



CITY OF VENLO

A Circular Economy Business Model Case

The newly built city hall Venlo, more than merely sustainable

*How City of Venlo creates positive impact for people and the environment
with a profitable circular business model*

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Executive Summary

This report presents a case study of the city of Venlo and its circular business model, selected by the R2π project along with 17 other cases, due to its position within the construction and building materials sector, which is one of the priority areas of the European Union's circular economy strategy. The objective of the report is to analyse the contextual and business factors affecting the circular business model, as well as to assess the enablers and barriers to implementing such a model and to provide considerations for both business leaders and policy makers.

The city of Venlo (NL) embraced the Cradle to Cradle® (C2C®) principles as first region in Europe. In 2008 Venlo decided to build their City Hall as shining example of C2C® design. The creation of a pleasant and healthy workplace for employees of the Municipality of Venlo has been the central theme: a building that offers a comfortable and healthy working environment, combined with sustainable innovation.

Venlo considers the C2C® principles as a revolutionary economic concept and true driver for innovation, based on new circular economy business models and the use of materials in perpetually cycles. Based on these principles, Venlo applied a wide variety of circular measures within a circular economy business model, for which they invested €3.4 mln. This investment creates a net saving of € 16.8 mln over the use time of the building and a positive cash flow after year 1. Besides, the building has been realized within the budget and without dependency on subsidies. Since the building is in use (October 2016), the operational costs are significantly lower compared to former and traditional (linear) buildings.

The above mentioned circular measures show that, during use time, indoor air quality is even better than outdoor air quality (while indoor air in offices is on average 4-8 times worse than outside). This is one of the results of the creation of a pleasant and healthy workspace being a central theme for the City Hall. Furthermore, due to its green roofs and facades, the building purifies a measurable 30% of the fine dust and CO2 level in an area of 500 meters around the city hall. Moreover, the building generates its own energy and a helophyte filter purifies grey water, which is reused in the building.

Numerous C2C Certified™ products are used. The building is approached as a material bank for future valuable raw materials and designed for disassembly. Arrangements are made with suppliers about residual value and guaranteed take-back of materials. This resulted, for example for the furnishing concept, in a residual value of 18% with a maximal number of C2C Certified™ materials.

In less than 1,5 years, after opening in October 2016, the city hall Venlo has seen over 25.000+ visitors with a special interest in the Cradle to Cradle® approach. Of these 60% are Dutch, 40% are international visitors. As a result of these visits, many organizations have been inspired to apply the circular principles within their own context.

Also other developers in Venlo have been applying C2C® principles in their real estate project, such as primary schools, gyms, residential houses and companies. The circular principles even became part of Venlo's strategy, facility management and procurement criteria.

This case study describes Venlo's vision and approach in realizing buildings with a positive impact. The municipality of Venlo wants to give an exemplary role in the transition towards a circular

economy and strives to “do good rather than less bad”. The scope of this case study is the business model of Venlo’s newly built city hall.

The uniqueness of this case study, compared to other case studies within the R2Pi project, is the fact that Venlo is a local government. As a consequence, this case study differs slightly from other case studies.

1 Introduction

1.1 Background and context

R2 π – Transition from Linear to Circular is a European Union Horizon 2020 project focused on enabling organisations and their value chains to transition towards a more viable, sustainable and competitive economic model in order to support the European Union’s strategy on sustainability and competitiveness.

R2 π examines the shift from the broad concept of a Circular Economy (CE) to one of Circular Economy Business Models (CEBM) by tackling market opportunities and failures (businesses, consumers) as well as policy opportunities and failures (assumptions, unintended consequences). Its innovation lies in having a strong business-model focus (including designing transition guidelines) as well as in the role of policy development (including designing policy packages).

The ultimate objective of the R2 π project is to accelerate widespread implementation of a circular economy based on successful business models and effective policies:

- to ensure sustained economic development,
- to minimize environmental impact and
- to maximize social welfare.

The mission of the project is therefore to identify and develop sustainable business models and guidelines that will facilitate the circular economy, and to propose policy packages that will support the implementation of these sustainable models.

A core part of this project is to work with organisations who are on the journey towards developing circular economy business models, as well as those who have the ambition to do so but haven’t yet begun. The project has conducted case studies of 18 selected organisations.

The 18 chosen cases covered all five priority areas highlighted in the EU Action Plan on the Circular Economy: plastics, food waste, biomass/bio-based, important raw materials, and construction & demolition. Additionally, the cases were selected to ensure learning in each of the seven business model patterns defined by the R2Pi project: re-make, re-condition, circular sourcing, co-product recovery, access, performance and resource recovery, and these will be discussed in more detail in this report. To gather wide-ranging lessons from differing company sizes and maturities, the following were selected: 7 large corporations, 8 small, medium enterprises, 1 public entity, 1 entire value chain with both public and private organisations and 1 ongoing social project.

This report presents the case study of the city of Venlo. It was selected based on its frontrunners role in the construction sector as the first European public entity to have embraced and implemented the circular principles for its own office as well as its sound circular economy business model.

The next section provides a more detailed overview of the case organisation’s business.

1.2 Business overview

This section presents a high-level overview of the City of Venlo.

Venlo is a municipality in the South of the Netherlands and counts approximately 100.000 inhabitants. Main economic drivers in the region are logistics, manufacturing industries and the agro- and food sector.

FIGURE 1 OLD CITY CENTRE OF VENLO



As first municipality in the world, the City of Venlo embraced Cradle to Cradle® (C2C®) as it's leading strategy for innovation and economic growth. Venlo considers C2C® as a revolutionary economic concept and true driver for innovation, based on new circular economy business models and the (re)use of materials in perpetually cycles.

The scope of this case study is the circular economy business model (CEBM) of the newly built city hall reflecting Venlo's C2C® and circular ambitions.

TABLE 1 FACTS & FIGURES CITY OF VENLO

- City in South of The Netherlands
- Approx. 100.000 inhabitants
- Surface: 27,14 km²
- Logistics hotspot
- Winner of the Cradle to Cradle® Frontrunner Award in 2013;
- Centre of knowledge-intensive and manufacturing industries, agro & food and logistics.

Strategy and Sustainability

In the first years of this century it became apparent that, from 2007 onwards expectations for demographic development in the South of the Netherlands would show a decline in population, which could also affect the Venlo region.

As a measurement, Venlo decided to develop initiatives to strengthen the economic structure and transform the predicted decline into structural growth. In their quest for solutions, and after careful consideration, C2C® was regarded a valuable economic principle and stepping-stone towards the turn-around strategy.

From the moment the City of Venlo embraced the C2C® principles, its motto has been “Realizing economic growth, by boosting innovation that goes beyond conventional sustainability.” Then, in a co-creation with both co-founders Braungart & McDonough as well as stakeholders from the region, The Venlo Principles were developed. These principles are specific for the Region of Venlo and focus on “doing good rather than less bad”.

FIGURE 2 HORTICULTURAL EXPOSITION FLORIADE 2012



Source: city of Venlo

TABLE 2 THE VENLO PRINCIPLES

- Innovate, innovate, innovate
- Link location and context
- Manage and appreciate food
- Enjoy mobility
- Let the sun shine
- Create clean air, water and soil
- Design with future generations in mind

Its implementation in combination with the clear and positive positioning of the municipality, encouraged companies to invest and attract talent towards the region. For Venlo, the application of the C2C® principles resulted in:

- economic growth;
- an increase of the average educational level of youngsters and (working) citizens;
- increase of the innovating strength of businesses;
- an increase of investments in the region.

