domestic Final Demand (FVA_{fd})* is the foreign value added embodied in intermediate imports used by domestic industries to produce goods and services consumed in domestic final demand (Y_D) calculated by taking the off-diagonal (foreign) regional elements of $VB \cdot diag(Y_D)$;
- *Foreign Content in Gross Exports (FC)* is the foreign value added embodied in imported intermediate goods and services processed in domestic production and embodied in gross exports (E), calculated by taking the off-diagonal (foreign) regional elements of $VB \cdot diag(E)$.

IVA explicitly measures supply chain reliance on imports across domestic production, excluding finished final goods imported and directly consumed domestically without domestic industrial processing.

6.1.2 Consumption

To capture domestic consumption's reliance on domestic production for a particular subsector, we calculate the value added by that subsector's domestic producers serving domestic consumption only (also called final demand Y_D).¹¹ Similarly, to capture domestic consumption's reliance on foreign production for a particular subsector, we compute the imported value added by any foreign subsector processed by the domestic producers of that subsector that is consumed domestically. This includes both the foreign value added that is directly consumed domestically and the foreign value added that is used in domestic production for domestic consumption.

Footnote 10

This is the factor income approach. Alternatively GVA can be calculated using the production approach where GVA is the total output of a sector (x vector) minus the value of intermediate goods and services (column sums of Z matrix).

Footnote 11

Note that final demand comprises both private and public consumption.

Consumption-based accounts are extracted from EXIOBASE for a given consuming region using the $VB\text{-}diag(Y_D)$ and partitioning by:

- Total consumption (CBA_{total}): Calculated by taking the sum of all regional elements of $VB\text{-}diag(Y_D)$ capturing total global value added across upstream supply chains to satisfy a region's final demand
- Imported Consumption (CBA_{imp}): Calculated by taking the off-diagonal (foreign) regional elements of $VB\text{-}diag(Y_D)$ capturing all foreign value added embodied in intermediate and direct final imports consumed within a region's final demand
- Domestic Consumption (CBA_{dom}): Calculated by taking the diagonal (domestic) regional elements of $VB\text{-}diag(Y_D)$, or equivalently as $CBA_{dom} = CBA_{total} - CBA_{imp}$.

6.1.3 Exports

To capture exports' reliance on a subsector's domestic production, we calculate the value added by that subsector's domestic producers serving domestic exports only. To do this, we first compute gross exports (E) using the fundamental input-output identity which states that a country's total output (x) must equal the sum of domestic intermediate use ($Z_{domestic}$), domestic final demand ($Y_{domestic}$), and exports (E)¹². Exports are then decomposed into **domestic content (DC)** and **foreign content (FC)** following the trade in value added framework (Koopman et al, 2014; Aslam et al, 2017):

$$Total\ Value\ Added\ in\ Exports\ Matrix = VB \cdot diag(E),$$

where the Total Value Added in Exports Matrix is decomposed into the domestic and foreign components using the block diagonal selector matrix (I_{block}):

- *Domestic Content (DC)*: Value added generated by domestic production embodied in gross exports;
- *Foreign Content (FC)*: Foreign value added imported as inputs and subsequently re-exported in gross exports.

6.1.4 Employment

To represent the value of domestic employment, we calculate the number of jobs or amount of wages associated with a specific subsector's domestic production. Labour headcounts and employee compensation are extracted directly from EXIOBASE production-based satellite accounts capturing total direct employment generated by economic production within each region. Specifically, the following are extracted:

- *Employment headcount (EMP_{pba})*: summed across total employment headcount rows in the employment satellite extension matrix F ;
- *Employee Compensation (COM_{pba})*: total domestic wage bill and labour compensation summed from factor input rows in matrix F .

The current methodology does not provide figures for the imported employment exposure as they are less relevant to a country's exposure.

Footnote 12

Alternatively, gross exports (E) can be calculated as the sum of all sales to foreign entities, encompassing both foreign intermediate sales (sales of intermediate goods to other countries) and foreign final demand sales (sales of final goods to other countries):
 $E = Z_{foreign\text{-}intermediate\text{-}sales} + Y_{foreign\text{-}final\text{-}demand\text{-}sales}$

6.2 Country-level aggregation

To obtain country-level estimates of our socio-economic components, one can simply sum the values of the country's subsectors that are relevant to a specific component. **Table 3** below provides short descriptions of those country-level components.

