



THE INNOVATION BARN:

Charlotte's Living Lab for the Circular Economy

COLOFON

AUTHORS:

Eva Gladek (*Metabolic*)
Fanny Thibault (*Metabolic*)
Liz Corbin (*Metabolic*)

RESEARCH TEAM:

Eva Gladek (*Metabolic*)
Fanny Thibault (*Metabolic*)
Liz Corbin (*Metabolic*)

GRAPHIC DESIGN:

Cassie Bjorck (*Metabolic*)
Marta Sierra García (*Metabolic*)

PROJECT MANAGEMENT:

Fanny Thibault (*Metabolic*)
Amy Aussieker, (*Envision Charlotte*)

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INTRODUCTION

CIRCULAR CHARLOTTE

Charlotte is committed to becoming the first circular city in the United States. The circular economy – a new economic system that is regenerative and waste-free by design – is not only an opportunity to eliminate negative environmental impacts and create new sources of value, but also to bridge the wealth divide and create new pathways for upward mobility in Charlotte.

As described in the recently launched Circular Charlotte report, the development of the Innovation Barn is one of the first priorities in implementing the city's circular strategy. The Innovation Barn will showcase circular economy innovation by providing space for entrepreneurs to develop circular products, hosting events to promote circularity, and fostering design and technologies for circular resource management.

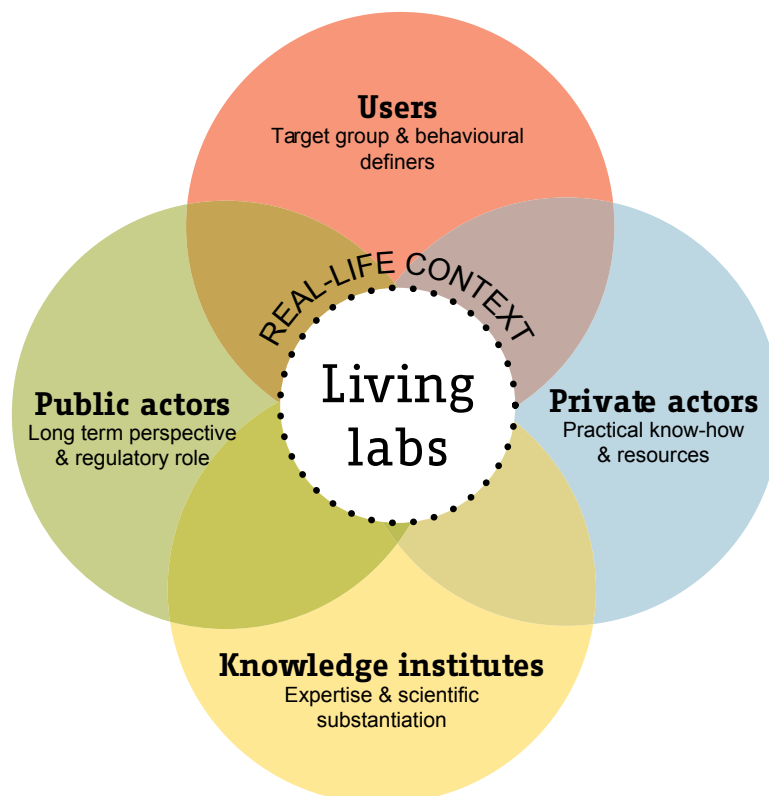
The circular economy is a new economic model in which resource usage and waste are minimized. This can be achieved through changing the design of products, business models, and supply chains in line with circular principles.

CHARLOTTE'S FIRST URBAN LIVING LAB FOR CIRCULARITY

Urban Living Labs are user-centered, open innovation ecosystems where new solutions are found to real-life (urban) issues (Amsterdam Institute of Metropolitan Solutions).

The Innovation Barn is set to become Charlotte's first Urban Living Lab for circular innovation and entrepreneurship.

Knowledge is produced through collaboration with stakeholders and can be used to upscale innovations across the city of Charlotte.