The scope of this case study is the circular economy business model (CEBM) of the newly built city hall reflecting Venlo's C2C® and circular ambitions.

In 2005 the Council of Venlo decided to build a new City Hall. As a result of the previous mentioned developments, Venlo decided in 2008 to build their City Hall as a shining example of C2C® design to residents and businesses. The creation of a pleasant and healthy workplace for employees of the Municipality of Venlo has been the central theme: a building that offers a comfortable and healthy working environment, combined with sustainable innovation.

TABLE 3 STARTING POINTS

- Floor surface: 13.500 m²
- 620 work places for 900 employees
- Additional 2.000 m² in next-door Nedinsco building
- 400 parking lots (3 stories)
- Total budget: € 55,7 million

The building design focused on four main aspects:

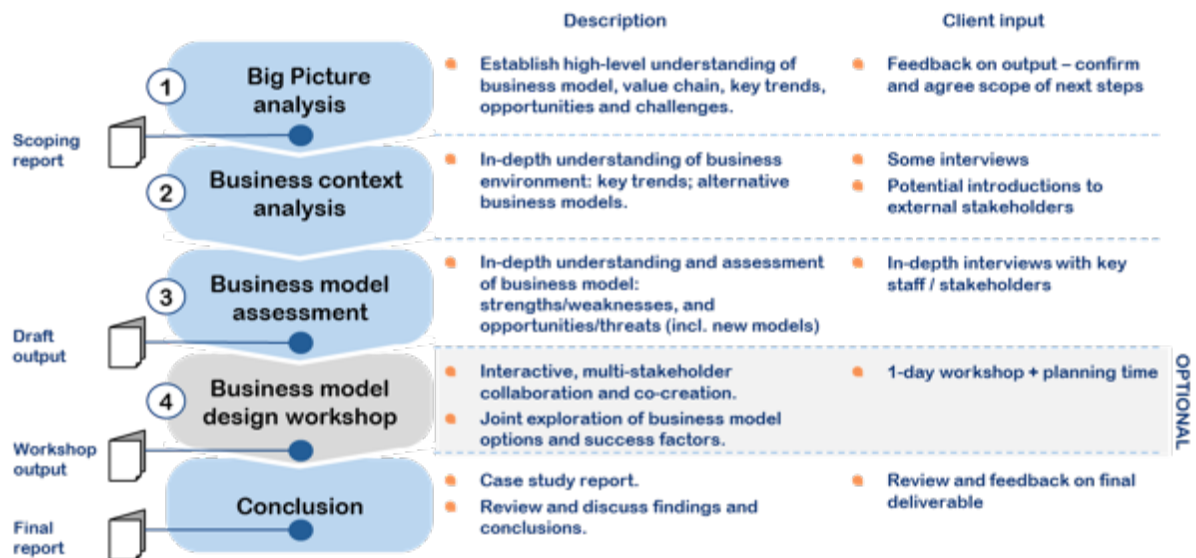
- Enhance air and climate quality, both inside as outside;
- Generate renewable energy, without dependence on fossil fuels;
- Create a material bank for the future, making use of healthy assessed materials that can perpetually flow in a biological or technological circle;
- Enhance water quality, by purifying and recycling water streams.

A documentary showing how these aspects were translated into the building design can be found [here](#).

1.3 The case study analysis process

The case study process was structured in three main steps, plus an optional workshop, and concludes with this document as the final report (see diagram below).

FIGURE 3 CASE STUDY ANALYSIS PROCESS



The case study analysis process is structured in four steps: 1) big picture analysis, 2) business context analysis, 3) business model analysis and 4) business model design workshop. The R2Pi-team worked closely together with stakeholders within the municipality of Venlo that were directly involved in the development of the circular business model.

The case study analysis process was deployed between November 2017 and March 2018. A kick-off meeting has been conducted, prior to starting the Big Picture Analysis. Attendees of the kick-off session for Venlo were involved as a steering group in all stages of the analysis process.

After the kick-off meeting, the R2Pi team worked with the case study organization to complete the preparatory activities:

1. **Big Picture Analysis** (November – December 2017)

This step was conducted in two stages. First desk-research was conducted, based on information that was publicly and rapidly available within the Case Organization. This stage was conducted with minimal involvement of the Case Organisation. Based on this desk research a high-level understanding of the business model was gained to confirm the broad scope of the case study.

After completing the high-level understanding, the findings were discussed with the steering group and the scope was defined with particular areas of focus.

2. **Business Context Analysis** – (January 2018)

Based on the information and the scope derived from step 1, a deeper analysis was conducted on the business context. Insights from the Case Organization and from desk-research has been used to find key barriers and enablers to circular economy business models. Unique for this Case Organization is the fact that Venlo is a governmental organization, rather than a business.

This step was finalized with targeted interviews within the Case Organization, with special focus on: regulation and policies, standards, economics, market and dynamics, technology and infrastructure, knowledge- and innovation systems as well as socio-cultural factors.

3. **Business Model Analysis** – (January – February 2018)

The case organization business model was mapped out, based on interviews and data collection. The result of this stage is an Interim report, which was shared with the Steering Group.

The obtained feedback and additional interviews with the Steering Group resulted in a visual representation of the organizations business model, a narrative description of the CEBM and a SWOT analysis.

4. **Business Model Design Workshop** – (March 22th 2018)

For the Business Model Design Workshop Venlo decided to bring together a wider group of stakeholders. The aim of the workshop was to discuss how the city hall Venlo process and results could become the new normal.

The workshop resulted in a visual report (appendix B), capturing the discussion with the participants, as well as the following statements:

- Several of the key themes were again raised in this discussion, thus re-confirming their importance
- General steps were proposed around people – seeking additional ambassadors, influencers (possibly famous) also including the new city council members
- Actions were proposed around mindset – creating awareness, telling the inspirational story, and marketing to a broader audience
- Longer-term steps were proposed around finance and legislation – making total cost of ownership/use mandatory, creating green investment legislation, and making circular concepts the new standard.

1.4 Report outline

The first chapter introduction has provided a high level overview of the case and case study process. Chapter 2 presents the big picture surrounding the business, showing the context in which it operates and the key external factors. Chapter 3 is an analysis of the business at the building block level of the business model, including the circularity of the business, the financials and the strengths and weaknesses. Chapter 4 draws conclusions about the current state of the business and its future potential.

2 Venlo's business context analysis

2.1 Scope of the business context analysis

The objective of the context analysis is to identify the main external factors that are to be considered in order to explain the success (or failure) of Circular Economy Business Models (CEBM), as well as their potential role in accelerating the transition towards a Circular Economy.

The business context research was carried out in two stages. In the first stage, the case study team conducted desk research in order to identify the country and sector-specific factors that may potentially affect the business model. In the second stage, the team conducted interviews with relevant key stakeholders of the case organisation.

FIGURE 4 NEWLY BUILT CITY HALL VENLO



Source: city of Venlo, Ton Desar

2.2 Contextual factor analysis

The aim of this section is to analyse the different contextual dimensions that influenced the project. In this section an explanation is given of the categories of contextual dimensions and factors on which the Venlo city hall was analysed. The following sub-sections present in further detail the findings of the contextual dimensions analysis, by explaining them regarding drivers and barriers. Based on desk-research and interviews the following key barriers and enablers are identified:

2.2.1 Economy and environment

- Venlo is the first region in the world that embraced the Cradle to Cradle® and circular principles and can thus be seen as frontrunner. As such, Venlo set a trend for macroeconomic developments on regional, national and international level;
- From the start, the Financial- and Concern controllers were involved in the city hall project city, which turned out to be important enablers for the CEBM;
- Except for the Green Public Procurement of the furniture, resource prices didn't influence the -making process;



- The creation of a platform to encourage innovation amongst suppliers resulted in circular solutions and measures to be incorporated in the design.