	Domestic	Imported
Production	The sum of the value added by a country's domestic producers' subsectors, serving either domestic consumption or exports. Also commonly referred to as a country's Gross Value Added or GVA.	The sum of the value added by foreign suppliers' subsectors used in a country's domestic production. We refer to this as a country's Imported Value Added or IVA.
Consumption	The sum of the value added by a country's domestic producers' subsectors, serving domestic consumption only.	The sum of the value added by foreign suppliers' subsectors either used in a country's domestic production serving consumption, or directly consumed domestically.
Exports	The sum of the value added by a country's domestic producers' subsectors, serving exports only.	The sum of the value added by foreign suppliers' subsectors used in a country's domestic production, serving exports only. Also includes re-exports.
Employment	A country's total number of jobs, or amount of wages, associated with its domestic production.	N/A

Table 3

Country-level economic size definitions

6.3 Decomposition limitations

The underlying logic for the calculation of the decomposed terms uses the Value-Added Content matrix ($VB = \hat{V}L$) matrix to avoid double counting intermediate outputs in the direct requirements matrix (A) by capturing the value created at each stage of production rather than the total value of the output. The adopted approach follows the trade in value added accounting (Koopman et al, 2014; Aslam et al., 2017) to partition export content into Domestic Content and Foreign Content. As global supply chains involve complex intermediate trade loops and re-exported goods, these terms do contain minor elements of double counting. This approach

was selected to provide insights into nature dependencies within different parts of a national economy's supply chain by origin for policy analysis, whilst acknowledging minor accounting overlaps relative to strict GDP accounting.

7. Combining nature dependency and economic size

The Country Dashboard is designed to identify the parts of a country's economy that are exposed to nature loss by bringing together our nature dependency data with subsectors' economic value, both calculated across domestic and foreign supply chains. To support the identification of exposed subsectors and sectors, for each country we create a Sector exposure profile. This includes a matrix and a table which both bring together **nature dependency** and **economic size**.

7.1 Sector exposure profile

The **Sector analysis's Matrix view** helps visualise, for a specific country, the relationship between a sector's **economic size** and its **nature dependency**. It is a scatter plot with two axes:

- The X-axis, showing a sector's scaled relative **economic size**, which varies according to the selected component (Production, Consumption, Exports or Employment) and view (Domestic or Imported).
- The Y-axis, showing a sector's scaled relative **nature dependency**, which varies by view (Domestic or Imported) but is the same for all components.

By mapping a sector's **economic size** against its **nature dependency**, the plot divides sectors into four distinct quadrants that reveal the relative scale of exposure for each sector:

1. **Critically exposed (upper-right):** Sectors in this quadrant have a large relative **economic size** and a high relative **nature dependency**. These sectors are highly significant to the economy and also acutely exposed to nature-related risks. Any disruption to the ecosystem services they depend on could have a widespread and severe impact at the national level.
2. **Economic driver (lower-right):** This quadrant represents sectors with a large relative economic size but a low relative **nature dependency**. They are key contributors to the economy with a relatively lower reliance on nature, suggesting a more resilient and less exposed position regarding nature-related risks.
3. **Exposed niche (upper-left):** Sectors in this quadrant are characterised by a high relative **nature dependency** but are smaller in relative **economic size**. Whilst relatively less significant at the national level, these sectors are highly dependent on nature. Their high exposure

could have significant impacts due to potential knock-on effects through the supply chain or due to their strategic economic importance beyond their size.

4. **Low exposure (lower-left):** This quadrant contains sectors with both a relative small relative **economic size** and a low relative **nature dependency**. They have a relatively lower impact on the overall economy and a lower reliance on nature, making them the least exposed to nature-related risks.

The **Sector analysis's Table view** allows users to quickly visualise exact figures along these two dimensions, for the Domestic, Imported or Total view. For employment, the table shows the employment exposure decomposition instead of nature dependency.

7.2 High exposure metrics

For each country we also more formally classify subsectors as low, medium or highly exposed to nature loss. This allows us to calculate the value of each sector that is highly exposed, as well as aggregating highly exposed values at the country level.

7.2.1 Subsector- and sector-level high exposure

In order to calculate how much of a subsector's monetary value is highly exposed to nature degradation, a subsector's **nature dependency** is categorised as high, medium or low using the bandings in **Table 4** below.¹³ Domestic **nature Dependencies** are used to categorise the country-sectors' domestic components and the foreign **nature dependencies** used to categorise the country-sectors' imported components. A subsector is therefore classified as highly exposed when its **nature dependency** is greater than or equal to 0.66.

Footnote 13

It should be noted that it isn't appropriate to use the original ENCORE rating scale from Table 1, as the consolidated materiality ratings are not comparable in distribution to the direct materiality ratings.

