

# **Circular and bio-based ambitions in construction projects; an integrated approach to the tendering process**

**Experiences of front-runners and living labs for the design of the procurement and tendering process to realise circular bio-based ambitions.**



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# 1.

## Introduction

The construction industry is a major consumer of materials and raw materials and is responsible for approximately 33% of total CO2 emissions. Currently, the components and materials used in buildings are often not adaptable during their life cycle and no high-value end-of-life reuse options are considered. This is because most building projects are still designed and built in a linear way, without considering future needs or the use of buildings. In addition, little use is yet made of construction products based on renewable bio-based raw materials. The choice of materials and products, origin and method of production determine the emissions, impact and footprint of a construction project on the environment. The purchasing power of public commissioning authorities can be accelerated if circular bio-based procurement becomes the standard. This can act as a catalyst for market parties to adopt and implement circular construction. If the market develops in this direction, it will also become easier for private clients to renovate and build in a circular bio-based way.

The transition to a circular economy means a different approach to the ambitions and realisation of construction projects. The procurement and tendering process plays a key role in this transition. This means that a different approach is needed to successfully realise a building or renovation. It means looking further ahead at possible future developments and adaptations for buildings. It is also necessary to examine what the market is already capable of. This white paper sets out the experiences and lessons learned in practice relating to circular bio-based procurement. You can explore how changes in the procurement process lead to innovative outcomes. The main lesson: the power of the questioner - that's you - is essential in the transition to a circular construction sector and in increasing the choice of bio-based raw materials and construction applications.

*“Getting the right answer starts with asking a good question.”*

Woud Jansen

This white paper has been written for professionals who are directly involved in the procurement or tendering of new-build projects and/or renovations, focusing on the demand side, such as buyers and policy makers, but also principals, tenderers, property project managers and facility managers. It is generally applicable to any project of any size, irrespective of whether the requesting party is a public or private party, or whether it involves housing, utility construction or infrastructure works. Architects, contractors, legal specialists and bankers can also benefit from taking note of all findings. They play an important role in circular bio-based construction and renovation.

From the interviews we conducted with front-runners in the field of circular bio-based construction, it became clear that they had not experienced any obstructive legislation or regulations in their procurement and tendering processes. This does not mean it is easy. For example, the application of transparent and measurable requirements and award criteria for circular bio-based materials is something that is in the process of being developed. This requires thorough preparation and explanation, both internally and to the market.

The development of technical solutions for circular buildings should not be an obstacle in the transition to a circular economy. Many inspiring initiatives and parties are already active in the market and more innovative solutions are coming to the market. Uncertainties of parties during the process seem to be the main obstacle for circular and bio-based construction. Uncertainty about pre-defined circular ambitions and approach of the project in addition to unfamiliarity with the market; finding suitable bidders and materials, and potential new forms of collaboration. Uncertainty about meeting quality standards and requirements and about the risks and scope for interpretation in the contract. Reading this white paper will increase your understanding of how to enter the circular bio-based tender process with more certainty.

### Creating this document

Ten organisations in the Netherlands, Belgium and the United Kingdom combined their knowledge, experience and research facilities to develop a new, working approach to circular bio-based construction within the Interreg CBCI project. Two of the ten partners, care institution Emergis (NL) and the Katholieke

Universiteit (KU) Leuven (BE) are also commissioning two construction projects within the project. In these two ‘Living Labs’, a procurement and tendering process was carried out. Experiences from the projects are collected and described in this white paper. This is the foundation of the CBCI project: we learn by doing and we share what we have learned.

Desk research was done on procurement/tender legislation and regulations in Europe and in the 2 Seas area, where CBCI’s partners are located. Twenty interviews with front-runners (see list in acknowledgements) in the field of circular bio-based construction were held, who were selected as case studies, with twenty-five people involved in various roles. In addition, workshops were conducted with a total of thirty experts and stakeholders with experience in procurement and tender processes and/or who have an advisory, supportive role in these processes. Findings were specified and compared. The workshops also provided insight into questions and uncertainties that experts and stakeholders are wrestling with.

Based on the insights gained, a procurement framework was developed that provides insight into the most important considerations leading to the successful integration and realisation of circular and bio-based applications in your building project.

### Reading guide

The white paper is structured around the main findings we learned from the desk research and the circular bio-based building projects in practice. In order to indicate where the recommendations and tips affect the construction process, a procurement framework was prepared. This is set out in Chapter 2. The explanation of the Living Labs and case studies is presented in chapter 3. The lessons learned from the Living Labs can be read chapter by chapter alongside the general text but can also be read as one continuous story. The recommendations and tips are set out in further detail in the following chapters.

## 2. Procurement framework

A framework has been developed to map out all the considerations and phases that are important when tendering for a circular and bio-based building project. This framework provides a practical overview of the steps to be taken and the most important considerations, milestones and decision moments. These components together form the prelude to a successful tender, integrating circular and bio-based applications into a construction project.

The following phases are generally applied in procurement literature and professional practice: preparation of the procurement process - specification - selection - contracting - evaluation.

Tendering circular bio-based building projects should be seen in a much broader context than traditional tender procurement. After all, the market and the products are in full development and future (re)use and adaptability of the building should be taken into account.

The figure below shows the procurement framework with different aspects and phases. It is a cyclical process and, compared to traditional procurement, cannot be viewed in a static or chronological way. The various subjects are part of the customary interconnected phases of a construction process, but can also be fed back, creating a dynamic process. The arrows indicate that within each phase, both reflection on the defined ambitions and forward thinking is required to prevent risks and take advantage of opportunities in the subsequent phase(s).



## Circular and bio-based ambitions

The four larger circles in the centre correspond to the (classic) building phases. It starts with the initiative and normally continues until the end of the use phase or end of life of a construction project. The model covers the entire life cycle of a building, based on the principle that there is no end of life. In the circular economy, we aim for maximum preservation and reuse as high-quality as possible. The left and right hand sides of the model show the issues that could be considered during the process in order to ultimately achieve the ambitions in practice. An important starting point is to pay thorough attention to the circular and bio-based ambitions for the building project. In chapter 4, we look more closely at the importance and continuation of the ambitions established at the outset.



### Initiative and feasibility

In the initiation and feasibility phase, the ambitions and feasibility of a building project are determined. A scan of the **internal organisation** is important at this point in order to be aware of its influence on the successful realisation of circular and bio-based ambitions in a building project. Consider not only the knowledge, skills and competencies available in this area, but also the mission and vision of the organisation in terms of sustainability, support and change orientation. The innovative capacity and the organisational structure should also be taken into account. More on this is set out in Chapter 4.

By conducting a **market orientation** as early as possible, you gain insight into which providers of circular solutions are on the market. It also provides an impression of the opportunities and constraints for defining the circular and bio-based ambitions of the project. In addition to the market orientation, we use a **market consultation** during the initiation phase. This is an exchange of information about a proposed tender

Many stakeholders are involved in a construction project, each with their own insights and interests. Internally in an organisation, this would include the director, property manager, project manager, user(s), policy maker, legal specialist, buyer, facility services, IT/domotics, finance, shareholders, etc. Externally, this would include the financial institution, contractors, architect, local authorities, client, etc. By involving stakeholders at an early stage and going through the procurement framework together, you increase the chances of a successful tender for a construction project that would allow for realising circular and bio-based ambitions. Below, we briefly explain the considerations in the procurement framework, grouped by construction phase, and, in the subsequent chapters, we discuss a number of common issues, points of attention and lessons learned based on practical examples.

with interested parties, organised by a client. The market consultation can be completed during this phase, but it can also be repeated at a later stage in order to deepen the process and move to the next refinement step. Further tips and tricks are set out in further detail in chapter 4.

The cooperation between the contractor and the client determines the extent to which bio-based and circular ambitions can ultimately be achieved and how the final tender and subsequently the contract are specified. It is about how risks and responsibilities are borne and distributed. Examples of suitable forms of cooperation are a construction team, design & build, alliance and the two-phase contract. When determining the **form of cooperation**, it helps to have an impression of the possibilities and limitations of the various forms of cooperation. You can read more about this in chapter 6.

All considerations in this initiation and feasibility phase that are decisive for the defined ambitions affect all further phases of the construction project.

## “Start with the end in mind”

Stephen Covey



### Definition

In order to achieve circularity, a possible **new use for** a building or renovation project should be considered at the outset. How long do you want to use the building? What happens to the building when functionality, needs or ownership change? Take into account other usage scenarios, functional changes; build in sufficient flexibility within the project. Also consider what will happen to the building, units or materials and products when the current phase of use ends, and aim for maximum future reuse.

Consideration should also be given to flexibility to make adjustments during the use phase. Think ahead about the required **management, adaptations, maintenance and overhaul** of the building, specifically in relation to applied bio-based and circular materials and their detachability. If yes, how will this be contracted in the tender?

For both new buildings and renovations, it is interesting to find opportunities for using materials from the reuse circuit. This can be done in situ, during renovations, or purchased from specialist companies or local material banks. Planning for

expected release of materials from ‘donor’ buildings, preferably in the vicinity (because of transport costs), are certainly interesting for renovation projects.

The above points are part of the **tender strategy**. The strategy determines the tender procedure to be applied, the market parties to be approached, the contract form to be chosen and the way in which the selection criteria, suitability requirements and award criteria will be specified in the call for tenders. Starting with the end in mind ensures that your tendering strategy takes into account the opportunities that market players see for circular construction.

For example, by putting **functional specifications** first in the performance-based tendering strategy instead of solution-oriented specifications, the market is challenged to think in this context. This means that it is better to specify the goal (the performance), for example ‘movable partitions of renewable material’ than a specific solution such as ‘screwed inner walls of reusable plasterboard’. The market is given the freedom to come up with its own innovative circular and bio-based solutions, which meet the desired adaptability and flexibility of the building. The market has the specific knowledge available.



### Tendering process

Once the functional specification has been prepared, the specific **selection criteria** can be defined to find the right cooperation partner(s). In the selection criteria, tenderers can demonstrate the required competencies through circular and/or bio-based practical experiences. In addition, the **award criteria** must include how the degree of circularity and bio-based applications and solutions will be assessed in the project.

Subsequently, the tendering process starts by means of the chosen **procedure**. During this phase, continued consultation is important to keep returning to the circular and bio-based ambitions that were established at the start. More on this in chapter 5. After selecting the right cooperation partner, the previously chosen form of cooperation is converted into a **contract**.



### Realisation

After contracting, new phases will follow, focusing on cooperation and contract management. Central message: prior to the tender, think about how you want to **cooperate and innovate** in all phases of the procurement framework. What agreements must be made about this? How can this be secured and **monitored**? This applies respectively to the design, realisation (construction), maintenance and possibly even the end (initial / first) use phase! You can read more about this in chapter 5.



# 3.

## Living Labs and case studies

The experiences from the two new construction projects within the CBCI form the basis for testing and fine-tuning the framework from a practical perspective. The Living Lab of KU Leuven University is a new building project for its research group Building Physics and Sustainable Building at the Technology Campus in Ghent (BE). The Living Lab of Emergis concerns the expansion of a mental health clinic in Kloetinge (NL). KU Leuven is a public contracting authority and is therefore by law required to invite tenders. This does not apply to Emergis as a private organisation. As a result, the Living Labs go through different procurement and tendering processes and strategies. These are examined later in this chapter.

In addition, the framework has been shaped in part by the wide range of experiences of the various case studies that have been examined. The case studies were selected based on their unique characteristics. Think of a combination of circularity and the application of bio-based materials in the buildings, but also of innovative business models and social added value. By talking to the parties involved about the details of their tender processes, determining the challenges, obstacles and solutions, they have served as a reference and reflection for the Living Labs and their process.

### Living Lab KU Leuven

The Living Lab KU Leuven is a building project in the city of Ghent (Belgium). There are a number of challenges that we want to address with this project. Firstly, by 2050, all houses in Flanders should achieve an EPC-A (energy performance requirement). This requires a huge **renovation effort**. However, the quality of the building stock in Flanders varies, which means that different strategies are needed. Some houses are in such poor condition that it is not sensible from an ecological perspective to renovate them; **new construction** is then the better option. The Living Lab of KU Leuven wants to respond to that scenario, applied to detached houses. Secondly, we must be careful that in resolving this first problem, we do not create a new problem for the future. In other words, the newly built or renovated house must be **circular and bio-based**. In the future, at the end of its useful life, our solution will not be an unusable pile of waste, but a **bank of materials** that will serve as a donor for new buildings. Any materials that are no longer usable can be easily recycled. Finally, with a **modular and flexible building system** produced on an **industrial scale**, we are responding to the ever-changing and also increasing demand for housing in the Flemish urban environment. The prototype is **adaptable**, the home can be expanded or split to accommodate larger or more families. The fact that the concept complies with the regulations for social housing makes the possibilities in terms of implementation in urban renewal projects and the target audience all the more extensive. The Living Lab of KU Leuven hopes that this setup will transcend the circular and bio-based ambitions by using them as a medium to address the larger challenges we face as a society.

To do this, it is setting up a Living Lab in the form of a residential house that will temporarily be available at its Technology Campus. The goal of this CBCI Living Lab is- among others- to realise a prototype for affordable housing in urban renewal projects based on circular, bio-based and industrial building principles. Flexibility and ease of disassembling (from a structural perspective) are key characteristics of the building. After seven years on the Technology Campus, the house will be demounted and given a second life at another location, in an urban renewal project to be determined at a later stage.

Innovating together and sharing knowledge are key principles in the tendering process. The Living Lab was put on the market in two tenders, after the submission of a building application file: 1) Structure & Shell as a Design & Build based on the preliminary design at scale 1:100 and output specifications. And 2) All installations as a plug-in lease. With this second tender, KU Leuven wants to experiment with other financing and business models that fit the circular ambitions of the project. KU Leuven pays a fixed amount per month for the use and maintenance of the installations and does not become the owner.

#### Influence of the tender process on the 'end' result

The division into product and service tenders ultimately produced a successful result. The CBCI team attributes its success in part to finding the right partner(s), as parties share the same ambition: the business ambition of general contractor Vanhout (and its cooperation partners beSteel BVBA and Comtis Energy) for both the building and the service concept. Both parties want to experiment and innovate with the ultimate goal of upscaling circular bio-based construction. This was achieved by selecting and awarding contracts on the basis of the competencies of the parties, rather than on the basis of hard requirements, ready-made solutions and price. For examples used and more background information, see Appendix 1.

**KU LEUVEN**

## Living Lab Emergis

Our Emergis Living Lab concerns an extension of an ambulatory centre for adults of the GGZ-clinic of the mental healthcare organisation Emergis in Kloetinge, Zeeland (NL). The project is divided into two parts, consisting of the renovation and new construction of the existing part, and the new construction of bio-based, circular and demountable units.

The goal of this Living Lab is circular renovation with bio-based materials, accommodating clients of the clinic in an environment as natural as possible. There will be a new dedicated entrance; the facade and the roof will be renovated; and the portacabins- which have been there for more than twenty years- will be replaced by new buildings. This gives the Ambulatory Centre a clear place on the Emergis site, and the choice of bio-based contributes to creating a 'Healing Environment'. Based on the current trends in mental healthcare, the centre requires a more permanent and also flexible solution. Moreover, the building and the units are outdated, not energy efficient or sustainable enough, noisy, and the centre does not have its own entrance.

The starting point for the new building is to create linkable units that can be used for different functions. Moreover, the units are easy to move, replace and industrially produced. The use of bio-based materials will be encouraged wherever possible. On

an organisational level, it is important for Emergis as a care institution to be able to use both the existing and new real estate as flexibly as possible- both in terms of functionality and availability- in order to be able to respond to developments in provision of care. At the same time, this means a quality improvement compared to the current real estate. Central for Emergis is to organise optimal care for its clients in a safe environment. The daily dynamics and complexity of healthcare require a lot of flexibility and are therefore at odds with the long-term organisation for circular and bio-based real estate. Emergis is in the middle of the process of developing a (scalable) circular bio-based real estate strategy.

In organising the tender, the property development phase played an important role in determining the topics in §2.1 and §2.2 in the Procurement Framework. Emergis does not have to comply with the obligations imposed pursuant to the Dutch Public Procurement Act 2012, Emergis can define their own interpretation of the tender process. This results in a greater degree of freedom, enabling flexibility for the aspects referred to in the Framework.



## Facts and figures

To give an idea of the Living Labs, some data have been listed in the table below.

Subject	KU Leuven	Emergis
Site	Ghent (Belgium)	Kloetinge (The Netherlands)
Budget	- Structure&Skin € 185.000 - Plug-in modules - Initial: Design and installation € 3,450 - Leasing € 422.25/month - Maintenance € 250/y - Demounting € 750	Approx. € 1.500.000
Construction time	4 weeks	6 months (incl. preparation and delivery)
Number of square m / cubic m	75 m <sup>2</sup> / 205 m <sup>3</sup>	1,252 m <sup>2</sup> / 4,495 m <sup>3</sup> (This includes the existing wing; alterations concentrate on the new part)
Number of users	2-3 pers. (family)- 5 pers. (on campus)	40 people
Construction layers	3 storeys	1 building layer
Designers Architect	KU Leuven; Alexis Versele & Lode Lefevre, Paul Lodewijckx	Architecten Alliantie, Bouwbedrijf Meliskerke
Main contractor	Vanhout- BeSteel- Comtis- Litobox- Renson- Open Motics	Bouwbedrijf Meliskerke

# 4. Organisation and ambitions

An important phase in the tender process is when the project ambitions are defined and determined. This gives direction to the raw materials that will be used in the construction project and also which form of cooperation will be necessary between the client and the contractor. In a traditional tender, the purchaser is usually involved at the point when the request for tender is as good as ready. This often leaves little room for the purchaser to give advice or contribute to defining the circular and bio-based ambitions of a project. And it is precisely these ambitions that are so important to translate into tender documents and contracts. The role of buyers is therefore crucial. In this chapter, we will help you on your way to realising circular bio-based ambitions with the right attention and focus.



