EU project C2C BIZZ
Summary of the project results from Bielefeld
CRADLE TO CRADLE BUSINESS
INNOVATION & IMPROVEMENT ZONES (C2C BIZZ)

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Summary of the project results from Bielefeld

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Business sites are at times a curse and a blessing: providing the jobs and business tax revenues that municipalities hunger for, along with the associated negative factors such as, among other things, land use, on which we only reluctantly enter into political debate. The Economic Development Corporation and Planning Department of the City of Bielefeld are looking for a way out of this dilemma and have therefore taken part in an EU project.

When environmental protection and improved quality of life are mentioned in Germany, it is often tied to climate policy. But climate change and the overuse of fossil fuels are not the only problems. There is also an excessive consumption of water, nature, soils and metals, which leads, in the medium term at the latest, to existential states of distress. And it increasingly involves products that have a short service life and thus, for example, over 100 million mobile phones fall into disuse somewhere in Germany, dusty and forgotten – or worse – they are simply thrown in the trash. These contain valuable metals such as gold, silver and rare earths. Devices that are no longer used may be broken down into their components, which can be reused again and flow back into the material. This is possible with mobile phones because of the different plastics, although not yet at 100 percent; but with other products it is feasible and why should there not be a goal of bringing all the products back into the recycling loop?

It is undeniable that excessive consumption of resources prevails and this does not even take into account global population growth. Emissions remain at a high level and emissions reductions are more often than not simply relocation to other areas. And even though some products are more economical in consumption, their manufacture is more energy intensive, and in the end they release even more greenhouse gases, not less, or they destroy part of a natural environment or consume rare metals.

This shows that climate change will not be solved by technical means alone, but the economy and consumers also need to change, and growth patterns must change with them. Growth does not need to be slower, just different. And it will not even reduce the balance of our quality of life. People increasingly
see their community as constituted of sharing and no longer constituted by property. A new mentality of a “Share Community” can be observed where production and consumption are brought together. This also means that synergy and flexibility are important factors.

Of the finite resources on the planet Earth, in particular our atmosphere, humanity can change little and can no longer wait for a convenient solution to climate change after two decades of climate negotiations. For a long time, talk of taking future generations into consideration was only a vague notion. Meanwhile, those who were children back then were born a long while ago and will live up to the last quarter of this century. They will have to bear the consequences of today’s decisions and today’s behaviour.

The EU has recognized this and thus funded a project in which eleven partners have made a start in investigating solutions for future business sites, business processes and growth based on the Cradle to Cradle® philosophy. The city of Bielefeld was one of the project partners. In terms of international cooperation, different aspects of the Cradle to Cradle® philosophy were studied and tested in order to design new model solutions for industrial areas and business planning.

City of Bielefeld  |  Head of Department for Urban Planning and Construction
Managing Director, WEGE Wirtschaftsentwicklungsgesellschaft Bielefeld mbH
Successful and sustainable local economic and urban development has been equated with a sufficient supply of business sites. If you look at the changing working and living conditions in our society, it is questionable whether the managed business site policies used in the past are still appropriate. The question is how business location requirements can be addressed to meet future challenges and which conditions must be created by a municipality in order to meet those requirements.

The city of Bielefeld and Wirtschaftsentwicklungsgesellschaft (Economic Development Corporation) Bielefeld WEGE mbH have examined this issue. By participating in the EU Interreg IV B “Cradle to Cradle Business Innovation & Improvement Zones (C2C BIZZ)” project, the possibility was opened to investigating, on the basis of a study, whether the integration of the innovative “Cradle to Cradle®” philosophy is possible within the requirements of urban land use planning.

This brochure reports on the project results obtained in Bielefeld in the form of a summary. Chapter 1 describes the overall project as well as the problem definition of the Project Group in Bielefeld. Chapter 2 explains the “Cradle to Cradle®” philosophy and its intersection with architecture/urban development. Chapter 3 deals with the possibilities for implementing the philosophy in urban land use planning and its transferability as a planning presentation in a structural plan. Examples of possible label criteria are listed.
The legal assessment of the implementation of the philosophy on business sites will be considered in Chapter 4. Chapter 5 deals with arguments for development of sustainable business sites in accordance with the C2C philosophy. The companies that were involved in the project in Bielefeld then explain their motivation to participate. Other C2C activities in Bielefeld and the surrounding area are then announced in a forecast.

It should be noted at this point that there are different ways of promoting and managing business sites. These can include informal planning tools for land-use planning, such as the establishment of a framework plan, urban design in the form of structural plans or (strategic) master plans, up to regulatory options within sales contracts. Each municipality must decide for itself which instrument is appropriate for implementation in individual cases. For the present study in Bielefeld, the project team decided on the preparation of a structural plan.

Detailed reports of commissioned external experts can be accessed on the Internet at www.bielefeld.de and www.wege-bielefeld.de.
In 2011, eleven partners from six northwest European countries agreed to examine the development of business sites on the basis of the “Cradle to Cradle®” philosophy in a joint project. The goal of the “Cradle to Cradle® Business Innovation & Improvement Zones (C2C BIZZ)” project was the creation of a concept with a future proof design for business sites. The project was funded by the European Union because of its transnational approach and the positive effects on the environment, society, economy, cities and regions. The findings should serve as important drivers of urban and regional development. They can be used as a basis for the development of prototype solutions and guidelines for the development of new business sites or to transform existing ones. In addition, it is hoped that the authorities responsible for regional planning and economic sites become aware of the issue and take the “Cradle to Cradle®” concept into consideration in the future planning of business sites.

The European Union is increasingly concerned with the transition to a more closed loop economy within its borders. The background is the fact that few resources are available within Europe and many valuable materials and raw materials end up as waste, which is lost beyond meaningful recovery. As worldwide demand and competition increases for finite and partly scarce resources, Europe can achieve economic and environmental gains from a better use of resources. Smart, sustainable and inclusive growth is being sought as part of the “Europe 2020®” strategy. A goal is to maintain the added value contained in products as long as possible within the closed loop economy. This requires a change over the entire value added chain. New ways should be
shown that demonstrate how the transition to a more closed loop economy is possible: from product design to new business and market models, from new ways of converting waste into a resource to new forms of consumer behaviour.