2.2.2 Rules and regulations

- As a local governmental body, the city hall project has been realized within a political environment. At the start, neither the organization nor the politics were ready for a CEBM and/or financial calculations based on a combination of initial- and exploitation costs. From 2010 onwards, the political and organizational *mindset* has evolved, step by step, from a short term linear approach into a long term circular approach;
- The political climate did affect the -making processes;
- EU and national regulations and legal factors didn't affect the CEBM negatively, neither did they encourage the CEBM;
- The absence of a push/incentive from the EU or national policy to focus on circular economy/Cradle to Cradle® with CEBM's;
- Local policy withheld the possibility to take residual value into consideration for the CEBM:
- The lack of subsidies or 3rd party money flows to boost investments into measures towards circularity / Cradle to Cradle® and CEBM's;
- Due to the lack of eco-taxes to fall back on, a fixed percentage of 5% had to be used. In other words, the tax system affected the CEBM negatively;
- The Tax Authority's requirements for depreciation of building costs made residual value on the building difficult;
- The success of the CEBM of the city hall Venlo resulted in the own local policy to become supportive of CEBM's and allowing calculations with residual value. Besides that: other cities, governments and organizations can learn from Venlo's experiences.
- Green Public Procurement as an important enabler for CE.

2.2.3 Technology trends

- The project was challenging, due to the scale, the high (C2C) ambitions and its general environment. Additionally, none of the stakeholders was familiar with the circular/Cradle to Cradle® principles, which was a barrier in the beginning;
- Now that the city hall and other C2C-inspired projects have been successfully realized, more organizations and projects are taking on circular principles as the main driver of their projects;
- No possibilities for R&D funding and investments.

2.2.4 Demographic trends

- Additional to the environmentally-friendliness and awareness, the decision-making process was mainly influenced through financial evidence and calculations;
- The framework made the circular approach possible, but still needed an extra push from the project team.



3 Business model assessment

3.1 The Venlo city hall business model

The aim of this sub-section is to explain how the business model assessment was undertaken as part of the case study analysis process, to gain an in-depth understanding of the Case Organisation's business model.

3.1.1 Business model overview

City of Venlo is a municipality in the south of the Netherlands. The region has a strong focus on circularity and cradle to cradle since the introduction of these principles in the Netherlands. Venlo is considered as frontrunner and embraced the CE principles as starting point for its new building development. The city hall project, as can be read in this case study, serves as important leverage for new developments, both by the city itself as businesses and other local governments.

The economic crisis of 2008 forced both the Council and the Project Team to look at the budgets differently and be smart about allocating the available capital. Without space for any (extra) investments the challenge was to shift the unexpected negative situation into a positive business case based on the Total-Cost-of-Usage approach, combining the overall investments with the operating costs during the total use-time.

Not only does Venlo deem C2C[®] as a strategic pillar, it also uses it as an **economic** principle.

While remaining focussed on the aforementioned C2C[®]-ambition for the building design, the Project Team started to look for innovative solutions. For this they examined how circular economy principles and C2C[®] methodology could add economic value.

Ultimately, the Project Team came up with a set of measures. And although every measure required investments, it was ensured that the financial return would outweigh the costs. In the end, the package consisted of the following measures:

- Triple glass;
- Rainwater collection;
- Waterless urinals;
- Grey water circuit with helophyte filter;
- Solar panels;
- Solar water heaters;
- Geothermal energy city hall;
- Geothermal energy Maaswaard¹ district;
- Energy efficiency measures;
- Heat recovery;
- LED lightning.

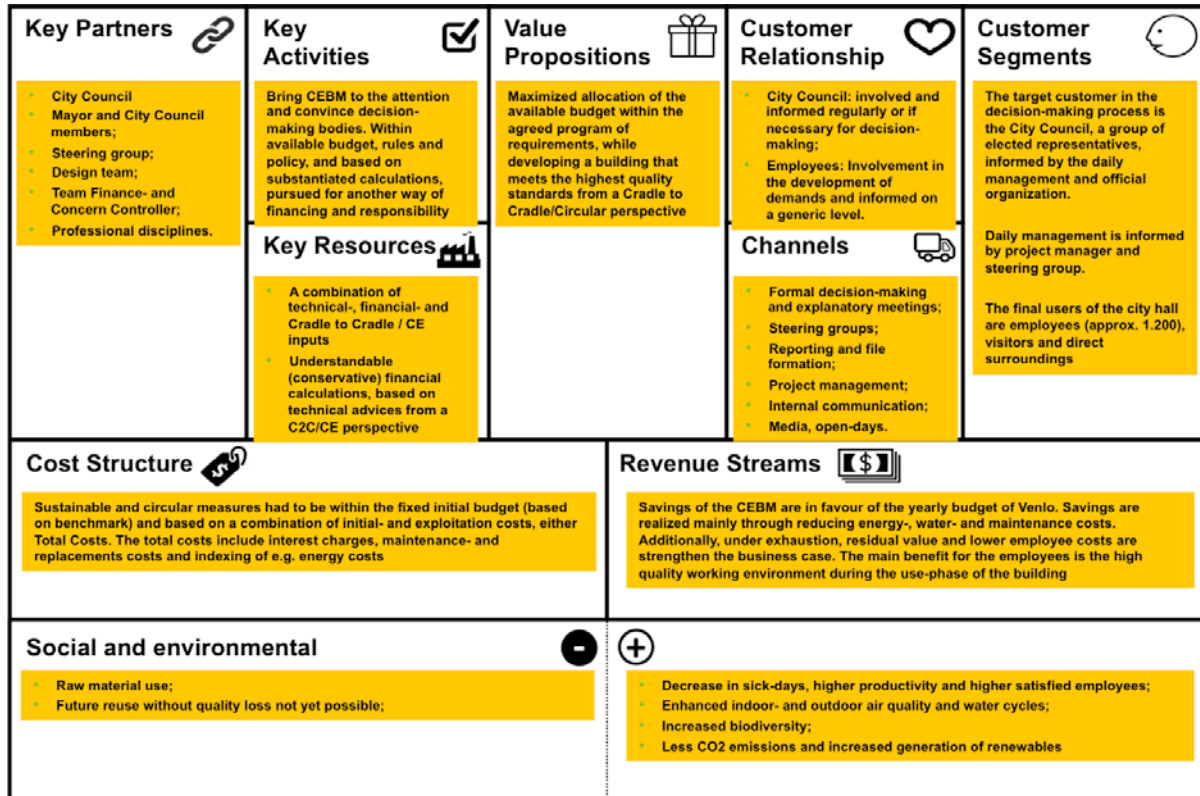
¹ Maaswaard is a district in the city of Venlo



3.1.1.1 Depicting the Business Model Canvas

This section shows a visual and narrative description of the Venlo city hall business model, using the Business Model Canvas framework. A narrative description on each of the nine building blocks can be found in the BMC in Figure 8 and the sections below.

FIGURE 5 BUSINESS MODEL CANVAS



 Strategyzer.com

Adapted by R2Pi

Customer Segments:

The target customer in the decision-making process is the City Council, a group of elected representatives, informed by the daily management. Daily management is informed by the project manager and the steering group.

The final users of the city hall are employees (approx. 1.200), visitors and direct surroundings.

