



Construction City

Applying Circular Economy in the Construction Sector

Written by:

Svein Lund, BI Norwegian Business School,
with help from Benedicte Økland and Birgitte Molstad, Circle City
for the International Case Competition
at BI Norwegian Business School, February 2020

Introduction

We need to meet the challenge of climate change in all sectors of society. The construction sector represents one of the major contributors to CO₂ emission.

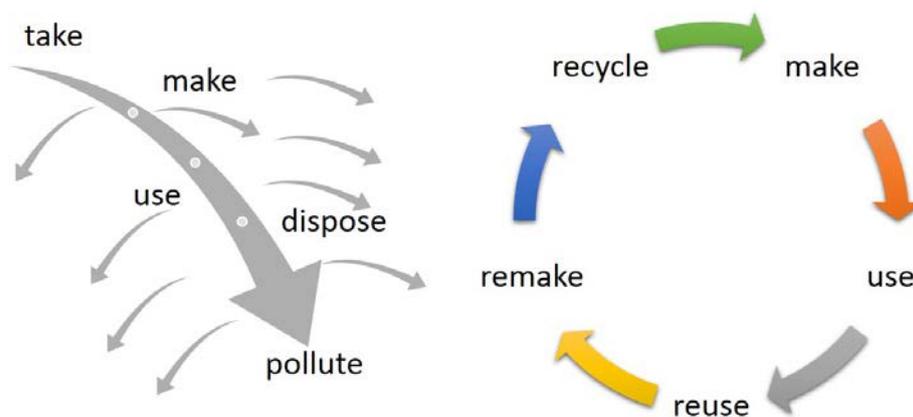
The construction sector represents the largest share of total global energy-related CO₂ emissions, according to the 2018 Global Status Report prepared by the International Energy Agency (IEA) for the Global Alliance for Buildings and Construction (GlobalABC).

In 2017, building construction and operations accounted for 36 percent of global final energy use and nearly 40 percent of energy-related CO₂ emissions, excluding construction-related energy use for transport associated with moving building materials to construction sites.

Building operations (heating, cooling, lighting, etc.) account for 28 percent of global carbon emission, and 11 percent is attributed to embodied-carbon emission, which refers to carbon that is released during the construction process and material manufacturing. The construction industry uses 4.2 trillion kilogrammes (kg) of cement annually. One kg of cement releases more than 0.5 kg of CO₂ into the atmosphere.¹

Construction City Oslo is an industry cluster for the building, construction and real estate industries in Norway with close to 60 member companies. Their aim is to be the world's premier competence center for the building, construction and real estate industry.

Benedicte Økland, the general manager of the cluster, sees the introduction of circular economy in the construction sector as a step forward to reducing the sector's large CO₂ footprint. According to the information above, 11 percent of global carbon emission comes from the construction process and material manufacturing.



CC 3.0 Catherine Weetman 2016

Rather than the linear model of *take – make – use – dispose – pollute* she would like to see a transition to the circular model of *make – use – reuse – remake – recycle* for the construction sector. To do this she needs your help. The process of making the transition from linear to circular thinking in the construction sector is complicated, and nothing much has been done. Ms .Økland would like you to look into the process and suggest a model for increasing the

¹ <https://theaseanpost.com/article/construction-sector-addressing-climate-change>

degree of reusing, remaking and recycling materials in the construction sector. The model she wishes you to design will be specified later.

Construction City

Construction City is a business cluster with a mission to be the driving force for collaboration and new solutions in the construction industry. Accommodating the entire value chain from promising start-ups to major entrepreneurs, this is where cross-sector players meet to share insights, collaborate on projects and lift the industry's competitiveness.

To move from wanting change to actually facilitating change, Construction City represents the gathering of a team of construction and real estate companies to spark new working methods, smart use of technology and more sustainable practices. After launching in 2018, a large number of players have joined us.

Through clustering, we are enabling rapid and direct exchange of knowledge. In our virtual and physical business campuses we will run innovation pilots and push forward new ways of working. The objective is to increase our members competitiveness and be a showcase for industry collaboration and co-location.



