

Report: Circular economy indicators in construction

Analysis of the key indicators identified during the Circular Construction in Regenerative Cities project and summary of interviews conducted for the analysis

Date	28.11.2023
Authors	Heikki Aronen and Sami Soininen
Reviewer	Anna Railo

28.11.2023

Table of contents

1	Introduction.....	3
1.1	CIRCuiT.....	3
1.2	Indicators	3
1.3	Objectives and scope of the study	4
1.4	Conducting interviews	4
2	Summary of the interviewees' comments	5
2.1	Circular economy in construction in general	5
2.2	Applications of the indicators	6
2.3	Benefits of the indicators	7
2.4	Challenges of the indicators	7
3	Analysis of the indicators.....	8
3.1	Overview	8
3.2	Analysis of the key indicators	10
3.2.1	Indicator 1: Amount of construction and demolition waste per inhabitant.....	10
3.2.2	Indicator 2: Recycling rate of construction and demolition waste	10
3.2.3	Indicator 3: Repair and alteration work in relation to new construction	11
3.2.4	Indicator 4: Annual discharge rate	12
3.2.5	Indicator 5: Average age of demolished buildings	12
3.3	Development proposals and future opportunities.....	13
3.3.1	Circular economy in the construction industry	13
3.3.2	Complementary indicators	14
3.3.3	Data and information gathering	15
3.3.4	Future opportunities.....	16



28.11.2023

1 Introduction

1.1 CIRCuiT

This report relates to a Circular Construction in Regenerative Cities project (CIRCuiT). CIRCuiT project include 31 partners/organisations and four cities/regions: Copenhagen, London, Hamburg and Helsinki region/ Vantaa. This report was ordered by Helsinki Region Environmental Services (HSY), which acted as the project coordinator in Finland. The project focused on three main themes:

- Dismantling of buildings, reuse of construction components and recycling of construction materials
- Extending lifecycles of buildings by refurbishment and transforming the use purpose of buildings
- Flexible construction: versatility, modifiability and plans that enable dismantling

The main objective of the project was to develop new solutions and operating models for promoting the circular economy in construction. In collaboration with international partners CIRCuiT project identified indicators how to measure progress of the circular economy in construction of specific cities and regions from multiple perspectives. This report focuses on five key indicators identified during the project.

1.2 Indicators

The key indicators are visualised yearly on the CIRCuiT project's Circularity Dashboard online. The key indicators are as follows:

Circular economy indicators for demolition

- Indicator 1: Amount of construction and demolition waste
- Indicator 2: Proportion of Construction and Demolition Waste Recycled

Circular economy indicators for existing building stock

- Indicator 3: Refurbishment and transformation relative to new construction
- Indicator 4: Demolition rate



28.11.2023

- Indicator 5: Average age of demolished buildings

1.3 Objectives and scope of the study

The aim of the study was to collect the views of cities in Helsinki region on the five key indicators identified during the CIRCuiT project. The key issues under examination were as follows:

- The usefulness of the indicators for the cities
- The benefits that can be derived from the use of the indicators
- Identification of areas where the indicators can be applied
- The cities' views on the most promising indicators
- Other recommendations

The study focused on the five key indicators, but the other indicators identified during the CIRCuiT project were also examined. The report analyses challenges of the key indicators as well as the potential of other indicators. The report is complemented by a blog post in English.

1.4 Conducting interviews

The key indicators were briefly introduced to the interviewees of the cities of Helsinki region. And the usefulness, potential applications and challenges of the key indicators were discussed. The interviews were conducted via Teams and included both one-on-one interviews and group interviews. The list of interviewees was provided by the client, and four interviews were conducted in total. The interviewees from the City of Helsinki were representatives of the Urban Environment Division and the Action Plan for the Circular and Sharing Economy. The interviewees from the City of Vantaa represented the Facility Management Department and the Urban Planning Department. The interviewees from Kauniainen were representatives of the Environment Sector. It was unfortunately not possible to interview anyone from the City of Espoo, which led to an absence of information in this respect.

The themes and the questions of the interviews were approved by the client before the interviews. The questions were sent to the



28.11.2023

interviewees before the interviews. A Windows Forms questionnaire was also created, which the interviewees were asked to fill up. The CIRCuiT project's Circularity Dashboard was reviewed in the interviews, dashboard visualises the key indicators identified during the project. Each interview lasted approximately one hour. The interviewees were given a chance to review their answers afterwards.