Value Proposition:

Maximized allocation of the available budget within the agreed program of requirements, while developing a building that meets the highest quality standards from a Cradle to Cradle® and circular perspective.



Channels:

- City Council: informed through formal decision-making procedures and explanatory meetings (2-3 times a year);
- Daily management: informed by the steering group and/or the project manager.
- Project managers responsibility is reporting and file formation;
- Steering group: informed by project manager (every 6 weeks);
- Employees: informed by project manager, internal communication and –briefings;
- Surroundings and inhabitants: informed through media, public decision-making by City Council, information meetings and open-days.

Customer Relationship:

- City Council: involved and informed regularly or if necessary for decision-making;
- Employees: involved in the development of demands for the new working environment.
- Subsequently informed on a generic level about the progress and status. If required, employees were substantively involved in the process on a specific topic.

Revenue Streams

The benefits in savings of the circular business model are in favour of the yearly budget of the City of Venlo. Savings are realised mainly through reducing energy-, water- and maintenance costs (=hard benefits). Additionally, residual value and lower employee costs strengthen the business case (=soft benefits). The main benefit for the employees is the high quality-working environment during the use-phase of the building.

The total costs for accommodation (40 years) of the new city hall is much lower, compared to former accommodation.

Key Resources

The key resources are a combination of technical-, financial- and Cradle to Cradle®/Circular Economy inputs. Detailed and understandable (conservative) financial calculations and the circular business model, based on technical advices of the design team, on the basis of which decisions can be made within the available budget.

To create the highest level of quality requires confidence and drive on both the level of project management and design team, to provide insight in the value of a circular economy business model to prepare correct, substantiated and clear decision-making.

Key Activities

Bringing the benefits of a Cradle to Cradle® and circular business model to the attention. Convincing (internal) decision-making bodies. Doing the above within available cash flow budgets, rules and policy. Providing substantiated calculations. Developing alternative ways of financing and taking responsibility. Creating the framework for further decision-making.



Key Partners

- City Council;
- Mayor and City Council Members;
- Steering Group, including:
 - Official mandatory;
 - Administrative mandatory;
 - Project manager;
 - Executive mandatory;
 - Building manager;
- Design Team, including
 - Architect;
 - Building Manager;
 - Installation Advisor;
 - Construction Advisor;
 - Cradle to Cradle® Advisor;
- Team Finance and Concern Controller (upon request supporting the Steering Group);
- Professional disciplines (upon request supporting the Design Team).

Cost structure

In order to guarantee the highest profitability on the investments, both sustainable and circular measures were required. These had to fit within the fixed initial budget (based on benchmark) and were based on a combination of initial- and exploitation costs, the Total Costs. The Total Costs include: interest charges, maintenance- and replacement costs and indexing of e.g. energy costs.



3.1.2 The Value Network

As this project has been realized by a governmental organization the procedures differed from those of a commercial organisation. As the client the city council has constantly been involved in the decision-making process. The steering group provided input for the mayor and aldermen, based on input of the design team, with a crucial role for the project management.

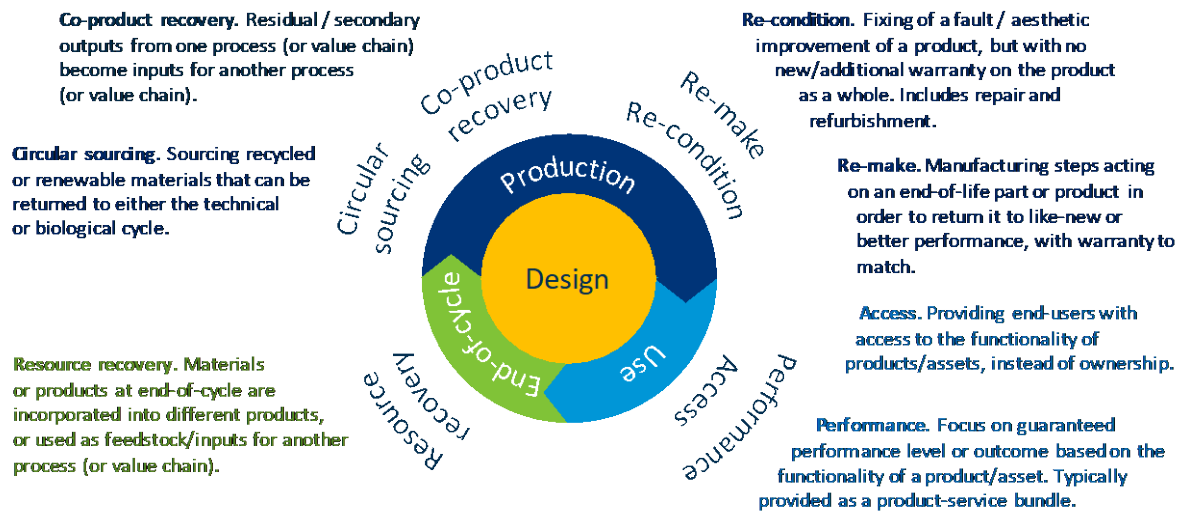
FIGURE 6 VALUE NETWORK



3.2 Business model circularity assessment

This section provides an assessment of the case organisation's circular business model. It begins with a description of the 7 Circular Economy Business Model Patterns identified by the R2Pi project team and describes which of these patterns are utilised by the case organisation. The patterns are shown and described in the following figure.

FIGURE 7 CIRCULAR ECONOMY BUSINESS MODEL PATTERNS



Source: R2Pi

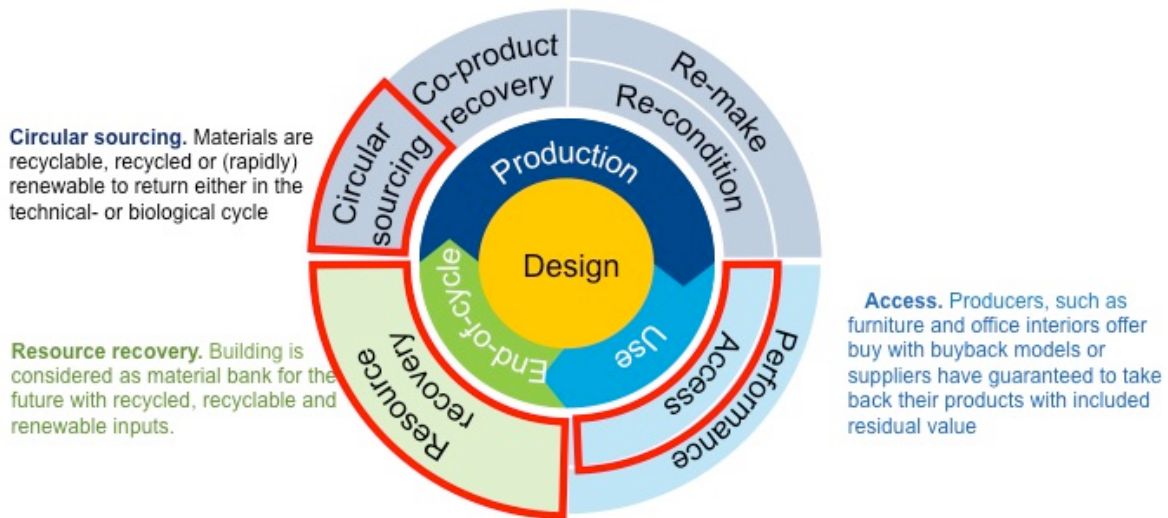
The Venlo case study covers multiple CEBM patterns. City hall is newly built and, through the sourcing of recycled or renewable materials that can be returned to either the technical or biological cycle, can be considered as a **circular sourcing model**.