## Room for innovation

What are the circular and bio-based ambitions of your organisation, and is there sufficient support for these ambitions? Circular and bio-based ambitions cannot be realised if they are or remain the initiative of just one inspired person. Administrator(s), project manager(s), building manager(s) and (future) user(s) of the new building or renovation must be on the same wavelength and share the conviction. It is important that the usefulness and necessity bio-based circularity are clearly translated into the procurement process within your organisation. Legal, financial, procurement and technical advice should also be agreed early on, so that opportunities to realise circular and bio-based building are duly considered. It takes energy to generate the positive energy and drive needed and to keep up the momentum during all phases of the construction process.

Circular and bio-based construction is still in the exploration phase. This is why it is a good idea to do a scan (page 28) to assess the degree and speed of acceptance of innovation embedded in the corporate culture, sustainability ambitions/ goals and strategy of the organisation. If this ambition is low and the culture is largely focused on risk avoidance or traditional approaches, this is a major obstacle to realising circular and bio-based ambitions.

The alternative is to experiment by means of a pilot project to test the various aspects of bio-based circular construction. This is especially applicable for professional clients, organisations in relation-related real estate (eg. Emergis Living Lab), real estate development, concept developers, industrial consortiums (e.g. Consortium Van Hout Group- Living Lab KU Leuven). The aim of the pilot is to test the scalability of bio-based circular construction and the resulting impact on the ambitions, basic requirements for the real estate or market strategy, the associated process and the relevant quality assurance. This step from 'project thinking' to 'process and programme mind-set' ultimately provides insight into the conditions under which bio-based circularity is possible on a large industrial scale. To gain this insight, the form of cooperation and the type of parties involved play a major role.

Practical experience shows that it is important for all disciplines to be represented and feel involved in the project at the earliest possible stage. The knowledge and possibilities relating to circular building need to be supported by the entire team and that requires a certain level of equal knowledge regarding the possibilities. Make sure that everyone, possibly with some extra training and explanation, can join in the discussion. In addition, there needs to be political/management support from the responsible managers/owners/directors. This ensures that they also propagate the circular and bio-based ambitions on behalf of the organisation and are committed to their realisation.

The financial aspect and the impact of possible choices play a key role in determining the circular and bio-based ambitions. When translating this into a concrete project, it is important to understand how the financing can be secured and what the scope of the project is. What you buy, a product or service and the associated business case, plays a role. For example, a product can be purchased as pay-per-use, rental, lease or with a buy-back scheme. The tendering strategy and business case must be adjusted accordingly and costs and benefits must be calculated with a long time horizon. From a financial point of view, the costs are often allocated to different budget items, and everyone is responsible for their own budget(s). By contrast, circular bio-based construction often crosses several items and also has to be considered and spread over a long period. Budgets for circular and bio-based building should not be allocated to a single department, but should be cross-departmental and project-based. This makes it easier to reserve financial space in the future, for example for operating and maintenance costs.

It may be possible to obtain grants or funding at special rates for circular and bio-based construction or renovation. However, take the conditions attached into due consideration and evaluate the impact this may have on the budget. It may also be necessary to convince a lender that applying circular and bio-based concepts in the construction or renovation project does not necessarily lead to unnecessary risks and may have long-term benefits, including financial ones. Thinking in terms of budgets can be limiting, especially with the current low interest rates. If you look at the financing from a short-term perspective, you might overlook the fact that a larger investment will be more profitable in the long run, due to advantages in energy consumption and maintenance costs, for example. We have also seen that a higher investment in a healthy indoor climate, for example through the use of bio-based materials, can benefit the well-being of the users.

Something that can help generate positive energy within your organisation is to indicate which (social and environmental) interests play a role in the realisation of the project. Achieving a positive social and sustainable (CSR) result also has a positive influence on the image of the organisation and creates a sympathetic image. Sustainability is not only enforced with agreements and rules; it is a positive trend in society. Society is increasingly aware of the impact of business activity on the environment and of the necessary ambitious targets set by Europe and national governments to meet the climate objectives. Sustainability and/or social involvement is therefore more often than not one of the core values of an organisation. This makes it easier to get support and focus for circular and bio-based building and increases the willingness to take that extra step to make changes.

### LIVING LAB EMERGIS

The organisation of the project is as follows. Within Emergis, a consultation structure has been set up with a steering committee and an associated project group (for implementation based on ambitions, starting points and tender documents). The project group consists of: Jeras Projectmanagement, the contractor to be selected and any other external parties deemed necessary. The project group provides regular feedback on planning and finance to the steering committee. The steering group also oversees the inclusion and embedding of ambitions for circular and bio-based construction. Emergis also ensures sufficient internal support by involving users and the maintenance department.

#### LESSONS LEARNED Emergis

Such an innovative process- industrial application of bio-based circularity- requires a lot of ambition, management power and commitment within the internal organisation. This is at odds with the core business and the dynamics and complexity of healthcare provision. Staff turnover in management positions, staffing levels of the project team and available time of real estate and facility management have an extra impact on the implementation of the project. The Living Lab helps to provide insight in how to deal with the tension between core business (care), dynamics and complexity versus ambitions in the field of bio-based circular building, and to process this into a long-term circular real estate strategy, where Emergis focuses on sustainability, circularity and bio-based materials.

### LIVING LAB KU LEUVEN

#### LESSONS LEARNED KU Leuven

The most important lesson is to develop support of the internal organisation for new forms of cooperation and the associated (innovative) contracts/tender documents.

In line with the above (internal stakeholders at the table at an early stage), we advise to make more time for involving the internal organisation when deviating from the usual method. At the KU Leuven, works are normally awarded to the lowest bid on the basis of technical specifications. The internal organisation needs to be ready for a different mindset and dare to deviate from the traditional way of tendering. Willingness to change and coordination are therefore important. Within this project, we experienced a dichotomy: the research group Building Physics and Sustainable Building of KU Leuven as knowledge partner on the one hand, with an interest to innovate and test, and the procurement office as the client on the other hand, with an interest to have the optimal legal tender with the lowest possible risks.

#### The economic viability of circular bio-based construction: The perspective of a UK retail client

It must be demonstrated that a project is truly sustainable. For a client, a building system or a particular building material can only be considered truly sustainable if it is economically sustainable in addition to its environmental and social benefits. There is a need for "project champions" in an ambitious, bio-based circular building project. A champion in the boardroom is required- at least one person in a senior position who can see a project through and communicate the long-term economic, environmental and social sustainability benefits. In addition, there must be champions within an organisation's staff to encourage a culture of sustainability within the business in terms of targets and day-to-day operations by staff and building users. For example, in relation to recycling and energy conservation (for example, turning off lights or reducing mechanical heating, cooling and ventilation).

## Space and time for a single leading ambition

Determining ambitions in a project starts with the question of what the new needs are that we must and want to satisfy, and how this is to be achieved in the implementation. It helps to have a clear picture of the goals and to communicate them clearly to the parties involved, including the future residents or users of the project. At the start of the project, it is important to consult with market players who can potentially become contractors and have expertise, to determine realistic ambitions and applications. You can also think of starting an innovative project together. We also recommend contacting organisations that have carried out similar assignments in order to challenge and sharpen your own ambitions and goals for the project.

### LIVING LAB EMERGIS

To complete the development of the Ambulatory Centre by the end of 2021, Emergis already started with the necessary preparations in 2019. The first step was to define the initial requirements and contours of the plan. This was based on collecting the various preferences and starting points within the project group and (future) users of the building. This became the basis for the first schedule of requirements.

The various practical examples show that focusing on a single leading circular ambition is experienced as very positive and workable. Think for example of a focus such as no waste, Cradle 2 Cradle or the use of as many bio-based materials as possible. It is important when setting the leading ambition that it is supported with full energy by everyone from the start, so that you stay focused on your goals until the end. It also helps you to focus your market orientation or to seek (external) expertise. As a client, you do not need to have all the knowledge internally. You can also hire external advisors, especially if you do not have frequent building/renovation projects. Continue to frequently review the original ambitions during the process to ensure that they remain clear for the entire team and can be used to clarify or adjust certain things.

Besides ambitions in the field of materialisation, circular and bio-based building can also offer benefits in a broader perspective. Bio-based materials can contribute to a healthier environment within the building due to their appearance and natural basis. Together with the applied and integrated technical installations, this can create a more pleasant living or working climate. This can lead to reducing sick leave rates and increasing productivity. In addition, flexible and demountable and remountable construction can enable you to change the use or location of a building more easily. This may help prevent new construction, major renovation or even demolition. Moreover, remountable and demountable construction helps preserve the value of materials at the end of their useful life. In consultation with stakeholders and experts, create various (usage) scenarios in relation to the role of the organisation, the relationship with the circular and bio-based ambitions and the considerations. Based on the different scenarios, determine what sort of flexibility is required and desired. This would include the relationships with the 'layers of Brand' (carrier, built-in, ....).

Several ambitions are summarised in the box below and are explained in more detail in appendix 4.

#### VILOGIA (FRANCE) Fewer materials and stimulating re-use

Vilogia is a French private social housing company. In tenders for major renovation projects and tries to encourage bidders to reduce material consumption and to use materials responsibly. Materials derived from demolition of buildings can be returned to the value chain.

#### WIEGELIED (BELGIUM) Ecological indoor climate

Childcare centre completed in 2019 using sustainable, renewable materials and visible techniques in a natural setting. Lime hemp and straw have been used to ensure a healthy indoor climate through their breathable, moisture-regulating and highly insulating properties.

#### TRIODOS (NETHERLANDS) Demountable and wooden building

A fully sustainable office was built in 2019. The innovative design is based on principles from the circular economy and biomimicry (nature as a model for inspiration and innovation). The building is remountable and modular and made of sustainable and reused materials.

#### ADNAMS BREWERY (UK) Bio-based construction

The distribution centre of a brewery, completed in 2006, consists of building blocks of lime hemp. These are made from locally produced hemp and offer a cooling benefit to the distribution centre. Also the largest green roof in the UK at the time of construction.

### LIVING LAB EMERGIS

#### SELECTION PROCESS ARCHITECT

Emergis usually uses the services of two architects (Rothuizen and Architecten Alliantie). Since Rothuizen built the children's and youth clinic with a circular character, the other party was chosen for this project (and to generate more awareness and spread within Zeeland). The relevant architect has successfully completed several bio-based projects in the past, and this gives confidence to continue with this party.

The starting points for Emergis were discussed with the architect at the time of the assignment. The possible usage scenarios, opportunities for upscaling and possibilities for different ownership were important themes. The starting points were eventually translated into an aesthetic and functional design. Preconditions for circular bio-based construction and bio-based materialisation were included and possible functional changes were outlined in the design. However, the Architecten Alliantie did not have enough time for further translation of the starting points. This is a learning point with regard to the preliminary briefing of the architect: specifying the available research time in relation to the total assignment. Based on the initial plans, further details are specified in the follow-up process with the realisation party/parties.

#### LESSONS LEARNED Architect - Preparatory procedure / request to architect

Prior to selection of the architect, it is important to determine the starting points and ambitions with the internal project team. In retrospect, more attention could have been paid to the internal ambitions in this project. For this reason, it was also difficult to test whether the ambitions of the architect corresponded to the CBCI project and thus to properly define the briefing and the role of the architect. This also influenced what the architect was able to contribute to the alternative scenarios in terms of details and interpretations of a healthy, healing environment for the users.

### LIVING LAB KU LEUVEN

#### LESSONS LEARNED Time

Experimentation or innovation takes time. Especially at the very beginning of the project. In a Design & Build contract, for example, output specifications are very important when it comes to guaranteeing quality on delivery. But the tenderers also needed extra time to read up on the material and understand what was expected of them. That extra time can be generated in different ways and with different goals. If potential bidders are aware of the overall content of the project before the publication of the tender, they can already select their team members. More time to submit (LL specific, 21 calendar days mandatory, extended to 1 month) allows for compiling a not-so 'standard' tender folder.

## Tools and guidelines to determine ambitions

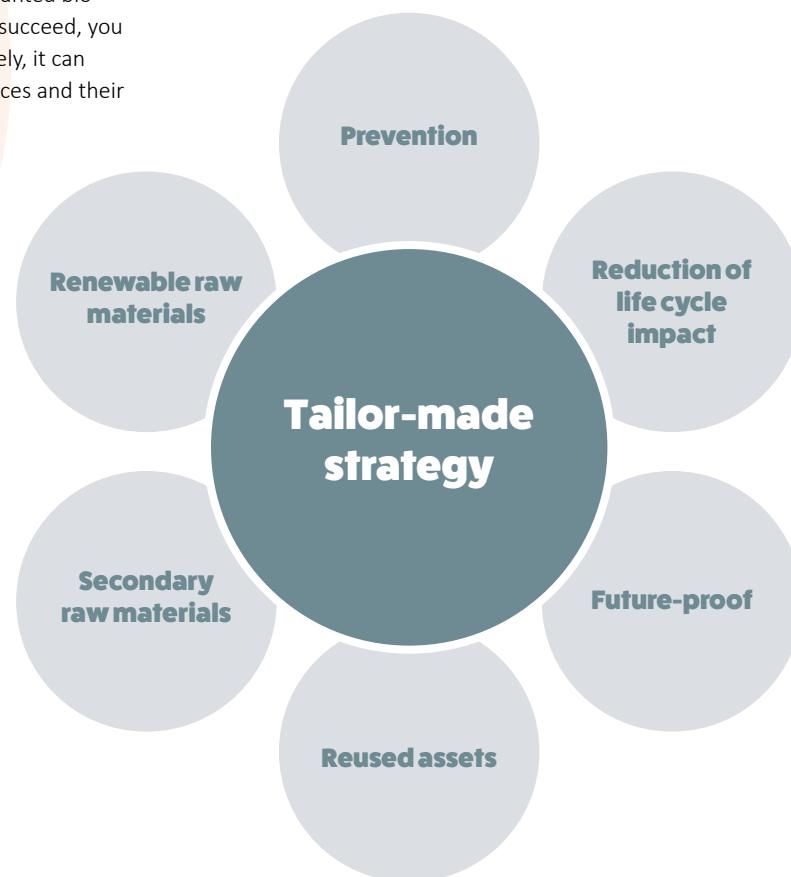
The translation of initial ideas or preferences into concrete circular ambitions for a new project is not yet a self-evident process. Lack of familiarity with possible circular applications, new materials, cooperation and contract forms, as well as the lack of own experience with circular projects is a barrier for many organisations to start. A number of instruments and guidelines have now been developed to help support this process. An increasing range of information and tools are also being shared through online platforms.

Within the framework of the CBCI project, work is being done on a methodology “Circularly Built”. This practical and accessible tool helps building initiators and designers to define their circular ambitions. By completing the various questionnaires, the user gains more insight into what the project can focus on in terms of circularity or sustainability. This relates to the design, choice of materials and forms of collaboration or information sharing. After filling in the tool, this can provide a clear picture of the degree of circularity of your project. By completing this exercise, you can substantiate your ambitions internally within the organisation and share them with stakeholders, thereby removing potential objections and creating space for achievable objectives. Completing the same exercise once again after the realisation of your project will give you insight into the differences between your initial ambition and the eventual realisation. For example, if you wanted bio-based insulation in the outer walls, but you didn’t succeed, you will see that difference in your evaluation. Ultimately, it can help you as an organisation to analyse the differences and their

causes and learn from them for the next projects. This tool will be further developed during the project, but is already available through the Flemish Confederation of Construction and the BBRI (Belgium).

A design strategy can be used to translate ambitions into strategy. The circular design guide of CB23 ([PlatformCB23\\_Conceptleidraad\\_Circulair-Ontwerpen\\_17032021.pdf](#)) provides guidelines for this by means of 6 design strategies- derived from the R-ladder ([R-ladder- strategieën van circulariteit | RVO.nl | Rijksdienst](#)). These guidelines set out which circular design choices have to be made and when, and which resources need to be used to implement a circular strategy. This is linked to: what type of roles and collaboration, type of business models, type of information and type of preconditions are needed.

When determining the specific strategy in the specific context, it is important to look at the full picture and its components (from urban context to functional components of the asset or series of assets) to arrive at a tailor-made strategy. This tailor-made strategy may require a different design strategy for different components.



## 5. Know the market

If you do not know the market well enough, you limit the possibilities for competitive procurement and you cannot make a good request to the market. The more you know about the market, the more effective your request for a proposal can be. This allows for defining the right purchasing request and an accurate assessment of whether the offer is in line with the circular bio-based ambitions. That market parties are hard to find for clients who potentially want circular bio-based construction or renovation is a frequently heard remark. It is therefore important that sufficient time is set aside for a market orientation. Make use of the available platforms and organisations that offer an overview of available knowledge on companies and projects (for an overview see ‘appendices and useful links’). Are there parties that can do what I would like them to do, or that could contribute in some way to the circular bio-based issues or materials? In addition, it is important to consider whether you can work with a single provider or whether a combination of several companies should be used for the realisation of the project. In this phase, you can also find out what forms of cooperation with parties are possible and whether there is room for innovation or experimentation with new materials, applications or business models.