This is where the approach of the “Cradle to Cradle®” concept (C2C) can be used for the design of intelligent products, processes and systems. The C2C philosophy is based on three principles that go beyond the approach of sustainability:

- There is no waste; everything is reusable as in nature
- Use of renewable energy
- Development of diversity

The C2C BIZZ project intends to demonstrate whether the “Cradle to Cradle®” philosophy is applicable to business sites.
For this purpose, the project partners have worked together from the beginning of 2011 to the end of 2014 in the following C2C areas of work:

1. **Developing diversity:**
   In the future, C2C inspired business sites will be created that will contain diversity in all its forms. The site will be characterized by durability, flexibility and positive impact on the environment. Together, relevant concepts were developed during the project on both “greenfield” and on industrial wasteland pilot sites.

2. **Energy solutions:**
   The use of fossil fuels in business sites is to be terminated. In the future, power supply will be secured from renewable sources and will use local energy resources.

3. **Closed loops:**
   Together, the partners developed plans for business sites in which waste is no longer generated from the development, testing and evaluation of closed materials and waste loops.

4. **Transnational cooperation**
   The development and exchange of accumulated C2C knowledge on this topic took place in the context of transnational cooperation.

As a result, the project should develop financial, planning, entrepreneurial and technical tools for the planning, development and management of C2C inspired business sites. Companies and authorities were actively involved in the project in order to make them familiar with the advantages of C2C.

For information about the project, please visit www.c2cbizz.com and www.c2c-centre.com
1.2 THE C2C BIZZ PROJECT IN BIELEFELD

The focus of the Bielefeld activities in the C2C BIZZ project was in the topic of “diversity development” and “energy solutions” (see 1.1, numbers 1 and 2). It was not, in contrast to other project partners, on the implementation of concrete measures or investments in certain business sites. Rather, the project work in the Bielefeld studies was conducted in order to serve as a basis for future planning.

In order to best tackle the task, a project team was assembled from the topics of land use planning, economic development, transport planning, and climate protection as well as from local companies Goldbeck GmbH, Schüco International KG and Stadtwerke Bielefeld GmbH.

For task formulation, the following targets were defined by the Bielefeld Project Group:

“Given increasingly scarce resources, the use of raw materials and energy are issues that need more attention in the future. The construction sector is a particularly large playing field. The materials to be used in buildings are simultaneously to be viewed as resources that can be integrated into both biological and technical cycles.

It is important to create a framework for the utilization of these resources. Here, the municipality is in demand in the context of their binding land use planning. Resources for the future will be secured by ensuring corresponding provisions in the preparation of commercial land development plans.

In order to meet the objectives, the content of the planning principles should be developed so that it optimally reflects the “Cradle to Cradle®” philosophy. The findings are then transferred to planning a specific site. Finally, suggestions for C2C label criteria in business sites are developed from the knowledge gained.”
2.1 THE “CRADLE TO CRADLE®” PHILOSOPHY

“Cradle to Cradle®” – abbreviated C2C – is a philosophy and an expression of a new way of thinking of business activities in which, ideally, there is no more waste. It relates generally to the production and consumption of goods and their impact on people and the environment.

But in order to understand the C2C philosophy, it is necessary to first deal with our existing system.

Our current system is called “Cradle to Grave”. This expresses the fact that our products are sent either to a waste or a down cycling process after they are used.

Fig. 2: “Cradle to Grave” system, grafikbüro wilk, 11/2014
But even after a product has been downgraded in value ("down cycled"), it will eventually end up as waste and the existing garbage will continue to grow. The current strategy, therefore, is merely waste prevention. In order to keep the environmental impact as low as possible, it attempts to produce as little waste as possible. In the product area, "eco efficiency" is mentioned, where better results can be obtained through the consumption of fewer resources or negative environmental impacts can be decreased through the reduction of pollutants.

C2C reconceives this approach. The philosophy invites us think from the outset about how many lives a product or material may have. This results in a much more conscious handling of our dwindling resources. C2C involves the entire production cycle, from raw material extraction to recycling. The development of reusable materials is an essential element for the creation of cycles. Therefore, it's not about avoiding waste, but rather ensuring that the waste produced becomes the food for new products. The term for this is "eco effective". This, at any rate, is the original idea of the founders of this concept, Prof Dr Michael Braungart and William McDonough.

The idea is represented in two cycles in which the material flow circulates:

**Consumer goods**
Components of the biological cycle
In this closed loop, biodegradable products are collected, which represent a breeding ground for new natural resources.

**Durable Consumer Goods**
Components of the technical cycle
The technical nutrients circulate in closed systems while always maintaining the same level of quality.
This is the basic idea of the “Cradle to Cradle®” philosophy. Here, sustainability is understood as a minimum requirement. Besides the new way of thinking about the economic cycle, a “vision for the future of our economic activity” is established. In this vision of the future, the question is whether we must always “own” things. Since we are primarily users and not consumers of, for example, televisions, washing machines and cars, thought will be given as to whether, as an alternative, leasing of products or services should be considered.
Buildings use up significant resources both in the construction phase as well as in the management and operation phases. Somewhere between 40 and 50% of all global resources are consumed during the construction and alteration of buildings. The construction industry is responsible for about 60% of waste.

A solution can currently be seen in “sustainable building”. But even that is a construction method that is focused on “efficiency”. So here, too: the consumption of fewer resources and reduction of pollutants. The process of pollution and the shortage of raw materials are thus only slowed, but not stopped.

The approach to construction, in accordance with the C2C philosophy, is determined by the circulation of the material flows within the two cycles. During the construction of a building, the life cycle, as it is already considered in sustainable construction, must be expanded to include the reusability of the products.

However, this entails that, even during the planning phase, the reusability of building construction products and materials should be considered as to their reusability after the deconstruction phase.

Furthermore, the founders of the C2C philosophy, Prof Dr Michael Braungart and William McDonough, suggest the leasing of products or buildings. The materials used would then remain the property of the manufacturer and could be recycled as raw materials in the production cycle in the demolition phase. The manufacturer would therefore have interest in guaranteeing the highest possible quality for its products.

In commercial and industrial construction, Braungart and McDonough recommend that the service life of production facilities be determined as a specific number of years. A timeframe for production periods or the operating life of the machinery would then be conceivable. Construction and building services would be planned so that they are optionally dimensioned for this period. The entrepreneur would then lease the building only for the period in which he needs it for his production.