Nature dependency Level	Bandings
High	≥ 0.66
Medium	≥ 0.5 and < 0.66
Low	< 0.5

Table 4

Nature dependency bandings

Note: The bandings for our analysis were informed by the distribution of domestic and foreign consolidated materiality ratings across all country-subsectors.

A sector's **nature dependency**, being the mean of its subsectors' **nature dependencies**, also ranges between 0 and 1 and can also be classified as high when greater or equal than 0.66.

An important metric of the Dashboard, therefore, is **high exposure** (available in **Table view**), which for a specific sector, component, and view (Domestic/Imported), is the sum of the **economic size** of all its subsectors whose **nature dependency** is high (≥ 0.66). In the Total view, it is the sum of the domestic and imported high exposure. Due to how it is calculated, this metric is not available at subsector level.

To capture the exposure of employment along social dimensions, we further define **Employment exposure decomposition** as follows. For a specific sector,

- **Applying no breakdown**, it is the sum of the jobs or wages (depending on the selection) in all subsectors whose **nature dependency** is high (≥ 0.66), as a percentage of the total number of jobs or wages in that sector.
- **Applying breakdown by gender**: it is the above sum of highly dependent jobs or wages is further broken down by male or female.
- **Applying breakdown by skill**: it is the above sum of highly dependent jobs or wages is further broken down by high, mid or low skill.

7.2.2 Country-level high exposure

While the Sector analysis in Matrix and Table view allows users to compare sectors and subsectors' relative exposure to nature loss, they do not provide figures at the country level. At the top of the Country Profiles we provide headline figures that allow users to understand at a glance the share of a country's economic value that is highly dependent on nature. For this we aggregate up a country's subsectors' **economic size**, paying particular attention to subsectors whose **nature dependency** is high.

In **Table 5** below we provide the definitions of the headline figures presented on the Country Dashboard across each economic component (production, consumption, exports and employment) and supply chain element (domestic, imported, and total).

Table 5
Country-level 'highly exposed' metrics definitions

Value highly exposed			
	Domestic	Imported	Total
Production	For a country, the sum of the <i>domestic production economic size</i> of each subsector whose nature dependency falls within the 'high dependency' category (i.e. a rating of ≥ 0.66). It is presented as a monetary value and as percentage of a country's value added by total domestic production.	For a country, the sum of the <i>imported production economic size</i> of each subsector whose nature dependency falls within the 'high dependency' category (i.e. a rating of ≥ 0.66). It is presented as a monetary value and as a percentage of a country's value added by total foreign production.	The sum of a country's domestic value highly exposed in production and imported value highly exposed in production.
Consumption	For a country, the sum of the <i>domestic consumption economic size</i> of each subsector whose nature dependency falls within the 'high	For a country, the sum of the <i>imported consumption economic size</i> of each subsector whose nature dependency falls within the 'high	The sum of a country's domestic value highly exposed in consumption and imported value highly exposed in consumption.

dependency' category (i.e. a rating of ≥ 0.66).

It is presented as a monetary value and as a percentage of a country's total value added by domestic production going into consumption.

dependency' category (i.e. a rating of ≥ 0.66).

It is presented as a monetary value and as a percentage of the total value added by a country's foreign supply chains going into domestic consumption.

Exports

For a country, the sum of the *domestic exports* **economic size** of each subsector whose **nature dependency** falls whose **nature dependency** falls within the 'high dependency' category (i.e. a rating of ≥ 0.66).

It is presented as a monetary value and as a percentage of a country's total value added by domestic production going into exports.

For a country, the sum of the *imported exports* **economic size** of each subsector whose **nature dependency** falls within the 'high dependency' category (i.e. a rating of ≥ 0.66).

It is presented as a monetary value and as a percentage of the total value added by a country's foreign supply chains going into exports.

The sum of a country's **domestic value highly exposed** in exports and **imported value highly exposed** in exports.

Employment

A country's total number of jobs (people employed), or amount of wages, associated with its *domestic production* **value highly exposed**.

It is also presented as a percentage of a country's total number of jobs or amount of wages in domestic production.

N/A

N/A

These headline figures provide an indication of dependency for risk prioritisation and screening across countries. They do not represent, and should not be interpreted, as probable or absolute economic losses but instead indicate *relative* potential in-country exposure for comparative analysis, for a first step in targeted risk assessment.

8. Appendix

8.1 Ecosystem Service Definitions

Table 6 provides the definition and description of each ecosystem service in the ENCORE dataset from ENCORE methodology (ENCORE, 2024).