It is also important in this phase to look at both short chains, local possibilities of producers and suppliers and possible use of the social economy, and the possibilities beyond, even internationally. For this circular scan, you can certainly also call on experts and learn from circular projects in the region.

### LIVING LAB EMERGIS

#### LESSONS LEARNED

##### Current market/market trends

Last quarter, the prices of wood and other raw materials have risen enormously. In addition, the availability of materials has come under severe pressure.

The market is uncertain with supplies, due to huge order backlogs and demand at global and national level, combined with supply constraints. This shows all the more that the system of supply and demand is essential in relation to the method of (circular) development (using no or less material, reusing, demounting, repairing/renovating, recycling) and management (material passport, material banks)..

There are two moments when it is important to know the market and to approach it. The first step is the market orientation and the second step is the market consultation.

## Market orientation

The first moment is early on in the process, when you start researching the market to map out the possibilities of fulfilling the ambitions. This can prevent initiating a purchasing demand that no supplier can fulfil, or you fail to find competitors, which can have a major impact on price. Much innovation in the field of circular and bio-based construction is provided by smaller suppliers who can only realise a small part of a new building

### LIVING LAB KU LEUVEN

#### LESSONS LEARNED Chain cooperation

A selected contractor often buys from a supplier they have done business with for a long time. Contracts with a smaller order size for circular solutions are also of interest to smaller companies. Now, the choice of subcontractors or suppliers often depends on the network of a contractor or architect. Especially in an overheated market, existing relations tend to gravitate towards each other. Trust and willingness play a major role, as selecting trusted, familiar parties is often perceived to prevent risks and delays in the project. Many circular innovations are presented by subcontractors or suppliers. This is why it is important to explore potential chain cooperation. We were confronted with this problem particularly with the plug-in tender. There are interesting circular systems in the market, but they were too small-scale to take on the broad task alone and we were unable to find partners to join forces. The consortium TM Vanhout and Comtis Energy that won the tender for the plug-in, was able to distinguish itself in this respect. They gathered various partners who had already worked together in the past, each with their own expertise, to jointly deliver the required competencies.



or renovation. Suppose that such a supplier could fulfil (part of) the ambitions, then it is important to know this early in the preparation of a project. In the preparation, it is important to already consider with whom and in what way market parties could be involved in the realisation. It is therefore sensible to carry out a market survey during the preparatory phase so that potential parties and opportunities can be identified.

How do you approach such a market orientation and where can you find market parties in the field of circularity and bio-based materials? In this context, you can make use of both the providers and already realised example projects that have already conquered circular challenges. Much information can already be found at trade fairs and in trade magazines. There are also numerous (national) platforms on circularity, bio-based materials and example projects and products. You do not have to have all the knowledge yourself. There are now several consultancies and professional federations that know the market well and offer support in this process.

### LIVING LAB EMERGIS

#### LESSONS LEARNED Market orientation in relation to willingness to develop

After the reference design and functional description were developed, preparations for the market orientation were started. The project group made a shortlist of contractors based on past experiences, location of the contractor, experience with circular / bio-based building and prefabrication of building processes, supplemented with generally available information. In addition, the following aspects were further explored and inquired in order to better identify the specific (business) competences through their relationship with the CBCI project: business strategy in knowledge sharing, collaboration method (with more entrepreneurial risk, more exploratory than transactional) and business culture (not only management but also other employees are competent and motivated).

The market orientation was experienced as a success! A good way to gauge how the market works, which local players are available, and how contractors view the project. In retrospect, the question as to why the parties are motivated to tender could have been asked in more detail. The challenge is to test the willingness to develop / motivation of a company (from director to employees). In addition, a similar market orientation in the choice of the architect could also have added value.

## Market consultation

#### KAMP C Market consultation and giving master classes

During the preparation of the tender for the circular office building 't Centrum, Kamp C organised a stakeholders meeting. Several knowledge partners, sector organisations, local and regional authorities, financial institutions, circular action takers and educational institutions were invited together to discuss Kamp C's approach to circular procurement. Three themes of the project were discussed: process approach, content and finances. In order to get sufficient feedback from this diverse group, a plenary debate was first held, and then everyone split into smaller groups according to the three themes. Kamp C's ambition with 't Centrum is to have this innovative building act as a catalyst for circular construction in Flanders and beyond. This will accelerate the transition to a sustainable society.

The next step was organising a series of masterclasses on circular construction, procurement and tendering, with the aim of spreading the principles and vision of circular construction. The five master classes that were organised prior to the call for tenders were, on the one hand, focused on transfer of knowledge, practical experience and sharing opinions. On the other hand, the ambitions of Kamp C for their circular office building 't Centrum were presented. Target group: as many building actors as possible, ranging from architects, contractors, urban planners, sociologists to building promoters. This preparatory phase, in which the principles of circular construction were extensively discussed, had to prepare the market for the circular tender that would be issued at the end of the year. In addition, market exploration was emphasised during this event. Based on short appointments with other construction professionals, they were able to scan the market and schedule any follow-up appointments.

Camp C made it clear in advance that it was looking for a consortium consisting of several parties not belonging to the same company or organisation for this contract. The client considers it important that new forms of cooperation are used to achieve new results. Cooperation and knowledge sharing are essential in this current market. Cooperation is about equal collaboration between the individual partners within the consortium, the collaboration with the client, the competent authority, the legislative framework, stakeholders and users. Kamp C wanted the various parties to sit down together around the table from the start. The involvement and competences of all these parties together make it easier to achieve the objectives.

Whereas market orientation focuses more on available providers and materials, market consultation goes one step deeper. The aim is to gain insight into the selection criteria that you can and are permitted to use (pursuant to legislation or Royal Decrees, for example) and how the award criteria can be prepared. Market consultation enables you to determine the ambitions and objectives of potential contractors on the one hand, and to keep abreast of developments in the sector on the other. An open and conscious approach of the market is important to test the feasibility of bio-based and circular preferences and possibilities. During a market consultation, you focus on the questions, but you should already have a clear goal. In this phase, it is important to phrase the question in such a way that you get what you are aiming for and to provide insight into which players in the market are interested in realising this. Examples of questions that help shape circular and bio-based criteria:

- On which bio-based and circular award criteria does the market want to be assessed in the tender?
- Can certain certification be requested as a requirement for the tenderer and/or as a requirement for the materials to be applied? If not, what basic tender requirements should apply?
- What financial and experience requirements can be imposed on participants?
- Under what conditions is a party interested in participating in a construction team for the relevant project?
- Is it necessary to provide a calculation fee to participants if a design is requested? If so, what is a realistic amount?
- Is a sample schedule for the preparation and construction phase realistic?
- Are bio-based materials and circular solutions available in time, in the quantity envisaged by the market player?

In market consultations for a circular project, the client's sharing of information is very important to receive helpful answers. The interviews showed that it is very useful to explain the project during a webinar or information session and to have a round of Q&A. This allows interested parties to verify that they understand the questions correctly.

Market consultation is not part of a tendering procedure. However, for public institutions it must be carried out objectively and transparently in accordance with the Public Procurement act. Parties participating in a market consultation will not receive any more information than other possible participants in the tender procedure. This can be ensured by drawing up a report on the market consultation and including this report in the tender documents.

#### **MUNICIPALITY OF VENLO** Offering an alternative for certified C2C products

The municipal building was one of the first pilots for circular buildings in the Netherlands. How did we achieve this ambition? The market orientation focused on companies that could supply C2C products. C2C principles have remained the starting point.

Companies are either 'C2C certified' or 'non-C2C certified'. Non-C2C certified means they had to offer an equivalent and verifiable C2C product. The C2C ambition had to be endorsed by the offering parties.

A list was made of what the relevant SMEs consider equivalent for C2C certifications with topics like health of materials, reusability, use of energy and water, social aspects.

How did the selection go? C2C quick scan was performed for € 500. Was the alternative satisfactory? Checked by a third party? Then the municipality of Venlo paid the fee. If not: the contractor paid the € 500 fee.

This has led to many more parties offering (C2C) products. Several producers subsequently opted to obtain the (official) C2C certificate. Click the following link for more information about this case: <https://c2cvenlo.nl/stadskantoor-venlo/>

#### **LIVING LAB EMERGIS**

##### **MARKET CONSULTATION AND SHORTLISTING**

Emergis Living Lab used the market consultation to interview the relevant companies in advance to determine whether they were motivated and suitable to take part in this tender. This type of tender and the supplementary process criteria that play a role in the circular approach and bio-based applications in the Living Lab project are complex. More research and substantiation is required from contractors compared to traditional projects. This additional research time required- partly concentrated in the preliminary phase- was a reason for some of the parties that were invited to tender not to participate.

The market consultation resulted in a shortlist with a mix of 'traditional' contractors for the complete renovation and new build, and 'prefab' contractors only for the new build units. These selected parties received tender documents and were asked to prepare a tender. By choosing a mix of 'prefab' and more 'traditional' contractors, the project group wanted to ensure a level of flexibility for the next steps within the tendering process, as well as appeal to the market as widely as possible, taking into account the complexity of the project as described above.

#### **LIVING LAB KU LEUVEN**

Market orientation and consultation are very important. How do you make sure that the right party finds your request? In this particular case, the tender was also published at the national level, even though this was not required by law. For the Living Lab KU Leuven in Ghent, market consultation was started before sending out the requests for tender. This was guided by a feasibility study by the technical partners in the project. A scope of appropriate construction methods was defined in line with the project ambitions (demountable, circular, bio-based, affordable) without being restrictive. This narrowed down the scope and allowed for more focused market research. Market players were asked about their experiences in reuse of materials, demountable construction, bio-based material use, Product as a Service models and their offerings. Available networks of project partners and customary public channels (publications and company websites) were used.

##### **LESSONS LEARNED**

In hindsight, the KU Leuven team would have asked more questions about feasibility and would have set up the questions more from the perspective of the market players; asking about the risks that market players see in the project and how they would approach it. This would certainly have been relevant for the leasing contract (for the plug-in), as this was a new concept for the parties involved.

# 6. Collaborate

To translate a good collaboration between client and contractor into a contract, a number of steps should be followed. First of all, it is important to be aware that circularity and the application of bio-based materials are often still a matter of innovation and experimentation. In this sense, there is less of a client-contractor relationship, but more of a partnership. However, there must be clarity about the distribution of costs and the investment and level of risk. The design of such a contract also requires less traditional forms of tendering. This is further set out in the following paragraphs.



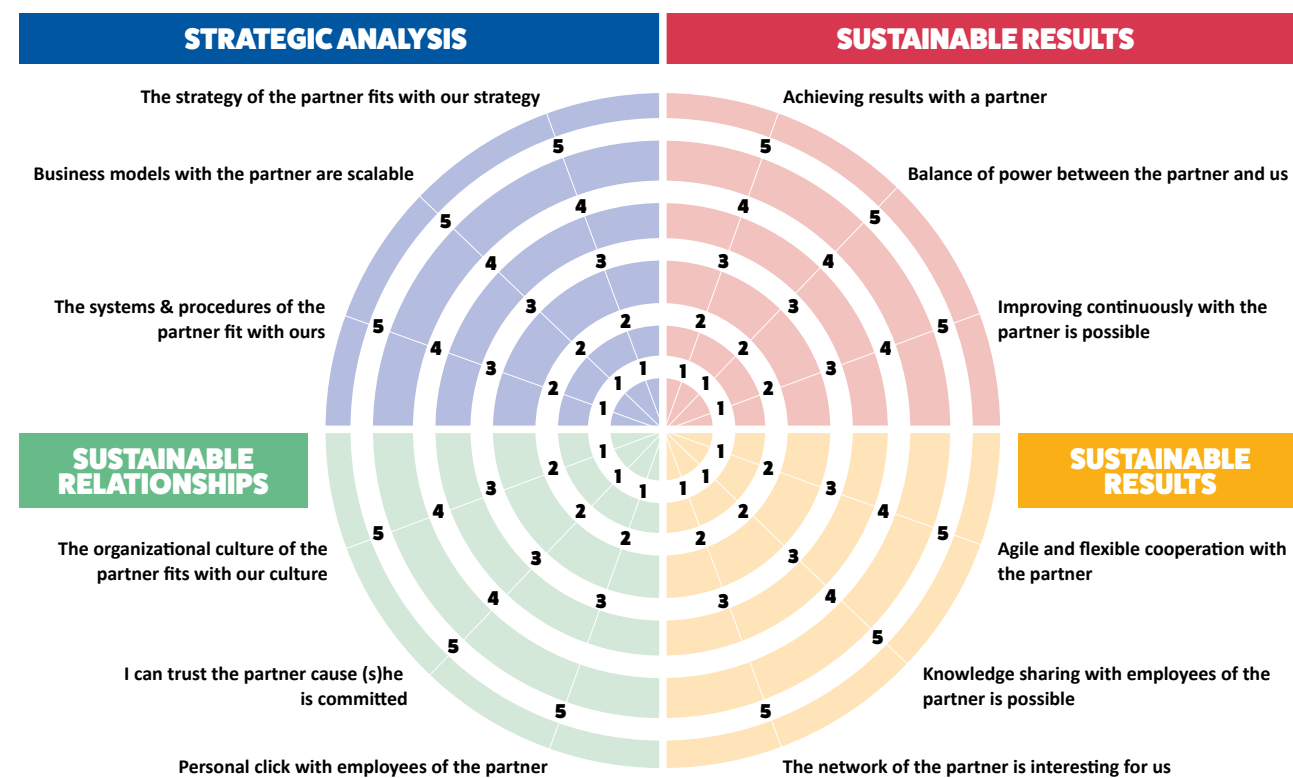
## Innovating and experimenting together

For the application and scaling up of circular bio-based construction, joint innovation and experimentation is a key success factor. This comes up again and again during the interviews and workshops. But how do you work together in a multidisciplinary manner (as client and contractor(s))? How do you arrive at the most suitable cooperation partners and form? And what type of contract can you use?

Other important aspects such as 'entrepreneurial collaboration', company culture and (readiness for) sharing knowledge are also key factors. Parties remain involved in the project longer (due to circular aspects of reuse, ownership etc.) after completion of the building. This says something about the criteria/aspects that are important in the orientation and when selecting partners, as well as about the preconditions for the type of contract.

A relevant tool is the so-called PAC Tool (Partnerships on Circular Business Models) (page 28) by Janssen & Snel (2018), which assumes four key-factors: strategic analysis, sustainable results, sustainable relationships, sustainable innovation development. These key factors determine the success of the collaboration required for innovative processes such as circular bio-based construction - a long-term partnership because there is no end of life for the building and its components. Each key factor is determined by a few subcriteria and the extent to which the (intended) partner is able or willing to contribute. Some, but not all, of these key factors and aspects were applied in the Living Labs, but not all were optimally translated into the type of partnership.





Reference: Janssen, K., Stel, F. (2018), collaboration in circular innovative business models changing roles in partnerships. The ISPM Innovation Conference - Innovation, The Name of The Game, Stockholm, Sweden, 17 - 20 June 2018

## LIVING LAB KU LEUVEN

**Enterprising & explorative collaboration:** Process-related requirements were also included in the tender (KU Leuven). For example in the area of cooperation and knowledge sharing: The aim of cooperation is to create added value for the short and long term. We work towards appropriate and functional solutions for the improvement and/or development assignment. In this case, exploratory design means ‘creating multiple designs/prototyping based on the content of the themes and the way these are interconnected’. The process can be experimental, exploratory and reflective. Work sessions are methodically prepared by the contractor in terms of the required work format and content. This requires a creative, open and facilitating style of organising and managing.

### LESSONS LEARNED

In terms of content, it would have been better to have a construction team to guarantee the cooperation in contractual terms as well. For budgetary reasons, we opted for a Design & Build, in which the client theoretically hands over the assignment completely, and is therefore not part of the development team, as is the case with a construction team. However, by making ‘cooperation and sharing knowledge’ an award criterion and embedding this in the output specifications, we are now going through a highly successful and collaborative process.

## Cooperation and contracting

In order to successfully realise a circular project using bio-based applications, all relevant stakeholders agree that intensive cooperation between parties is necessary for experimenting and innovating. The search for the optimal form of collaboration

translates into the form of contract and how to record it. This is important for the realisation phase, during which you want to innovate and cooperate successfully and for monitoring the realisation; this applies to both the construction phase and the maintenance phase or a new usage phase.

### REHAFUTUR (FRANCE) Cooperation

In the French eco-renovation project Réhafutur, initiated by parties such as CD2E (Institute for Environment and Renewable Energies in Loos-en-Gohé Living Lab, France), great cooperation between the different building actors in a project is considered very important. This translates into a tendering procedure by opting for a ‘design and build’ so that architects and engineers can work together with the contractors to realise their ambitions. At Réhafutur, the call for tenders for their renovation project explicitly asked for a group of tenderers, a consortium. About 10 teams registered, with a total of 108 companies.