**Fig. 4: Sustainable building and C2C, grafikbüro wilk, 01/2015**
2.3 “CRADLE TO CRADLE®” IN BUSINESS SITES

The task facing the Bielefeld project group was to examine, in the context of a study, the transferability of the Cradle to Cradle® philosophy to a business site. As a result of the study, it was found that the implementation of C2C criteria cannot be directly transferred to an area using the same approach as for a product or a material. In order to obtain a C2C product certification, criteria are examined in areas such as environmental health and safety, recyclability, use of renewable energies, protection and improvement of water quality and responsibility and commitment in the social sphere. For the implementation of C2C criteria in a business site, the perception of a particular spatial area using different extents is required (total areas, buildings, space, infrastructure) and the different stages of development (project planning to operation) involving a variety of actors (policy, administration, companies, etc.).

2.4 PRINCIPLES OF A “CRADLE TO CRADLE®” INSPIRED BUSINESS SITE

In order to implement the C2C philosophy in a business site, new guidelines and principles must first be developed from the three basic C2C principles. Since C2C certification principles for a spatial area cannot be transferred directly from those used for products, the term “C2C inspired business site” is also used.

From the basic principles below, guidelines, principles and recommendations for action have been developed, which are shown in the diagram immediately following:

- There is no waste; everything is reusable as in nature
- Use of renewable energy
- Development of diversity
GUIDELINES AND PRINCIPLES IN BUSINESS SITES

C2C philosophy | C2C guidelines and principles | Description
--- | --- | ---
**Concept of a total area “in the cycle”** | In its structure, the business site is intended and developed as a park from the outset. For instance, the business site fits in, during the period of its existence, in a way that makes sense to the overall landscape and settlement structures, and provides the city, even after the expiry of its useful life, with spatially conscious, environmental and social value. Instead of a mono functional business site, a high quality, multi functional city component is developed, standing in relationship with its environment.

** Establishment of material loops for buildings, open space, infrastructure** | All building materials, open spaces and infrastructure should support the technical or biospherical cycle. Rain water, industrial water from the buildings, as well as wastewater from production, are collected, cleaned and returned to the biological cycle. All companies are committed to gathering and publishing their needs and excesses in terms of energy, heat, water and materials.

**“Sharing and borrowing” instead of “owning”** | Community facilities (warehouse, kindergarten, seminar rooms, mobility, etc.) are located in the centre of the business site and can be used by all companies. Funding will take place jointly.

**Formation of synergies through cooperation** | All material flows of the business site will be recorded and utilized under park management. Cooperation between the companies is promoted.

**Energy efficiency and use of renewable energy** | When setting up a development plan, framework conditions for the use of renewable energy are taken into account (orientation of the property, land use designation for renewable energy, etc.). An EnergiePLUS area is desired.

**Creation of design guidelines** | Specifying design guidelines that reflect the C2C philosophy results in an attractive urban quarter with a high quality of life and a pleasant working atmosphere.

**Integration of the business site with the surroundings** | This involves linking the adjacent landscape areas with the business site by local public infrastructure (cycling and walking access), creating a high performance connection to public transportation systems, and providing use of recreational activities for the public, open periods for the common areas, etc.

**Hybrid design and effective use of space** | Multiple uses and sharing of buildings, open spaces, infrastructure for more efficient use of space, creative diversity and innovation.

**Participatory development and operation of the area** | The area will obtain a park management that guarantees the involvement of all stakeholders from the planning phase to its use. This ensures that companies will be actively involved.

Fig.5: C2C guidelines and principles for business sites, grafikbüro wilk, 01/2015
3.1 STRUCTURE OF A “CRADLE TO CRADLE®” INSPIRED BUSINESS SITE

An important component in the framework development concept for a C2C inspired business site is the selection of companies that will establish themselves there. At the time of the preparation of a development plan the companies that will settle have not yet been determined. The sectors that should be considered in terms of their industrial symbioses are listed below.

Requirements on the part of

- the municipality:
  The municipality is responsible for the creation of the basic conditions in land use planning, infrastructure and open space design.

- the park management:
  The park management must ensure a functioning flow within the business site, in the form of services/service offerings. This must be ensured by a corresponding set of agreements with the companies.

- the companies:
  A company participates by getting involved in working in networks and communities. To ensure recyclability, companies make the appropriate data (waste, sewage, energy, etc.) available to the park management. Furthermore, the buildings (administration, production, storage) are set up so they can be dismantled and (for materials) recycled, according to the concept of the “business site as part of the cycle.” A corresponding documentation requirement will be linked to the construction of commercial buildings.

Only when all actors comply with the above mentioned basic conditions will the basis for a C2C inspired business site be in place.
3.2 SECTORS

An important component in the framework development concept for a C2C inspired business site is the selection of companies that will establish themselves there. At the time of the preparation of a development plan the companies that will settle have not yet been determined. The sectors that should be considered in terms of their industrial symbioses are listed below.

The study about which sectors can mutually set up cycles has led to the conclusion that the economic activities in the secondary sector (industry, manufacturing trades) are completely suitable and in the tertiary sector (services) are suitable for the most part, for establishment in a C2C business site. All input and output flows, as well as consumption media (electricity, heating/cooling, water, waste, etc.), which are supplied to a system, that leave it or are converted within the balance limit, run cyclically in business and industrial areas, much as “ecosystems” act in the sense of a network of interacting organisms.

The symbiotic media under consideration are divided into three groups:

<table>
<thead>
<tr>
<th>EXPENDABLES</th>
<th>INDUSTRIAL RAW MATERIALS &amp; INDUSTRIAL BY-PRODUCTS</th>
<th>INFRASTRUCTURE &amp; SERVICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>Ferrous metals</td>
<td>Soil / area / ecosystems</td>
</tr>
<tr>
<td>Heating / Cooling</td>
<td>Non ferrous metals</td>
<td>Spatial infrastructure</td>
</tr>
<tr>
<td>Water / Wastewater</td>
<td>Precious metals</td>
<td>Carpark</td>
</tr>
<tr>
<td>Gases</td>
<td>Ceramic materials</td>
<td>Machinery</td>
</tr>
<tr>
<td>Oil</td>
<td>Polymer materials</td>
<td>IT infrastructure</td>
</tr>
<tr>
<td>Biomass</td>
<td>Renewable resources</td>
<td>Employees / staff / experts</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Industrial gases</td>
<td>Catering (canteen / cafe)</td>
</tr>
<tr>
<td>Pressurized air</td>
<td>Liquids</td>
<td>Services of all kinds</td>
</tr>
</tbody>
</table>

Fig. 6: Outline of symbiotic media/exchange of materials, Drees & Sommer Advanced Building Technologies GmbH, 10/2014
The potentials that can act in a business site are shown in the following diagram. The highlighted potentials are crucial for the implementation of the C2C philosophy and should have greater consideration in further planning.

