

## **Business models for building material circularity: learnings from frontrunner cases**

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### **ABSTRACT**

One of the expected key outcomes of the Horizon 2020 BAMB (Buildings As Material Banks) project is new business models for material circularity. The team has interviewed four “frontrunner” cases which have pioneered in incorporating elements of building circularity. The study included well-known cases such as the new Venlo city hall (the Netherlands), PROgroup (Luxembourg), Rotor DC (Belgium) and Karlstad hospital (Sweden), while taking a fresh focus on business aspects such as value propositions, stakeholders, financials and operations.

Preliminary analysis suggests that successful circular building projects are devised with a holistic view on various sustainability elements and ecosystem stakeholders. In comparison to more developed building sustainability elements such as energy, material circularity is still rather new in many aspects. Related business models vary significantly in maturity depending on product/material category, overall with ample room for growth. Supplier buy-back agreements and product-service systems are being developed, though how to put retrieved items back into the economy, as well as how to establish solid financial cases for involved stakeholders, are among the topics which still need further substantiation. Encouraging advance has been made in deconstruction business models, while more attention is needed to developing second-hand market demand. The potentials of public procurement and regulatory incentives as additional key drivers are also to be further investigated.

**Keywords:** circular economy, business model, building materials, case study.

### **INTRODUCTION**

The BAMB (Buildings As Material Banks) project is dedicated to promote material circularity in the building sector with architectural and IT innovations (transformable building design and material passport). In addition to technical feasibility demonstration, expected key outputs also include business models. Viable and robust business models, with thorough consideration of the entire ecosystem and its highly-interdependent actors, are key success factors to implement pilot practices in real-life situations and to scale up adoption to an impactful level.

To get a good understanding of relevant practices already available on the market, the team has studied several “frontrunner” cases which have pioneered in incorporating elements of building circularity in real life. The four chosen frontrunner cases are based in four different EU member states, involving different value chain actors (such as engineering companies, consultancy firms and deconstruction companies) and different market segments (public and private). Interviews were conducted with key personnel who have had direct and in-depth involvement in these building projects, including owners, project managers, contractors and

sustainability consultants. Interviews were conducted either by phone, or face-to-face with visits to the building sites.

## **FRONTRUNNER CASE DESCRIPTION**

The frontrunner cases are briefly described below. More detailed descriptions can be found on the internet<sup>1,2,3,4</sup>.

**Venlo City Hall, the Netherlands.** The new Venlo City Hall, completed in 2015, has become an icon of Cradle-to-Cradle inspired buildings. It integrates four major circularity elements: renewable energy, building as material bank, enhanced indoor and outdoor air quality and creating water loops. Next to the design and construction achievements, a concrete business case has also been developed: an additional investment of €3.4M in sustainability is expected to result in €16.9M savings in e.g. energy and water over 40 years. The extra investment was made through mortgage, which is paid off with realized savings. Positive cash flow was already achieved after one year. Further savings could be accounted once the relation between better indoor air quality and reduced sick-leave rate is proven. On material circularity, the Venlo city hall has incorporated Cradle-to-Cradle<sup>®</sup> certified products, lease contracts and buy-back agreements with suppliers (typically at 15-25% of original prices, for office furniture and indoor finishing). Overall, a 10% residual value was estimated for the building in 40 years and the bank has reduced mortgage interest accordingly.

**PROgroup, Luxembourg.** PROgroup, founded in 1996, is a group of engineering companies active in sustainable buildings based on circular economy principles. Their office buildings in Windhof, Luxembourg feature a wide range of environmental and social sustainability concepts, such as Cradle-to-Cradle, product service systems, transformability, biodiversity, employee well-being and community building. Economic feasibility was demonstrated by low vacancy rates even at above-average rent. In a new steel-structure parking lot project, as contingency for future demand uncertainty, PROgroup has reached agreement with the supplier on a buy-back option of their steel beams at deconstruction. The supplier has agreed to a price point higher than the second-hand market average, since buying back their own products significantly lowers the risks compared to acquiring used beams from other manufacturers. Deconstruction will be carried out by the supplier to ensure proper dismantling and handling. It is speculated that such buy-back schemes may further incentivize suppliers to design for simple deconstruction and standardize beam specifications for various applications.