In the first selection phase, the criteria were mainly based on the technical skills and individual abilities of each company. Experiences with bio-based building, energy efficiency, sustainable building etc. were asked. It is remarkable that each skill could only be supplied by 1 or 2 companies. As a result, a lot of small and medium-sized companies were included in the teams. The client wanted to help scale up their sustainability skills through the realisation of a real project.

In the second phase, one of the important criteria was motivation. Why did the individuals on the team want to work together, and why should the client choose them over others? The team is very important, the architect, the engineer and all the contractors must be able to work well together in a pleasant ambiance, with the same vision in mind. A project is much more likely to succeed when the members of the team are happy to work together on an innovative project. Innovation was also an important factor, and the bidders were awarded extra points accordingly. Among other things, this translated into the reuse of parts of the building rather than the use of new materials or into recycling on the site itself, which allowed for a considerable reduction of transports.

### COOPERATION AGREEMENTS AND CONTRACTS

Make agreements in and during the tendering procedure about how you are going to measure, monitor and demonstrate, use of the materials passport, BIM, etc.

In the initiation and feasibility phase, as well as in the definition phase, it is essential to inform the market about the new criteria that the transition to circular bio-based construction will entail. Despite having a market consultation relating to the market capabilities in the new standards, it can be relevant to bring potential stakeholders together to share the criteria and measurement standards that will be observed. This will make them aware of the new regulations that will be aimed at the circular bio-based construction industry.

By using the market consultation to demonstrate the technical viability of circular bio-based projects, the agenda towards the transition is open for innovation. However, regulatory and leading bodies need to set up and regulate the technical and quality standards for these types of solutions. A legislative framework or, for example, a Green Deal is needed to guarantee the proper application of circular bio-based solutions. Open access to successful projects can be used as a basis for generating new business models within the market. This is especially important when using technological developments such as Digital Twins, BIM models with the information of the circular bio-based solutions included; and in general Construction 4.0, etc. This would allow solutions to be simulated in advance to guarantee the correct application.

Reference: Platform CB'23. (2020). Lexicon Circular Construction Unambiguous terms and definitions.

## LIVING LAB KU LEUVEN

### LESSONS LEARNED Bringing internal stakeholders together at an early stage

For the procurement department and the legal specialist of KU Leuven, a construction team, a Design & Build contract and a lease construction were new and innovative. A knowledge gap existed in relation to the risks and the form of contract. If those involved had been brought together from the start, the project manager and the CBCI team could have provided more information and any uncertainties could have been cleared up and questions answered. Ideally, the most appropriate form of cooperation and contract would have been reached at a much earlier stage in the process in a workshop-like setting, also bringing in the expertise of the procurement and legal departments.

Lode Lefevre KU Leuven:

*“In the tender for the Living Lab Ghent, we went looking for parties who could convince us based on their expertise, vision and ambition for the project. You could almost see it as a job application.”*

## LIVING LAB EMERGIS

### LESSONS LEARNED

In this project, the architect was appointed first, followed by a separate tender for the contractor. In retrospect, a Design & Build contract would have been more appropriate given the ambitions and framework of the CBCI project. Then the design and realisation could have been included in one agreement, with both the architect and the contractor, but also in a more optimal collaboration and development form. It is also important to include sufficient time in the planning for the parties to prepare for the tender and to specify the tender in the contract phase. Some of the potential candidates indicated that they did not have enough time and therefore dropped out.

A suitable form of collaboration is a construction team, because different areas of expertise are then brought together at an early stage in the process. In May 2020, the new 2021 Building Team Agreement Model was launched in the Netherlands by Duurzaam Gebouwd (Sustainably Built). This is seen as a tool for the successful integration of circularity in a project. Design & Build is another form of collaboration that is mentioned frequently within the various projects realised. This resembles the construction team; executive experts are involved at an early stage, so that roles and responsibilities are clarified and optimal use can be made of knowledge and ownership.

It is striking that in the practical examples studied, the maintenance and/or management phases are not included in the form of cooperation or contract, while this would fit in with finding and applying circular solutions in new projects. In addition, entering into long-term collaborations between client and contractor(s) is a recurring advice for circular solutions to succeed. This indicates the importance for the client of working with the right principles from the orientation phase onwards, and making these part of the characteristics of the intended partners, the type of collaboration, and the type of business case and contract. The previously mentioned PAC-Tool of Janssen & Snel can serve as a basis to achieve this (p. 28).

In England, a set of contracts, NEC 4 ([About NEC- NEC Contracts](#)), is available, setting out the principles of working together in an agreement. This combines the contractual basis and a description of the attitude/cooperative behaviour. For example, Article 1: ‘parties act in a spirit of mutual trust and co-operation’.

In particular, the “target contract” has the potential to create a collaborative problem-solving capability. Within this cooperation form, we work with an ‘open book’. The target price is the tendered amount (whether or not set as a ceiling amount by the contracting authority). Then, during the cooperation, the actual costs are paid with a profit mark-up. The amount that differs from the target price is then allocated with an allocation key. That way, both parties benefit from a good solution. In addition, agreements have been made about issuing ‘early warnings’ combined with risk management. This prevents unpleasant situations where a client feels pressurised to approve additional work, or vice versa, when a change made by the client is implemented immediately.

NEC contracts are widely used by contracting authorities in the UK, but can be applied worldwide. In the Netherlands, for example, the NEC 3 Engineering & Construction target contract was applied to the development of the International Court of Justice in The Hague.

## CITY OF EINDHOVEN Making municipal buildings more sustainable

Based on the desire for sustainable procurement, the City of Eindhoven has defined three principles: 1) system approach, 2) long-term approach, and 3) different cooperation, resulting in a different market approach. The system approach meant ‘not just renovating the tower but involving several municipal buildings’, with a long-term vision. How are we going to do that together with market parties? We do not define what we want and tell the market to deliver it. Instead, we figure out together how we can approach the assignment in the smartest way possible. This led to the request that we issued to the market under the name Smart Sustainability Municipal Buildings.

The scope of the contract was specified based on objectives and published using the Best Value Procurement principle in combination with competition-focused dialogue. A matchmaking event was set up on 2 April 2014 in order to find partners and probe possible collaborations to facilitate this project. The goal of this event was to achieve optimal bundling of expertise and strength, accompanied by cooperation between parties based on a shared vision. The matchmaking event resulted in nineteen registrations from consortia with a total of 77 companies. The municipality entered into a dialogue with five of these parties.

The City of Eindhoven wanted to integrate flexibility into the contract. ‘We have to understand that a market player has to make a profit, and vice versa, a market player has to understand that we have to be accountable and spend our money wisely’. One of the components that came out of the tender is an alliance collaboration. This form of cooperation resulted in a Design & Build agreement between the City of Eindhoven and the Impuls consortium. The flexibility in the contract and the open and transparent way of working have resulted in a Code of Conduct. The Code of Conduct has been signed by all partners involved in the collaboration.

Both parties took a lot of time to make decisions in the design phase. During the realisation, this resulted in a lot of hassle because of the price increases. In turn, it resulted in lost time and frustrations. That is why for the next major investment project, we will opt for a construction team (construction team followed by UAV contract) rather than an integrated contract (request specification based on UAV-GC).

Joyce Verkoelen - programme manager Vsolution

*“Collaboration is by far the most important key/success factor of the project!”*

Collaboration and contracting are very much related; the contractual conditions lay down the rules of the collaboration. It is important to ensure that the contractual arrangements are in line with the intentions of this collaboration. Dividing and sharing risks fairly is the basis. The same applies to costs: the client wants a favourable price; the contractor deserves a fair price.

Sometimes it is not possible to lay down a desired form of cooperation in a contract. An example was found in the Living Lab KU Leuven.

## LIVING LAB KU LEUVEN

### LESSONS LEARNED Ensuring demounting is part of the contract

With the Living Lab, we would have liked a buy-back or at least demounting option to be part of the contract. For example, as Design, Build and Remove. The subsidy conditions that apply to this Interreg project have been obstructive because the contracts with non-project partners also had to be settled after the CBCI research project. This means that the Remove phase could not be part of the contract form.

Once the contractual basis with the conditions for cooperation has been established, it comes down to the actual interpretation of the terms between the parties involved (the so-called organisation DNA) down to the individual. This requires specific competencies of the parties involved. This can be achieved by organising the tender process itself in such a way that cooperation, innovation and competencies take centre stage. An example is specified in the case study description of the Emergis Living Lab.

## LIVING LAB EMERGIS

Because of the daily operational real estate dynamics and the phase of real estate development of the project, it was necessary for Emergis to carefully consider the interpretation of the client role. Eventually, the choice was to delegate the client role, fulfilled by Jeras Projectmanagement. The advantages of this choice are that Jeras has more knowledge and experience of the market and can take a more independent position as a pivot between Emergis and the realisation parties. Particularly because of the European subsidy rules, it is important that Jeras, as the delegated client in the construction team during specification, is able to influence certain choices. In addition to Emergis' expertise and knowledge relating to the preferences and requirements of its users and clients, the project team benefited from more knowledge of and experience with this type of complexity and scale of projects, as well as a solid basic capacity (staffing) in the project team. In reflection, however, there are also drawbacks. Jeras has an assignment on a project basis, which makes working on the strategic level- the real estate strategy of Emergis as such- and the link to the follow-up of the Living Lab more difficult.

The agreement between Emergis and Bouwbedrijf Meliskerke concerns a derivative of a construction team agreement (Duurzam Gebouwd), directly incorporating an agreement for contracting work (UAV 2012). Particularly because of the European subsidy rules, it is important that Jeras, as the delegated client in the construction team during specification, is able to influence certain choices.

## Innovating together and tendering

Which tendering process is best suited to collaborative innovation and experimenting in the context of circular bio-based building?

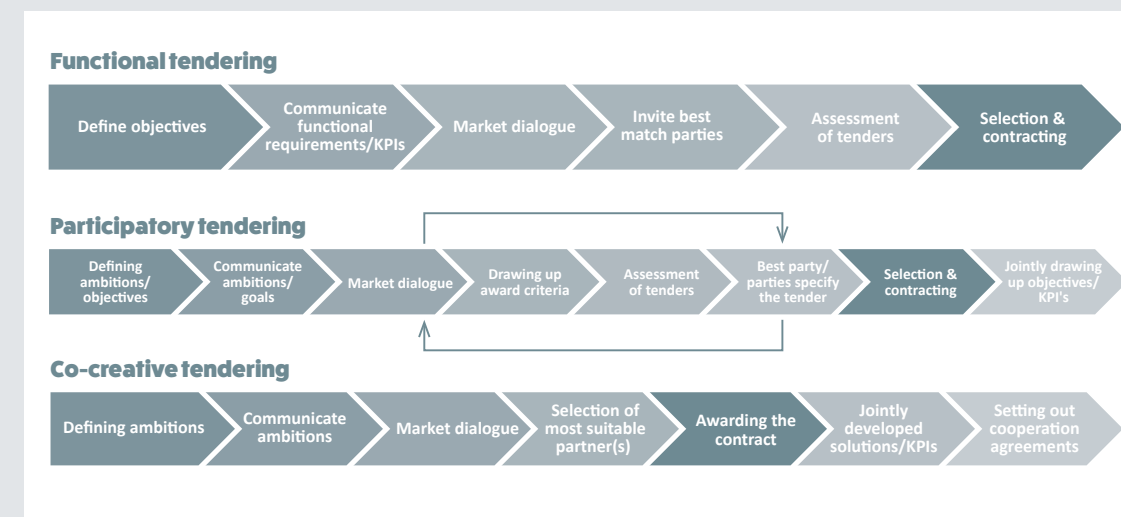
The four basic principles for procurement by public services are defined by law: non-discrimination, equal treatment, transparency and proportionality. For circular procurement, Copper8 adds the following:

- Cooperation: "Stimulate cooperation between the client and market parties within the legal frameworks and use the tender to bridge the traditional gap between the two parties."
- Innovation: "Make it possible to stimulate innovation and circular developments within the tender."

The extension of this framework requires choosing a tender form that allows these principles to be implemented. This starting point is the basis for both public and private clients to successfully start the tendering process. A number of tender forms are set out below.

- Functional tendering by means of a competitive dialogue. This is a two-stage procedure that leaves room for innovative solutions from the market. During the dialogue phase, agreements can also be reached about how to collaborate and how to divide and share the risks. It is therefore important to prepare a functional specification of roles in the request for tender document.
- Best value procurement, as an example of participatory procurement. Here too, the functional description of ambitions and objectives provides scope for dialogue and input from market parties. However, the tender process is different. Once the intended contractor has been selected on the basis of award criteria, a specification phase follows. During this phase, the intended contractor will further specify the plan in terms of management measures and the use of opportunities. Awarding and contracting will not take place until this is completed.
- Co-creative tendering with Rapid Circular Contracting ([www.rapidimpactcontracting.nl](http://www.rapidimpactcontracting.nl)) as an example. This form of tendering focuses on selecting the right partner(s) rather than the right 'product'.

Circle City (Montenegro Navarro & Bolech, 2020) categorised these into three streams (see figure below for flowchart):



Tender methods (source: Montenegro & Bolech, 2020)

Participative or co-creative tendering requires a completely different attitude from the contracting authority than 'traditional tendering'. The division of roles between the contracting authority and the tenderers also changes. "One needs to be willing to be open and transparent throughout the process- about risks, interests, uncertainties. In addition, the long-term, shared goal must be prioritised over short-term individual interests" (Montenegro Navarro & Bolech, 2020). 'Adding as much value as possible' is central to these forms of procurement. You can achieve this by including a ceiling amount or fixed budget in the tender documents. This enables you to assess tenders entirely on the basis of circularity/bio-based and quality because price alone is no longer a distinguishing factor.

Not every organisation is ready for innovative forms of tendering. "Thoroughly embedding circular ambitions and associated principles within the internal organisation is key to the success of co-creation."

Because it is often new, also for market parties, it is important to take enough time and make time available within the tendering procedure. Market parties need time to get immersed in the task, to research, to find partners to arrive at an integrated solution proposal, or to involve an external advisor in order to master the tendering method.

In summary, during the tender process, it is important for you, as the tender issuer, to:

1. be transparent: describe clearly what you want to achieve; both in technical terms (the circular, bio-based ambitions), in terms of process (the way you want to achieve this together), and in financial terms (what is your ceiling amount and what risks are you able to bear). Or be clear in what you do not know yet;
2. keep talking to each other;
3. build flexibility into the process, take sufficient time;
4. make contractual arrangements that can be monitored.



## LIVING LAB EMERGIS

As a basis for the tendering process, the reference design was specified into a functional specification. This specification is divided into the two building parts: renovation and new construction (units).

The renovation/new construction of the existing part of the Ambulatory Centre consists of treatment rooms for people with mental problems. A treatment room in this case is actually an office space set up as a consulting room with a desk and a chair etc. For specification section A, the focus is mainly on the reuse of materials from the former RWS building, rather than on circular & bio-based or industrial. The great added value here is that the choice was made to reuse the existing building as much as possible, and to efficiently increase its quality (use and sustainability). The biggest change is the realisation of a separate entrance to the Ambulatory Centre. As a basis for this section, we applied the traditional STABU system (<https://www.stabu-bestek.nl/>).

The most impactful development within the Living Lab concerns the new construction of bio-based, circular and demountable units. The focus here is on using bio-based materials as much as possible in the new section of the building, through functional specifications in the call for tenders. The goal of Emergis is to be able to respond to future developments in healthcare. This means it is a key ambition for the Living Lab units that it must be possible, through choices in the construction, to adapt the function and/or location (relatively) easily.

In addition to the technical specification documents, the tender documents also contain a manual describing the process criteria.

Part of it is functional or performance based. Other sections of the request for tender are fully specified where it is considered necessary to steer the contractor in a certain direction - with starting points that are important for the users of Emergis and the CBCI project.

The tender documents set out that Emergis participates in a European subsidy scheme, and therefore is required to provide accountability before, during and after construction relating to the use of materials. As a result, the tenderer must submit a materials passport, a document substantiating the products and services to be delivered, and (for the renovation part) a demolition file. In addition to this written record, the tendering parties were asked to substantiate the various quality aspects by means of an action plan, circularity, assembly/demounting plan and presentation.

In order to motivate the selected contractors to put sufficient effort into their offer, the project group decided to reward them for a complete tender by means of a calculation fee. This compensation has been well received by the market. It is safe to conclude that this has contributed to obtaining an appropriate and complete tender.

## LIVING LAB KU LEUVEN

In the case of KU Leuven, each strategy mentioned above has been applied to some extent. Because it concerned such a specific case, a tailor-made set of specifications was devised, covering cooperation, innovation, functional tendering, best value procurement and even rapid circular contracting. First of all, collaboration and innovation were at the forefront of the case of the KU Leuven Living Lab. The specific assignment concerns the development of a prototype for a circular & bio-based home and therefore exceeds the limitations in time and scale of a single project. In the introductory texts of the tender instructions, extra attention was paid to the 'different' nature of this contract. Also, during the selection, the candidates were asked to show their skills and experience in these two aspects. Secondly, an extensive form of functional specification was used, in which hard requirements and also ambitions were set out. Moreover, the output specifications set out product-related requirements (on the building, the materials used) as well as process-related requirements specifying stakeholder involvement, project follow-up, etc. During the award process, the selected parties could then indicate in an action plan how they intended to realise the requirements and which additional ambitions they wanted to commit to. This was extensively discussed in the negotiation rounds. If the cooperation was not sufficiently explained in the submission, details were requested during the negotiations in order to clarify it. In other words, the contract was awarded on the basis of competencies and intentions rather than on the final product that the selected contractors could deliver. After all, the final product was not yet fully specified.