2 Summary of the interviewees' comments

2.1 Circular economy in construction in general

Many of the interviewees were already familiar with CIRCuiT project, but there were a few who had not heard of the project before. Some of the interviewees had also been involved in circular economy pilots that were part of the CIRCuiT project. Many had experience of their respective cities' internal circular economy initiatives or other circular economy projects.

The interviews revealed that several of the cities have their own past or ongoing projects involving the circular economy of construction. These projects focused on, for example, with the improvement focus on re-using building components and repurposing existing buildings. There are also projects that aim to improve demolition surveys. Some of the cities had introduced various kinds of 'Vahti' tracker tools and explored indicators that could be used with these tools. Examples include the City of Helsinki's Circular Economy Tracker and Biodiversity Tracker as well as the Climate Watch applications of Kauniainen and Espoo. The circular economy and indicators for measuring progress in this respect are high on the cities' agendas, and Kauniainen, for example, has carried out its own studies into the applicability and scope of indicators for its own purposes.

The interviewees had consulted with the Building Control Services of their respective cities to find out what data can feasibly be collected. The current measures in circular economy in construction have been put in place without the necessary data. Having access to the relevant data could help to target measures more effectively.



28.11.2023

2.2 Applications of the indicators

Cities already report to investment banks on their efforts to increase energy efficiency as well as their renovation projects. They are also working hard to lower their CO₂ emissions and report on their progress. Repair and alteration work in relation to new construction is often among the most important indicators, and some of the cities have incorporated this indicator into their investment programmes. However, investment banks typically ask for project-specific information instead of city-specific information.

'Just having access to data is a game-changer! What the data can be used for comes after.'

Some of the interviewees emphasised the fact that even if the indicators identified during the CIRCuiT project have no clear use in town planning, they could be helpful in public relations. The cities' Environment Centres could also find uses for them. One example that the interviewees mentioned was the annual discharge rate, which could be a useful indicator to include in cities' annual environmental reports. The annual discharge rate could be used to share information with local communities and residents especially if cities that have strategic objectives related to this indicator.

The interviewees also pointed out that city organisations regularly review their climate roadmaps and that the indicators identified during the CIRCuiT project could prove useful later. The indicators could be used to reaffirm cities' commitment to their strategies. The indicator data can also be shared online, for example, on the website of Helsinki Region Environmental Services HSY, to provide comparisons between different cities' performance. However, the indicators may not be directly comparable between cities, which must be considered and informed clearly if the indicators were to be used in this manner.



28.11.2023

2.3 Benefits of the indicators

In principle, these kinds of indicators and raw data are both useful for cities. Indicators can help city organisations, for example, to implement their action plans. Indicators relating to construction have their uses even in cities that have not yet fully adopted the circular economy. It should be noted, however, that some of the interviewees felt that the indicators identified during the CIRCuiT project do not really provide any significant new information.

The indicators could nevertheless be useful in climate work and especially in the context of public relations. They could also help to illustrate the effects of city organisations' efforts. Going forward, the indicators could be incorporated into internal decision-making processes, such as land use and project planning. On the other hand, the interviewees felt that the indicators could not be used to inform decisions as such. Progress towards achieving the goals of the cities' strategies could be measured in the light of the indicators. The indicators could also be useful in providing information about, for example, privately owned buildings.

The indicators have considerable potential when it comes to preserving the cities' existing building stock. The city organisations are currently looking for ways to encourage local residents and businesses to renovate old properties instead of having them demolished. The indicators identified during the CIRCuiT project could be useful in this context, especially if they provided information about the emissions attributable to demolishing old buildings versus renovating them. The problem lies in the fact that demolition permits are usually granted if the building is not conserved and there are no restrictions in town planning. The indicators nevertheless have potential in respect of buildings owned by the city, as they could be used to estimate emissions and based on information make decisions about whether to demolish or renovate.

2.4 Challenges of the indicators

The cities' existing building stock consists of a wide variety of buildings of different ages and types, which makes it difficult to draw direct comparisons between different cities using the indicators. There may



28.11.2023

be less demolition going on in growing cities in particular, which are focused on building new infrastructure. Moreover, indicators that measure performance across an entire city may not be suitable for more specific analyses. What would be useful is that city-owned buildings, residential properties, and other buildings could be separated in the indicators.

