

d-fine



How to measure circularity

Guidance on commonly used metrics

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Circular economy is an economic system that aims to reduce ecosystem harm from greenhouse gas emissions, pollution, and waste, and to sustain biodiversity by extending the lifetime of products and creating closed loops through sharing, maintaining, reusing, refurbishing and recycling.

Today, more and more corporates strive to increase the sustainability of their business operations. An increasing focus is often put on the degree of circularity. They are doing so to demonstrate corporate responsibility, comply with regulatory requirements or realise cost reductions and emerging business opportunities. Regardless of the cause and of how far they have come along their way, measuring circularity and computing adequate KPIs is crucial for all of them. However, as of today, there is no standardized way to measure circularity. In fact, the opposite is true: in recent years, a variety of circularity metrics like Circulytics, MCI, CTI and many others have been developed and for many companies it is not clear which metric to use.

Defining circularity is challenging.

As detailed below, circularity metrics vary widely in their scope and results. This is primarily due to the fact that circularity is a rather holistic concept and can involve information from many different subject areas, some of which are sketched in Figure 1.

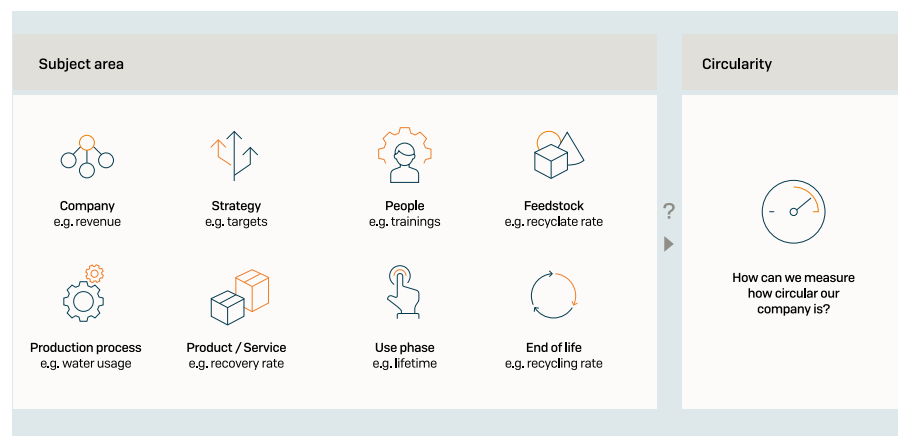


Figure 1: Circularity metrics are typically based on information from a multitude of different subject areas.

To establish a circularity metric, a quantitative or qualitative assessment of circularity-related aspects of these subject areas is required. We provide some concrete examples for selected areas:

- **Feedstock:** how much of the raw material used represents recycled input (→ recycle rate)?
- **Production process:** How much water is consumed during the production process (→ water usage)?
- **Production process:** How much of the energy consumed stems from renewable sources (→ renewable energy rate)?

Clearly, there are many more such questions and the information taken from them can be combined in multiple ways to form a circularity metric. Accordingly, there is a large number of conceivable metrics to measure circularity. However, for a company seeking to improve the circularity of their products, processes or services, the choice of a suitable metric is crucial to manage the transformation from a “take-make-waste” business model to a circular one. This whitepaper aims to support companies in choosing an appropriate metric. To this end, we present and evaluate three prominent circularity metrics with a focus upon how they can be applied, which input is required and what kind of output is provided.

2.1

Rationale for selected circularity metrics to be investigated

In the following, we present and analyse three different circularity metrics systems: **Circulytics**¹, **Circular transition indicators (CTI)**² and **Material Circularity Indicator (MCI)**³.

We choose these metrics because they are (i) commonly used and have a certain maturity, (ii) non-sector specific, (iii) openly available⁴ and (iv) suited for performing a self-assessment (excluding metrics requiring external certificates).

2.2

Overview

Before presenting the actual assessment, let us briefly introduce the metrics under consideration. Circulytics and MCI have both been developed by the Ellen MacArthur Foundation, a charity focussed on circular economy. CTI, in turn, is published by the World Business Council for Sustainable Development, an organization of over 200 international companies.

The three metrics differ with respect to their scope: Circulytics provides a holistic circularity evaluation of the company in general. In contrast, MCI and CTI focus on the circularity of the output products while also providing a company-level aggregation of these individual assessments. CTI additionally outputs KPIs on the circular use of water and energy.

Further, while Circulytics and CTI are suitable for companies that offer both products and services, MCI is exclusively designed for producing companies.

2.3

Evaluation of metrics

In the following, we evaluate the three chosen metrics with respect to four dimensions: input data, output KPIs, practical usability and license costs.

Input data

Corresponding to their range of application, the three metrics differ in the amount and variety of internal and external input data required. The differences with respect to the sources and scope of input data are substantial and are summarised in Table 2.

As shown in Table 2, MCI requires the least amount of information. CTI and Circulytics are more comprehensive and include information from additional subject area, with Circulytics requiring the largest variety.



Internal data represents information from internal data sources, e.g., the energy consumption during production.

External data are gathered from open-source data bases, e.g., average recycling rates, or from other suppliers, e.g., material details.

¹ <https://ellenmacarthurfoundation.org/resources/circulytics/overview>

² <https://www.wbcsd.org/Programs/Circular-Economy/Metrics-Measurement/Circular-transition-indicators>

³ <https://ellenmacarthurfoundation.org/material-circularity-indicator>

⁴ Metrics that require registration or application are included.