**Karlstad hospital, Sweden.** Karlstad is a public hospital owned by the county council of Varmland, Sweden. The county council included healthy building materials as a requirement in the neonatal unit renovation project in 2013. As a result, 800 kg of phthalates and 1598kg PVC plastic were avoided, at an additional cost of less than 0.33% of the total project budget. It was recognized that the additional upfront cost is insignificant compared to long-term costs if hazardous materials need to be taken out at a later stage. In fact, there has been a growing demand for healthy building materials over the past decade in Sweden, primarily from the public sector. Although this case is not directly about material circularity, it does provide interesting insight on the role of public procurement in mainstreaming sustainability practices.

**Rotor Deconstruction (Rotor DC), Belgium.** Rotor DC is a spin-off company of the Brussels-based non-profit organization Rotor. Leveraging on years of research and deep

insight of the local second-hand building material market, Rotor DC pioneers an innovative way-of-working in deconstruction. The reclaim potential of large buildings is assessed and information is made available to potential buyers already before the deconstruction starts. Cost is made neutral for building owners (deconstruction = demolishing), while additional expenses are paid by sales of used materials.

## LEARNINGS AND DISCUSSIONS

**Ample room for growth in building material circularity business models.** In comparison to more developed building sustainability elements such as energy, building material circularity is still a rather new concept in many aspects. Different building products/materials require different business models, determined by characteristics such as lifecycle (e.g. beam vs. partition wall), supply risk (e.g. steel vs. concrete) and value retention potential (e.g. cable tray vs. carpet). The maturity of business models varies significantly: down-cycling and recycling at raw material level date back a long time; product-service systems for shorter lifecycle items are growing; supplier buy-back agreements for structural components are being explored. In the newer business models, how to put retrieved products/materials back into the economy, as well as how to establish solid financial cases for involved stakeholders, are among the topics which still need further substantiation.

**Holistic approach is key.** Successful circular building projects are devised with a holistic view on sustainability elements such as energy, user health, water and materials management where synergies and trade-offs arise. Furthermore, a common success factor in circular building design emphasized by all is stakeholder engagement from the very beginning. Early co-design processes with end-users, technicians, suppliers and communities take everyone's needs into consideration, therefore resulting in a more holistic design, as well as creating the foundation for future support.

**Public procurement can be a powerful driver.** Public procurement can play a significant role in mainstreaming circularity practices. For example, healthy building materials remained expensive and niche in Sweden till municipalities started including them as requirements in their tenders. Being one of the largest client groups, demand from the Swedish public sector pulled the entire supply chain and significantly lowered extra cost over time by economy of scale. Finished public building projects are well positioned for further awareness raising and experience sharing.

**Regulatory considerations.** While energy has become core for most building codes and certification systems, material circularity has received much less attention in comparison. Moreover, some of the major challenges faced by new circular building business models are related to regulations. As a consequence of increased residual value with circular practices, the discrepancy between building (component) market value and book value will likely widen and needs to be properly managed in e.g. accounting and taxation. In another example, important circular business models such as product-service systems with third-party ownership (e.g. leasing) may not be feasible for some building materials due to leasehold property legislations.

**Market demand needs more attention.** Most frontrunner cases demonstrate the design phase of material circularity, such as choosing Cradle-to-Cradle® certified products and setting up supplier buy-back agreements, which facilitates the supply side of used building components. It is known that supply exceeds demand in today's second-hand building

material market. Therefore in addition to improving technical feasibility and information management on the supply side, further attention is needed to direct stimulation of second-hand market demand, which would be of utter importance to the actual final realization of material circularity in the building sector.

## **CONCLUSION**

Compared to more developed sustainability elements such as energy, material circularity is relatively a new concept in the building sector. Encouraging advancements have been made in new business models such as supplier buy-back schemes, product-service systems and deconstruction, as well as processes such as stakeholder co-design. Suggested business model development needs include realizing circularity after take-back (e.g. re-use/refurbish/remanufacture/recycle), substantiating the financial models and stimulating second-hand market demand. The potentials of public procurement and regulatory incentives as additional key drivers are also to be further investigated.

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