INNOVATION BARN: VISION

The Innovation Barn, the city's center for circular innovation, is one of the busiest places in the city. Its restaurant serves food from its greenhouse and garden, and its circular stores have a wide variety of upcycled products on offer. It is also a center for experimentation and education, home to specialized repair facilities and workshops on sustainable design and the potential of waste. New ideas, ranging from 3D printed plastic building bricks to leather made from fruit peels, are piloted at The Barn, and then scaled up in many other parts of the city. The Barn has also led to a completely different social dynamic than existed in the 2010s, when the main options for spending time with friends included drinking at a café or bar. People from all corners of the city come to the Barn to learn new skills, but also to socialize while repairing their own clothes or trading their old furniture for something new.



THE SEVEN PILLARS OF THE CIRCULAR ECONOMY EMBODIED BY THE BARN

HARDWARE. Circular Design, Construction, and Resource Flows



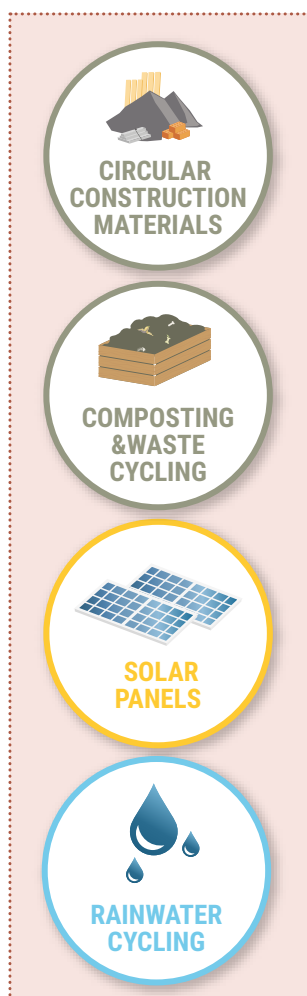
MATERIALS

Low impact and circular materials management in all phases of the building life cycle, from design to demolition.