Table 6
Definition and description of each ecosystem service in the ENCORE dataset

Ecosystem services	Definition
Provisioning Services	
Biomass provisioning services	Biomass provisioning services include the ecosystem contributions to the growth of the following: cultivated plants that are harvested by economic units for various uses including food and fibre production, fodder and energy; grazed biomass that is an input to the growth of cultivated livestock; cultivated livestock and livestock products (e.g., meat, milk, eggs, wool, leather); animals and plants (e.g. fish, shellfish, seaweed) in aquaculture facilities that are harvested for various uses; trees and other woody biomass in both cultivated (plantation) and uncultivated production contexts that are harvested for various uses including timber production and energy; fish and other aquatic biomass that are captured in uncultivated production contexts for various uses; wild animals, plants and other biomass that are captured and harvested in uncultivated production contexts for various uses. Biomass provisioning services are final ecosystem services (except the grazed biomass provisioning services, which may also be an intermediate service to livestock provisioning services).
Genetic material services	Genetic material services are the ecosystem contributions from all biota (including seed, spore or gamete production) that are used by economic units, for example (i) to develop new animal and plant breeds; (ii) in gene synthesis; or (iii) in product development directly using genetic material. This is most commonly recorded as an intermediate service to biomass provisioning.
Water supply	Water supply services reflect the combined ecosystem contributions of water flow regulation, water purification, and other ecosystem services to the supply of water of appropriate quality to users for various uses including household consumption. This is a final ecosystem service.
Other provisioning services – Animal based energy	Physical labour is provided by domesticated or commercial species, including oxen, horses, donkeys, goats and elephants. These can be grouped as draught animals, pack animals and mounts.

Regulating and maintenance services

Global climate regulation services	Global climate regulation services are the ecosystem contributions to the regulation of the chemical composition of the atmosphere and oceans that affect global climate through the accumulation and retention of carbon and other GHG (e.g., methane) in ecosystems and the ability of ecosystems to remove (sequester) carbon from the atmosphere. This is a final ecosystem service.
Local (micro and meso) climate regulation	Rainfall pattern regulation services are the ecosystem contributions of vegetation, in particular forests, in maintaining rainfall patterns through evapotranspiration at the sub-continental scale. Forests and other vegetation recycle moisture back to the atmosphere where it is available for the generation of rainfall. Rainfall in interior parts of continents fully depends upon this recycling. This may be a final or intermediate service.
Rainfall pattern regulation	Local climate regulation services are the ecosystem contributions to the regulation of ambient atmospheric conditions (including micro and mesoscale climates) through the presence of vegetation that improves the living conditions for people and supports economic production. Examples include the evaporative cooling provided by urban trees ('green space'), the role of urban water bodies ('blue space') and the contribution of trees in providing shade for humans and livestock. This may be a final or intermediate service.
Air filtration services	Air filtration services are the ecosystem contributions to the filtering of air-borne pollutants through the deposition, uptake, fixing and storage of pollutants by ecosystem components, particularly plants, that mitigates the harmful effects of the pollutants. This is most commonly a final ecosystem service.
Soil quality regulation services	Soil quality regulation services are the ecosystem contributions to the decomposition of organic and inorganic materials and to the fertility and characteristics of soils, e.g., for input to biomass production. This is most commonly recorded as an intermediate service.
Soil and sediment retention services	Soil erosion control services are the ecosystem contributions, particularly the stabilising effects of vegetation, that reduce the loss of soil (and sediment) and support use of the environment (e.g., agricultural activity, water supply). This may be recorded as a final or intermediate service. Landslide mitigation services are the ecosystem contributions, particularly the stabilising effects of vegetation, that mitigates or prevents potential damage to human health and safety and damaging effects to buildings and infrastructure that arise from the mass movement (wasting) of soil, rock and snow. This is a final ecosystem service.