Fig. 7: Material flows in the business site ecosystem, Drees & Sommer Advanced Building Technologies GmbH, 08/2014
To enable the highest level of cooperation and exchange of materials and media, the needs/potentials of the various economic sectors that are established in the business site must be identified.

The idealized group of companies within a business site, however, can only be planned conditionally. A successful industrial symbiosis that enables the represented economic added value can only be made between the parties themselves. The willingness and the definite will to create added value for all stakeholders, through cooperation, sharing and collaboration, is the central prerequisite. Higher level planning and the provision of an appropriate infrastructure for this purpose are critical for achieving the potential for guidance and impetus.

For the companies to participate in partnership, the “matching” of the material flows is an essential component for establishing exchange processes. During a matching process, the output flows of a company are examined for matching potential, then coordinated and adapted to the input streams of another company.

Fig. 8: Symbiotic media; investigated groups, grafikbüro wilk, 02/2015
German municipalities have the ability to determine the quality of a business site through land use planning. Since it is a necessary planning level on the path to the implementation of a C2C inspired business site, it should join the operation at an early stage to influence the development of the entire area.

3.3 LAND USE PLANNING STIPULATIONS

As shown by the commissioned studies we have provided for this purpose, an initiator (e.g. a functioning park management) is needed here. It will gather all relevant data on the input and output streams of the companies and identify where synergies may arise and potentials exist for cooperation within the meaning of C2C. A necessary precondition is that this data must be handled sensitively and confidentially.

![Matching process diagram](Image)

Fig. 9: Matching process, Drees & Sommer Advanced Building Technologies GmbH, 08/2014

German municipalities have the ability to determine the quality of a business site through land use planning. Since it is a necessary planning level on the path to the implementation of a C2C inspired business site, it should join the operation at an early stage to influence the development of the entire area.
During the project work, it was found that the conversion of these guiding principles in the establishment of a land development plan is limited. Principles such as “The total area designed in cycles”, “Manufacture of material loops for buildings, open space, infrastructure” or “Forming a resource community” cannot be transferred as stipulations in a plan in a legally binding manner.

The basis for building regulation stipulations within a land development plan (binding land use planning) in German judicature originates in the specifications of the Building Code.

The land development plan and the textual stipulations are the components of formal land use planning, which become legally binding with statutory resolutions. Therefore the German building code includes a catalogue of (final) stipulation possibilities. Additional stipulations that would be necessary to implement the C2C philosophy are excluded by this specification. An exception is made for a so-called project specific land development plans. In this area alone, the planner may deviate to a certain extent from the limited catalogue and provide more specific stipulations. However, in this case further laws have to be taken into account.

The following individual guidelines are closely considered with regard to the integration in a (not project related) land development plan.

**Concept of a total area “in the cycle”**

This principle, with its core being the deconstruction of the total area, is not able to be directly stipulated. The level of usage can be controlled by setting a so-called “Site Occupancy Index”. It controls the building density on a site. However, German legislation is fixing a limit on the sealing surfaces. To keep this limit and still achieve the highest possible level appropriate stipulations should be carried out (e.g. the use of roof areas for sports facilities or other). The long term availability of surfaces can be ensured by the establishment as public areas.
The guidelines of “Manufacture of material loops for buildings, open space and infrastructure,” and “Companies create synergies through cooperation,” are not stipulated in key areas. A transfer can be realised only by creating the basic structures. By stipulating an area as a business site and the definition of the type of use, the foundation for exchanges between companies can be laid.

Common areas (Commons) promote “sharing and borrowing” instead of “owning”

The guideline of “common areas promote ‘sharing and borrowing’ instead of owning” is ensured by building regulations, and communal facilities can be established. Unlike public community facilities, which include traffic areas and public green spaces, these sites may have a “private” use. These include community gardens, playgrounds as non public facilities, as well as cafeterias and recreation areas for work breaks and other community, social or cultural institutions. The land use planning creates the conditions to secure the area. The use or the extent of ownership and usage rights are, however, not determined by land use planning. This requires a private legal structure.
The use of renewable energies taking place “in a local and integrated mix” and is promoted by intelligent planning

The stipulation of areas for renewable energy is possible. A structure under which a certain portion of the roof areas (e.g. at least 50%) is equipped with photovoltaic systems provides an important basis for the local mix. Design regulations associated with the stipulation of requirements linked to the building position and/or orientation can be set up. Thus, adverse effects, such as the shading of photovoltaic systems, can be prevented. Other measures, such as the promotion of natural cooling, can also be controlled thereby.

Creation of design guidelines

In Germany, local authorities have the option to pass so called “local building codes” to implement guidelines. These local building codes, which are also called “design guidelines” can include profile of roofs, expression of advertising structures and other principles of architecture. The goal is, to achieve a connection and an architectural unity of the building despite of high diversity. By specifying of building lines on which the buildings are constructed, urban areal patterns will be determined that lead to a clear structuring of the overall area.

Integration of the business site with the surroundings

The key objective of merging the superordinate settlement and landscapes can be achieved using the motto “integration of the business site with the surroundings”. The planned geometries can be stipulated and build a relationship with the environment. Instead of a mono functional business site, a high quality, multi functional city block can be developed. By stipulating a public green space or valuable green cross links, in the form of tree planting in the street spaces and on public land, visual integration can be made with the environment. Planned path connections over private land can be secured by public access rights.
Hybrid design

“Hybrid design” refers to the multiple uses of buildings, open spaces and infrastructure for more efficient land use and promotion of building density. A specific stipulation for a mixed function construction of buildings or open spaces is not possible by means of land use planning. Therefore, it should be attempted to exhaust the permissible limit of legislation to the extent possible, and thereby foster a vertically stacked and hybrid use.
Participatory development and operation of the area

A stipulation within a land development plan is not possible. Here it is possible to resort to informal planning instruments in land use planning or to involve stakeholders by establishing a design advisory group or area advisory group.