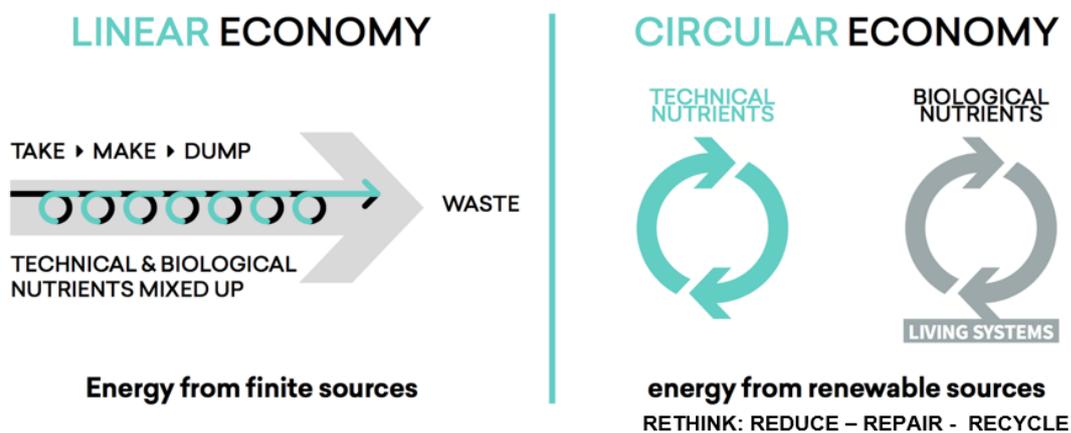
Construction City - cluster members

Circle Economy ²

Circular economy is a manifestation of economic models that highlight business opportunities where cycles rather than linear processes, dominate. It is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times.

In today's established economic systems, goods are produced, used and discarded, a linear economy where the flow has a clear beginning and a clear end. A circular economy works quite differently. Products and services in a circular economy are designed in a way that allows them to be reused, either in the biological or technical cycles.

All products are manufactured in a way so they can be disassembled and materials will either be broken down by nature or returned to production. Biological material therefore consists of non-toxic, clean feeds and technical materials are designed to be a resource to be used industrially again. The goal is to throw nothing away and to reduce the need for purchasing new commodities, while production and transportation is best achieved with renewable energy.



after W McDonough and M Braungart

The three Rs (3R)
Reduce, Reuse and Recycle. The rule of the three Rs (3R).

The three Rs in the construction sector:

Reduce: Building “green” buildings, designing them as zero-emission buildings, thus reducing the amount of energy required to operate and using renewable energy to operate the buildings.

Repair: Repairing and reusing materials from demolished buildings when building new, or repairing components like windows and doors instead of replacing them.

Recycle: Recycling materials into raw materials to be used for production of new materials and products, replacing virgin material. For the construction industry

² <https://sustainabilityguide.eu/sustainability/circular-economy/>

there are mature technologies for recycling of metals , such as steel, aluminium and cobber, cardboard, plasterboard and certain plastics. Less commonly building materials being recycled include wood waste, concrete and insulation.

All the materials acquired when pulling down a building have value, and these values need be utilised. But the road to applying the three Rs is long. The problems are many.

Problems with applying the three Rs

Reusing

Planning a new building starts with an architect drawing the building. The architect would like to reuse materials and components from buildings due for demolition or from materials from old buildings, stored somewhere. But information about available materials is scarce. Old buildings are poorly documented with little or no information about the dimensions of components or the quality of the components/materials and are also lacking required documentation

Some companies are addressing this problem:

Madaster³ and GreenStock⁴ are both building databases where companies can register their buildings.



It is Madaster's mission to eliminate waste by providing materials with an identity. The Madaster Platform functions as a public, online library of materials in the built environment. It links the identity of materials to a location and registers this in a materials passport. Through the materials passport, materials keep their identities, changing every building into a depot of materials with a certain value.



Get an overview of available materials, share information with partners and get help related to logistics, technical or legal issues. View detailed reports on potential savings - economy, construction waste and CO2.

Similarly, demolishing companies, such as Øst Riv, R3, Veidekke and AF Decom, are also exploring and industrialising more circular deconstruction techniques. For example by documenting building materials with potential for reuse prior to demolishing, or by

³ <https://www.madaster.com/en>

⁴ <https://www.greenstock.no/web/>

developing new technologies for “lifting/jacking” entire building floors in existing buildings – and by this avoiding/reducing demolition altogether.