This case study also contains elements of the CEBM **access** pattern during the use phase. For example, the furniture contains a buy-back scenario, where suppliers take back their own products after a defined use period with guaranteed residual value.

The building is considered as a material bank for the future. The building not only contains valuable products that can safely return into regenerative cycles, also materials and products at end-of-use are incorporated into the building. By doing so, this case study both consist of recycled-, recyclable and renewable content. This case study can thus be seen as a **resource recovery** model during the end-of-use scenario.



FIGURE 8 CIRCULAR ECONOMY BUSINESS MODEL PATTERNS OF VENLO CITY HALL



3.2.1 CEBM within the business context

The city hall of Venlo project can be seen as a best-practice project in the built environment, designed and built according to the Cradle to Cradle® / circular principles. The project shows that a circular approach creates both a positive impact for people and environment, including a positive business model.

Starting such a project requires both ambition and leadership, as capability and trust to make the transition happen. The city hall project is realized within the budget, with a higher quality level than expected.

Since embracing the Venlo Principles (table 2), the city hall project was one of the first projects implementing the circular principles in practice. The Case Organization had no experience with the implementation of circularity into practice, nor circular processes, policies or business models in place. Indeed, the city hall project had to create the new standard for its own organization and beyond.

There are three bold conclusions on the contextual factors as enablers and barriers to the implementation of CEBM opportunities. These are more explained below.

- The political context;
- Economic situation had a mayor role in the decision-making process and eventually influenced the decision-making process positively. The CEBM showed, also during times of economic uncertainties, that investing in circularity results in savings- and earnings during the use time of the project with a positive cashflow;
- Mindset and personal drive of the people, such as the project manager, architect, Cradle to Cradle® consultant, et cetera.



FIGURE 9 BIOLOGICAL GREEN FAÇADE



Source: city of Venlo, Ton Desar

Political and legal factors:

- As a local governmental body, the city hall project has been realized within a political environment. At the start, neither the organization nor the politics were ready for a CEBM and/or financial calculations based on a combination of initial- and exploitation costs. From 2010 onwards, the political and organizational *mindset* has evolved, step by step, from a short term linear approach into a long term circular approach;
- The political climate did affect the decision-making processes;
- EU and national regulations and legal factors didn't affect the CEBM negatively, neither did they encourage the CEBM;
- The absence of a push/incentive from the EU or national policy to focus on circular economy/Cradle to Cradle® with CEBM's;
- Local policy withheld the possibility to take residual value into consideration for the CEBM:
- The lack of subsidies or 3rd party money flows to boost investments into measures towards circularity / Cradle to Cradle® and CEBM's;
- Due to the lack of eco-taxes to fall back on, a fixed percentage of 5% had to be used. In other words, the tax system affected the CEBM negatively;
- The Tax Authority's requirements for depreciation of building costs made residual value on the building difficult;
- The success of the CEBM of the city hall Venlo resulted in the own local policy to become supportive of CEBM's and allowing calculations with residual value. Besides that: other cities, governments and organizations can learn from Venlo's experiences.
- Green Public Procurement as an important enabler for CE.



Economic and market factors:

- Venlo is the first region in the world that embraced the Cradle to Cradle® and circular principles and can thus be seen as frontrunner. As such, Venlo set a trend for macroeconomic developments on regional, national and international level;
- From the start, the Financial- and Concern controllers were involved in the city hall project city, which turned out to be important enablers for the CEBM;
- Except for the Green Public Procurement of the furniture, resource prices didn't influence the decision-making process;
- The creation of a platform to encourage innovation amongst suppliers resulted in circular solutions and measures to be incorporated in the design.

Technology and the innovation systems:

- The project was challenging, due to the scale, the high (C2C) ambitions and its general environment. Additionally, none of the stakeholders was familiar with the circular/Cradle to Cradle® principles, which was a barrier in the beginning;
- Now that the city hall and other C2C-inspired projects have been successfully realized, more organizations and projects are taking on circular principles as the main driver of their projects;
- No possibilities for R&D funding and investments with the lack of sufficient grants for CE/C2C solutions in the building sector (focus on energy and CO₂-emissions).

Sociocultural factors:

- Additional to the environmentally-friendliness and awareness, the decision-making process was mainly influenced through financial evidence and calculations;
- The framework made the circular approach possible, but still needed an extra push from the project team.

The Case Organisation nor others had already circular processes or business models in place. Venlo set a new trend towards businesses and organizations to cope with circular principles. Five key themes can be distinguished towards a 100% circular building and/or region:

- Circular mindset;
- Financials;
- Resources;
- People;
- Know-how

Therefore, the vision principles are based on adding value to all areas. Doing good, rather than less bad. That is the value of circularity and C2C® as path to future good.



3.2.2 Circularity assessment

This section discusses various outcomes of Venlo's sustainability and circularity activities, with focus on the economic translation to strive to economic growth. The assessment is based on interviewees, available data on the CEBM patterns as identified in the R2Pi-project. The circularity tool as identified in the R2Pi-project is not implemented for this assessment, while this is mainly focused on businesses and not a local government.

In order to demonstrate the positive financial impact of the measures, the cost implications (the additional investment, the life span of the measures, incl. costs for their replacement, as well as the effect on energy- and maintenance) have been plotted over a period of 40 years, the estimated use time of the building.

These are the principles used for the financial calculation:

- Additional investments were shown in comparison to the investment of a "traditional" project set-up, e.g. using triple-glass with double glass, solar panels with traditional energy systems, etc.
- Replacement costs were calculated based on the total "new" investment ("traditional" plus additional investment)
- Linear depreciation of the surplus investment over 40-years was assumed.
- Costs consisted the interest charge on both the investment and the replacement costs.
- Benefits consisted of energy savings and lower maintenance costs.

For the yearly average interest rates and indexation over the period of 40 years, the following percentages were used:

Capital interest:	5,0%
Indexing operating and replacement costs:	2,5%
Indexing energy costs based on average expected increase:	4,0%

In order to show the sensitivity of the results of the energy cost indexing used, three alternative calculations were drawn up:

- A nominal calculation in which the energy costs, but also the operation and replacement costs are not indexed;
- A calculation with a conservative indexation of energy costs of 2.5%;
- A calculation with a positively estimated indexation of the energy costs of 6.0%.

In the end, each measure (see previous page) that contributed to the outlined goals, and/or saves and earns money during the defined use time of the building, were translated into an individual business case. Subsequently, all separate business cases were joined in an overall business case for the building design (see below).

Compared to a "standard" project set-up, the most profitable overall business case indicated that an additional investment of approx. 3,4 million euros would bring a net result of 16,9 million euros after the defined use time of 40 years, with a Return on Investment of 12,5%.