In the course of the project, this turned out to be the right choice. The development of the prototype is truly a collaborative effort, in which CBCI partners, building principal KU Leuven and the contractor's consortium work closely together on the development of a building concept to be implemented.

# 7. Tender

A tendering procedure for a circular bio-based construction project is not primarily different from a regular tendering process. However, there are some important points to consider. The above-mentioned factors of time and the ability to integrate as much as possible in order to communicate and provide clarity on the internal ambitions. This will help the tenderers form an accurate impression of what you want to achieve. The tender phase should therefore offer room to obtain input on solutions from market parties with expertise. It is a challenge to find functional, measurable and verifiable selection and award criteria for your project. This chapter shows you the traps and bottlenecks.

## Selection of contractor(s)

The selection of the right contractor(s) is crucial to the success of your project. Make sure you get to speak to them during the tender process. This could be an explanation of the tender or an interview round, but we also saw workshops being organised prior to the selection phase.

## Requirements

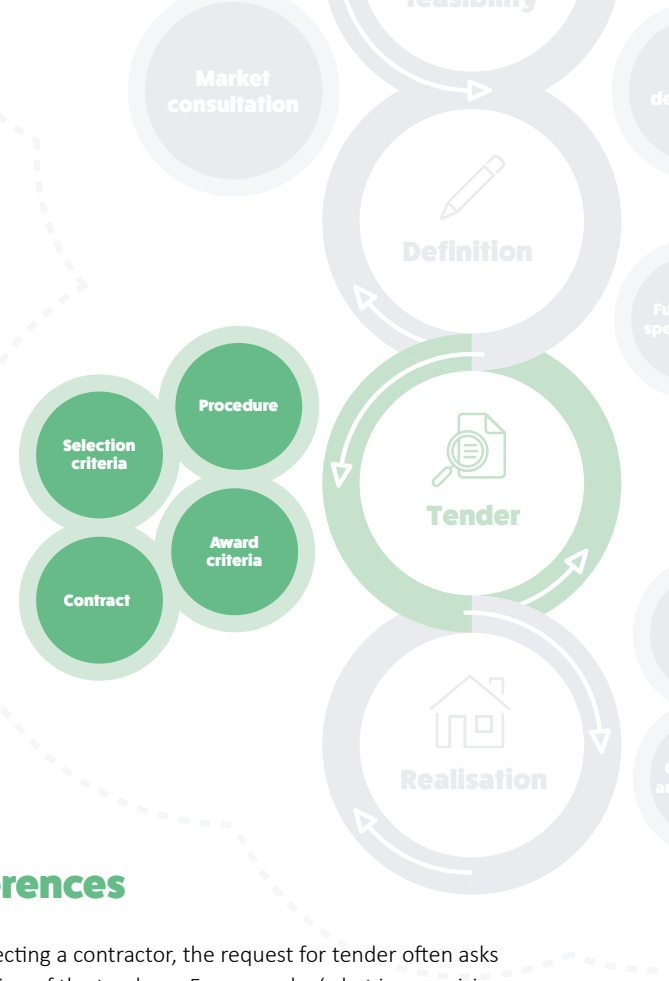
In order to enable new entrants to the market, who often have innovative ideas, from participating in the tender, it is advisable not to set reference/experience requirements in the area of circularity/bio-based. Financial requirements also need to be taken into account. The same applies to certificates. Naturally, safety certificates need to be requested, but sustainability labels or certifications often cost a lot of money. Sometimes sustainability certificates have to be requested from suppliers in order to qualify for a subsidy; ask yourself whether the subsidy outweighs the qualitative or financial gain that can be achieved in a free market.

## Preferences

When selecting a contractor, the request for tender often asks for the vision of the tenderer. For example, 'what is your vision on circular utility construction?' However, it is very difficult to assess a vision on a scale when this is generically requested because it is the vision of the tenderer. Moreover, it must always be possible to link the preferences to the execution of the assignment. It is great if a client has fully sustainable operations. This gives an idea that a party is consciously working on it. However, it still says little about how your job will be done. This is why it is better to inquire about:

- the way in which the contractor intends to work with the principal and other contractors involved in the project to realise your tender;
- which networks the contractor can tap in order to obtain help with the execution of the contract, for example, the availability of second-hand materials or the refurbishment of such materials;
- the way in which the contractor wishes to involve the principal in the execution of the contract and the role that the environment can play in this respect;
- how the contractor will be able to fulfil its warranty obligations;
- how the contractor intends to guarantee the quality of the execution of the contract;
- the contractor's staff turnover rate and what control measures have been put in place to ensure a healthy rate;
- which building system the contractor considers most suitable for the project and why.

Insight into the performance of a potential contractor is certainly important when entering into a construction team phase or a Design & Construct in which the price is not yet issued at the front end of the process.



## Award of contract

The previous chapters have set out extensively that it is important to think very far ahead to be able to give substance to circular and bio-based solutions for utility buildings. Think of demountable, flexible construction and reuse.

## Requirements

If an explanation of the tender is requested, or an interview forms part of the tender procedure, always demand that the person who will carry out the contract on behalf of the contractor will provide the information / attend the interview. Further requirements that can be defined for circular and bio-based are:

- use and make available a materials passport from which the original origin of the materials can be traced;
- minimum percentage of bio-based materials to be used instead of virgin materials;
- avoidance or no use of toxic substances;
- guarantee periods for bio-based and circular materials, what is realistic?
- changeover times for flexible construction;
- use social work facilities to refurbish, adapt and process circular materials;
- use of available materials (second-hand or new via a direct delivery);
- demonstrate the minimum impact to be achieved by means of measurement data, projections and realised impact on CO2 emissions, NOx, energy savings, etc.;
- price has a ceiling budget;
- minimum maintenance period is... years.

A number of the above requirements, going even further in circularity, can also be requested by using existing measurement systems such as BREEAM, W/E Advisors, Alba Concepts, OneClickLCA, Madaster.

## Preferences

The requirements that can be set for the realisation of the assignment itself.

- Minimum impact to be realised should be exceeded. This should be demonstrated with measurement data, forecast and realised impact on CO2 emissions, NOx, energy saving, etc.;
- Higher than minimum percentage of bio-based materials applied instead of virgin materials;
- Longer maintenance period optional, falls outside the ceiling amount so must be priced separately;
- Longer guarantee periods on bio-based and circular materials than the minimum required.
- What ideas does the contractor have for the design and/or realisation of the building to prevent vacancy in the future?
- Does the contractor have opportunities or ideas for using a donor building?

### LIVING LAB KU LEUVEN

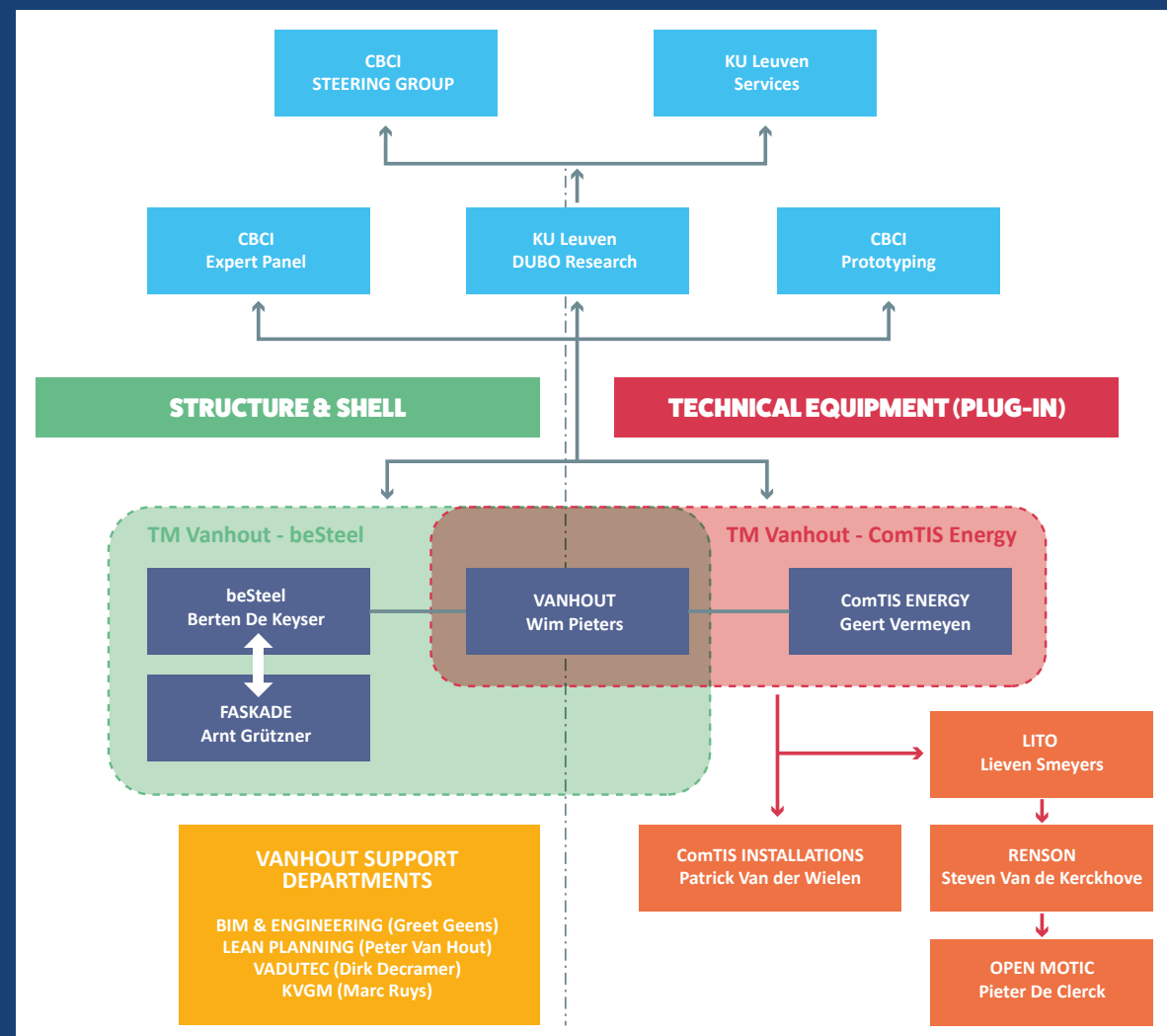
#### LESSONS LEARNED Tender process

It has been helpful to start from the vision document. From vision to ambitions, from project objectives to basic principles, to indicators for both selection and award criteria and for the output specifications. The tender was based on functional specifications that do not prescribe the solution, but the requirements to be met by the building. This allowed suitable candidates with different building systems (and variants within a building system) to tender for the contract. By also applying a maximum budget, the focus of the tenders was shifted from lowest price to quality and innovative solutions.

Both tenders (building and technical plug-ins) were issued in the market at the same time. The procedure included a mandatory webinar. One of the purposes was to meet potential cooperation partners. Because of the digital character, this did not turn out well. Some parties sought contact with other attendees of the webinars, but those collaborations did not materialise.

## LIVING LAB KU LEUVEN

## TECHNOLOGY CAMPUS GHENT



Bottom left of 'Vanhout' are the parties in the consortium for tendering Structure & Shell, and on the right are the parties in the consortium for leasing the plug-in.

For the tender of the Living Lab at KU Leuven, 2 core competitions were applied: innovative attitude and experience with equal cooperation between partners. In addition, the following two award criteria played a role: added value of circular innovation under the ceiling amount and cooperation and knowledge sharing.

**CORE COMPETENCY1 Innovative attitude**

The bidder has developed projects, products or processes within the last 3 calendar years that can demonstrate significant innovation. Significant innovation is defined as: "A product, process or service that is new to the market and disrupts standard processes or ways of working with the aim of achieving higher circularity. In doing so, the significant innovation answers an existing problem statement." Please indicate what the initial question was and what innovative circular answer was defined. It is not necessary for the innovation to have been put into practice; the intention must be demonstrated.

**CORE COMPETENCY2 Experience with equal cooperation between partners**

Relevant experience in the area of cooperation forms (e.g. in a construction team, DB(FM)(M) etc.) must be demonstrated by means of a certificate of satisfactory realisation for at least two completed projects (with reference to the submitted reference projects). Please explain the following topics:

- Good cooperation based on equality within a consortium;
- A satisfactory cooperation based on equality with the client;
- The importance of proactively working with all relevant stakeholders, both in the design process and realisation process, as a success factor for realising circular ambitions.

**AWARD CRITERIA1 Added value of circular innovation within the ceiling amount**

Indicate which ambitions- defined and shaded in yellow in the output specifications- you will achieve for the ceiling amount, in addition to the minimum project goals as stated in the output specifications (shaded in green).

**AWARD CRITERIA2 Cooperation and knowledge sharing**

Describe in an explanatory note:

- What action plan is needed to make effective and smart use of each other's knowledge and skills as a success factor in order to facilitate proactive collaboration and to guarantee a coherent end result?
- Which process approach can contribute to synergies of available disciplines in order to come to innovative and feasible (design) solutions?
- How can the quality and performance requirements be monitored before, during and afterwards?



## LIVING LAB KU LEUVEN

### LESSONS LEARNED Dialogue

Engaging with tenderers during the tender process is crucial.

Due to the method of tendering, this is more of an open question. This is why it is important to clarify this question during information sessions before the submission in order to ensure that the tenders remain equivalent and comparable. The same clarification and adjustment can also take place in the period between submission and award, taking care to avoid cherry-picking.

### Obstacles / concerns / recommendations:

In the Flemish context, the Belgian regulations require accreditation. Compliance with this accreditation requirement is time-consuming for foreign companies. As a result, a number of interesting Dutch parties were unable to submit a tender in this specific case. This regulation seems to conflict with case law on cross-border interests and innovation in works.

### Learning points from interested parties who were not awarded the work:

- A number of parties indicated that they felt that “what was asked in the tender” was not in proportion to the size of the contract. This was mainly due to the development costs in relation to open knowledge sharing. This is understandable when the task is seen as only one building. The objective of the LL and the opportunities of collaborative research and prototyping extend beyond a single building and should be the foundation for upscaling.
- A construction team was preferable to a D&B. A construction team would assure more of the builder’s involvement in the process. However, thanks to smart output specifications, this was nevertheless successful with a D&B contract.
- A number of parties also experienced a ‘lopsidedness’ in the contract (such as penalty clauses, copyrights, many points fixed). This arose from the use of standards to which the purchasing department wanted to adhere. As a result, a limited willingness of the client to assume risk was contractually established.

The SRI criteria tool was applied ([www.mvicriteria.nl](http://www.mvicriteria.nl)), to draw up the output specifications of the LL KU Leuven. This is an online tool that allows for selecting on suitability requirements, selection criteria, requirements, award criteria and contract provisions.

Examples of CBC performance requirements:

**Circular use of materials:** *“At least 20% of the volume of new materials to be brought in must be materials originating from refurbishment, remanufacturing or reuse.”*

**Bio-based materials use:** *“At least 75% of the volume of materials used should be bio-based.”*

**Demountability:** *“The building should be fully demountable and remountable. A mock-up should prove that it is remountable. The entire building must achieve a minimum score of 0.7, according to the Measuring Methodology Demountability of Circular Buildings.”*

Examples of output specifications from the tender Structure & Shell Living Lab KU Leuven

## LIVING LAB EMERGIS

### LESSONS LEARNED Tender process and contract

After publication of the tender, it became clear that the six selected parties needed more time to provide a complete tender. Therefore, the period of registration was extended for all parties. However, despite the extra time, many contractors dropped out due to lack of time with deadlines and/or capacity problems with the proposed construction schedule. However- within the overall planning for Emergis and CBCI- less time would then be available for the research part of the project.

The Project Group’s assessment of the bids for the two tenders was held internally on the basis of whether the submitted action plan complied with the fundamental requirements of the tender specifications. During the negotiation phase- based on functionalities- proposed changes and/or optimisations were honoured. The proposed changes were as follows: better functional flexibility, dropping a canopy (saving on materials to be used for the Living Lab) and the construction of the new build part by means of stand-alone corridor and detached (interconnected) units.

The contract was awarded to Bouwbedrijf Meliskerke. The interpretation of the main ambitions of the Ambulatory Centre, the proposed changes and the experience with bio-based and circular elements were important here. In addition, Bouwbedrijf Meliskerke is a local player. They have local connections in the region and the corporate vision of Meliskerke fits well with the circular, bio-based and sustainability ambitions of Emergis.

### Request for tender

In order to focus more on the end result, a number of components- such as the exterior and energy concept- were specified in more detail during the preparations. The VO, composed with parts more explicitly specified, results in a reference design. This includes layout options, movability of the units, demountability, an image of the facade details and finish, and options for bio-based materials. The units are presented as three interconnected and movable units, the middle one being adaptable to a sanitary / pantry unit.

The primary objective of using a reference design as the basis for the request for tenders was to make optimal use of the design/material/realisation and production knowledge of market parties in the further specification and optimisation of the Living Lab.

# 8.

## Realisation

As soon as the (first) contracts have been concluded, the realisation phase will follow. From here, the clients and the contractors set out to work together towards realisation. This phase includes the design, the construction itself, the maintenance phase and possibly the end of the first (initial) use phase. These latter two steps depend on what is in scope of the tender.