Solid water remediation	Solid waste remediation services are the ecosystem contributions to the transformation of organic or inorganic substances, through the action of micro-organisms, algae, plants and animals that mitigates their harmful effects. This may be recorded as a final or intermediate service.
Water purification services	Water purification services are the ecosystem contributions to the restoration and maintenance of the chemical condition of surface water and groundwater bodies through the breakdown or removal of nutrients and other pollutants by ecosystem components that mitigate the harmful effects of the pollutants on human use or health. This may be recorded as a final or intermediate ecosystem service.
Water flow regulation services	Baseline flow maintenance services are the ecosystem contributions to the regulation of river flows and groundwater and lake water tables. They are derived from the ability of ecosystems to absorb and store water, and gradually release water during dry seasons or periods through evapotranspiration and hence secure a regular flow of water. This may be recorded as a final or intermediate ecosystem service. Peak flow mitigation services are the ecosystem contributions to the regulation of river flows and groundwater and lake water tables. They are derived from the ability of ecosystems to absorb and store water, and hence mitigate the effects of flood and other extreme water-related events. Peak flow mitigation services will be supplied together with river flood mitigation services in providing the benefit of flood protection. This is a final ecosystem service.
Flood mitigation services	Coastal protection services are the ecosystem contributions of linear elements in the seascape, for instance coral reefs, sand banks, dunes or mangrove ecosystems along the shore, in protecting the shore and thus mitigating the impacts of tidal surges or storms on local communities. This is a final ecosystem service. River flood mitigation services are the ecosystem contributions of riparian vegetation which provides structure and a physical barrier to high water levels and thus mitigates the impacts of floods on local communities. River flood mitigation services will be supplied together with peak flow mitigation services in providing the benefit of flood protection. This is a final ecosystem service.
Storm mitigation services	Storm mitigation services are the ecosystem contributions of vegetation including linear elements, in mitigating the impacts of wind, sand and other storms (other than water related events) on local communities. This is a final ecosystem service.
Noise attenuation services	Noise attenuation services are the ecosystem contributions to the reduction in the impact of noise on people that mitigates its harmful or stressful effects. This is most commonly a final ecosystem service.

Pollination services	Pollination services are the ecosystem contributions by wild pollinators to the fertilization of crops that maintains or increases the abundance and/or diversity of other species that economic units use or enjoy. This may be recorded as a final or intermediate service.
Biological control services	Pest control services are the ecosystem contributions to the reduction in the incidence of species that may prevent or reduce the effects of pests on biomass production processes or other economic and human activity. This may be recorded as a final or intermediate service. Disease control services are the ecosystem contributions to the reduction in the incidence of species that may prevent or reduce the effects of species on human health. This is most commonly a final ecosystem service.
Nursery population and habitat maintenance services	Nursery population and habitat maintenance services are the ecosystem contributions necessary for sustaining populations of species that economic units ultimately use or enjoy either through the maintenance of habitats (e.g., for nurseries or migration) or the protection of natural gene pools. This service is an intermediate service and may input to a number of different final ecosystem services including biomass provision and recreation-related services.
Other regulating and maintenance service - Dilution by atmosphere and ecosystems	Water, both fresh and saline, and the atmosphere can dilute the gases, fluids and solid waste produced by human activity.
Other regulating and maintenance service - Mediation of sensory impacts (other than noise)	Vegetation is the main (natural) barrier used to reduce light pollution and other sensory impacts, limiting the impact it can have on human health and the environment.

Cultural services

Recreation - related services	Recreation-related services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that enable people to use and enjoy the environment through direct, in-situ, physical and experiential interactions with the environment. This includes services to both locals and non-locals (i.e. visitors, including tourists). Recreation-related services may also be supplied to those undertaking recreational fishing and hunting. This is a final ecosystem service.
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Visual amenity services	Visual amenity services are the ecosystem contributions to local living conditions, in particular through the biophysical characteristics and qualities of ecosystems that provide sensory benefits, especially visual. This service combines with other ecosystem services, including recreation-related services and noise attenuation services to underpin amenity values. This is a final ecosystem service.
Education, scientific and research services	Education, scientific and research services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that enable people to use the environment through intellectual interactions with the environment. This is a final ecosystem service.
Spiritual, artistic and symbolic services	Spiritual artistic and symbolic services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that are recognised by people for their cultural, historical, aesthetic, sacred or religious significance. These services may underpin people's cultural identity and may inspire people to express themselves through various artistic media. This is a final ecosystem service.

8.2 Understanding ENCORE materiality ratings

ENCORE materiality ratings provide the *direct* dependency of *operations* on nature, based on the *physical* exposure from an economic activity's reliance on ecosystem services. This excludes exposure from further up the supply chain and the exposure of financial institutions' investments and insurance policies.

A materiality rating provides the dependency on ecosystem services per 1 Euro of output (it is an intensity measure). Materiality ratings are assessed as a function of two key components: the loss of functionality due to ecosystem service disruption and the financial cost of adaptation. The combined score of these two components produces a rating from very low (VL) to very high (VH) as shown in **Figure 4**.