However, materials are getting scarce and prices for new building materials are increasing. This trend might make reusing materials cost effective in the future. Many companies are now registering new buildings, even though it is still a cumbersome process. Registering old buildings is even more time consuming and costly.

Legal issues

There are many legal issues related to selling reusable materials. For example, the owner of the building supplying the materials (the building being torn down) is required to sell the materials under the same conditions as a company selling new materials. The materials have to comply with current industry standards and come with a five-year guarantee.

Recycling

A considerable amount of construction waste is possible to recycle. Both metals and concrete from demolished buildings can and are to a certain extent being recycled. Crushed concrete may for example be used as gravel for new construction projects. The recycling of one tonne of cement could save over 5000 litres of water and 900 kg of CO₂.

Maybe walls or columns made of reinforced concrete could be moved and used in new buildings rather than being crushed to gravel.

From 2020, EU has imposed new regulation requiring that 70% of all construction waste either is reused or recycled (hazardous waste exempt). Current status varies across EU-member countries, but in general the 70% requirement is much higher than current reuse and recycle levels.

To sum up; Circular economy is all about retaining value. The better the integrity of the product is preserved, the more is retained.

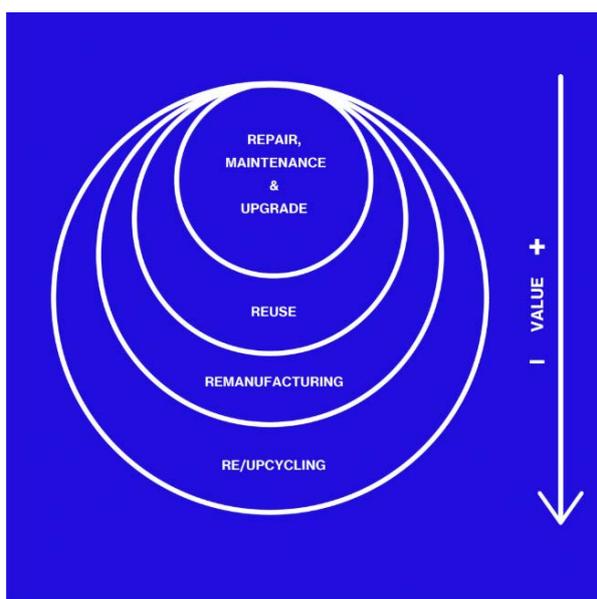


Image source: Ethica, Anne Raudaskoski

Stakeholders in a building project

There are many stakeholders when a new building is being planned and built.

The *owners*, who will own the finished building.

The *architects*, who draw the building.

The *finance* sector, who finance the building.

The *authorities*, who control the planning and building.

The *constructors*, who build the building.

The *material producers and recycling companies* that are providing materials and potentially raw materials.

All of these are able to make the building process more sustainable. The architects by planning to reuse materials; the owners by having sustainability as part of their vision for the new building; the finance sector by favouring sustainable buildings with better rates; the authorities by imposing dues and taxes on unsustainable buildings and reviewing regulations on the reuse of materials; the constructors by reducing waste in the building process; material producers by replacing virgin raw material with recycled raw materials.

At the moment building new buildings in the linear economic model is much cheaper than applying the circular model. But this will have to change if we are to curb climate change. The construction industry needs to become more sustainable.

Your task

Introducing the circular model in the construction industry is a momentous task and cannot be achieved overnight. Benedicte Økland, the general manager of the Construction City cluster is aware of this, but she appreciates that “the times they are a changing” (to quote Bob Dylan). Things must start with small projects where the circle model is applied in small steps. Models for running the projects must be made, models that can be scaled up when the time is ripe.

Your task will be to supply Ms Økland with this model. You are business students and the model needs to be a business model.

Define a small project. Identify the stakeholders in your project. Show what type of information each of the stakeholders require and explain the key success factors that will enable real change towards circular construction.

What are the cost drivers in the project? Are there new business opportunities in going circular? For whom? What types of incentives from the authorities (if any) are needed for the projects to be attractive for the building of new buildings?

Ms Økland is looking forward to hearing your suggestions.

Good luck!



**INTERNATIONAL
CASE COMPETITION**