TABLE 4 SAVE AND EARN MATRIX (CEBM)

	Initial investment	Replacement investment within 40 years	Payback in years	Return on Investment	Lifespan	Savings over 40 years	Result after 40 years
Total package of measures	€ 3.410.050	€ 1.702.000	15	12,5%		€ 27.285.530	€ 16.884.008
1. Triple glass	€ 465.300	€ -	26	7,0%	40 years	€ 1.847.173	€ 904.941
2. Rainwater collection	€ 27.500	€ -	9	18,3%	40 years	€ 327.396	€ 271.708
3. Waterless urinals	€ 3.300	€ 4.000	16	7,8%	20 years	€ 20.906	€ 5.878
4. Grey water circuit with helophyte filter	€ 102.000	€ -	32	5,1%	40 years	€ 302.755	€ 96.205
5. Solar panels	€ 496.100	€ 300.000	47	8,3%	25 years	€ 2.723.694	€ 1.126.472
6. Solar water heaters	€ 16.500	€ 20.000	8	20,0%	20 years	€ 250.491	€ 175.350
7. Geothermal energy	€ 1.066.000	€ 520.000	10	15,3%	20 years	€ 11.801.940	€ 8.603.867
8. Geothermal energy	€ 861.000	€ 265.000	18	11,4%	20 years	€ 6.250.983	€ 3.824.732
9. Energy efficiency measures	€ 146.850	€ -	17	10,8%	40 years	€ 930.300	€ 632.929
10. Heat recovery	€ 49.500	€ 65.000	37	12,4%	20 years	€ 473.358	€ 235.443
11. LED lightning	€ 176.000	€ 528.000	7	22,8%	10 years	€ 2.356.534	€ 1.006.483
Sensitivity Analysis							
Total package nominally	€ 3.410.050	€ 1.702.000	28	7,6%		€ 11.039.800	€ 2.561.211
Total package with 2,5% energy	€ 3.410.050	€ 1.702.000	17	10,3%		€ 18.815.090	€ 8.413.570
Total package with 4% energy in	€ 3.410.050	€ 1.702.000	15	12,5%		€ 27.285.528	€ 16.884.008
Total package with 6% energy in	€ 3.410.050	€ 1.702.000	13	15,3%		€ 45.612.917	€ 35.211.397

Source: city of Venlo

The final business case showed a pay-back-period of approx. 15 years, but a positive cash flow already after year 1. This means that by investing in sustainable solutions, adhering to Circular Economy principles and purchasing C2C® certified products and materials, the City of Venlo could have more money 'in their wallet' after year 1 and have a profitable business case.

In the end, the Council unanimously agreed (the only unanimously decision that year) to the proposed business case. With this they decided to, instead of cutting the budget, invest in sustainable, high-quality products and materials and save money in the total cost of usage.

Above all, in an adopted motion the Council agreed that this approach should become the standard for new developments in the City of Venlo.



Residual Value

Traditionally, a building has no value at the end of the defined use time in the accounting reports; the building is completely *amortized*. Venlo strived to not completely amortize the building and considered the residual value of the building at the end of the use time. This means that materials will keep a financial value after the use time of the building.

One of the design focus points was to approach the building as a material bank. As a starting point, and as building owner and user, the City of Venlo wanted to use products and materials of which all ingredients have been assessed and are proven free of any hazardous chemicals. In order to establish and guarantee this, suppliers were involved at an early stage.

A second requirement was the recyclability, or even up-cyclability, of the products and materials, as well as the use of recycled or rapidly renewable materials, that could be safely returned and perpetually cycled.

These requirements were new to most of the suppliers and challenged them quite a bit. Especially, the calculation of the economic value of their products after the initial use time was new and required special attention.

Although the calculation of the residual value was one of the requests to the suppliers, it has consciously **not** been taken into account in the business case, **nor** in the decision-making process. The reasons for that were the uncertainties about agreements regarding residual value at that specific time and not to make the CEBM too complex for a positive decision-making process.

When drawing up the business case as it stands today though (based on supplier agreements, raw material indexation and material passports) it is apparent that the residual value is highly relevant and positively impacts the CEBM. Approaching the building as a valuable raw material bank with a residual value, meant that the debt capital could be decreased, resulting in yearly cost savings on interest of 80.000 euros. Since the residual value in all probability will be even higher, this is considered a conservative calculation.

Taking residual value into account was not part of Venlo's policy. Moreover, it was not *permitted* to do so as defined by local policy, national rules and regulations. This policy is still accurate, although it is currently being investigated if and in what way residual value **can** be part of new policy-making. As mentioned above, the positive effect of residual value on the business case has not been taken into account in the CEBM and can be seen as an extra surplus – an addition to the save- and earn matrix.

Part of the residual value will derive from the intelligent disassembly of the building itself. For this reason, it is designed accordingly and a green demolition plan with material passports has been developed.



FIGURE 10 TECHNOLOGICAL SOUTH FAÇADE INCLUDING ENERGY PRODUCTION



Source: city of Venlo, Ton Desar

Furnishing concept

The ambition to adhere to the C2C® methodology is also reflected in the furnishing concept of the building.

The furnishing was tendered separately from the construction of the building. In line with the building design, the quality of the furniture, including their next use and/or recyclability, were key in their procurement. Suppliers were challenged to assess and show the ingredients of their furniture and moreover, prove that they do not contain any hazardous chemicals.

The awarding criteria for this tender were a combination of an action plan, implementation of the C2C® criteria (minimum), Total Cost of Usage (TCU) and aesthetics of the furniture.

Candidates were asked to calculate the residual value of their products after a use time of 10 years. After those 10 years suppliers become the owner of their products again. As such, they are no longer selling *products* but a *service*.

The winning bid foresees a residual value of 18% after the 10-years use time. Other bids scored higher on residual value and TCU, but scored less on other criteria. The residual value of 18% resulted in a payback of approximately 250.000 euros. The residual value is deducted from the initial price, resulting in considerably lower costs.

Moreover, the supplier offered to take on the maintenance costs (approx. 50.000 euros) while directly benefitting from good maintenance.



FIGURE 11 INTERIOR CITY HALL

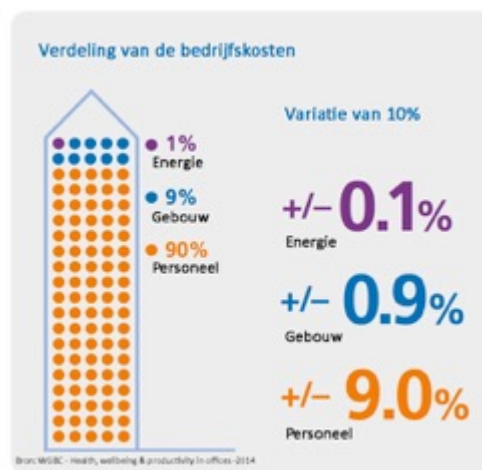


Source: city of Venlo, Ton Desar

Healthy building

Research shows that on average, only 10% of the total operational costs of an organization can be allocated to energy and real estate costs. The major part, the remaining 90%, is directly related to personnel costs, making it a priority to monitor and control these.

FIGURE 12 DIVISION OF OPERATING COSTS



Source: WGBC, 2014

Former city halls offered poor indoor climate, high above target values, and with 6,2% the number of absence-days due to sickness was substantially higher than the Dutch national average. Given this, Venlo saw the necessity to create a pleasant and healthy working environment by the newly built city hall.



Data show that now (January 2018), with the building in use for over 1.5 years, the indoor climate quality exceeds outside air quality. In comparison: on average, indoor climate in office buildings is 4-8 times worse than outside. In order to monitor the improvements, the indoor climate is continuously being measured, data and employee surveys are examined by the University of Maastricht.

Moreover, the number of absence days due to sickness has decreased with from 6,2% to 4,7% compared to the former location. Also, in comparison with 'shadow projects' of the city of Venlo with the same ("traditional") conditions and users, a substantial improvement has been registered. As part of an INTERREG IV-B project (EU funded), named "Financial Healthy Buildings", this data will be measured for the next four years and examined by universities.

As with the residual value, the 'soft' benefits of a healthy building have not been taken into consideration in the abovementioned business case, nor in the decision-making process. By proving the causality, the overall CEBM could be even more positive.