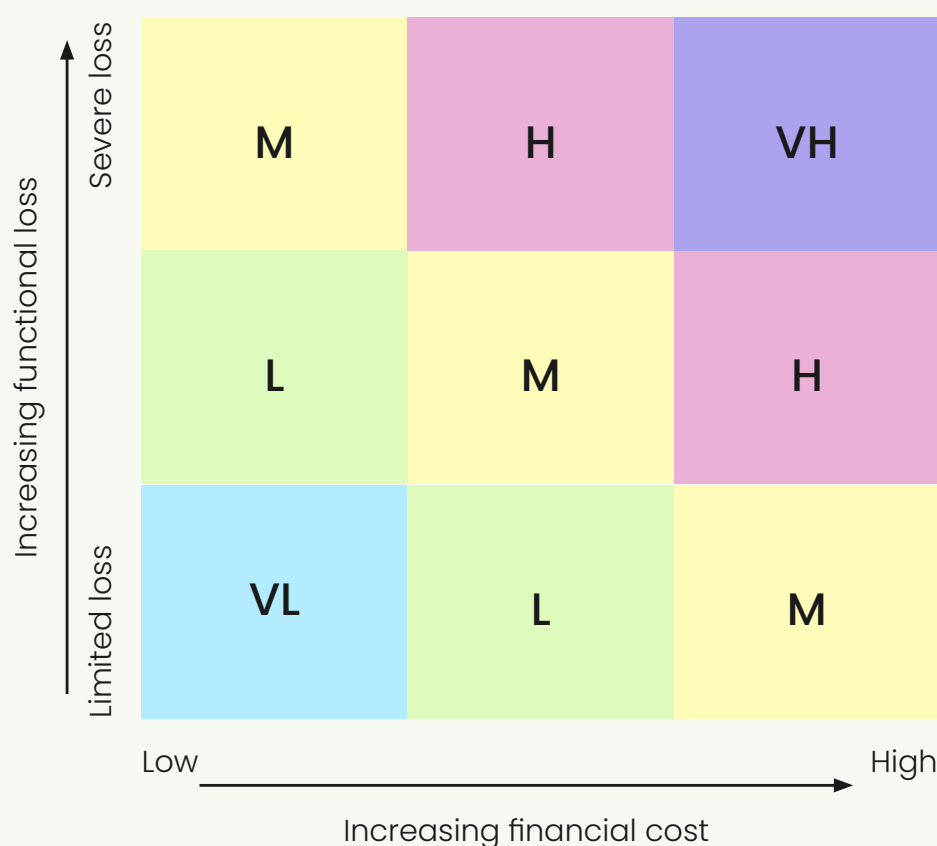


Figure 4

Approach for assigning dependency materiality ratings in ENCORE based on two components: loss of functionality due to ecosystem service disruption and the financial cost of adaptation.

1. Loss of functionality

This component evaluates the impact of an activity on an economic activity if an ecosystem service is disrupted from low to high:

- Limited loss of functionality: The economic activity can continue as is or with minor modifications.
- Moderate loss of functionality: The economic activity can continue only with important modifications. This might include slower production or the use of substitutes.
- Severe loss of functionality: Disruption in the service provision prevents the economic activity from continuing.

2. Financial Cost

This component quantifies the economic burden on an average company within a given economic activity when adapting to a disruption in ecosystem services:

- Low financial cost: Adaptation to the disruption of the ecosystem services will represent a minor cost to an average company engaging in the economic activity, which will not significantly affect the financial position of the company in the long run.
- Moderate financial cost: Adaptation to the disruption in the ecosystem service will represent a relatively significant cost to an average company engaging in the economic activity, but the cost would not affect the financial viability of the economic activity for the company.
- Severe financial cost: Adaptation to the disruption in the ecosystem service will have a significant effect on the financial viability of the economic activity for an average company engaging in the economic activity.

8.3 Component Calculations

Index & Notation Reference

- r, s : Regions (r = domestic country, s = foreign country where $s \neq r$).
- i, j : Sectors (i = focus sector, j = supplying sector).
- $x(r, i)$: Gross output of sector i in region r .
- $v(r, i)$: Direct value-added coefficient vector ($v(r, i) = 1 - \sum_{s,j} A_{(s,j),(r,i)}$).
- $L_{(s,j),(r,i)}$: Global Leontief inverse matrix element $(I-A)^{-1}$, representing total direct and indirect requirements from sector j in region s per unit of final output in sector i in region r .
- $VB_{(s,j),(r,i)}$: Global Value-Added Content matrix element ($VB_{(s,j),(r,i)} = v(s, j) \cdot L_{(s,j),(r,i)}$), representing value added originating in (s, j) embodied per unit of final demand or export of (r, i) .
- $Y_D(r, i)$: Domestic final demand in region r for goods/services of sector i .
- $E(r, i)$: Gross exports of sector i from region r .