Key elements in this phase are, on the one hand, maintaining cooperation between all project partners, both internally and between the client and the contractor, and, on the other hand, contract management; as well as monitoring and measuring the process and making adjustments where necessary. Although this approach and agreements are already set out in the tender stage, it is important to specify these during the earlier definition phase by including these in the market consultation or orientation. In this phase, you agree with potential contractors how the circular bio-based ambitions can be realised. Again, you need to start thinking about these issues early on in the process.

A final important step, after the project has been realised (read built), is to perform an evaluation of the entire process. Interim progress evaluations are also recommended. This way, adjustments can be made during the process. This generally benefits the relationship between the project partners.

### Preparation

A common rule in project planning is “a good start is half the job done”. When the planning phase has not received enough attention, the chances of success decrease. Not surprisingly, this is even more applicable to circular building projects. These are relatively new to the sector and, coupled with the often-increased complexity, require even more preparatory planning. This will ensure that the project objectives can be managed during project realisation.

Preparations must be made both before and after a project is awarded. It must be clear what the objectives of the project are so that the contractors can endorse them and take them into account during the realisation phase. The tender documents should set out the conditions to ensure a correct start and to maintain the cooperation. The same applies to quality assurance tools and monitoring mechanisms.

To make it more specific, the following could be included in the tender documents:

- the project background, how the need for the project arose;
- the objectives of the project;
- a clause on cooperation and knowledge sharing. The expected attitude in this respect can be explained in the tender documents;
- BIM vision document;
- information on monitoring mechanisms; number or frequency of meetings, logbooks, etc.;
- list of detailed award criteria, clarifying how quality assurance will be assessed in qualitative and quantitative terms in view of project delivery.

## Maintaining cooperation

The cooperation between parties in circular and bio-based projects requires special attention. This often concerns innovative projects where new possibilities are discovered or implemented. Also, in general, not all parties involved are familiar with this new approach, both internally and externally, or are not yet convinced of the feasibility of the project.

Sometimes the application is based on performance, which must be followed up during the construction phase. This is in addition to managing budgets and delivery schedules, both for specific materials or components and for the project as a whole.

The long duration of construction projects, from the very beginning of the ambition to their eventual realisation, requires a long-term vision. This includes how to guarantee and maintain

the collaborations. Who is responsible within the internal organisation for the total project, for the operational day-to-day activities? How is this documented and how are agreements recorded? Ensuring proper follow-up, including with external parties, is crucial to the success of the build and the subsequent steps.

Short lines and regular meetings are essential for productive cooperation. Here are some examples:

- Regular, pre-planned consultations. These may be split into general and technical meetings depending on the project, for example; with both internal and external stakeholders and partners
- Working groups involving all stakeholders
- Construction team including client
- Advisors for quality assurance
- Agreeing how to deal with each other as client and contractor (e.g. applying the 'past performance system')

### LIVING LAB KU LEUVEN

Preparations made before the award should be actively pursued. In the case of the CBCI LL of KU Leuven, a so-called kick-off meeting was organised. The stakeholders of the project convened to review the content and objectives of the project. The project itself is what the stakeholders have in common. At the same time, the project fits within the context and activities of each individual partner. Presenting and explaining these contexts provides mutual understanding of individual goals and project interests, an understanding of the size and competencies of the group, and a concept of the individual share and role of the stakeholders in relation to the whole project.

In addition to this general session at the project level, two detailed brainstorming sessions were organised that focused more on the content. First of all, the action plan was discussed and validated with the project partners based on a process map (Appendix 1). This established the organisational path to results, which was necessary because of the functional specification from the tender. The final version was validated by all stakeholders and with it, the process of how to get results. In terms of content, the team identified the challenges relating to realisation of the output specification.

## Realisation of the construction process, contract management and monitoring of ambitions

The contractual agreements between the client and the contractor(s) need to be followed up during the construction process. Adequate contract management prevents objectives from not being met, agreements from not being honoured, or budget and time related surprises from occurring. Even before the tender is issued, this must be clear and organised internally, so that responsibilities are clearly defined. The market consultation and orientation help further shape this together with potential contractors. Ultimately, this is set out in the contracts.

In order for the process to run smoothly, it is important to use software to keep track of the planning and to record important choices. It is also crucial to organise regular consultation meetings in order to keep a finger on the pulse together and to determine the next steps. Tools such as BIM can help record choices and information in the model to facilitate maintenance and transfer.

All this generated information leads to a realistic and validated schedule that should be used during the project as a monitoring tool for the progress of the project. Other instruments may be used in addition to this one.

### LIVING LAB KU LEUVEN

For monitoring the entire process, two methods were introduced in addition to the work sessions, namely the CBCI Logbook (for use by the project leader) and the CBCI Decision Matrix/Morphological Chart (for use by the construction team). The CBCI logbook is a tool for the project manager but is not regularly 'filled in'. Rather, the minutes are used and the logbook format (correlation changing roles, stage of development and failure/success factors and key components/methods) is used as a general analysis tool. The CBCI decision matrix is more concrete and user-friendly to capture the key issues, variants, considerations and decisions.

This is a visual way of defining the necessary product functionality (in the case of the CIRCULAR AND BIO-BASED BUILDING Living Lab building components and building method criteria) and exploring alternative means and combinations to achieve this functionality (See table). For each element of the product function, there may be a number of potential solutions. For each solution, the benefits and disadvantages can be documented.

Table morphological graph

	Solution 1	Solution 2	Solution 3
Functionality/outputspec/component 1			
Pros.			
Cons.			
Functionality/outputspec/component 2			
Pros.			
Cons.			

#### Decision making chart

This tool can be seen as an additional layer on top of the morphological graph. Final solutions are highlighted and the decision for a particular solution is argued in an additional column. It is a tool for converting implicit information into explicit information.

#### Multiple assessment tools, e.g. the Demountability index of Alba Concepts or LCA

Existing (circularity) assessment instruments can be listed in the tender as instruments to be used. The expected level of performance should also be stated. The tools can be used during the project to check whether goals are being achieved and as a guide if adjustments are needed. They can also be used as proof of commissioning.

#### The integration of BIM

BIM can ensure the cohesion of the tools and information used. For example, by integrating demountability index, LCA, material properties, etc., non-obvious conflicts are avoided and information transfer in time is provided.

#### The output specifications

This is perhaps the most obvious tool contained in the contract form. After the research phase (see process map), as the client, we made an evaluation of the output specifications and reviewed this in a management meeting with the contractor. In concrete terms, for each functional requirement, we assessed to what extent it had already been achieved and whether there was a need for additional efforts. Ultimately, the output specifications will serve as the basis for the final delivery.



## Successful management

Maintenance is an important aspect of management. Maintenance can be done in-house, outsourced or as part of the construction contract through a Design, Build & Maintain (DBM) contract. It is important to think carefully in advance about what suits the organisation and its core business. The advantage of entrusting maintenance to the building contractor or the consortium may be the knowledge lead on the building. Whether internal or external, safeguarding information is essential.

Interim changes, such as renovations or relating to circularity through reconfiguration, are also an important part of management. In the design phase, you can already think about the different rebuilding and reconfiguration options. By taking this into account, you can prevent future new construction or simplify renovations.

### LIVING LAB EMERGIS

In the development of the Emergis Ambulatory Centre, flexibility is an essential part of the design and requirements. Because regulations within the healthcare domain are subject to change, this is actively taken into account. The care here seems to alternate regularly between centralised and decentralised (ambulatory vs. residential). This enables Emergis to incorporate the possibility to convert common rooms and offices into apartments when the healthcare becomes more individually oriented again. In order to make a good assessment, it can help to make a business case for potential renovations. You weigh up the probability of something happening against the potential cost savings. Within CBCI, we are developing a calculator that can help you with these types of flexibility choices.

Commercial buildings change ownership on average once every 25 years. Management actually goes beyond maintenance and interim changes. To ensure that the circular and bio-based potential of a building is used, transfer and safeguarding within the organisation of the new owner is essential. When writing a tender, consider how the objectives can be guaranteed after realisation. This allows you to better organise the process to increase the of post-realisation assurance.

A potential 'new destination' is certainly relevant to circularity. This can apply at different levels and not just at the end of life. During the life cycle, parts of the building, components, installations and materials can also individually find a new use. Digitalisation, for example in BIM or a materials passport, and physical labelling of unique components can play an important role in this. Interim changes to the building or maintenance to components should also be tracked in order to keep the current state of the building up to date. This simplifies management. To illustrate the relevance of detailed information, we would like to share the example of the Temporary Court. At the time the building is relocated, recertification of all components should officially take place. This would be very pricey and probably difficult to work with. By closely tracking logistical movements and changes in BIM, recertification based on this data becomes realistic and the building can be relocated relatively inexpensively.

It regularly happens that, at the moment the person with a leading role in the field of circularity leaves the organisation, the subject starts to collect dust. Assurance within the organisation can make a difference. So far, we have learned that it can be valuable to involve operational departments such as management and maintenance. Also involve users at an early stage because this can facilitate the embedding in the organisation.

## Evaluation of ambitions and process

Throughout the entire process, from the first ideas and ambitions to the realisation of the project and even during the management phase, evaluation is an integral part. Intermediate evaluations enable you to keep control of the process and the realisation of the applicable objectives. On the other hand, an evaluation offers the possibility to capture lessons learned and use them for future projects. These lessons can also be important for making organisational changes, adjusting policy and sharing them with important stakeholders outside your organisation.

We distinguish different forms of evaluation:

- Realisation of functional requirements
- Realisation of circular bio-based ambitions
- Process related (timing, budget, cooperation)

### Realisation of functional requirements

An essential part of a tender are the functional requirements that are laid down. It is crucial to keep track of whether these requirements are being met. This enables you to make adjustments along the way. To give circularity and/or sustainability more of a chance, it can be helpful to conduct a dialogue about the considerations involved when monitoring the requirements. It may be that a particular requirement compromises circularity and that the requirement turns out to be less important than the circular goal after all. You can only make choices about this during the process if you talk about it and make decisions together about removing, tightening or changing requirements.

### Realisation of circular ambitions

Have you succeeded in your mission, have your ambitions been achieved? Is circularity integrated and have the right materials choices been made in the building or renovation project? Capture the lessons learned- use them to evaluate, but also for the internal organisation. Adjust internal procedures. Also think about communication (especially if you want your building to set an example or contribute to your image).

To measure objectively how successful you have been, you can use the Circularly Built tool again. The tool helps you at the beginning of your project to quantify and qualify the circular ambitions. By doing this same exercise after realisation, you analyse the differences between the ambitions/start of the project and the realisation. The result helps to reflect on the differences. It is quite possible that certain choices had to be made in the interim because of timing, availability, budget, etc. Are these matters that could also play a role in the future?

This evaluation helps you as an organisation to better assess new projects and trajectories and to define your goals and ambitions more clearly. Perhaps something needs to change within the organisation; perhaps new functionalities or more specialisation are needed. On the other hand, it certainly shows thresholds that you can actively address. In order to apply more circularity and bio-based materials in future projects, it is important that all knowledge and experience is further deployed to promote the transition to the circular economy. This can only be done by experimenting- learning- improving- changing!

Here, too, the Circularly Built tool (section 4.3) can provide support, as the analysis can also be used to draw conclusions arising from process control and monitoring.

### Process related

At the end of the construction phase at delivery, you look back at your process and identify where it went well and where it did not. Good project monitoring and registration makes it easy to do a broad evaluation and to draw and record conclusions.

### Relevant questions are:

How did the collaboration actually lead to circularity? How is this guaranteed?  
How was this taken into account at each stage of the process, in the tender process and/or tender documents? What lessons do you draw from it, and how does this translate to your future projects (different approach, project monitoring, organisational changes, etc.)?

# 9.

## In conclusion

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The urgency to build with circularity using bio-based materials is greater than ever. This is a major challenge for all players in the construction sector. In recent years, many wonderful projects have been realised in which innovation, experimentation, close cooperation and a healthy dose of courage were the main priorities. These ingredients also play a major role within the Living Labs of the CBCI project. We have endeavoured to learn from all these practical experiences and to translate them into the processes and choices in both projects.

The urgency to build with circularity using bio-based materials is greater than ever. This is a major challenge for all players in the construction sector. In recent years, many wonderful projects have been realised in which innovation, experimentation, close cooperation and a healthy dose of courage were the main priorities. These ingredients also play a major role within the Living Labs of the CBCI project. We have endeavoured to learn from all these practical experiences and to translate them into the processes and choices in both projects.

For this white paper, in addition to thorough desk research, the learning experiences from completed construction projects from four European countries were researched, classified and bundled. It is safe to conclude that circular bio-based construction and renovation is quite possible, but that there should be an emphasis on the uncertainties in the process. By identifying these at an early stage and continuing to identify them throughout the process, they can be reduced and ultimately resolved. A procurement framework has been developed in order to carry out a tender process in which nothing is overlooked. This helps in making decisions and ensures that ambitions are clear from the very beginning and are translated into the final construction project.

Once a successful construction or renovation project has been carried out, it is necessary to translate the ambitions and the lessons learned from the project into an organisation's real estate strategy and policy. This creates a clear and long-term policy that includes the circular and bio-based theme, ensuring that learning experiences can actually be applied. It also helps develop and maintain the right expertise within the organisation.

One factor not to be underestimated in circular and bio-based building is that it is an innovative market with new suppliers and materials. Much is still under development, is sometimes only tested during the realisation of the project or arises spontaneously. This underlines the importance of good collaboration between client and contractor(s): having a common goal and being transparent about risks

and responsibilities. A good contract that allows room for collaboration in order to innovate is a prerequisite.

Everyone who plays a role in the tendering process needs to look much further than just the tender itself. To convert ambitions and ideals into concrete circular building projects, using bio-based materials and new techniques, many factors play a role. Internally, for example, this is the extent to which an organisation is ready to innovate and experiment or which resources, in terms of finance, knowledge, human power and time, can be freed up. External factors play a role on the supply side. What can the market offer and are there parties that can help think about the potential future (re)use of the building or help develop new applications and materials?

Successful realisations of circular and bio-based building projects are characterised by:

- Setting real goals and ambitions;
- Ensure support within your organisation and with key stakeholders;
- Taking sufficient time for the process across all phases;
- Knowing the market and being open to innovation;
- Commit to strong cooperation and secure this in contracts and monitor the process;
- Ensure that the knowledge and experience gained are not lost and are secured in a circular manner;
- Use and share these experiences in new projects and to help everyone go one step further!

In conclusion, circular building with bio-based materials is possible for both large and small projects, for public and private owners. In order to reduce our impact on the climate and apply more circularity in the construction sector, we will have to take steps and take the plunge. By experimenting and learning in practice, circular building will become the norm in the future. Start by defining initial circular ambitions for the new project. This does not have to be very big and ambitious. Use the procurement framework to check if all steps have been sufficiently thought through and see what is feasible. Let it help you in the follow-up of the entire tender process. Make sure you have enough time with the right group of enthusiastic and ambitious partners around you, and successful projects will find their way into practice!

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## Attachments and useful links

Useful resources and existing initiatives:

### Netherlands

- [Barrièredesk - Cirkelstad](#)
- [Cirkelstad, hét platform voor koplopers in de bouw - Cirkelstad](#)
- [Convenant NL BTL invulbaar.pdf \(hibin.nl\)](#)
- [De circulaire bouwconomie](#)
- [GG-22-Catalogusbouwmaterialen-site.pdf \(biobasedeconomy.nl\)](#)
- [Home - Madaster](#)
- [Kennisbank Biobased Bouwen](#)
- [Milieuprestatie en de circulaire bouwconomie - Nationale Milieudatabase](#)
- [Nationale Database Biobased Producten - CoE BBE](#)
- [Nieuwe modelovereenkomst voor bouwteam | Duurzaam Gebouwd](#)
- [PIANOo Expertisecentrum Aanbesteden](#)
- [Portal Platform CB'23 \(platformcb23.nl\)](#)
- [Procurement of biobased products explained | PIANOo - Dutch Public Procurement Expertise Centre](#)
- [Producten - Maatschappelijk Verantwoord Inkoop Platform \(mviplatform.nl\)](#)

### Belgium (Flanders)

- [Circubestek | circubuild.be](#)
- [Circulair Aankopen Vlaanderen \(vlaanderen-circulair.be\)](#)
- [Home | C-Bouwers](#)
- [Homepage - WTCB](#)
- [Materialen - VIBE](#)
- [Producten | C-Bouwers](#)
- [Vlaamse Confederatie Bouw - VCB](#)
- [Vlaanderen Circulair - Knooppunt van de circulaire economie in Vlaanderen \(vlaanderen-circulair.be\)](#)

### France

- [Commande publique et matériaux biosourcés : Construire des bâtiments puits de carbone - enviroBOITE](#)
- [Produits biosourcés durables pour les acheteurs publics et privés \(Des\) - La librairie ADEME](#)
- [Réglementation environnementale RE2020 | Ministère de la Transition écologique \(ecologie.gouv.fr\)](#)

### UK

- [About NEC - NEC Contracts](#)
- [Circular-Economy-Report.pdf \(ukgbc.org\)](#)

### Europe

- [Circular procurement as a way to address pollution: experiences from ProCirc, Interreg VB North Sea Region Programme](#)
- [EU criteria - GPP - Environment - European Commission \(europa.eu\)](#)
- [InnProBio :: Home \(innovation-procurement.org\)](#)
- [Procura+ | Procura+ European Sustainable Procurement Network \(procuraplus.org\)](#)
- [Search a product or a supplier | Agrobiobase, the showcase of biobased products](#)

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- **Sunny Kempen, Belgium** Joris van der Flaas (Expert in sustainability and techniques)



## Appendix 1 Living Lab KU Leuven

The Living Lab KU Leuven is a building project in the city of Ghent (Belgium). There are a number of challenges that we want to address with this project. Firstly, by 2050, all houses in Flanders should achieve an EPC-A (energy performance requirement). This requires a huge renovation effort. However, the quality of the building stock in Flanders varies, which means that different strategies are needed. Some houses are in such poor condition that it is not sensible from an ecological perspective to renovate them; new construction is the better option. The Living Lab of KU Leuven wants to respond to that scenario, applied to detached houses. Secondly, we must be careful that in resolving this first problem, we do not create a new problem for the future. In other words, the newly built or renovated house must be circular and bio-based. In the future, at the end of its useful life, our solution will not be an unusable pile of waste, but a bank of materials that will serve as a donor for new buildings. Any materials that are no longer usable can be easily recycled. Finally, with a modular and flexible building system produced on an industrial scale, we are responding to the ever-changing and also increasing demand for housing in the Flemish urban environment. The prototype is adaptable, the home can be expanded or split to accommodate larger or more families. The fact that the concept complies with the regulations for social housing makes the possibilities in terms of implementation in urban renewal projects and the target audience all the more extensive. The Living Lab of KU Leuven hopes that this setup will transcend the circular and bio-based ambitions by using them as a medium to address the larger challenges we face as a society.