The interviewees felt that the Circularity Dashboard may show an overly optimistic picture. For example, a recycling rate may look impressive, but city organisations would hope more concrete information, such as the volume of recycled material in tonnes and the types of material recycled. The interviewees questioned the reliability of the data and whether the figures could be trusted to draw informed conclusions. When it comes to data collection, the division of responsibilities is not always clear within city organisations. The interviewees also wondered how HSY had gained access to the data in the first place. They felt that tracking demolition waste and keeping records in Building Control Services' information systems would be difficult in practice.

City organisations have limited influence on private demolition projects, and better coordination and more resources would be needed in this respect. The interviewees were especially sceptical about measuring flexibility. They also would have preferred to have the Circularity Dashboard available in Finnish.

3 Analysis of the indicators

3.1 Overview

The interviewees would have liked the indicators to be more concrete and presented in a clearer fashion. They particularly called for more information about how the indicators work in practice and what they actually mean. For city organisations to be able to make use of this valuable information, the Circularity Dashboard should make it clearer how the data for each indicator were collected and from which sources. For the indicators to make it possible to measure progress, the data should be collected in the same way every year. Historical



28.11.2023

data would also need to be incorporated to understand better the trends.

Overall, the interviewees felt that the indicators were a welcome addition, especially because data are actually being collected and made available to the city organisations. All data that HSY can provide is valuable to the cities. Raw data would also be useful, as they would enable more in-depth analyses and give a better understanding of the root causes of each city's unique situation. Some of the interviewees also liked the idea of every city being able to present tailored indicators based on the raw data.

The indicators provide an overview of each city's progress, but they cannot yet be used as a basis for strategic decision-making, as there is not enough information available and no benchmarks. Being able to use the indicators more quickly and with less data would surely be beneficial. However, getting access to reliable data in short timeframe is unlikely. City organisations can take the indicators into account in their strategies and roadmaps, and also emphasise them, but the limited indicator data can make it challenging to identify clear targets and priorities.

The interviews also brought to light the fact that the key indicators proposed by HSY are not often used. The interview with representatives of Facility Management Department and Urban Planning Department revealed that the indicators do not provide a lot of new information and that the city can use their existing data to make better decisions. Interviewees wished clearer separation between city-owned buildings and private properties across all the indicators. This has already been done in respect of indicator No 4 (Demolition rate).

The deployment of the indicators could be coordinated with the next review of the cities' roadmaps and targets. Sustainable development indicators are already being developed by the cities' Environment Departments and other departments. The city organisations are also in the process of designing their own systems. A national system would be the preferred option, especially dealing with new construction and renovation projects.



28.11.2023

Projects that the cities are currently working on, such as RYHTI and the development of the Circular Economy Tracker (a circular and sharing economy programme that also potentially involves the introduction of performance indicators), could learn from each other and have synergy.

3.2 Analysis of the key indicators

3.2.1 Indicator 1: Amount of construction and demolition waste

The indicator that measures the amount of construction and demolition waste per inhabitant was seen as important in general, but it needs to consider each city's characteristics and existing building stock, especially the age of buildings. This indicator can also reflect the trends in the construction industry, and therefore the industry's ups and downs can affect the comparability of the indicator data. Moreover, variations in the number of inhabitants in a city can have an impact on the results. This is why it could be useful to present the indicator as a measure of the 'amount of construction and demolition waste per built or demolished square metre' instead. This format could provide a more accurate and comparable measure of the sustainability of urban construction and demolition projects.

It should be noted that there are some weaknesses in this indicator, e.g. it does not cover effects of waste transport, even though transport is an essential part of the entire waste management process. The sorting of waste is also important in order to make the indicator more efficient and versatile. Whether or not more efficient sorting techniques will become available is still uncertain, but the rising cost of waste management could make sorting more of a priority. Burning is the easy option when it comes to the disposal of wood waste, and measuring the degree of reuse is more complicated. Recycling small amounts of waste components can be economically challenging on the big picture. The cost of research into the usability of recycled materials can affect the degree of recycling and recovery.