3.4 THE “ERDBEERFELD” [STRAWBERRY FIELD] AREA

After the C2C guidelines and principles were defined, a further task of the project was to transfer the results to an area. For this, an area was chosen with a size of about 59 ha, which was used as agricultural land, partly for growing strawberries, at the time of planning. The area therefore has the name “Erdbeerfeld” [Strawberry field] and is hereinafter referred to as such.

The “Erdbeerfeld” is a non developed area to the east of the city of Bielefeld. The area is framed to the north and west by residential areas, and to the south and east by business sites. The total area is about 59 hectares, of which only about 37 hectares are buildable (see above).
The plan area is bordered to the west by the Hillegosser Straße, to the south by Bechterdisser Straße, and to the east by the Ostring, one of the main thoroughfares of Bielefeld. Planning took into account the fact that an opening onto the Ostring is not possible, and therefore transportation connections had to be exclusively from Bechterdisser Straße.

Another consideration is that the residential courtyard in the central area of the site is accessed by Hillegosser Straße. To the west and north, approximately 20 hectares areas have been designated as a conservation area, including a nearly 9 hectares floodplain on both sides of Oldentrupper creek.
Depending on the task, a “structural plan” has been developed, which corresponds qualitatively to a schematic plan that is drawn up, and includes the essential relationships and main planning features (zoning, development, space allocation, building structures, green spaces, etc.). The realisation is accompanied by a list of the (fictitious) companies indicating the sector representation, plot size and number of employees.

The sectors consist of production, administration, vehicle, craft, trade and service companies. The distribution of the type of businesses in terms of their required plot sizes is shown in the graph below.

![Graph showing the fictitious industry mix](image)

The structure plan follows, in its outline, the overarching principle of “business site in the cycle”, and is conceived as “greenfield” (undeveloped area) for the creation of a business site merging the urban and landscape context. The possibility of dismantling an urban spatial development is taken into account in the planning from the outset. Superordinate scenic and urban spatial references determine the structure of the business site and create a multi-functional framework for a diverse and high quality future of the “Erdbeerfeld” as a city block. The guidelines and principles listed individually above have been incorporated in the plan, insofar as these were capable of being implemented in the planning.
The design of the “Greenfield” is influenced by overarching design elements. To this end, the plan area has been structured along a central axis, on which public functions are arranged. The development system is based on this axis. It represents the constant in the temporal development of the area, from the initial phase to the commercial full settlement and other return or conversion scenarios (return to Landscape Park). The zoning of the land follows the idea of an efficient development with a main street and roads at right angles to this. This type of development allows not only for the development of the land in accordance with the prescribed mix of industries, but also allows for extremely flexible parcelling, with a variety of property sizes and cuts (small plots from 2.000 m²).
The centrally arranged axis of the “Erdbeerfeld“ becomes the main access route for truck and car traffic, as well as a generous allowance for bicycle and pedestrian traffic on both sides. Furthermore, it acts as an important public space and contains a variety of community facilities (Commons), such as the power station, various services, warehousing and supply areas. Through the provision of these “Commons”, private plots of land can be reduced, cooperation and synergies between companies can be produced. Thus, a social and programmatic added value is created.
CONCEPT OF THE TOTAL AREA IN THE CYCLE

STRUCTURE PLAN. PHASING

The total area is designed in cycle
The business site is integrated into the environment

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Phase 1. 2015
Out of an undeveloped, scenic area (Greenfield) comes a landscaped park, which is linked to the urban and natural environment. The parkways are already aligned in the technical design to the subsequent transport function. The central axis is expanded with the appearance of a street and the central infrastructure (water management, etc.) is created. Bike rentals and connections to public transportation are provided. At this early stage, “Erdbeerfeld“ is a place for recreation and a starting point for exploring the scenic surroundings of Bielefeld. From unused land, energy crops (e.g. miscanthus sinensis) are grown, allowing for the agricultural use of the park.

Phase 2. 2018
The development of the access ways to the business site is given priority. In the business site, the first company is settled. Park Management establishes the appropriate service offerings, thus ensuring the smooth operation of the business site.

Phase 3. 2025
The business site is fully developed and operational. A kindergarten, vegetable gardens and a cafeteria in the old courtyard are also available for users of the area. On the central axis, diverse community offerings are available (sports, seminar and conference rooms, storage space, etc.). Individual operational shiftings and changes of use can be realised easily by the flexible building plots and structures without changing the overall image of the business site.

Phase 4. 2060 and beyond
Larger areas, long term return or conversion scenarios are supported by the structure of the “Greenfields”. Vacant building plots can also be included in the agricultural management and design mode of a landscaped park.

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3.4 THE AREA „ERDBEERFELD“ [STRAWBERRY FIELD]
BASIC REQUIREMENTS FOR THE COMPANIES

SECTOR CLUSTERS

Material loops for buildings, open spaces and infrastructure are established
The companies create synergies through cooperation

The fictitious sector mix serves as the basis for the development of the “structural plan”, and is presented contextually in a “technical infrastructure”. From this it can be seen which companies can cooperate in the areas of heating/cooling, electricity, water, waste, data/IT, materials and infrastructure. To enable optimal control, the requirements need to be defined with a suitable, ideal infrastructure that ensures an intensive exchange of diverse media and collaborations in advance. The “Erdbeerfeld” and the companies settling there are shown on the diagram below.

In order to match linked sectors in neighbourhoods, which can generate optimal synergies between the individual companies, the appropriate spaces should be created in the plans. In “Erdbeerfeld”, along the central axis and
grouped in the common areas (Commons), there are the production facilities in the north eastern area, vehicle companies in south, and smaller companies, such as trade, service, administrative and crafts located in the western area.

**Requirements for the Manufacture of Material Loops in the Development Plan**

**Construction and Material Principles**

Material loops for buildings, open spaces and infrastructure are established

To protect the primary resources and to keep emission levels low, all of the materials and components of buildings, open spaces and infrastructure are selected and used to support the technical or biological cycles in accordance with C2C. In addition, the materials and components used should have positive effects on health, wellbeing, performance and the environment. Biodiversity will be strengthened, air quality improved and the working environment optimised using these materials.

**Water**

Material loops for buildings, open spaces and infrastructure are established

The rainwater accumulating on roofs and surfaces is collected, retained locally and drained away. Rainwater management is achieved using linear elements that are designed as channel like swales and are oriented along the main streets and byways. All sealed access areas will be upgraded artistically and ecologically. Furthermore, the provision of channels on private land is planned, provided that this is possible.