To do this, it is setting up a Living Lab in the form of a residential house that will temporarily be available at its Technology Campus. The goal of this CBCI Living Lab is - among others - to realise a prototype for affordable housing in urban renewal projects based on circular, bio-based and industrial building principles. Flexibility and ease of disassembling (from a structural perspective) are key characteristics of the building. After seven years on the Technology Campus, the house will be demounted and given a second life at another location, in an urban renewal project to be determined at a later stage.

Innovating and sharing knowledge together are key principles in the tendering process. The Living Lab was put on the market in two tenders, after the submission of a building application file: 1) Structure & Shell as a Design & Build based on the preliminary design at scale 1:100 and output specifications. 2) All installations as a plug-in lease. With this second tender, KU Leuven wants to experiment with other financing and business models that fit the circular ambitions of the project. KU Leuven pays a fixed amount per month for the use and maintenance of the installations and does not become the owner.

Finding the right building partners to develop such a concept is quite the challenge, to put it lightly. The multitude of aspects and complexity of the question made the CBCI Living Lab at KU Leuven an interesting test case to see how the right tendering process could help to find the right partners.

Lode Lefevre:

*“In the tender for the Living Lab Ghent, we went looking for parties who could convince based on their expertise, vision and ambition for the project. You could almost see it as a job application.”*

### Influence of the tender process on the ‘end’ result

All in all, we can conclude that this was a successful tender. The CBCI team experiences it as such because parties share the same ambition: the business ambition of Vanhout (and its cooperation partners) coincides with the CBCI objectives. Both parties want to experiment and innovate with the ultimate aim of upscaling Circular Bio-based Construction. This was managed by selecting and awarding contracts on the basis of the related competencies of the parties, instead of on the basis of hard requirements, ready-made solutions and price. For examples of the award criteria used, see the box.

### Core competency 1 Innovative attitude

The bidder has developed projects, products or processes within the last three calendar years that can demonstrate significant innovation. Significant innovation is defined as: “A product, process or service that is new to the market and disrupts standard processes or ways of working with the aim of achieving higher circularity. In doing so, the significant innovation answers an existing issue.” Please indicate what the initial question was and what innovative circular answer was defined. It is not necessary for the innovation to have been put into practice; the intention must be demonstrated.

### Core competency 2 Experience with equal cooperation between partners

Relevant experience in the area of cooperation forms (e.g. in a construction team, DB(FM)(M) etc.) must be demonstrated by means of a certificate of satisfactory realisation for at least two completed projects (with reference to the submitted reference projects). Please explain the following topics:

- Good cooperation based on equality within a consortium;
- A satisfactory cooperation based on equality with the client;
- The importance of proactively working with all relevant stakeholders, both in the design process and realisation process, as a success factor for realising circular ambitions.

### Award criteria 1 Added value of circular innovation within the ceiling amount

Indicate which ambitions- defined and shaded in yellow in the output specifications- you will achieve for the ceiling amount, in addition to the minimum project goals as stated in the output specifications (shaded in green).

### Award criteria 2 Cooperation and knowledge sharing

Describe in an explanatory note:

- What action plan is needed to make effective and smart use of each other’s knowledge and skills as a success factor in order to facilitate proactive collaboration and to guarantee a coherent end result?
- Which process approach can contribute to synergies of available disciplines in order to come to innovative and feasible (design) solutions?
- How can the quality and performance requirements be monitored before, during and afterwards?

It has been helpful to start from the vision document. From vision to ambitions, from project objectives to basic principles, to indicators for both selection and award criteria and for the output specifications. The tender was based on functional specifications that do not prescribe the solution, but the requirements to be met by the building. This allowed suitable candidates with different building systems (and variants within a building system) to tender for the contract. By also applying a maximum budget, the focus of the tenders was shifted from lowest price to quality and innovative solutions.

The output specifications of the LL KU Leuven were based on using the SRI criteria tool ([www.mvicriterial.nl](http://www.mvicriterial.nl)). This is an online tool that allows for selecting on suitability requirements, selection criteria, requirements, award criteria and contract provisions.

Examples of CBC performance requirements:

**Circular use of materials:** “At least 20% of the volume of new materials to be brought in must be materials originating from refurbishment, remanufacturing or reuse.”

**Bio-based materials use:** “At least 75% of the volume of materials used should be bio-based.”

**Demountability:** “The building should be fully demountable and remountable. A mock-up should prove that it is remountable. The entire building must achieve a minimum score of 0.7, according to the Measuring Methodology Demountability of Circular Buildings.”

Process requirements are also included. For example in the area of cooperation and knowledge sharing:

**Enterprising & inquisitive collaboration:** ...“The aim of collaboration is to create both short-term and long-term added value. We work towards appropriate and working solutions for an identified improvement and/or development challenge. In this case, research design means ‘creating multiple designs/prototyping based on the content of the themes and the way these are interconnected’. The process can be experimental, exploratory and reflective. Work sessions are methodically and thoroughly prepared by the contractor with regard to the required work format and content. This requires a creative, open, enabling style of organising and managing.”

Examples of output specifications from the tender Structure & Shell Living Lab KU Leuven

Both tenders, one for the structure and shell, the other for the technical installations, were put on the market at the same time. The procedure included a mandatory webinar. One of its purposes was for candidates to meet potential cooperation partners. Because of the digital character, this did not turn out well. Some parties sought contact with other attendees of the webinars, but those collaborations did not materialise. The consortium Vanhout NV - BeSteel BVBA was awarded the contract for the structure and shell, and the consortium TM Vanhout and Comtis Energy for the technical equipment as plug-in module.

Reflecting on the tender process/model, the key learning points are:

- **Internal stakeholders around the table at an early stage.** For KU Leuven’s purchasing department and legal specialist, a construction team, a Design & Build and lease construction were innovative. If the stakeholders had been at the table together at the start, the project manager and the CBCI team could have provided information. Ideally, the most appropriate form of cooperation and contract would have been reached at a much earlier stage in the process in a workshop-like setting, also bringing in the expertise of the procurement and legal departments.
- **Include your own organisation in new forms of cooperation and the associated (innovative) contracts/tender documents.** In line with the above, we recommend devoting more time to involving the internal organisation when deviating from standard practices. At KU Leuven, tenders are normally awarded on the basis of technical specifications. The internal organisation needs to be ready for a different mindset and dare to deviate from the traditional way of tendering. This means the willingness to change is important. This time, we have experienced a division: the research group Building Physics and Sustainable Building of KU Leuven as knowledge partner on the one hand, with an interest to innovate and test, and the procurement office as the client on the other hand, with an interest to have the optimal legal tender with the lowest possible risks.
- **Market research:** Market orientation and consultation is very important. How do you make sure that the right party finds your request? For the Living Lab in Ghent, market consultations were held for the purpose of sending out tenders. This was guided by a feasibility study by the technical partners in the project. A scope of appropriate construction methods was defined that were in line with the project ambitions (demountable, circular, bio-based, affordable) without being restrictive. This narrowed down the scope and allowed for more focused market research. Market players were asked about their experiences in reuse of materials, demountable construction, bio-based material use, PaaS models and their offerings. Available networks of project partners and customary public channels (publications and company websites) were used.

In hindsight, the KU Leuven team would have asked more questions about feasibility and would have set up the question

from the perspective of the market players; asking about the risks that market players see in the project and how they would mitigate these.

- **Time:** Time is needed for experimentation or innovation, especially at the front end. In a D&B contract, for example, output specifications are very important when it comes to guaranteeing quality on delivery. But the tenderers also needed extra time to read up on the material and understand what was expected of them. That extra time can be generated in different ways and with different goals. If potential bidders are aware of the overall content of the project before the publication of the tender, they can already select their team members. More time to submit (LL specific, 21 calendar days mandatory, extended to one month) allows for compiling the tender file, which is not exactly ‘off the shelf’, and to get the right partners on board.
- **Dialogue:** Engaging in dialogue with tenderers during the tender process is crucial. Due to the method of tendering, this is more of an open question. This is why it is important to clarify this question during information sessions before the submission, in order to ensure that the tenders remain equivalent and comparable. The same clarification and adjustment can also take place in the period between submission and award, taking care to avoid cherry-picking.

Obstacles / concerns / recommendations:

- In the Flemish context, the Belgian regulations require the bidders to be accredited. Compliance with this accreditation requirement is time-consuming for foreign companies. As a result, a number of interesting Dutch parties were unable to submit a tender in this specific case. This regulation seems to be at odds with case law on cross-border interest and innovation in tendering works.
- Making demounting part of contract: With the LL, we would have liked a buy-back of at least a demounting option in the contract, for example Design, Build and Remove. The subsidy conditions were an impediment to buy-back because the contracts with non-project partners also had to be settled at the end of the CBCI research project.
- Chain cooperation: A contractor who is selected often buys from a party they have known for a long time. It is still a question of how to deal with a relevant order size for circular solutions, so that it also becomes interesting for the smaller companies. Now it often depends on the network of contractors or the architect. The market is now approached as a catch-all term. A lot of innovation is done by sub-contractors and suppliers. It is important to enter into chain cooperation, even if it is still a question of how. We were confronted with this problem particularly with the plug-in tender. There are interesting circular systems in the market. But they were too small to take on the broad task alone and could not find partners to be able to submit a bid. These concern, for example, a bathroom or a focus on ventilation, or solar panels, etc., to be involved in a combination in one tender. The consortium TM Vanhout and Comtis Energy that won the tender for the plug-in was able to distinguish itself in this respect. It brought together different partners who had already worked together in the past, each with their own expertise, to jointly deliver the required competencies.

Learning points from interested parties who were not awarded the work:

- A number of parties indicated that they felt that “what was asked in the tender” was not in proportion to the size of the contract. This mainly concerned the development costs in relation to open knowledge sharing. This is understandable when the task is seen as one building. The objective of the LL and the opportunities of collaborative research and prototyping extend beyond a single building and should be the foundation for upscaling.
- The preference for the structure and shell was a construction team rather than a Design & Build. D&B was nevertheless chosen. In the case of the construction team formula, two tendering procedures would have been necessary. This would not have been conducive to continuity between the research, optimisation and realisation processes.
- A number of parties also experienced a ‘lopsidedness’ in the contract (such as penalty clauses, copyrights, many points fixed). This arose from the use of standards to which the purchasing department wanted to adhere. As a result, a limited willingness of the client to assume risk was contractually established.

## Practical experience Living Lab KU Leuven

A common rule in project planning is “well begun is half done”. When the planning phase has not received enough attention, the chances of success decrease. Not surprisingly, this is even more applicable to circular building projects. These are relatively new to the sector and due to this novelty, coupled with the often-increased complexity, require even more preparatory planning. This ensures that the project objectives can be managed during the realisation of the project.

Preparations must be made both before and after a project is awarded. First and foremost, the project objectives must be very clear. This enables the contractors to endorse them and take them into account during the realisation phase. The tender documents should already contain the conditions for a correct start and maintaining cooperation. The same applies to quality assurance tools and monitoring mechanisms.

To make it more specific, the following could be included in the tender documents:

- the background of the project, how the need for the project arose;
- the objectives of the project;
- a clause on cooperation and knowledge sharing. The expected attitude in this respect can be explained in the tender documents;
- BIM vision document;
- information on monitoring mechanisms; number or frequency of meetings, logbooks, etc.
- list of instruments that clarify how quality assurance will be assessed in qualitative and quantitative terms in respect of project delivery.

If the project is awarded, the principle of “well begun is half done” still applies. Preparations made before the award should be actively pursued. In the case of the CBCI Living Lab of the KU Leuven, a so-called kick-off meeting was organised. The stakeholders of the project were brought together to go through the content and objectives of the project. The project itself is what the stakeholders have in common. At the same time, the project fits within the context and activities of each individual partner. Presenting and explaining these contexts provides mutual understanding of individual goals and project interests, an understanding of the size and competencies of the group, and a concept of the individual share and role of the stakeholders in relation to the whole project.

In addition to this general session at project level, more detailed sessions can be organised. For the Living Lab of the KU Leuven, two brainstorming sessions were presented that were more focused on content. First of all, the action plan was discussed and validated with the project partners by means of a so-called process map. This established the organisational path to results, which is necessary because of the functional specification and performance requirements from the tender. In terms of content, the team identified the challenges relating to realisation of the output specification.

### Morphological chart

This is a visual way of defining the necessary product functionalities (in the case of the CIRCULAR AND BIO-BASED CONSTRUCTION Living Lab: building components and building method criteria) and exploring alternative means and combinations to achieve that functionality (see table). For each element of the product functionality, there may be a number of possible solutions. For each solution, the benefits and disadvantages can be documented. In this way, final decisions are clearly argued and documented.

Table: the morphological chart

	Solution 1	Solution 2	Solution X
Functionality/outputspec/component 1			
Pros.			
Cons.			
Functionality/outputspec/component 2			
Pros.			
Cons.			

### Decision making chart

This tool can be seen as an extra layer in addition to the morphological map. Final solutions are highlighted and the decision for a particular solution is argued in an additional column.

### Multiple criteria assessment tools, e.g. the Demountability Index from Alba Concepts or LCA

Existing (circularity) assessment instruments can be listed in the tender as instruments to be used. The expected level of performance should also be stated. The tools can be used during the project to check whether the goals are being achieved and as a guideline if adjustments are required. They can also be used as proof of commissioning.

### The integration of BIM

BIM can ensure the cohesion of the tools and information used. For example, by integrating demountability index, LCA, material properties, etc., non-obvious conflicts are avoided and information transfer over time is made possible.



## Appendix 2 Emergis Living Lab

Our Emergis Living Lab concerns an extension of an adult ambulatory centre of the GGZ clinic of the healthcare organisation Emergis in Kloetinge, Zeeland. The project is divided into two parts. This consists of specification section A (the renovation/new construction of the existing part) and specification section B (the new construction of bio-based, circular and demountable units).

The goal of this Living Lab is circular renovation with bio-based materials and to accommodate clients in as natural an environment as possible. There will be a dedicated entrance; the facade and the roof will be renovated; and the portacabins - which have been there for more than twenty years - will be replaced by new buildings. Based on current trends in the mental health industry, the centre calls for a more permanent solution. Moreover, the building and the units are outdated, not energy efficient or sustainable enough, noisy, and the centre does not have its own entrance. In short, it is time to renovate and replace.

The starting point for the new building was to create linkable units that can be used for different functions, can be replaced as easily as possible and can be produced industrially, making use of bio-based materials as much as possible. On an organisational level, it is important for Emergis as a healthcare institution to be able to use the existing and new real estate with flexibility - both relating to functionality and availability - with an improvement in quality compared to the current real estate. Core business for Emergis is to organise optimal care for its clients. The daily dynamics and complexity of healthcare are at odds with the long-term organisation for circular and bio-based real estate. Emergis is still in the process of developing a (scalable) circular and bio-based real estate strategy.

In organising the tender, the phase of real estate development naturally played a role, as well as the fact that - according to the Public Procurement Act 2012 - Emergis is not a contracting authority. Because of the latter aspect, the principles of Public Procurement law were not applied to the Emergis Living Lab.

Because of the daily dynamics of real estate in the phase of real estate development, it was necessary for Emergis to think about the interpretation of the client role. Eventually, the choice was to delegate the client role, fulfilled by Jeras. The advantages of this choice are that Jeras has more knowledge of the market and can take a more independent position than Emergis. Additionally, Jeras has more knowledge of and experience with projects of this complexity and scale. In reflection, however, there are also drawbacks. Jeras has an assignment on a project basis. This makes it more difficult to work on the strategic level - the real estate strategy - and the link to the follow-up of the Living Lab.