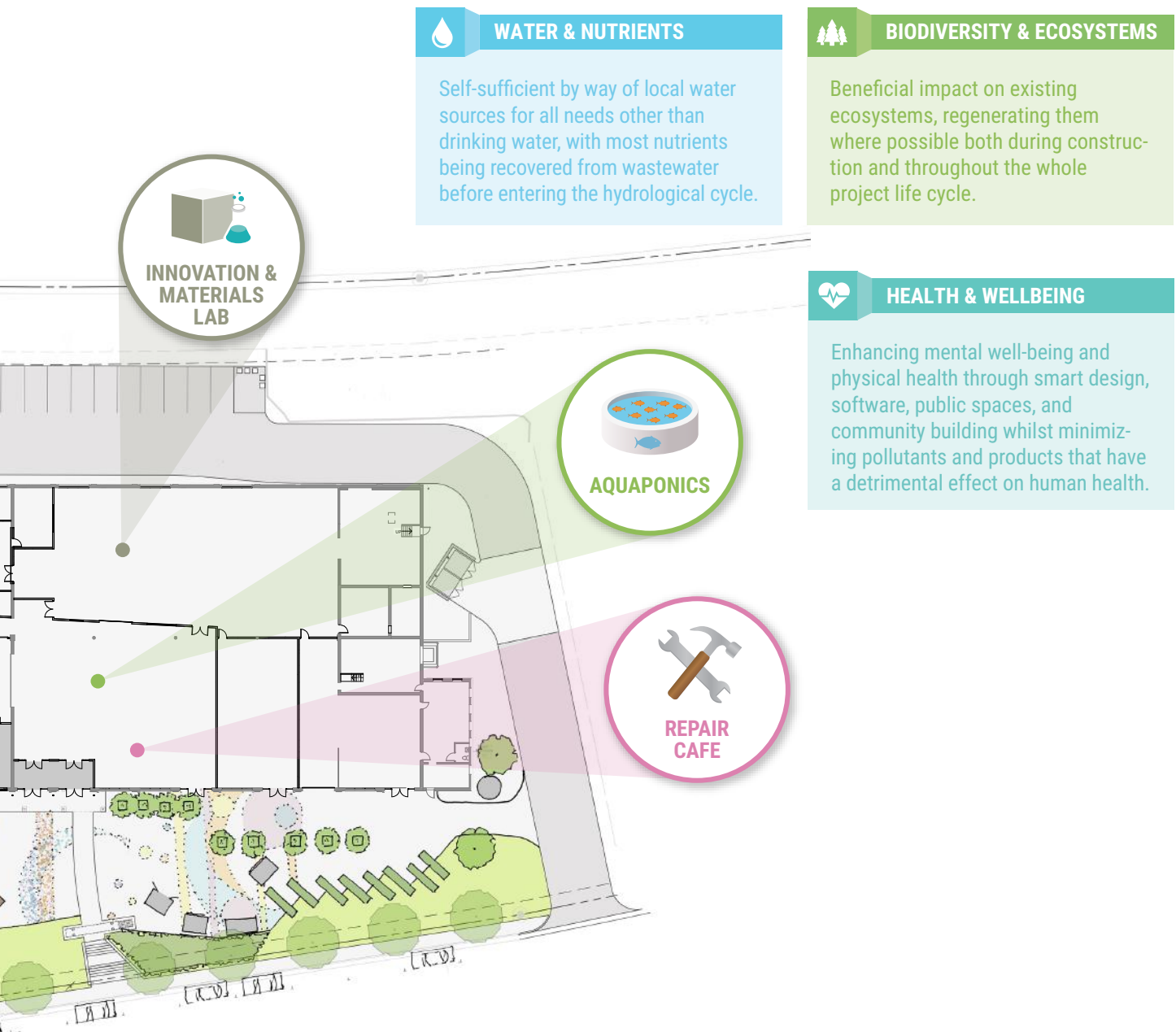


ENERGY

Fully renewable energy supply that is used as efficiently as possible, during both renovation and use phase.



The graphic above illustrates the Seven Pillars of the Circular Economy as defined by Metabolic, applied to the Barn: Energy, Materials, Water, Ecosystems & Biodiversity, Health & Wellbeing, Society & Culture, and Value Creation beyond Financial. These pillars are the foundation of the circular vision that the Barn embodies. To fully embody circularity, the Barn should yield good results across all of these areas rather than just a subset. The Barn will represent the seven pillars in two dimensions: through circular design, construction, and resource flows, and through its Circular Program of activities and events.



SOFTWARE. Circular Program: Activities and Events



SOCIETY & CULTURE

Represents the culture of the local community and promotes cohesion among all socioeconomic layers of Charlotte.



VALUE BEYOND FINANCIAL

Long-term economic value and non-financial value - aesthetic, emotional, ecological value - is maximized over short-term benefits, during both the design and use phase.

The vision for the Barn is of a cutting edge, sustainable building that fully embodies the Circular Charlotte strategy, both through circular “hardware” - its design, construction and resource flows - and “software” - the program of activities and events taking place within the building.

CIRCULAR DESIGN, CONSTRUCTION, AND RESOURCE FLOWS

A circular building is a building that is developed, used, and reused without unnecessary resource depletion, environmental pollution, or ecosystem degradation. It is constructed in an economically responsible way and contributes to the wellbeing of both people and the environment.

All of the building's materials can be deconstructed and reused at high value or safely returned to ecological cycles. The building's resource footprint during its use phase is minimized and all resulting materials can be reused at high value.

The building will uphold the highest standards of circular economy performance: it will be a zero-waste building, designed and retrofitted according to circular building principles:

- Design all products to be fully disassemblable and recyclable.
- Create the necessary business structures and incentives to get the components and materials in these products back into the economy at the highest possible value (preferably as whole products or components).
- Strive to use only sustainably-sourced, renewable resources for both energy and material provision.
- Avoid the use of toxic substances. If these must be used, take all precautions to prevent their further circulation in our environment.

Adhering to these design principles and sustainable design practices should result in a building that performs well on all Seven Pillars of the Circular Economy.