Credit new building city hall

The figure below shows the development of the credit for the new city hall (including parking garage) from 2005 onwards. The primary assignment was based on a credit of approximately € 60 million. With an amendment, the municipal council adjusted this to € 50 million in December 2006.

TABLE 5 DEVELOPMENT CREDIT IN ACCORDANCE WITH FORMAL DECISION-MAKING

November 2005	Initial Order Assignment	EUR 60'000'000	
December 2006	Amendment	EUR 50'000'000	
January 2010	Coalition Agreement	- EUR 2'000'000	
2011	Financial Framework 2011	- EUR 2'000'000	
August 2011	Save and Earning Matrix	EUR 3'410'000	
November 2011	Formalization credit parking garage	EUR 10'005'000	Credit after subtraction contribution EURO 5.2mln
	Formalization tender	- EUR 6'500'000	
	Interior city hall and Nedinsco	EUR 383'000	
	Reserves Underexhaustion	EUR 2'615'055	<i>Capital costs were delayed due to later finalization of the project. In accordance with a decision by the Council these resources were preserved towards the city hall and added to the Reserves</i>
	Disclosure Parking Garage	EUR 173'000	
	Total city hallexcl. Parking Garage	EUR 55'740'055	

source: City of Venlo



The above-described CEBM is realized without (substantial) subsidies or other 3rd party cash flows. Over a 5-year period Venlo receives merely €2.000 per year for their efforts towards sustainable energy. Approximately €100.000 is granted for the development of functional green facades, as also used in the Venlo City Hall project. Thus, generally can be said that hardly any subsidies are used to create a positive CEBM.

Despite cut-downs on the credit, the total project has been realized within the total budget. Moreover, by using circular economy and Cradle to Cradle® principles as the main strategy, almost 1 million euro of the total budget is left. Completely in line with Venlo's strategy and vision, it can be concluded that, by adhering to circular economy and Cradle to Cradle® principles innovation was boosted beyond conventional sustainability.

Overall results

- Positive business case of 16,8 million euros in 40 years and a positive cash flow after year 1
- The building is realized within budget / the budget has been partly returned to the Council
- The operational costs are significantly lower (e.g. from 600.000 to 140.000 euro/yr for energy costs)
- The indoor air quality is better than outside, while indoor air in average office buildings is 4-8 times worse than outside
- With a green roof and façade, the building purifies 30% of the fine dust and CO₂ in a radius of 500m around the building
- Numerous C2C Certified™ products are used
- The building generates its own energy
- A helophyte filter purifies the grey water, which is reused in the building again as toilet water or for watering the green roof
- Involvement of suppliers boosted various circular and C2C® innovations, such as the green façade
- Arrangements have been made about residual values and guaranteed take-back, e.g. in the furnishing concept;
- Both national and international reach and attention, with 20.000+ visitors in less than 1.5 year since opening
- The project directly encouraged new C2C® -, circular projects and policy. Not only Venlo is realizing new C2C inspired buildings; also private parties are now developing with the C2C® principles in mind (e.g. residential, hotel, school)
- The circular principles became part of the organisations strategy and facility management



3.2.3 SWOT analysis

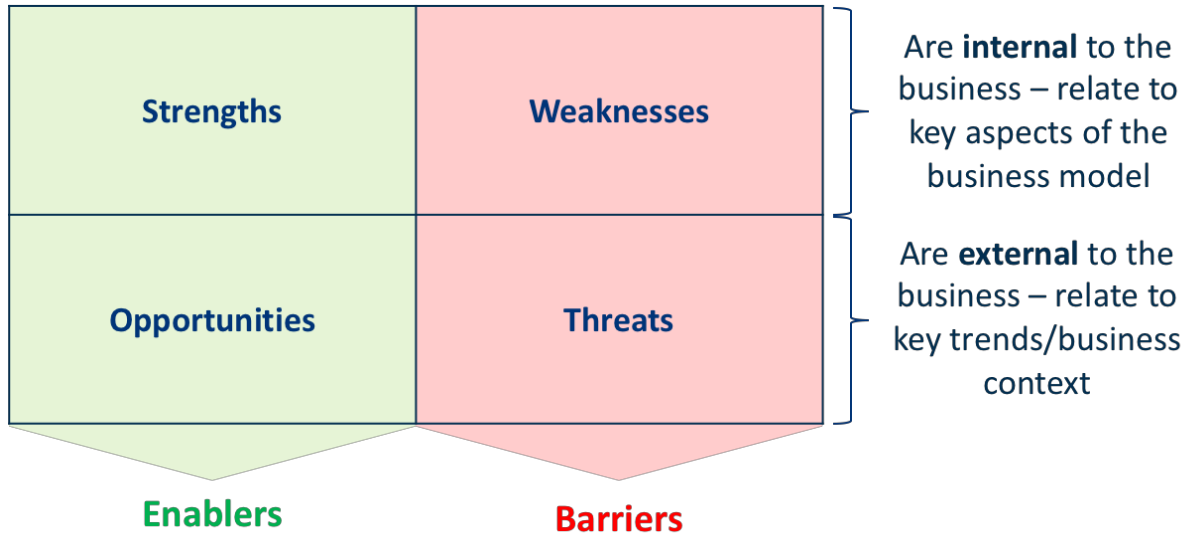
This section contains an analysis of the Strengths, Weaknesses, Opportunities and Threats (SWOT) associated with the circular business model. It is important to note that this is primarily an assessment of the attributes of the business model itself and only secondarily of the specific attributes of the individual company. As is customary in SWOT analyses, the Strengths and Weaknesses are INTERNAL to the case organization's business model. Whereas the Opportunities and Threats are EXTERNAL to the case organization's business model, coming from the context in which they operate.

FIGURE 13 SWOT ANALYSIS

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Showcase of financial benefits of a circular economy business model; • Early involvement of financial benefits, based on Total Cost; • Adding value for people and environment by doing good; • Decision-making process to invest in circular measures; • Involvement of soft benefits in the decision-making process (e.g. health, biodiversity, etc.) • C2C*/CE as guiding principles during the whole process; • Circularity as criteria in Green Public Procurement; • Involvement of financial and concern controllers as important enablers 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Dependence on individuals to give substance to the ambition; • Lack of knowledge on the potential of CE; • Setting the scene as frontrunner required leadership and courage; • City Hall Venlo is one of the few circular buildings in EU, with lack of earlier experiences; • Decision-making process is mainly influenced through financial evidence and calculations;
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Existence of an innovative environment where businesses are prepared to offer CE/C2C solutions; • Businesses that are prepared to offer CE building solutions, based on a circular economy business model (e.g. calculate residual value); • Business that offer CE building solutions that contribute to a healthy built environment (productivity of people, decrease sick-days and improve wellbeing); • Existence of a regulatory / policy context favourable to adapting CE in the building sector; • Processes that foresee early involvement of businesses to encourage innovative solutions. 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Political situation; • Policy (local, national, European) neither supported nor made CE development impossible; • EU and national regulations and legal factors didn't affect the CEBM negatively, nor did they encourage the CEBM; • The lack of subsidies or 3rd party financial flows to boost investments into measures towards circularity / Cradle to Cradle* and CEBM's; • The Tax Authority's requirements for depreciation of building costs made residual value on the building difficult; • The absence of a platform to encourage innovation amongst suppliers; • Economic environment (project was realized within an economical crisis);



FIGURE 14 SWOT ANALYSIS FEEDS INTO ASSESSMENT OF ENABLERS AND BARRIERS



3.2.4 Final assessments

The aim of this sub-section is to summarise the main conclusions of the assessment as input for follow-up discussions regarding opportunities and understanding enablers and barriers.

