THE CIRCULAR JOBS METHODOLOGY
The adoption of circular economy strategies will result in changes in the labour market. To tap into the employment potential of the circular economy, policymakers and other stakeholders need evidence on how jobs contribute to deploying circular strategies and in which economic sectors they occur.

Circle Economy and the United Nations Environment Programme (UNEP) have teamed up to develop a methodology for measuring employment related to the circular economy. It makes use of the Key Elements framework, created by Circle Economy and the Spatial Microsimulation Urban Metabolism model developed by UNEP. The methodology processes employment, economic and environmental data. The results of the methodology are displayed on the Circular Jobs Monitor (CJM), a digital tool that maps the number and range of jobs that drive circular strategies in different geographies.

What is a circular job?

A circular job is any occupation that directly involves or indirectly supports one of the strategies of the circular economy, as according to the Key Elements framework. We differentiate between three types of circular jobs: core, enabling and indirectly circular jobs:

- **Core** circular jobs are all jobs that ensure the closure of raw material cycles, including jobs in repair, renewable energy, and waste and resource management. They form the core of the circular economy.
- **Enabling** circular jobs are jobs that remove barriers to and enable the acceleration and upscaling of core circular activities, including jobs that arise in leasing, education, design and digital technology. They form the supporting shell of the circular economy.
- **Indirectly** circular jobs are jobs that indirectly uphold the circular economy. These jobs occur in other sectors that do not play a direct role in furthering the transition to the circular economy but can still adopt circular strategies. They include jobs that provide services to core circular strategies, including jobs in information services, logistics and the public sector.

*In order to properly follow the step-by-step explanation, the reader must be knowledgeable in Input-Output methodology and matrix algebra.*
The Circular Jobs Methodology

**ENABLING CIRCULAR JOBS**

**DESIGN FOR THE FUTURE**

Adopt a systemic perspective during the design process, to employ the right materials for appropriate lifetime and extended future use.

Circular equipment engineers design products to enable parts and resource recovery after the product’s use phase. They excel in complex problem solving on a technical level designs for the future.

**RETHINK THE BUSINESS MODEL**

Consider opportunities to create greater value and align incentives through business models that build on the interaction between products and services. Demand planners oversee supply and demand to make refurbishment a profitable business model. This role requires logical thinking and reasoning.

**INCORPORATE DIGITAL TECHNOLOGY**

Track and optimise resource use and strengthen connections between supply-chain actors through digital, online platforms and technologies. Building information managers maintain data on construction components so as to keep track of these physical assets. They understand how to integrate and interpret virtual information management systems.

**TEAM UP TO CREATE JOINT VALUE**

Work together throughout the supply chain, internally within the organisation and with the public sector to increase transparency and create shared value.

Procurement professionals stimulate the demand for secondary materials and discern and connect new suppliers in order to do so. This profile points to the need for entrepreneurial, interpersonal skills.

**STRENGTHEN AND ADVANCE KNOWLEDGE**

Develop research, structure knowledge, encourage innovation networks and disseminate findings with integrity.

Teachers transfer knowledge and skills to the current and future workforce so as to equip workers with skills for circular economy strategies.

**INDIRECT CIRCULAR JOBS**

Examples of indirectly circular jobs are:

- The courier, who uses and maintains a fleet of second-hand bikes to bring packages to and from consumers as part of a reverse logistics scheme;
- The bank, which uses repair services to maintain the electrical equipment used in its day to day operations;
- The farmer, who utilises renewable energy in the production of their agricultural products.

**TABLE ONE - High-level mapping of sectors into the Key Elements framework applied**

<table>
<thead>
<tr>
<th>DIRECT CIRCULAR JOBS</th>
<th>ECONOMIC SECTOR</th>
<th>CIRCULAR ECONOMY ELEMENT</th>
<th>EXAMPLE SECTORS AND ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core sectors</td>
<td>Stretch the lifetime</td>
<td>Use Waste as a Resource</td>
<td>Repair services, Recycling, Renewable energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prioritise regenerative resources</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENABLING SECTORS</th>
<th>CIRCULAR ECONOMY ELEMENT</th>
<th>EXAMPLE SECTORS AND ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design for the Future</td>
<td>Industrial design and architecture</td>
<td></td>
</tr>
<tr>
<td>Incorporate Digital Technology</td>
<td>Digital technology</td>
<td></td>
</tr>
<tr>
<td>Rethink the Business Model</td>
<td>Renting or leasing activities</td>
<td></td>
</tr>
<tr>
<td>Team up to Create joint Value</td>
<td>Professional and networking associations</td>
<td></td>
</tr>
<tr>
<td>Strengthen and Advance Knowledge</td>
<td>Education services</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INDIRECT CIRCULAR JOBS</th>
<th>INDIRECT CIRCULAR SECTORS</th>
<th>EXAMPLE SECTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government services</td>
<td>Professional services</td>
<td></td>
</tr>
</tbody>
</table>
CIRCULAR ECONOMY ELEMENT | EXAMPLE SECTORS AND ACTIVITIES
---|---
Stretch the lifetime | 3311, 3312, 3313, 3314, 3315, 3319, 4520, 4540, 9511, 9512, 9521, 9522, 9523, 9524, 9529
Use Waste as a Resource | 3600, 3700, 3811, 3812, 3821, 3822, 3830, 4311
Prioritise regenerative resources | 3500*
Design for the Future | 7110, 7410
Incorporate Digital Technology | 5820, 6110, 6120, 6130, 6190, 6201, 6209, 6311, 6312
Rethink the Business Model | 4912, 4923, 5012, 5221, 5222, 5224, 5229, 7710, 7721, 7722, 7729, 7730, 9601
Team up to Create joint Value | 7810, 8411, 8413, 8890, 9411, 9412, 9420
Strengthen and Advance Knowledge | 1811, 1812, 5811, 5812, 5813, 5819, 7210, 7220, 7310, 7320, 8521, 8522, 8530, 8541, 8542, 8549, 8550