3.2.2 Indicator 2: Proportion of Construction and Demolition Waste Recycled

The indicator that measures the recycling rate of construction and demolition waste was seen as too abstract, and the city organisations



28.11.2023

would have liked more concrete information, such as the volume of recycled material in tonnes and the types of material recycled. The interviewees also wondered whether the indicator is oversimplified. In respect of this indicator, the focus should be on providing clear information on the origin of the data and presenting the existing data in as comprehensive and detailed manner as possible.

Indicator one and two could also be combined. In that case it could be more concrete way of showing what is the impact of reuse and recycling measures in the future. Also further information on different types of waste could be added to the indicator. Then this could be also analysed what measures are the most effective.

3.2.3 Indicator 3: Refurbishment and transformation relative to new construction

The indicator that measures the ratio of repair and alteration work versus new construction is especially important for the cities' Town Planning Departments and Building Control Services. It is important, in respect of this indicator, to consult with these actors as they play key roles in the decision-making process. However, this requires taking into account the differences between individual cities and neighbourhoods as well as their objectives.

Having a clearer understanding of the kinds of information that can be obtained, and whether it should be broken down by neighbourhood, would be useful. This would give access to more detailed and more useful information but could damage the comparability of data between old and new neighbourhoods. Information on the locations of properties could potentially be pulled from the Land Information System, but how this would work in practice still requires more development. This indicator nevertheless has potential, and it could also prove useful in the context of individual projects.

Another option worth considering is a measure of the absolute volumes of repair and alteration work without the comparison to new construction. Alternatively, the volumes of repair and alteration work could be compared against demolition rather than new construction.



28.11.2023

The city organisations also expressed interest to measure the volume of demolition relative to the volume of renovation. Such an indicator could be a useful benchmark. One of the interviewees had previously contacted their city's Building Control Services to enquire about this, but the information had not been available.

3.2.4 Indicator 4: Demolition rate

The indicator that measures the annual discharge rate was seen as useful especially for the purposes of the cities' annual environmental reports. This indicator could also be incorporated into the cities' Circular Economy Trackers. The fact that this indicator makes a distinction between city-owned buildings and private properties was considered especially useful.

This indicator can be used to present information to communities or residents. It could also potentially be used to share the cities' strategic objectives and measure progress towards them. The indicator could be made clearer by providing more information about which data are being compared against each other.

Overall, all the indicators that related to construction and demolition were considered important, especially the ratios between new construction, demolition, and renovation. Town planning officials would benefit from information about why demolition is taking place elsewhere or why a private property owner has not gone ahead with demolition. Sharing this kind of information more openly between cities would benefit everyone.

The indicator could also reflect the age and condition of buildings to provide more information. As it stands, the indicator raises questions about why a building has been demolished. More information about the condition, age and repair deficit of buildings would be useful. External conditions rarely change, which is why such information could prove valuable. Collecting this kind of information is challenging if the condition of a building is only known to its owner.

3.2.5 Indicator 5: Average age of demolished buildings

The indicator that measures the average age of demolished buildings is highly dependent on the age of each city's building stock. There is a



28.11.2023

risk that the indicator could be misleading. It could stop the demolition of relatively new buildings that have fallen to a stage beyond repair.

The information provided by the indicator is nevertheless useful on the whole. Incorporating information about the condition of buildings could make the indicator more informative, but this could be difficult to implement in practice. One possibility could be to incorporate information about building materials and construction techniques into condition assessments.

3.3 Development proposals and future opportunities

3.3.1 Circular economy in the construction industry

Unlike the linear economy, the circular economy is made up of several stages. Comprehensive progress in circularity thinking can have a positive impact on the circular economy and promote recycling in the construction industry. The longer lifespan of buildings and building components is a key part of the circular economy of construction. Longer lifespan can be achieved through the adoption of a long-term property maintenance plan based on up-to-date information on the building's current condition. A mathematical formula can be developed for this, to estimate annual wear and tear.

The repair deficit indicates, in monetary terms or as a ratio, how much should have been invested in the building for it to be in good condition in terms of use. The repair deficit grows until the repairs are done. More information is needed about repair deficits, and this is likely to require a clearer definition of the concept itself. The repair deficit of a building can only be reliably established on the basis of regular condition assessments. Analysing the repair deficit and exploring the possibility of repurposing buildings are also important. A building's repair deficit is often the reason for demolition, and opportunities for repurposing are usually explored in connection with town planning. Converting office buildings into residential properties, for example, can be complex and require completely new infrastructure to give the new residents access to local services.