1. Gross Value Added (GVA)

Direct value added (wages, profits, taxes) created by sector i in domestic region r : $GVA(r, i) = v(r, i) \cdot x(r, i)$

2. Foreign Value Added in Production (FVA_{prod})

Total foreign value added imported from all foreign regions $s \neq r$ and sectors j processed through sector i 's domestic production chain (combining local consumption and exports): $FVA_{\text{prod}}(r, i) = FVA_{\text{fd}}(r, i) + FC(r, i) = (\sum_{s \neq r} \sum_j VB_{(s,j),(r,i)}) \cdot (Y_D(r, i) + E(r, i))$

3. Total Consumption Footprint (CBA_{total})

Total global value added required worldwide across all regions s and sectors j to satisfy region r 's domestic final demand for sector i :

$$CBA_{\text{total}}(r, i) = (\sum_s \sum_j VB_{(s,j),(r,i)}) \cdot Y_D(r, i)$$

4. Domestic Consumption Footprint (CBA_{dom} / DVA_{fd})

Domestic value added created by domestic sectors j in region r that stays home to satisfy domestic final demand for sector i :

$$CBA_{dom}(r, i) = (\sum_j VB_{(r,j), (r,i)}) \cdot Y_D(r, i)$$

5. Imports for Consumption (CBA_{imp})

Foreign value added from all foreign regions $s \neq r$ and sectors j embodied in region r 's domestic final demand for sector i :

$$CBA_{imp}(r, i) = (\sum_{s \neq r} \sum_j VB_{(s,j), (r,i)}) \cdot Y_D(r, i)$$

6. Gross Exports ($EXGR / E$)

Total gross intermediate and final sales from sector i in region r to all foreign countries $s \neq r$: $E(r, i) = \sum_{s \neq r} (\sum_j Z_{(r,i), (s,j)} + Y_{(r,s,i)})$

7. Domestic Content in Exports (DC)

Domestic value added originating in all domestic sectors j in region r that leaves the country embodied in sector i 's gross exports:

$$DC(r, i) = (\sum_j VB_{(r,j), (r,i)}) \cdot E(r, i)$$

8. Foreign Content in Exports (FC)

Foreign value added originating in foreign regions $s \neq r$ and sectors j imported as intermediate inputs and re-exported in sector i 's gross exports:

$$FC(r, i) = (\sum_{s \neq r} \sum_j VB_{(s,j), (r,i)}) \cdot E(r, i)$$

8.4 Sector Groups and Subsectors

Table 7 provides the mapping of EXIOBASE3 NACE subsectors to sector groups used for aggregation to sector-level.

Table 7

A list of Sector Groups mapped against EXIOBASE NACE sectors used for aggregation.

Sector Group	Subsector (EXIOBASE3 NACE classification)
Forestry	Forestry, logging and related service activities (02)
Agriculture	Cultivation of paddy rice Cultivation of wheat Cultivation of cereal grains nec Cultivation of vegetables, fruit, nuts Cultivation of oil seeds Cultivation of sugar cane, sugar beet Cultivation of plant-based fibers Cultivation of crops nec Cattle farming Pigs farming Poultry farming Meat animals nec Animal products nec Raw milk Wool, silk-worm cocoons Manure treatment (conventional), storage and land application

Manure treatment (biogas), storage and land application

Fishery and aquaculture	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05)
Food beverages and tobacco	<ul style="list-style-type: none"> Processing of meat cattle Processing of meat pigs Processing of meat poultry Production of meat products nec Processing vegetable oils and fats Processing of dairy products Processed rice Sugar refining Processing of Food products nec Manufacture of beverages Manufacture of fish products Manufacture of tobacco products (16)
Heat utilities	Steam and hot water supply
Construction	<ul style="list-style-type: none"> Construction (45) Re-processing of secondary construction material into aggregates
Electricity	<ul style="list-style-type: none"> Production of electricity by coal Production of electricity by gas Production of electricity by nuclear Production of electricity by hydro Production of electricity by wind Production of electricity by petroleum and other oil derivatives Production of electricity by biomass and waste Production of electricity by solar photovoltaic Production of electricity by solar thermal Production of electricity by tide, wave, ocean Production of electricity by Geothermal Production of electricity nec Transmission of electricity Distribution and trade of electricity Manufacture of gas; distribution of gaseous fuels through mains Processing of nuclear fuel
Water utilities	<ul style="list-style-type: none"> Collection, purification and distribution of water (41) Waste water treatment, other