The organisation of the project can be represented as follows. Within Emergis, a consultation structure has been set up. A steering committee is linked to a project group for implementation based on ambition, starting points and tender documents. The project group includes Jeras and the contractor to be selected, and if necessary other external parties. The project group provides regular feedback to the steering committee on planning and finance. The steering group also oversees the incorporation and embedding of ambitions for circular and bio-based construction. Emergis also ensures sufficient internal support by involving the user, management and maintenance department.

### Preparation

In order to complete the renovation and partial new construction by the end of 2021, Emergis started the necessary preparations in 2019. The first step was to define the initial requirements and contours of the plan. This was based on collecting the various preferences and starting points within the project group and (future) users of the building. This became the basis for the first schedule of requirements.

### Selection process architect

Emergis usually uses the services of two architects (Rothuizen and Architecten Alliantie). Since Rothuizen built the children's and youth clinic with a circular character, the other party was chosen for this project (and to generate more awareness and spread within Zeeland). The relevant architect has successfully completed several bio-based projects in the past, and this gives confidence to continue with this party.

The starting points for Emergis were discussed with the architect at the time of the assignment. A central theme were the possible usage scenarios, opportunities for upscaling and possibilities for different ownership. The starting points were eventually translated into an aesthetic and functional design. Preconditions for circular bio-based construction and bio-based materialisation were incorporated in the design. Functional changes are designed globally, with the sanitary / pantry unit as the main input. However, during the implementation, there was not enough time available at the Architecten Alliantie. This is a learning point with regard to the briefing in advance: further inquiries relating to available (research) time in relation to the total assignment. This meant that the role of the architect in the follow-up process was very limited. The basis/briefing for the translation became more important with regard to the selection of and follow-up process with the realisation party/parties.

The preliminary design with a functional description/specification was used as the basis for the request for proposal. In order to focus more on the end result, a number of components, such as the exterior and energy concept, have been further specified. Put together, the result is a reference design. This includes layout options, movability of the units, demountability, an image of the facade details and finish, and options for bio-based materials. The units are presented as three interconnected and movable units, the middle one being adaptable to a sanitary / pantry unit.

Tom Kretschmann:

*“The request within this Living Lab asks the parties to develop in an experimental, explosive and reflective way. Unlike a traditional call for tenders, this one is aimed not only at the available technical expertise but also at the competencies required to facilitate enterprising collaboration. This means that with the input of the available knowledge and skills of the parties involved, working solutions are specified for an identified improvement or development issue. The process is aimed at developing/facilitating a design research approach to enable multiple designs/scenarios within certain frameworks, based on substantive themes and their cohesion.”*

The primary objective of the reference design was to expand the possibilities of using the realisation and production knowledge of market parties in the further specification of the project.

### Market consultation and shortlisting

After developing the reference design and functional description, preparations were started for the market orientation. The project group made a shortlist of contractors based on past experiences, location of the contractor, experience with circular / bio-based building and prefabrication of building processes - supplemented with generally available information. In addition, the following aspects were further explored and inquired in order to better identify the specific (business) competences through their relationship with the CBCI project: business strategy in knowledge sharing, collaboration method (with more entrepreneurial risk, more exploratory than transactional) and business culture (not only management but also other employees are competent and motivated).

The main aim of the market consultation was to use interviews in order to assess whether the relevant companies were motivated and suitable to take part in this tender. This type of tender and the additional process criteria that play a role in the circular and bio-based approach are complex. This requires more research and substantiation from contractors in advance, compared to traditional projects. This necessary extra research time, even in the preliminary phase, was a reason for some of the invited parties not to participate.

The market consultation resulted in a shortlist with a mix of ‘traditional’ contractors for the complete renovation and new build, and ‘prefab’ contractors for the new build. These contractors received tender documents and were asked to bid. By choosing a mix of ‘prefab’ and more ‘traditional’ contractors, the project group wanted to ensure a level of flexibility for the next steps within the tender process.

### Basic tendering and contracting

In addition to the reference design/functional specification, a set of specifications was drawn up as a basis for the tender. These specifications consist of two parts, A and B.

Izhar van Eenennaam:

*“The danger when you’re in the middle of tendering is that everything seems to be self-evident. It helps to talk about it with experts. It makes you start looking at it in a different way, and I realised that it’s not self-evident. We are researching this and reviewing how we can apply circularity and bio-based as much as possible appropriately within this industry.”*

Specification section A concerns the renovation/new construction of the existing part. It consists of the treatment rooms for people with mental problems. A treatment room in this case is actually an office space set up as a consulting room with a desk and a chair etc. For specification section A, the focus is mainly on the reuse of materials from the former RWS building, rather than on circular and bio-based or industrial.

Specification section B concerns the new construction of bio-based, circular and demountable units. The focus here is on making the new part of the building as bio-based as possible. These units allow for future changes in use and location. This part of the contract will be realised on the basis of a performance contract in accordance with the STABU system.

In addition to the technical specification documents, the tender documents also contain a manual describing the process criteria.

The requests for tenders set out that Emergis participates in a European subsidy scheme, and as a result, choices before, during and after construction with respect to material use must be justified and recorded in writing. As a result, the tenderer must supply a materials passport, a document with substantiation of the products and services to be delivered, and a demolition file (only for tender section A). In addition to this written record, the quality aspects were requested on the basis of an action plan, circularity, assembly/demounting plan and presentation.

In order to motivate the selected contractors to put sufficient effort into their offer, the project group decided to reward them for a complete tender by means of a calculation fee. This compensation has been well received by the market.

#### **Tendering process and contract**

After publication of the tender, it became clear that the six selected parties needed more time. This is why the registration period was extended for all parties to give contractors additional time to prepare their bids. However, despite the extra time, many contractors dropped out due to lack of time with deadlines and/or capacity problems with the proposed construction schedule. However, within the overall planning for Emergis and CBCI, less time was then available for the research part of the project.

In the end, two applications were received, one of which was a valid application. The second company - a prefabricated builder - indicated that it would supply the necessary information (the action plan) subsequently, but this was ultimately not submitted. The exact reason for non-submission is not (yet) known.

The evaluation of the tender was conducted internally by Jeras and the steering committee on the basis of whether the action plan supplied met the fundamental requirements of the tender documents. During the negotiation phase, proposed changes, based on functionalities, were honoured. The proposed changes included: improved functional flexibility, the elimination of a canopy, and the construction of the corridor and detached units.

The contract was awarded to Bouwbedrijf Meliskerke. The interpretation of the main ambitions of the Ambulatory Centre, the proposed changes and the experience with bio-based and circular elements were important here. In addition, Meliskerke is a local player, and they have local connections in the region.

The agreement between Emergis and Bouwbedrijf Meliskerke concerns a derivative of a building team agreement with a final design for a fixed price. (adapted building team agreement with contracting agreement and UAV GC - Check Izhar)  
Part of it is described in a functional or performance-based way. The contract was specified where considered necessary to guide the contractor in a certain direction, with starting points that are important for the users of Emergis and the CBCI-project. Particularly because of the European subsidy rules, it is important that Jeras, as the delegated client in the construction team during specification, is able to influence certain choices.

For the monitoring of the whole process, two methods were introduced besides the work sessions, also at LL KU Leuven: the CBCI Logbook (to be used by the project leader) and the CBCI Decision Matrix/Morphological Chart (to be used by the construction team). The CBCI logbook is a tool for the project manager but is not regularly 'filled in'. Rather, it uses its own minutes, and the project manager uses the logbook format (correlation changing roles, stage of development and failure/success factors and key components/ methods) as a general analysis tool. The CBCI decision matrix is more concrete and user-friendly to capture the key issues, variants, considerations and decisions.

#### **Reflection**

Reflection on the tendering process / Framework - lessons learned

- **Internal organisation**

Such an innovative route - bio-based, circular and industrial - requires a lot of ambition, management power and commitment within the internal organisation. This is at odds with the core business and dynamics and complexity of healthcare. Staff turnover in management positions, staffing levels of and time of real estate and facility management have an extra impact on the success project. In this sense, the Living Lab helps build up insight and incorporate it in a long-term circular real estate strategy.

- **Preliminary project / request for an architect**

Prior to selection of the architect, it is important to determine the starting points and ambitions with the internal project team. In retrospect, more attention could have been paid to the internal ambitions in this project.

For this reason, it was also difficult to test whether the ambitions of the architect corresponded to the CBCI project and thus to properly define the briefing and the role of the architect. This also influenced what the architect was able to contribute in terms of alternative scenarios, details and healing environment.

- **Market orientation**

The market orientation was experienced as a success! A good way to gauge how the market works, which local players are available, and how contractors view the project. In retrospect, the question as to why the parties are motivated to tender could have been asked in more detail. The challenge is to test the willingness to develop / motivation of a company (from director to employees). In addition, a market orientation in the selection of the architect could also have added value.

- **Contract**

The architect was appointed first and then separately the contractor. Looking back, a Design & Construct contract would have been more appropriate, given the task and the CBCI project. This would have covered the design and realisation in a single contract, with both the architect and the contractor, with a more optimal collaboration and development. It is also important to allow sufficient time for the parties to prepare for the tender and the specification in the contract phase. Some of the potential candidates indicated that they did not have enough time.

- **Current market/market developments**

Last quarter, the prices of wood and other materials have risen enormously. The market is uncertain about supplies, due to a huge global and national demand at global. This shows that the system of supply and demand is important in relation to the method of (circular) development (do nothing / reconsider, reduce, reuse, demounting / repair, recycle) and management (material passport, material banks).

## Appendix 3 The economic viability of circular bio-based construction: The perspective of a UK retail client

A client organisation can be very open to using new and innovative products; however, the organisation also needs to include economic viability in the decision-making process. Retail organisations are ultimately judged on the experience and availability provided to the customer.

A building system or a particular building material can only be considered truly sustainable if it is economically sustainable in addition to its environmental and social benefits. In an ambitious, bio-based circular building project, there is a need for “project champions” who can deliver the sustainability objectives for the business.

Finance and economics play a role during the tender process when deciding material types for use. The client needs to manage the project from an economic, environmental and social perspective. External market conditions can also affect the economic sustainability of an organisation and the planning of their construction projects. Over the past decade, major global events such as the economic downturn (or ‘credit crunch’) and the challenges posed by the global COVID-19 pandemic can complicate the commitment to bio-based projects.

## Appendix 4 Practical examples

### Vilogia - Less materials - more recycling

**Function:** Private social housing corporation

The French private housing company Vilogia, which operates in northern France among other places, offers a full range of adapted housing for low-income workers in major employment areas. In addition to their mission of social benefit, Vilogia is strongly committed to innovation to provide more and better housing, with less expenses. In their tenders for major renovation projects, they try to encourage bidders to reduce material consumption and use materials consciously. Materials from the (partial) demolition of buildings can be revalorised. By placing the responsibility of the materials on the demolition contractor or the contractor who disassembles the building, they will make a greater effort to repurpose or recycle and sell the materials. This generates additional income, enabling them to tender for the demounting or demolition of buildings at a lower price. This ensures that they are very competitive during a tendering process, which can be classed as a win-win situation. On the one hand, it achieves the ambition to incur lower material waste; on the other hand, the bidder tenders at a lower price but can still generate sufficient income.

### Wiegelied (Lullaby): Modern childcare in a healthy environment realised in record time

**Use of building:** Childcare

**Focus:** Ecological indoor climate

**Collaboration basis:** Design & Build

**Year of completion:** 2019

The childcare facility finished in 2019 was completed in a record-breaking nine months. There was a need for more space for the nursery, eventually a new building, which had to be realised on a prearranged date. Based on the desire to create an indoor climate as sustainable and healthy as possible, ecology was an important consideration in the design and construction of the childcare centre. Lime hemp, straw and CLT have been used and these provide a good and healthy indoor climate.

Prior to specifying the tender documents, several reference projects were visited, including material suppliers. In addition, a thorough analysis was made of stakeholder needs for the use of the building, and this was incorporated into the design. The standards and obligations that a childcare centre must meet have also been agreed with Kind en Gezin (Child and Family) and the fire brigade. The stakeholders involved, including the local residents, were kept informed of progress throughout the project. This has resulted in very little resistance.

The initiative to include bio-ecological materials (straw bales) in the call for tenders came directly from the municipal councillor responsible for childcare and energy. The tender and the process were outsourced to Farys (intermunicipal company), using a Design & Build formula in order to meet the deadline. A project manager was appointed. Subsequently, through nomination, it was reviewed whether the bio-based and circular ambitions could be met. The candidate was selected based on two forms of selection. The first was the selection relating to the personal qualities of the contractor, and the second was the award, which relates to the subject matter of the contract.

Fully in line with the philosophy of the circular ambitions, BAST architects was selected. BAST consciously focuses on social and bio-ecological projects. In order to meet the tight schedule, namely realising the childcare centre within nine months, a construction team was selected so that the architect and contractor could be appointed in one step. From the initial design phase, the architect and contractor formed a construction team. A construction team was developed, and this led to smooth cooperation between the building owner, architect and contractors.



### Triodos Bank - as many bio-based materials as possible with the longest possible lifespan

**Use of building:** Office building

**Focus:** Demountable wooden building

**Collaboration basis:** Engineer & Build

**Year of completion:** 2019

Triodos is a bank with a high sustainability profile, and the building fits seamlessly into this vision. The stabilising core of the building consists of a unique, durable wooden construction. The building is remountable and modular and made of sustainable and reused materials. Because the building is remountable, it can be demounted at the end of its life, after which the parts and materials can be reused.

Furthermore, the building is energy-neutral thanks to the application of heat and cold storage and the use of solar panels. The green roofs on the office have an insulating and cooling effect and are also insect friendly. The roofs collect rainwater. This is put to good use, for example for flushing toilets or watering the estate. The tables in the meeting rooms are made of trees from the estate.

The project has a gross floor area of approximately 12,500 m<sup>2</sup>, divided among three towers (floors 2, 3 and 5) that are connected by floors on the ground floor and first floor. The stabilising core of the building consists of a unique, durable wooden construction. The self-supporting glass facade is connected to the wooden floor construction by means of a steel construction. A basement has been created under the building to accommodate technical and facility rooms. The partially covered car park on the estate provides space for over 3,000 m<sup>2</sup> of solar panels and 120 'smart' charging stations that can supply power to the entire office.

With a wooden support structure, refurbishment of all existing workplaces and circular carpets, Triodos contributes to its sustainable mission.

Quote Sander Kok, project manager construction company J.P. van Eesteren

*“The architect had the same goal, namely sustainable construction.  
The fact that we had the same goal in mind was the strength of working  
together.”*

### Adnams brewery: distribution centre

**Use of building:** Distribution centre brewery Adnams

**Focus:** Bio-based construction

**Cooperation:** Architectural firm,  
traditional contract with direct management and control remaining with Adnams brewery

**Year of completion:** 2006

Adnams is a sustainable company that considers how it can minimise its impact on the environment, respect the natural beauty of the surrounding city and surroundings, and stimulate the local economy. Because of the heavy freight traffic through the old coastal town of Southwold, the decision was to locate the distribution company outside the town. A specification was prepared for the architect, setting out that this should be a building with the lowest possible impact, using bio-based materials.

The new building is built seven metres down in unused gravel pits- this provides some thermal stability as there are earth mounds around it.

Work has been carried out in collaboration with the University of Bath on the thermal properties of hemp blocks, as well as on the laminated beams and wefts of the sedum roof. For the hemp concrete, attempts were made to set up a local production process, but this was not successful. An industrial process was eventually organised elsewhere for this purpose.

The hemp was grown in East Anglia. It is a very flexible and fast-growing material and can be used for all sorts of things. Its use in construction was a real milestone. A key factor in the use of the material is the desire to maintain conditions in the building and reduce fluctuations in temperature and relative humidity. This was very important in connection with the storage of cask beer. This is a living product that reacts badly to changes in temperature (yeasts). Experience says that the ambient temperature should be maintained between 13 and 16 degrees throughout the year. The bio-based material performs as hoped. The building is also built with a lot of glass on one side. This allows employees working in office functions to make maximum use of daylight and solar gains to keep their part of the building warm.

The glulam beams came from sustainable sources in Scandinavia. These beams were huge and were delivered to the UK with some difficulty.

In addition to the environmental benefits through annual savings in operating costs, there is also an economic benefit to the business in that the initial equipment cost is more than recouped in the long run, especially on energy costs.

The East Anglia region is very dry. It is the lowest lying, driest and warmest part of the UK. The water reclamation system therefore needs more water. It is possible to collect water from the sedum roof (at the time the largest in the UK) and cascade it to three levels of a reed bed, filtering it. The indication is that after completing this filtration process, it is drinkable water. Subsequently, it is returned to the building to be used. The water is also used to wash the trucks and flush the toilets in the building. Water conservation was a very important part of the vision, because the company is part of the great East Anglian plain.

## Project partners



[www.interreg2seas.eu/nl/cbc\\_i](http://www.interreg2seas.eu/nl/cbc_i)

[www.interreg2seas.eu/nl](http://www.interreg2seas.eu/nl)



[www.agrodome.nl](http://www.agrodome.nl)



[www.avans.nl](http://www.avans.nl)



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[www.kampc.be](http://www.kampc.be)



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[www.zeeland.nl](http://www.zeeland.nl)



[www.bath.ac.uk](http://www.bath.ac.uk)



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