3.4 The area „Erdbeerfeld“ [Strawberry Field]
FRAMEWORK FOR THE EXPLOITATION OF RENEWABLE ENERGY

ENERGY

Use of renewable energy

The energy system for the whole area can comprise an energy centre with combined heat and power plant (BHKW) and bio gasification, supplemented by wind power and decentralised distributed photovoltaic systems (for example, on the roofs). The biogas for the BHKW should preferably be obtained from locally or regionally grown biomass.

CREATION OF DESIGN GUIDELINES

BUILDINGS AND URBAN OPEN SPACE

SPATIAL DESIGN GUIDELINES

Design guidelines are provided

In order to guarantee compliance with the C2C guidelines and principles, a catalogue is set up with design guidelines according to the C2C philosophy. Using this, it can be determined how the principles will be implemented in practice.

For example,

- the building and roof orientation can be set to ensure optimum utilization of facilities for the production of renewable energy.
- the water cycles can be supported through the stipulation of green roofs.
- the arrangement of parking facilities on the roofs of buildings with direct access can be stipulated.
- storage, production and workshop areas can be arranged for optimum functionality on the ground floor, and offices only on the upper floors.
- the requirement can be stipulated that, in principle, the construction of the building must use modular building systems.
PLANNING TOWARDS INTEGRATION OF THE BUSINESS SITE WITH THE SURROUNDINGS

URBAN OPEN SPACE STRUCTURE

The business site is integrated into the surroundings

Since the business site is designed in accordance with the deconstruction “in cycle” concept, the urban open space structure takes on a special meaning. The Oldentruper creek in conjunction with the northern water and energy areas provide the framework for the business sites as a powerful green space. The central axis, with the communal areas (Commons), the small recreation areas as well as the access to sporting facilities, which may well be arranged on the roof surfaces, all contribute to an urban feeling. The “extension” created connects the east-west routes to the central axis of the landscape park. All street spaces are oriented using water, greenery and additional usage considerations (residences, leisure activities, etc.) enriched with quality open space. On private plots, there is an opportunity to use areas that are not necessary for operational processes for the cultivation of energy crops. Their care could be taken over by park management.

PUBLIC TRANSPORT / BIKE / FOOTPATHS

The business site is integrated into the surroundings

Part of the development system is the pathways for pedestrians and cyclists. The northern residential area and the southern business site are connected locally by a north-south path. This connection is incorporated into the planning of the business site and has been extended by a further connection from west to east. Thus, the western residential area and the eastern business site now have a connection to “Erdbeerfeld”. By crossing the Ostring via a pedestrian/cyclist bridge, a connection is established to the eastern business site.

To increase bicycle mobility, the users (employees, customers, visitors and others) to “Erdbeerfeld” will be provided with offers for rental and electric bikes. Leasing stations are set up at various locations throughout the planning area. In the central axis (Commons) area, a bus stop is also located for connections to public transport. The park management located there will provide offers for car sharing or alternative mobility concepts (commuter exchange programs, etc.).
LOCAL PUBLIC INFRASTRUCTURE / TRANSPORT

Surface areas are used effectively

Access to the plan area is achieved only via the southward facing Bechterdisser Straße. Using the adjoining Ostring, the A2 motorway can be reached in a few minutes. The development system consists of the north-south main axis and four side road, with three of them going to the east and two to the west. This provides for short distances and low road sealing. Production, storage and exhibition spaces are limited to the ground floor. To emphasize the addressing (appearance of a building), the entrances to the buildings are located mainly along the north-south axis. Deliveries take place exclusively via the side road. Parking is located primarily on the roofs. The administrative areas are reached through the side entrances there, which are, in principle, located on the upper floors.

OFFERINGS FOR COMMUNITY ACTIVITIES / IDENTIFICATION OF COMMUNITY AREAS IN THE DEVELOPMENT PLANS

DIVERSITY

Commons promote “sharing” versus “owning”

A wide range of measures will contribute to the support of social and cultural diversity, biodiversity and an exchange of information. The communal area (Commons) with its axis, contains the playgrounds and sports facilities, service facilities as well as knowledge and educational institutions. It provides impetus for cooperation and networking. Initiatives, such as company clusters, including micro entrepreneurs and incubators provide a common bond to those settling at the site. Available service facilities (e.g. cafeteria, day care, park management, business incubation centre as well as tank/charging stations with repair service) promote effective work and entrepreneurial exchange.

The landscaped park, in combination with the many green spaces of the built up area, will strengthen and link diverse habitats that are carefully made available to local residents and employees as free time areas. Land for “Urban Farming
“Cradle to Cradle® business site” or “Cradle to Cradle® inspired business site” label does not exist yet. The studies commissioned by us have shown that label criteria for business sites are subject to other conditions than those for product certification. As already noted in chapter 2.3, these include the different extents of a particular spatial area in the various stages of development. Furthermore, a variety of stakeholders influence the process. As a result of the study, therefore, a transferability of product certification is not applicable to the development of a label for a business site.

At this point, it is expressly stated that the term “Cradle to Cradle®” is protected. The contact person in Germany is the EPEA Institute Hamburg/Dr Michael Braungart (www.epea-hamburg.org).

The label for business sites is primarily a marketing tool for municipalities. This is an expression of a guarantee of the quality and sustainability of an area.

In the research, label criteria are proposed from which a certification system can be developed to award a C2C inspired business site (subject to the approval of the EPEA Institute). The proposed label criteria are inspired by the C2C philosophy and these apply to specific spatial development measures. It involves explicitly transferable, customizable and extensible bases, which have not yet been completely determined. For specific applications, (for example for land use planning, marketing strategies, evaluation or certification systems, etc.) specific label criteria must be developed.
PROPOSALS FOR LABEL CRITERIA

Cyclability
- Removal of all buildings, urban open spaces and infrastructure existing in an area
- Recycling of all components and materials used
- Collection, treatment and recycling of all types of water (rainwater, building service water, production water)

Energy
- Use of renewable energy for the operation of the business site
- Creative integration of technical systems in buildings and urban open spaces
- Use of design principles (low tech) for effective use and generation of energy

Design
- Integration of the business site with the surroundings
- Use of design resources (material, light, colour, shape) for high residential value, working atmosphere and identity of the whole area
- Use of water as a design element (sports, leisure and recreation)
- Representation of C2C criteria of the overall area in a showroom

Diversity
- Programmatic added value by combining business with other uses, such as sports, games, educational and cultural institutions
- Multifunctionality through multiple uses of land and buildings
- Provision of green spaces as recreation areas

Community
- Promotion of cooperation in business networks
- Shared use of rooms, areas and facilities
- Participatory development and operation of the business site

Park Management
- Services provided by Park Management
- Point of contact for all issues of resident companies
In chapter 3.3, the implementation of the C2C philosophy was considered in the context of German laws regarding land use planning and the limitations became visible. Therefore, according to our research, other options, such as implementation by a form of contract (purchase agreements, business park agreement) or a voluntary commitment should also not be ignored.