Supply chain and transport	Transport via railways Other land transport Transport via pipelines Sea and coastal water transport Inland water transport Supporting and auxiliary transport activities; activities of travel agencies (63)
Chemical and materials industry	Manufacture of textiles (17) Manufacture of wearing apparel; dressing and dyeing of fur (18) Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19) Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20) Re-processing of secondary wood material into new wood material Pulp Re-processing of secondary paper into new pulp Paper Plastics, basic Re-processing of secondary plastic into new plastic N-fertiliser P- and other fertiliser Chemicals nec Manufacture of rubber and plastic products (25) Manufacture of glass and glass products Re-processing of secondary glass into new glass Manufacture of ceramic goods Manufacture of bricks, tiles and construction products, in baked clay Manufacture of cement, lime and plaster Re-processing of ash into clinker Manufacture of other non-metallic mineral products n.e.c. Manufacture of basic iron and steel and of ferro-alloys and first products thereof Re-processing of secondary steel into new steel Precious metals production Re-processing of secondary precious metals into new precious metals Aluminium production Re-processing of secondary aluminium into new aluminium Lead, zinc and tin production Re-processing of secondary lead into new lead, zinc and tin Copper production Re-processing of secondary copper into new copper Other non-ferrous metal production Re-processing of secondary other non-ferrous metals into new other

non-ferrous metals

Casting of metals

Manufacture of fabricated metal products, except machinery and equipment (28)

Aviation travel
and tourism

Air transport (62)

Hotels and restaurants (55)

Real estate

Real estate activities (70)

Mining and
metals

Mining of coal and lignite; extraction of peat (10)

Mining of uranium and thorium ores (12)

Mining of iron ores

Mining of copper ores and concentrates

Mining of nickel ores and concentrates

Mining of aluminium ores and concentrates

Mining of precious metal ores and concentrates

Mining of lead, zinc and tin ores and concentrates

Mining of other non-ferrous metal ores and concentrates

Quarrying of stone

Quarrying of sand and clay

Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c.

Manufacture of coke oven products

Manufacture of machinery and equipment n.e.c. (29)

Retail consumer
goods and lifestyle

Retail sale of automotive fuel

Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)

Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)

Publishing, printing and reproduction of recorded media (22)

Manufacture of furniture; manufacturing n.e.c. (36)

Oil and gas

Extraction of crude petroleum and services related to crude oil extraction, excluding surveying

Extraction of natural gas and services related to natural gas extraction, excluding surveying

Extraction, liquefaction, and regasification of other petroleum and gaseous materials

Petroleum Refinery

Automotive	Manufacture of motor vehicles, trailers and semi-trailers (34) Manufacture of other transport equipment (35) Sale, maintenance, repair of motor vehicles, motor vehicles parts, motorcycles, motorcycles parts and accessories
Healthcare delivery	Health and social work (85)
Electronics	Manufacture of office machinery and computers (30) Manufacture of electrical machinery and apparatus n.e.c. (31) Manufacture of radio, television and communication equipment and apparatus (32) Manufacture of medical, precision and optical instruments, watches and clocks (33)
Information technology	Computer and related activities (72)
Insurance and asset management	Insurance and pension funding, except compulsory social security (66) Activities auxiliary to financial intermediation (67)
Banking and capital markets	Financial intermediation, except insurance and pension funding (65)
Digital communications	Post and telecommunications (64)
Public services	Public administration and defence; compulsory social security (75) Extra-territorial organizations and bodies
Water and waste utilities	Recycling of waste and scrap Recycling of bottles by direct reuse Incineration of waste: Food Incineration of waste: Paper Incineration of waste: Plastic Incineration of waste: Metals and Inert materials Incineration of waste: Textiles Incineration of waste: Wood Incineration of waste: Oil/Hazardous waste Biogasification of food waste, incl. land application Biogasification of paper, incl. land application Biogasification of sewage sludge, incl. land application

Composting of food waste, incl. land application
 Composting of paper and wood, incl. land application
 Waste water treatment, food
 Landfill of waste: Food
 Landfill of waste: Paper
 Landfill of waste: Plastic
 Landfill of waste: Inert/metal/hazardous
 Landfill of waste: Textiles
 Landfill of waste: Wood
 Collection, purification and distribution of water (41)
 Waste water treatment, other

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