Steps to quantify jobs

1. DATA SOURCES

The Circular Jobs Methodology requires three main data sources for a correct estimation of circular jobs.
- Macro-economic data:
  - National Input-Output Tables (IOTs) from EORA database.
- Employment data:
  - National employment data at granular sectoral level
  - Regional/City employment data at granular sectoral level
- Material data:
  - National Raw Material Equivalents (RME) data to calculate Material Import Dependency.

*The Renewable Electricity Production Sector Codes at ISIC level 4 are not standardised, therefore bottom-up data is used to establish proxy codes for 3500—Production of Renewable Electricity.
3. ACCOUNTING FOR MATERIAL IMPORT DEPENDENCY

Material Import Dependency (MID) is defined as an index of material usage and resource efficiency for economic sectors at the national level, accounting for imported material as a share of the total material used to meet domestic demand.

Material Import Dependency (MID)

\[ \text{MID}_i = \frac{\sum \text{MI}_i}{\sum (\text{MD}_i + \text{MI}_i)} \]

where \( \text{MID}_i \) is the Material Import Dependency of sector \( i \)

\( \text{MD}_i \) is the material import dependency

\( \text{Z} \) is the inter-industry economic activity

\( \text{M} \) is the monetary import dependency

\( \text{RMI} \) is Raw Material Import Dependency

\[ \text{RMI}_i = \text{Z}_i \times \text{M}(\text{Domestic}) \]

\[ \text{MD}_i = \text{Z}_i(\text{Domestic}) \times \text{M}(\text{Domestic}) \]

\[ \text{MI}_i = \text{Z}_i(\text{Imports}) \times \text{M}(\text{Imports}) \]

4. CALCULATING CIRCULAR ACTIVITY PER SECTOR

In order to estimate circular activity within each sector, we calculate the amount of materials (along the supply chain) that are required to meet the final demand. We do this by applying the Leontief Inverse to the final demand vector to determine the proportion of circular activity over the total economic output per sector. This coefficient will also determine the proportion of employment that takes part in circular activities, finally referred to as circular jobs.

TABLE THREE - Subset of original IO table

<table>
<thead>
<tr>
<th>SECTOR A</th>
<th>SECTOR B</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

TABLE FOUR - Subset of original IO table with circular proportions applied

<table>
<thead>
<tr>
<th>SECTOR A - CORE</th>
<th>SECTOR B - CORE</th>
<th>SECTOR B - ENABLING</th>
<th>SECTOR B - INDIRECTLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>24</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SECTOR A - ENABLING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>16</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SECTOR A - INDIRECTLY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Once the original table has been disaggregated to ISIC level 4, we can determine circular activity within core, enabling or indirectly circular sectors. The estimation of these circular employment shares is based on the inter-industry relationships between sectors and on the assumption that monetary transactions in the form of supply and demand of products and services are a proxy for employment generation.
### The Circular Jobs Methodology

For indirectly circular sectors, we assume that the extent to which they can be considered circular is determined by the share of demand (input) of indirectly circular sectors for core (cell C1) and enabling (cell C2) products or services over the total demand of indirectly circular sectors. The MID of core (M1) and enabling sectors (M2) is used in this case to discount non-domestic extraction. This can also be thought of as the (circular) input coefficient of indirectly circular sectors from core plus enabling over the total input of indirectly circular sectors.

**Circular Activity**

\[
\text{Circular Activity}\ _\text{INDIRECTLY} = \frac{\sum Z\ _\text{CORE, INDIRECTLY} \times M\ _\text{INDIRECTLY} + \sum Z\ _\text{CORE, ENABLING} \times M\ _\text{ENABLING}}{\sum Z\ _\text{INDIRECTLY}}
\]

*Where Z is economic activity*

### Demand for linear sectors

Conversely to the demand for core sectors, the final demand for extractive sectors like mining and fossil fuels industries is always regarded as linear and takes the coefficient 0.

### Geographical tiers

This methodology could be applied to three levels of territory. These territories correspond to the administrative boundaries of the region of interest. For example, in Europe, we apply Eurostat’s Nomenclature of Territorial Units for Statistics (NUTS) regions and display NUTS0-NUTS2-NUTS3, where NUTS0 refers to the state boundaries. Although this territorial classification aims to describe regions at all hierarchical levels, the regions at a given level can differ significantly with respect to land area, population, economic strength and administrative importance.

