Circularity for Educators

04. An Interdisciplinary Approach to Circularity

Measuring circularity: The New Normal

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As we embark on this transition towards a circular economy, a fascinating question emerges: How can we determine the degree of circularity and assess the success of our ambitious goals? How do we measure our progress in achieving these objectives? Before we delve into the specifics of measuring circularity, let's explore why this process is of paramount importance.

Objective measurement is an indispensable tool, not just for property owners but also for designers operating within the built environment. It *equips designers with the ability to evaluate the impacts of diverse circular design strategies.* Additionally, policymakers have a keen interest in the measurement of circularity, as it *offers a means to monitor market trends over time and assess the progress towards policy objectives*, such as the ambitious target of achieving 100% circularity by the year 2050. We can conclude developing indicators for objectively measuring circularity is highly valuable.

To measure circularity, we need a structured framework with indicators that are related to the three fundamental goals of circularity, which are protecting: *material resources, the environment* and *existing value*.

Together, we will examine a specific framework as an illustrative example, developed by Platform cb23. This framework is founded on a conceptual model that traces input and output flows across the entire life cycle of materials and energy. It's worth noting that similar models can be found in the scientific literature with slight variations. The model describes the input and output flows of materials in the various phases of an object's life cycle: manufacturing, construction, use, and demolition.

The use of indicators

When it comes to *safeguarding material resources*, we evaluate specific indicators connected to the input and output of materials in the construction process. This involves considering which materials are introduced into the system to construct the building and which materials might be released.

For *input-related indicators*, we pay close attention to the *quantity of input materials* utilized in constructing, repairing, or refurbishing the building. The key goal here is to maximize the use of secondary materials while minimizing reliance on primary raw materials. When primary raw materials are necessary, it's beneficial to differentiate between renewable and non-renewable resources. Secondary materials can further be categorized into those sourced from reuse and those obtained through recycling. When it comes to *output-related indicators*, we assess factors like the *quantity of* *end-of-life materials available for reuse* and the *quantity of materials that can be redirected into recycling* processes.

When it comes to assessing the degree to which we're achieving our second circular goal, *safeguarding the environment*, we can turn to the *Environmental Performance Coefficient*, often referred to as MPG in the Netherlands. This metric is built upon the foundation of the Life Cycle Analysis (LCA) methodology. MPG takes into account the cumulative environmental impact of all materials used in a building. It then divides this total by the gross floor area and incorporates the number of years the building is expected to be in use. The environmental impact of CO_2 is part of the Environmental Performance Coefficient. Due to its significant importance, it is often presented separately as *material-related CO_2 emissions* and *material-related CO_2 sequestration*.

Measuring the extent to which the third circular goal, *protecting value*, can be achieved with indicators that describe the value of a building at the end of its life cycle. This might be one of the most challenging indicators to figure out because it depends on many factors. This value is closely tied to both the functional and technical aspects of a building, which are determined by factors like the loss of quality and the potential for reusing materials, products, or even entire buildings. Indicators that can be used here include *adaptability*, indicating how easily a building can be repurposed in the future, and *disassembly*, measuring how easily materials and components of a building can be taken apart at the end of the life cycle for use in a future project with minimal impact.

Defining values: The New Normal

Now that we've established the key indicators for evaluating circularity, a compelling question arises: what defines good values for these indicators? What signifies a high level of circularity, and what is considered low? In practice, especially clients in the built environment, wonder what is realistically achievable.

To address this, we embarked on a collaborative journey with the industry. In the 'Samen Versnellen' project, we carefully analyzed numerous projects that were recognized as circular. We then evaluated how these projects performed across a subset of the indicators we've discussed earlier. The culmination of our efforts is 'Het Nieuwe Normaal,' which translates to 'The New Normal' in English. This term underscores the idea that the associated values can be considered achievable benchmarks for the market.

In this figure, you'll find a selection of values from 'The New Normal,' shedding light on what we consider attainable and impactful in the journey towards a more circular built environment. The previously outlined indicators have achievable scores, which we have incorporated as a standard in "Het Nieuwe Normaal". As you can see, this score depends on the type of object to be built. Taking the MPG (Environmental Performance Coefficient) as an example: a low MPG is easier to achieve when constructing ground-based housing than in commercial building construction.

However, it appears that in practice it takes more work to set up a standard for all the indicators mentioned due to a lack of measurements, or the difficulty of obtaining the necessary data in the examined projects. Ultimately, we've established a standard for environmental impact, material-related CO_2 emissions, material usage (renewable, reused, or recycled mass), and disassembly.

We have now explored several indicators that allow for the measurement of specific aspects of circularity. Stakeholders such as clients, architects, and engineers can utilize these indicators to steer towards the highest possible level of circularity.