In addition, the activities will have various resource demands and produce other material streams (for example, organic waste from agricultural production) that should be handled in a circular manner. The Barn design will integrate a variety of technologies that facilitate the ability to close resource flows locally, showcasing best practices in the circular management of materials, energy, water, nutrients and biodiversity.

CIRCULAR PROGRAM: ACTIVITIES & EVENTS

The Innovation Barn will be home to a circular program that fosters momentum towards achieving the Circular Charlotte vision. The Barn will host a wide variety of activities and events that clearly translate the vision and establish its profile as a community space and showcase of locally closed resource flows.

The circular programming will:

- Provide space for mission-driven, innovative organizations and startups, that represent circular development and entrepreneurship.
- Serve as a community hub, activating participation from local communities and adapting to local needs.
- House circular, two-directional commerce, including food, arts, crafts & products, knowledge services, and resource recovery enterprises.
- Host activities, events and educational programs to promote circular thinking.
- Serve as a think tank for circular innovation.

The circular program cannot be realized without continuous stakeholder engagement and a dedicated community of people. The circular program will therefore always have to resonate with the demands and ambitions of stakeholders.

CIRCULAR PERFORMANCE GOALS



MATERIALS

The Innovation Barn employs low impact and circular material management in all phases of the building life cycle, from design to demolition.

Performance goals:

- The building is designed for flexibility and disassembly.
- All materials are “circular” meaning they are either recycled, sustainably sourced from renewable sources, or designed for longevity and reuse.
- All use phase materials are cycled on site.

How this could look:

The Barn is a place where all waste is considered as a new resource. Everyone at the Barn, employees as well as visitors, separate waste in at least five streams: organics, plastics, paper, glass, and metals.

Organic waste is composted and turned into a valuable fertilizer on the property. The loop is closed when fresh fruits and vegetables, grown from this fertilizer, are served in the restaurant.

Plastics are shredded and reused to 3D print all kinds of new products in CharM, the city’s newly-opened materials lab, a joint project of several of Charlotte’s incubators and accelerators.

The Barn is also known throughout Charlotte to be the place to bring textile and electronics at the end of their lifecycle. At the weekly repair workshops, citizens bring their old tablet back to life, or learn how its parts can still be used for another device.



ENERGY

The Barn has a fully renewable energy supply and energy is used as efficiently as possible (during both renovation and use phase).

Performance goals:

- The building will be retrofitted according to bioclimatic design principles to achieve minimal energy demand.
- 100% renewable electricity and heat supply, with a maximum quantity produced locally.

How this could look:

The gigantic roof surface of the Barn functions as a harvesting plot of its own fuel: PVT panels harvest both electricity and heat to provide solar energy for the entire building. In winter, the Barn taps into rest heat of the nearby data center, which would otherwise go to waste. Electricity that isn’t directly used is stored in batteries and in the electric vehicles that are charged on site.

Inside the building, energy use is minimized to such an extent that the Barn is proudly called the most energy-efficient retrofitted building of North Carolina.



WATER & NUTRIENTS

The Barn harvests rainwater and recovers wastewater and cycles it back for non-drinking purposes. This makes the Barn self-sufficient by way of local water sources for all needs other than drinking water, with most nutrients being recovered from wastewater before entering the hydrological cycle.

Performance goals:

- Maximum reduction of water demand through implementation of best practices and highest efficiency technologies.
- Maximise collection and use of rainwater or greywater for non-drinking water quality uses.
- Recover resources from wastewater (e.g. water, heat, nutrients, minerals, etc.).

How this could look:

The water cycle is almost entirely closed at the Barn, and valuable nutrients, that would otherwise end up in the sewer, are recovered. Rainwater is collected from the roof and stored at the spot to minimize demand from the grid, which is also an infiltration buffer in times of heavier precipitation. The harvested water is used to flush toilets, for washing, and for production in the materials lab. Only the remaining water demand is supplied by drinking water from the grid. Wastewater from the kitchen, sinks, and toilets is processed by the helophyte filter on the property.