Top internal enablers, barriers and breakthroughs for the stakeholder:

- Venlo is the first region in the world that embraced the Cradle to Cradle® and circular principles and can thus be seen as frontrunner. As such, Venlo set a trend for macroeconomic developments on regional (and national/international) level;
- From the start, the Financial- and Concern controllers were involved in the city hall project city, which turned out to be important enablers for the CEBM;
- Green Public Procurement as an important enabler for CE;
- Personal drive and mindset of internal organization (e.g. project manager) and project team;
- Additional to the environmentally-friendliness and awareness, the decision-making process is mainly influenced through financial evidence and calculations;
- The absence of a platform to encourage innovation amongst suppliers;
- Resource prices didn't influence the decision-making process yet.

Top internal enablers, barriers and breakthroughs to engage with customers, partners and suppliers:

- The project was challenging, due to the scale, the high (C2C) ambitions and its general environment. Additionally, none of the stakeholders was familiar with the circular/Cradle to Cradle® principles, which in the beginning was a barrier;
- Now that the city hall and other C2C-inspired projects have been successfully realized, more organizations and projects are taking on circular principles as the main driver of their projects;
- No possibilities for R&D funding and investments.



Top internal enablers, barriers and recommendations at EU level:

- EU and national regulations and legal factors didn't affect the CEBM negatively, nor did they encourage the CEBM;
- The absence of a push c.q. incentive from the EU or national policy to focus on circular economy/Cradle to Cradle® and CEBM's;
- The lack of subsidies or 3rd party financial flows to boost investments into measures towards circularity / Cradle to Cradle® and CEBM's;
- The Tax Authority's requirements for depreciation of building costs made residual value on the building difficult;
- Green Public Procurement as an important enabler for CE.
- No eco-taxes to fall back on. Consequently, having to deal with a fixed percentage, i.e. the tax system affected the CEBM negatively;

Top policy enablers, barriers and recommendations at local level:

- Local policy withheld the possibility to take residual value into consideration for the CEBM:
- National and local regulations and legal factors didn't affect the CEBM negatively, nor did they encourage the CEBM;
- As a local governmental body, this project was realized within a political environment. At the start, neither the organization nor the politics were ready for a CEBM and/or financial calculations based on a combination of initial- and exploitation costs. Since 2010 onwards, the political and organizational mindset has evolved, step by step, from a short term linear approach into a long term circular approach;
- Green Public Procurement as an important enabler for CE.
- The success of the CEBM of the city hall Venlo resulted in the own local policy to be supportive of CEBM's and allowing calculations with residual value. Besides that: other cities, governments and organizations can learn from Venlo's experiences.

Top contextual factors that have an impact on the circularity level of the stakeholder:

- The political context (the project was realized within a political context);
- Economic situation at that time had a major role in the decision-making process and eventually influenced it positively. The CEBM showed that, also in times of economic uncertainties, investing in circularity results in savings- and earnings during the use time of the project with a positive cashflow after year 1;
- Mindset and personal drive of the people, such as the project manager, architect, Cradle to Cradle® consultant, etc.



General recommendations to foster CEBM

The city hall Venlo project can be seen as a best-practice project in the built environment, designed and built according to the Cradle to Cradle® and circular principles. The project shows that a circular approach creates both a positive impact for people and environment, including a positive business model.

Starting such a project requires both ambition and leadership, as capability and trust to make the transition happen. The city hall project is realized within the budget, with a higher quality level than expected.

Both process and applications of circular measures are replicated and transferred in other projects, other sectors and other geographies.



4 Discussion & Conclusions

For several decades scientific warnings have been issued about the deterioration of the environment. Studies show that - with a certainty of 90% - the emission of greenhouse gases as a result of human actions have a negative impact on the environment. In response, many initiatives worldwide have emerged to achieve sustainable development.

As far as the built environment is concerned, the initiatives focus mainly on finding alternative solutions for the methods of energy generation and energy consumption, the selection and use of raw materials and the development and implementation of alternative principles in the design of buildings.

This section contains a discussion and conclusion which derive from the conducted case study.

Enablers and barriers

In the construction industry, applying circular principles is still difficult. An important reason for this is the lack of governmental policy to encourage application in continuous cycles. There is also still a lack of ecological and / or economic awareness. These are important conditions for the successful implementation of recycling principles in construction. A third concern is the lack of design knowledge, design experience and possibly also the will to design a building that meets the requirements of a circular economy.

In order to achieve the desired adaptation in construction, a change in the *mindset* is most important.

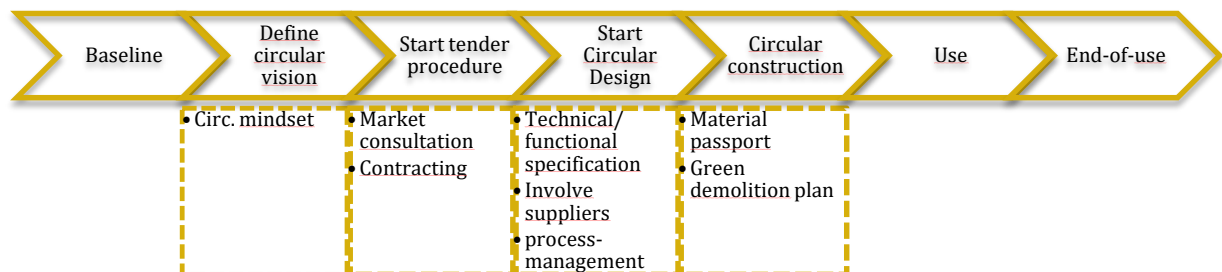
The business model of city hall Venlo proves that investing in circular measures pays off. Not only in the sense of economics, but also in benefits for people and environment. However, there is still suspicion and the circular principles are not yet widely implemented. This can partly be attributed to the fact that the construction industry is a conservative sector. Other reasons are: the lack of knowledge, the need for courage and the will to.

Replicability and transferability

In less than 1,5 years, after opening in October 2016, the city hall Venlo has seen over 25.000+ visitors with a special interest in the Cradle to Cradle® approach. As a result of these visits, many organizations have been inspired to apply the circular principles within their own context.

The process of these circular projects can be visualized as follow:

FIGURE 15 APPROACH TOWARDS CEBM'S IN CONSTRUCTION SECTOR



source: C2C ExpoLAB

The approach, experiences and lessons-learned from the city hall Venlo project, as one of the first Cradle to Cradle® inspired buildings, are replicable and transferable to other real estate projects. Although, and this goes especially for the financial business model, each project requires context-specific inputs and should be customized to the setting.



Total Cost of Usage

Usually, at the start of a real estate project, the focus lies on the investment and the feasibility is often based on the initial costs. However, the use costs (such as energy or maintenance costs), nor the costs or benefits of healthy buildings (such as productivity or prevention of sick-days), are hardly considered. This short-term vision limits the full potential of a project.

The construction industry is not yet sufficiently challenged, or forced, to work according to circular principles. Regulations and legal factors do not affect a CEBM negatively, neither do they encourage a CEBM. Also, many subsidies are still focussed on the reduction of energy or carbon dioxide rather than encouraging the transition towards circular economy and appropriate business models.

The business model of city hall Venlo shows a net-saving of € 16.8 mln, with a positive cashflow after year one, combined with positive impacts on e.g. healthy indoor climate, the outdoor air quality, the generation of renewable energy, biodiversity and the cleaning of water cycles.

Should a circular approach become mandatory for the construction industry, a now polluting industry could be transformed into an industry with positive impact.



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