For the contractual objectives to be achieved, three instruments are identified.

1. In a purchase agreement, certain “direct duties” may be added. Herein, a buyer undertakes to implement certain conditions in the erection of the proposed building or structure.

Examples:
- “The buyer is obliged to use only building materials in accordance with Appendix ...”
- “The buyer must have at least the following energy standard for the construction of the planned structural facility at the property ...”
- “The buyer is obliged to provide at least ... percent of its facade with green plantings.”

2. This can be complemented by a point or bonus system. Thereby, an incentive to implement further measures will be set, where in each measure is assigned a point value. These are coupled with a concession, for example, a subsequent purchase price reduction, if those scores are achieved.

3. The purchase agreement can be combined with the conclusion of a business park agreement. Requirements for the operation of a C2C inspired business site, and the introduction of users/purchasers to the land are described herein. It consists of the C2C guiding principles the C2C business site regulations and establishes the basic requirements for the Community interaction. The guiding principle of “The area is developed and operated in a participatory way” can find its basis within this framework.

Advanced basic information with respect to the development of legal structures can be found at the overall report of C2C BIZZ project “Guide to Cradle to Cradle® (C2C) inspired Business Sites” or can be accessed on the Internet at www.c2cbizz.com and www.c2c-centre.com
Examples:
- The company agrees to be established with the disclosure of its data (to the Park Management), which is required for the “cyclability” within the business site (energy, water, materials, waste, etc.).
- The house rules and the cost structure for the use/operation of communal facilities (sports facilities, conference rooms, day care, etc.) are described therein.
- The regulation of multiple uses of land and buildings is specified.
- The willingness to implement the design guidelines is reaffirmed.

Park Management ensures the smooth running within the business park, and the implementation of the conditions laid down in the business park agreement specifications. Furthermore, services (for example: establishment and operation of bicycle sharing, joint office supply purchasing, etc.) and janitorial services will be provided to the local companies. The continued existence of the business park agreement is guaranteed in the purchase agreement, by e.g. the municipality being entitled to a refund claim as the seller of the land, if the business park agreement is or becomes invalid. In addition, the city has a right of repurchase for protection against sale to third parties. Protection is provided by a contractual penalty provision, but also by preemption rights.
A strategy should initially be developed for the construction of a C2C inspired business site, in the form of a framework development concept. In the concept, the fundamental objectives are to be presented in accordance with the C2C philosophy, the individual site requirements and the various stakeholders. The concept of the “business site as part of the cycle” should be prioritized.

For each municipality, the question arises: Is it worth the apparently greater effort in planning and implementing the development of a C2C inspired business site? As a result of the research commissioned by us, the following convincing arguments can be mentioned:

**5.1 THE BENEFITS OF A “CRADLE TO CRADLE®” INSPIRED BUSINESS SITE**

*Fig. 30: Benefits | Review, Drees & Sommer Advanced Building Technologies GmbH, 08/2014*
Local authorities can provide companies that locate in C2C inspired business sites the offer of an intelligent, economical, and future-proof infrastructure for heat, water, electricity, and waste as well as provision of a completely regenerative supply of energy and heat. Furthermore, versatile, central services in the field of mobility, real estate, child care, cafeteria services, etc. are provided. When marketing of commercial space in competition with other regions, a C2C inspired business site offers a unique selling point.

Through the cooperation of the companies in the areas of energy, water, and waste, the creation of an innovative business cluster is possible, with a stimulus effect on other businesses in the region. The local share of added value can be caused by, for example, local energy and heat contracting concepts or business collaborations affecting the entire region. Furthermore, a start-up friendly environment can promote the formation of new companies.

A C2C inspired business site appeals to companies with future-proof and innovative business models. Professionals are linked through an attractive environment, and high quality and permanent jobs are generated.

The creation of hybrid types and higher building density area efficiency is increased and land consumption reduced. The readiness of the population for the creation of new commercial space could be positively influenced. The development of innovative business sites leads to an increased identification with the location, which thereby becomes more attractive.

The basic structure of the C2C philosophy is the preservation of resources and biodiversity for future generations. In a C2C business site, these principles are implemented and made transparent for everyone. Local waste and emissions can be reduced, thus contributing to the political sustainability agenda in the region. The development of the area "in cycle" ensures that the dismantled materials are reused. When the area is abandoned, it is not left fallow, leading to the value retention of the business site and infrastructure.
BENEFITS FOR COMPANIES

The advantages arising for a company when settling in a C2C business site are versatile and go far beyond the direct monetary value added increase. These include, among others:

Attractiveness of the working environment

In the race for highly skilled workers, the attractiveness of the working environment has increasing significance. Today, companies must use their property and the integration of the workplace in the environment as a strategic marketing tool. Points can be had with employees, customers and visitors by providing pollution free work spaces, a good microclimate and adequate planting. An attractive working environment brings about a sense of identity and a pleasant working environment has a positive effect on employee productivity, and can thus increase the economic component.

Competitive advantages

The construction sector and the manufacturing sector are already suffering from rising commodity prices. Through the use of recycling processes, the recovery of production waste and the substitution of increasingly scarce materials with renewable resources, this resource dependency can be reduced. Dependence on raw materials can also be counteracted through the use of renewable energy and the use of waste heat.

The economic added value and cost savings through the use of material flow synergies, reduction of dependence on raw materials and energy prices as well as increasing local business constitute a competitive advantage not to be underestimated. Predictable cash flows and low opportunity costs are essential controlling instruments at major industrial corporations. C2C business models that the leasing and contracting types describe can also be employed here.

C2C as an innovation driver

Many companies that have had prior contact with the Cradle to Cradle® philosophy use the topic consciously as innovation drivers. Recycling and material efficiency is considered an important issue for the future by many companies in the manufacturing sector and the construction industry. Cooperating in an innovative Cradle to Cradle® network provides the opportunity for many companies to draw attention from the market to their range of products and their cooperation with partners in research and development.