### Advantages and limitations

The approach holds advantages and limitations:

- The method employs up-to-date, reliable and existing macro-economic data to calculate the number of jobs in the circular economy. There is no need to collect new data, a time-intensive and costly process.

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**TABLE FIVE - Schematic representation of circular activity per sector**

<table>
<thead>
<tr>
<th>INDUSTRY BY INDUSTRY TO TABLE</th>
<th>Core sector</th>
<th>Enabling sector</th>
<th>Indirect sector</th>
<th>Original final demand</th>
<th>Circular final demand</th>
<th>1 - MID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core sector</td>
<td>a1</td>
<td>b1</td>
<td>c1</td>
<td>d1</td>
<td>(D1)*</td>
<td>M1</td>
</tr>
</tbody>
</table>
| Enabling sector               | a2         | b2             | c2             | d2                    | D2 * \[
| Indirect sector               | a3         | b3             | c3             | d3                    | D3 * \[
| Linear sector (mining & fossils) | a4     | b4             | c4             | d4                    | 0                    | M4     |
| Totals                        | Σa         | Σb             | Σc             |                       |                      |        |

The formula to determine the circular coefficient as a share of the final demand (varying between 0 and 1) differs according to the sector and the Key Element associated with the sector code.

**Core sectors demand**

The final demand of core sectors is always regarded as circular, therefore delivering a coefficient equal to 1.

**Circular Activity**

\[
\text{Circular Activity}\ _\text{CORE} = \frac{\sum Z\ _\text{CORE}}{\sum Z\ _\text{CORE}} = 1
\]

*Where Z is economic activity*

**Enabling sectors activity**

For enabling sectors, we assume that the extent to which they can be considered circular is determined by the share of supply (output) of enabling products or services to core sectors (cell A2) over the total supply of enabling products or services (cell D2). This can also be thought of as the (circular) market share of enabling-to-core sectors over the total enabling output.

**Circular Activity**

\[
\text{Circular Activity}\ _\text{ENABLING} = \frac{\sum Z\ _\text{ENABLING, CORE}}{\sum Z\ _\text{CORE}}
\]

*Where Z is economic activity*
• This data is structured following the ISIC classification: an internationally standardised classification system. This allows for replication and comparison of results over time and across borders.
• Depending on the territorial location, a different classification system could be in place. For instance, the European region implements the NACE Rev. 2 system, which in some cases could differ from the ISIC classification at the 4-digit level. Even though ISIC is the international standard, regions have opted for alternative classifications to better represent certain economic activities. In the case of data provided by a different classification system, it is required to harmonise industrial codes to make the country, region or city in question comparable to the other observations already included in the CJM.
• The method consists of an original application of IOA, which is currently under peer review. Additionally, the method inherits all the assumptions and constructs behind the production of IOTs.
• The method scales down and aggregates employment data based on monetary information. The relationship between employment and monetary transactions rests on the following assumptions:
  ▷ Employment is a good proxy for downscaling national IOTs to lower geographical scopes.
  ▷ Employment is a good proxy for disaggregating sectors in IOTs, which implies full proportionality between monetary transactions and employment.
  ▷ The volume of monetary transactions is a good proxy for estimating the number of jobs (for the estimation of circular market shares and input coefficients), which again implies full proportionality between monetary transactions and employment.
• The method allows for bottom-up estimation of circular activity within sectors.
• The quantification of material use has been a challenge mainly for local economies. Commonly, this quantification relies on urban metabolism approaches. For instance, the Economy-Wide Material Flow Analysis (EW-MFA), which looks at the entire economy of a city-system in an attempt to quantify all material flows within the system. It uses a physical IOT for the description of material flows: for example, Substance Flow Analysis (SFA), which could focus on a group of materials or a specific flow, or the Life Cycle Assessment (LCA) approach focused on a specific process.
• The quality of results produced from data collected at a local level is highly dependent on the quality of the data, and may be limited by ease of collection. Collection of data at a local level can be time-consuming and costly. Usually, key information is scattered or the government may have to retrieve it from costly private repositories.
• The current methodology only calculates MID for each sector at a national level. By assuming the same national-level import dependencies for regions and cities, there is a possible bias towards large countries with lower import dependencies at a national level.
• As the current methodology considers data at an aggregate level for population and employment, it is not possible to observe policy effects on marginalised groups with this methodology at present. For example, The current methodology does not yet incorporate the informal dimension of the labour market.

Considering both the opportunities and limitations, the current methodology makes an important contribution and forms the basis of a monitoring practice for employment in the circular economy.

Updates to the methodology

With the aim of continuous improvement in monitoring jobs in the circular economy, Circle Economy and UNEP update their methodology for quantifying circular economy jobs on a yearly basis, using newly available data from more recent years where possible. It therefore follows that in some cases the results shown in reports using previous versions of the methodology may differ from those displayed on the CJM. In those cases, we include a method update notice on the landing page of all relevant reports.

REFERENCES