Renovation projects should be coordinated together with the lifespan of building services engineering systems. Property maintenance and



28.11.2023

repairs should be planned in a systematic manner over the long term. If the goal is for buildings to have a useful life of 120 years, they really need to be designed and built with adaptability in mind. What this means in practice is that ensuring long lifespans are not prevented by aesthetic factors or town planning regulations. Defining what it means for a building to be 'genuinely adaptable' can be challenging, and this is a job for the cities' Town Planning Departments and Building Control Services and in national level a job for Ministry of Environment.

Pilot projects focusing on extending the lifespan of buildings and upgrading building services engineering systems could provide a way to experiment with the circular economy in different types of buildings. The reuse of construction components could also be explored.

The protection of built heritage and the value of demolition need to be addressed when promoting the circular economy. Questions that must be answered include whether the price of demolition should compensate for the damage caused, on what grounds should demolition go ahead and what the criteria should be. The circular economy is not just a matter for one city or neighbourhood; wider social debate and potentially legislative reform are needed to promote it.

3.3.2 Complementary indicators

In addition to the key indicators, a number of complementary indicators were analysed for their relevance and usefulness as well as to study how easily the required information could be obtained and what changes would be needed if these indicators were to be introduced. The following are examples of complementary indicators:

- Emissions from new construction relative to emissions from renovation projects
- Degree of the use of recycled materials in new construction
- Reasons for demolition (beyond the volume of demolition)
- Building surface area data
- Volume of demolition relative to the volume of renovation



28.11.2023

- Ratio between emissions from new construction, demolition and renovation
- Repair deficit (Cities' Facility Management Departments are interested about this information)
- Time interval between end of use and demolition
- Average age of building stock (to enable comparisons between cities)
- Primary building materials
- Occupancy rate (promoting efficient use of space has already been incorporated into the cities' strategies but a good measure is yet to be found; this is a challenging indicator)
- Occupancy rate versus the condition of the building

The main issues with the above mentioned complementary indicators relate to how they can be tracked and where the necessary data would come from.

3.3.3 Data and information gathering

The data collection process needs to be explained more clearly to all departments of city organisations. In respect of at least for the City of Helsinki data collection and management are responsibilities of the Facility Management Unit and not Building Control Services. Data collection needs to be made more systematic, and the Buildings Register kept by the Digital and Population Data Services Agency could be the best way to coordinate collective information gathering. The various forms that are used for this purpose need to be revised to make it easier to collate and automatically share data. More communication is also needed between different projects and systems.

It is important to collect useful data and utilize interfaces in the circular economy. Automated data collection plays a particularly important role, as it reduces the amount of manual labour and ensures that information is always up to date. City organisations limited resources, and changes in personnel can affect the data collection process.



28.11.2023

The exchange of information between the cities and HSY is vital, as the data collection process and tracking procedures can also be affected by legislative reforms and the cities' different priorities. Consistent objectives are needed to optimise the use of the data provided by HSY.

Many of the Helsinki region cities, with the exception of Espoo, use the lupapiste.fi digital building control application, which could provide means to collecting more data. It would also be useful to know whether there are interfaces between the lupapiste.fi application and HSY's information systems. Another option worth exploring is whether the new Construction Act could open up new ways for collecting data via Building Control Services' information systems.

3.3.4 Future opportunities

Some progress has already been made towards national circularity targets for construction. Change is happening thanks to regulation and guidance. However, the effect of regulation remains unclear. It would be worth considering whether change could be accelerated with stricter regulation. How can we distinguish between changes that have occurred thanks to a city organisation's own actions and changes that are due to external causes? And how should we compare the effect of economic viability of recycling with the effects of sanctions and regulation?

The reform of the Land Use and Building Act can make it easier to collect data on the circular economy in construction. However, individual cities are unlikely to have the necessary resources. The preparatory phase is underway regarding the legislative change. Economic considerations also play a big role when it comes to the circularity of buildings and construction components.

Increasing dialogue between HSY and individual cities on the development of circular economy indicators has the potential to generate more valuable information and resources. HSY has valuable knowledge and experience on knowledge production, and continuous



28.11.2023

improvement of cooperation with city organisations is useful also in enhancing circular economy in construction in cities.