Types of data

X - mandatory, [X] - optional









								
Information about	Company	Strategy	People	Feedstock	Production process	Product / Service	Use phase	End of Life
Circulytics	X	X	X	X	X	[X]	X	[X]
CTI	[X]			X	X	X	[X]	X
MCI				X		X	X	X

Table 1: Subject area information required by the three considered circularity metrics

While all three metrics are processing quantitative information, Circulytics does also enclose qualitative information including insights regarding the circular readiness of a company. The additional qualitative information about the company characteristics and business model is used to tailor the Circulytics approach to a given corporate (restricting the required quantitative information to applicable subject areas).

Output KPIs

Apart from the input, also the output KPIs differ for the three metrics, with respect to (i) what aspect of circularity is measured (e.g., a holistic circularity score only or a set of scores) (ii) with which granularity and (iii) on which level (e.g., company level or product level) this is the case, as shown in Table 3.

Circulytics outputs an ordinal grade with values from A to E. It enables a high-level comparison between business units, as well as an anonymous benchmark of the company-level score against the average Circulytics grade in the respective industry. In contrast, CTI outputs a continuous level of achievement indicating 0% to 100% circularity. It allows for the most extensive comparability – in terms of material circularity on product and business unit level. The MCI also outputs one circularity score with a range from 0 to 1 for single products that can be aggregated on company level.

Output




	Score	Granularity	 Product	 Business Unit	 Company
Circulytics	Circularity score of current activities and ability of the business activities towards circularity	[A-E]	—	✓	✓
	Benchmark to competitors	[A-E]	—	—	✓
CTI	Material circularity of feedstock and final product	[0-100%]	✓	✓	✓
	Water circularity in processes	[0-100%]	—	✓	✓
	Renewable energy used in processes	[0-100%]	—	✓	✓
MCI	Material circularity indicator of feedstock and final product including usage during lifetime	[0-1]	✓	—	✓

Table 2: Output of circularity metrics



Common **circularity measures** include reducing virgin materials, offering sharing or leasing services and collecting products at their end of life to refurbish or recycle.

Practical usability

Users need to understand if and how the generated output can help them to become more circular by analysing the potential impact of targeted actions on their KPIs. The CTI tool provides the functionality to calculate the effects of circularity measures via scenario analyses. While the MCI tool does not directly provide such an option, it is possible to recalculate the results for different setups manually. With Circulytics, however, results are calculated by the Ellen MacArthur Foundation after an official submission and provided via e-mail afterwards – making it impractical to try out different scenarios.

In terms of the methodological transparency, CTI and MCI are fully transparent allowing to identify cause-and-effect relationships, while Circulytics does not provide all information necessary to reconstruct the final scores.

With respect to availability, MCI is directly available without the need for registration, while CTI requires a registration and Circulytics is accessible only after an official application at the Ellen MacArthur Foundation.

The MCI metrics is available as an Excel tool. In contrast, CTI and Circulytics have a user-friendly online tool with a guided walkthrough.

Data for CTI and Circulytics are submitted to the online tool by uploading a standardised template or directly using a web interface. Data for MCI are directly inserted into the provided template.

License costs

Circulytics and MCI are both free of charge. The CTI online tool offers a free trial for the first assessment with 3 accounts and costs 7.500 € per year thereafter. To avoid expenses, the CTI methodology could also be implemented manually with the downside of being less convenient to use and the absence of additional features.

2.4

Choosing the right metrics for your use case

There ain't no such thing as a free lunch.

As detailed in the previous section, each metric has its own advantages and disadvantages. Therefore, the specific choice strongly depends on the application setting.

For corporations striving for a holistic view, integrating both qualitative and quantitative business characteristics, **Circulytics** is a suitable metric. The evaluation is tailored to the individual business model and provides an industry benchmark. However, the methodology lacks transparency and requires an online application to access the tool. Further, the effort to meet the extensive input requirements is not to be underestimated.

CTI is ideal for corporations requiring a quantitative analysis of their material, energy, and water circularity. The methodology provides circularity scores on several levels of granularity, allowing direct comparison while being completely transparent. It supports decision-making via scenario analyses that allow prioritising actions according to their impact. The online-tool is not available without charge – however, the transparency allows a self-implementation.

MCI is well suited for companies that prefer a low-effort approach and want to focus on the circularity of one or more individual products. With relatively little input, it provides a lean initial assessment. The scores are calculated on product level enabling a clear product comparison. As the method is completely transparent, the results are easily comprehensible. However, it only provides a rough indication regarding the business' circular performance – missing out information about the manufacturing process, organisation and people. In addition, service companies cannot use the tool as it focusses entirely on the material flow.

03.

The bigger picture

Choosing the right metric is just one of several steps to put a company on the path towards circularity by making the circular performance quantifiable. In addition, the objective and methodological requirements should be defined. To operationalise the measurement, the required data must be collected from internal and external sources, results must be analysed and circularity potentials must be discussed. As not all aspects will be of equal relevance, measures to improve circularity need to be defined according to the specific situation and objectives. Finally, to ensure actual, consistent, and measurable progress, it is recommendable to monitor the evolution of the chosen metric while implementing the measures.



The upcoming **Corporate Sustainability Reporting Directive** of the European Union expands the required sustainability reporting and especially includes circularity-related information.

In addition to achieving economic benefits, measuring your circular journey now will help you reporting future circular economy indicators as mandated by EU regulations such as the Corporate Sustainability Reporting Directive (CSRD).

d-fine supports you along all or, alternatively, individual steps with an end-to-end service offering. We have experience in quantifying the sustainability of processes and products, in making procurement and production networks transparent, and in developing strategies for appropriate transformation paths to a circular value chain. In doing so, we draw on a variety of different tools depending on the issue at hand - from mathematical system modeling and the simulation of network effects to the customised design of software solutions.

Get in touch with one of our experts to start transforming your business towards a more circular future!

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