New product categories open up new business options and new markets. In particular, the concept “Renting is the new Owning” offers, in conjunction with the C2C principles, a broad range of new business ideas. Furthermore, it is observed that companies increasingly hand over the care, maintenance and purchase of, for example, cars, photocopying, computers and real estate services to service providers. This opens up the opportunity for manufacturers such as service providers to offer high quality products that can be broken down into their constituent components.

Health and healthy products are one of the great issues of the future of the economy. Products that are contaminated with pollutants, hazardous substances or other harmful chemicals will have more and more difficulties in a market of informed consumers. Because they represent a precondition for a high quality recycling process, C2C products are completely free of harmful and hazardous substances. This added value will continue to constitute a crucial selling point and positively affect competitiveness.

CSR and reporting

For many businesses, especially large public companies, the creation of a “Corporate Social Responsibility (CSR) Report” is an important points to demonstrate the pioneering role of the company in terms of an ecologically responsible business model to its customers and business partners. A company’s participation in cooperative processes, use of community facilities and the support of the cycling system in a C2C business site can be marketed publicly and fed into the report.

5.1 THE BENEFITS OF A “CRADLE TO CRADLE®” INSPIRED BUSINESS SITES 45
5.2 STATEMENTS

GOLDBECK GmbH
Sequential, mono causal and short term considerations are relics of the past. As technology evolves, we are able to look at issues in their interdependence and in their parallels today. The holistic, interdisciplinary and long term view of our environment requires that we will be able to, and that we must, manage the complexity of multidimensional reality. This requirement is consistent with the Cradle to Cradle® approach, whether for products, buildings, or entire business sites or development areas. In the context of contemporary environmental challenges, the C2C concept is the most consistent approach. As a company that has lived by the standard “design – building – caring” as a closed loop for many years, we support the C2C BIZZ initiative as a sensible approach to embody stringent environmental sustainability in Germany and Europe.

Jan-Hendrik Goldbeck

Schüco International KG
Times of dynamic change require innovative approaches. Cradle to Cradle® is a revolutionary idea that will inspire and will have an impact. The development of sustainability in the construction sector has led to significant improvements in energy efficiency, comfort and quality of execution in recent years. With regards to certification systems, sustainability has become predictable and assessable. As part of the current debate on climate change and the consequent demands, further improvements are expected. Is this sufficient to ensure quality of life and availability of resources in the future? In the face of global development, this should be considered critical – new concepts need to be found and implemented quickly. Core elements of C2C are the complete recyclability in closed loops, products free of harmful substances, the use of renewable energies, and creative diversity. Schüco International KG is a leader in sustainable systems for thermal windows, doors and facades on the market. New stimulus from C2C and the European project C2C BIZZ will be used to create committed, supportive and responsible future products.

Rolf Brunkhorst
City of Bielefeld Department for Urban Planning and Construction
WEGE Wirtschaftsentwicklungsgesellschaft Bielefeld mbH

Keywords such as globalisation and internationalisation, climate change, demographic change and sustainability provide businesses and municipalities with new challenges. Dealing with the associated environmental, urban and economic consequences gives municipal politics and administration a complex task that requires a high degree of responsibility and involves a variety of aspects.

As a city with a limited supply of space, Bielefeld is particularly dependent on intelligent concepts for land use and sustainable business sites. By participating in the EU project C2C BIZZ, the city of Bielefeld and the WEGE Wirtschaftsentwicklungsgesellschaft Bielefeld mbH have shed new light on the topic and the results can be used to increase the attractiveness of the business location in Bielefeld. The contacts that have arisen from the participation in an EU project in Europe can be used to support the local economy in their efforts to implement sustainable management.

Gregor Moss

Stadtwerke Bielefeld GmbH

Stadtwerke Bielefeld, as a public utility, has a special obligation to maintain and improve the quality of life in intensively used residential and commercial locations in Bielefeld. Designed to target the year 2020, it has programmed the local energy transition towards optimum use of resources with the expansion of renewable energies and the consistent use of synergetic cogeneration. Participation in the C2C project consistently continues this trend and gives further food for thought and project approaches that will be considered in the future, not only for commercial properties.

Friedhelm Rieke
A central challenge of sustainable urban development is the use of the finite “land” resources. The central theme is land use, which should be gradually reduced. This means that the development of competing uses for “residential”, “business” and “green and recreational areas” needs to be in an even more balanced relationship in the future.

This is no easy task for municipalities. But new challenges also appear for companies. Changes in production capacities, new work processes and modern technologies are just some of the changes that move the world of work at present. Companies and municipalities have to adapt to these changes in time and place through the creation of appropriate conditions, the basis for economic development. Resource efficient thinking in economic cycles is as important as in the construction and use of a commercial property in production.

To limit it only to analysis and knowledge gains will not be enough to counter the pressure for action. On the other hand, the buttons shouldn’t be pushed simply to achieve an immediate change. Rather, viable ways must be demonstrated. To this end, participation in the EU project C2C BIZZ has delivered new approaches that should not be “shelved” at the end of the project. Quite the contrary – after the end of the project, the city of Bielefeld/WEGE mbH, IHK Ostwestfalen Lippe and interested companies from the region want to develop a concept together for a C2C inspired model region. This model region will highlight and show how the Cradle to Cradle® philosophy can strengthen the attractiveness of corporate locations, the networking of economic cycles and sustainable living and working in Bielefeld and the region.
In four years of project work, the development of C2C inspired business sites has been illuminated by the Bielefeld project team in cooperation with its European partners. They received additional support in various ways from different actors from all over Germany. The team would like to give special thanks to the experts who supported it in terms of planning and time on their part:

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Dr Claas Birkemeyer and Dr Hermann Gördes of Streitbörger Speckmann Part GmbH – lawyers and tax consultants (Bielefeld), who have made a detailed approach to the legal framework, which is inevitably linked to the implementation of the philosophy on a business site.

Further thanks go to the architect and city planner, Klaus Beck, who supported the team as a presenter at various events with his extensive knowledge and many ideas.

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imagine envelope, Rotterdam, Netherlands
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INNOVATION & IMPROVEMENT ZONES (C2C BIZZ)

EU project C2C BIZZ
Summary of the project results from Bielefeld
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