After having a delicious, locally grown meal at the restaurant, the waitress tells customers that their leftovers do not simply end up in the bin, but are composted and used as a fertilizer for the restaurant gardens. In this way, their food waste is directly turned into food for their next dinner at the Barn.

**BIODIVERSITY & ECOSYSTEMS**

The Barn has a beneficial impact on existing ecosystems, regenerating them where possible both during construction and throughout the whole project life cycle.

Performance goals:

- Large variety of plants and incorporation of micro-ecosystems and habitat elements for insects, birds and small mammals into the building and exterior spaces.
- Selection of materials that have a minimum impact on biodiversity throughout their life cycle.

How this could look:

The Barn is not only a place where people gather, but also an attractive living space for flora and fauna. The helophyte filter provides habitat for amphibians, insects, and water birds. The garden is designed for resilience in times of climate change. The reed beds of the helophyte filter retain water in case of heavier rainfall, and shrubs and trees provide shade when temperatures peak. Swallows fly in and out of the nesting boxes installed in the walls and under the roof of the Barn.

**HEALTH & WELL-BEING**

The Barn enhances mental well-being and physical health through its smart design, software, public spaces, and community building whilst minimising pollutants and products that have a detrimental effect on human health.

Performance goals:

- Reduction of the amount of pollutants emitted to the environment during construction, use phase and demolition.
- Integration of mental and physical wellbeing measures into the design of the entire building by ensuring air quality, thermal comfort, visual comfort and acoustics.
- Provide access to, and space to grow healthy, nutritious food.

How this could look:

The building provides a healthy and comfortable environment for its employees and visitors.

The restaurant has set itself a personal mission: the managers want to reach self sufficiency in food production for all food types that can be feasibly produced on the plot itself or closeby.

Their team of growers cultivate a wide variety of fruits and vegetables in the garden and in the greenhouse.

Fresh herbs and leafy greens are grown year-round in the hydroponic system, the vertical garden in the restaurant.

As the ultimate example of circularity, coffee grounds from the cafe are directly used as a substrate for shiitake mushroom cultivation, which customers can also find on their plate throughout the year.



SOCIETY & CULTURE

The Barn represents the culture of the local community and promotes cohesion among all socioeconomic layers of Charlotte.

Through the activities and events, it promotes creation, gathering, connection, and engagement of the community. Skill development, training, and inclusive programs are taking place to lift up those who were economically disadvantaged.

The Barn makes use of appropriate governance and management models that reflect the needs of affected stakeholders.

How this could look:

Everyone can bring broken appliances to the repair workshops to bring them back to life, or to learn how their parts can be of other use.

In regular gardening sessions in the community garden, local kids, elderly and anyone interested can learn about the origin of their food in a fun, connective way.

Everyone involved in the Barn comes together for the yearly Barn Fest to celebrate the harvest season. The community feasts on the harvest from the gardens and the greenhouse, listens to live music, and takes workshops on sustainable living.

The circular ROAST matches startups to experienced professionals to lift their circular companies to a higher level. Startups pitch their concept and are sharply criticized by the crowd.

In order for the Barn to function as a community space for the neighbors, which is needed to guarantee the liveliness of the Barn, the Community Manager (CM) organizes activities that resonate with the demand of the neighborhood. The CM also makes sure that the office spaces in the Barn are rented out to parties whose practices are in line with the vision of Circular Charlotte.



VALUE BEYOND FINANCIAL

During the design as well as the use phase of the Barn, long-term economic value is maximized over short-term benefits. The space of the Barn is designed to avoid unnecessary costs and to bring multiple benefits, including non-financial value (aesthetic, emotional, ecological value) simultaneously.

Performance goals:

- Ensure long-term financial gains through energy, water and resource savings.
- Maximize resource sharing (materials, tools, and transport) to reduce individual purchasing.
- Installation of systems that allow for value recovery (of water, materials, energy).
- Purchase smartly, favouring products that generate sustainable value whilst also having a sound business model.



+31 (0) 203690977
info@metabolic.nl
www.metabolic.nl

Meteorenweg 280M
1035RN Amsterdam
The Netherlands