B4C Valorisation Strategy

Deliverable 5.1

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1. Executive Summary

1.1. Background

Europe's transition towards climate neutrality requires innovative solutions that combine greenhouse gas reduction with sustainable resource management and regional economic development. Biochar has emerged as one of the few technologies capable of delivering permanent carbon sequestration while simultaneously contributing to soil improvement, water management, circular bioeconomy and renewable materials. However, the widespread implementation of biochar systems depends not only on technological innovation but equally on the availability of qualified professionals who are able to design, implement and manage circular carbon systems across different sectors.

The Erasmus+ project **B4C – Biochar and Circular Carbon Economy Competences** was initiated to address this challenge. Rather than focusing solely on the transfer of technical knowledge, the project developed a comprehensive competence ecosystem supporting vocational education and training, continuing professional development and lifelong learning in the emerging field of the Circular Carbon Economy.

1.2. From Project to Competence Ecosystem

During its implementation, B4C developed far more than a curriculum. The consortium created an integrated framework that combines competence development, innovative learning methodologies, digital learning environments and practical implementation tools. These elements form a coherent educational ecosystem that enables learners, trainers and organisations to develop the competences required for planning and implementing biochar-based circular carbon projects.

The project generated a portfolio of complementary results including:

- a European Competence Framework for Circular Carbon Economy and Biochar;
- competence-based learning designs and assessment methodologies;
- modular learning programmes and Continuing Professional Development (CPD) concepts;
- the Carbon Manager Course as an advanced qualification programme;
- a digital Support Hub and Learning Suite;
- the B4C Virtual Marketplace for connecting educational institutions and stakeholders;
- practical pilot projects demonstrating biochar applications in agriculture, horticulture, construction and environmental management; and
- a growing European community of educators and practitioners.

Rather than representing isolated project outputs, these components constitute an integrated competence ecosystem designed for long-term use and continuous further development.

1.3. Purpose of this Valorisation Strategy

This strategy describes how the intellectual outputs and practical results of the B4C project will continue to create value after the end of the Erasmus+ funding period. It provides a roadmap for the dissemination, exploitation, further development and long-term sustainability of the project's educational resources, digital infrastructure and stakeholder community.

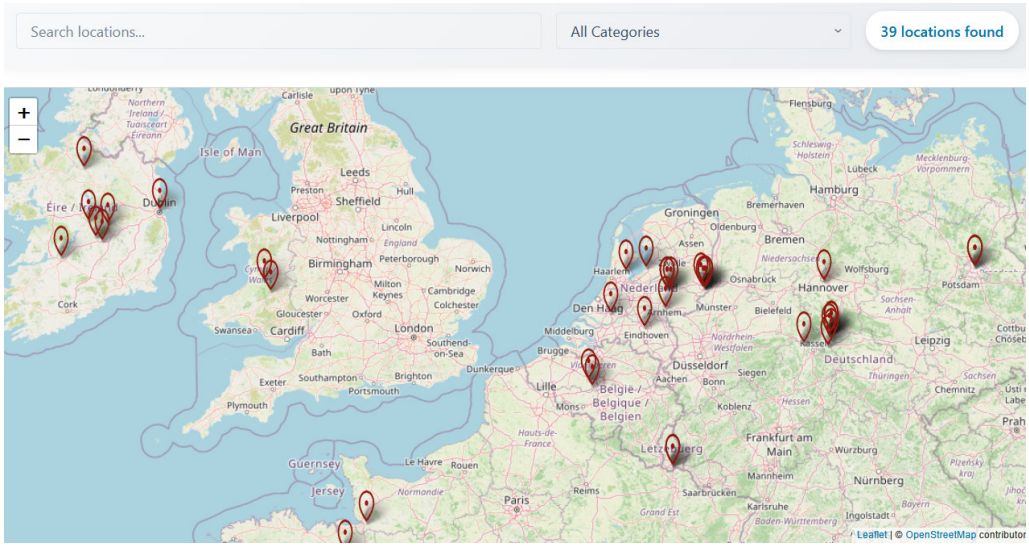
The strategy therefore extends beyond traditional dissemination. It outlines how the developed competences, learning resources and digital services can become permanent elements of European vocational education and lifelong learning for the Circular Carbon Economy.

1.4. The Role of the THREE C Network

The long-term sustainability of B4C is based on its integration into the THREE C (Creating The Circular Carbon Economy) network, which has been developed in parallel since 2023.

Within this ecosystem, B4C represents the educational and competence-development pillar. While other initiatives within THREE C focus on technological innovation, demonstration projects, regional implementation and circular carbon value chains, B4C provides the educational infrastructure required to qualify professionals capable of implementing these innovations.

The B4C Support Hub, Carbon Manager Course and Virtual Marketplace therefore become permanent services of the THREE C community, facilitating cooperation between vocational education providers, higher education institutions, municipalities, companies, farmers, technology providers, researchers, NGOs and public authorities.



1.5. Towards a European Circular Carbon Competence Community

The long-term ambition reaches beyond maintaining project results. The B4C consortium envisages the establishment of a self-sustaining European competence community that continuously develops educational resources, organises training activities, supports practical implementation and contributes to future European initiatives in the field of Circular Carbon Economy.

Building upon the existing THREE C Association, this strategy supports the gradual evolution towards a European Cooperative capable of providing stable organisational structures for education, networking, innovation and project development. In this way, the results of B4C will continue to contribute to Europe's green transition long after the project has formally ended.

2. Vision and Mission of B4C

2.1. Competences for the European Circular Carbon Economy

The transition towards a climate-neutral and circular economy requires more than technological innovation. It depends equally on people who possess the knowledge, practical skills and entrepreneurial mindset to design, implement and manage innovative carbon management systems. While significant progress has been made in developing biochar technologies and Circular Carbon Economy concepts, there remains a substantial shortage of professionals who are able to translate these innovations into practical applications across agriculture, horticulture, construction, environmental management and regional development.

The B4C project addresses this challenge by placing competence development at the centre of Europe's Circular Carbon transition. Rather than focusing on a single occupation or industrial sector, B4C promotes a comprehensive competence culture that enables learners and professionals from different vocational backgrounds to contribute to local and regional circular carbon systems.

This competence culture is characterised by five guiding principles:

- Systems thinking. Circular Carbon Economy requires understanding complete value chains, from biomass production and biochar generation to application, carbon sequestration and circular resource management.
- Practice-oriented learning. Competences are developed through authentic projects, demonstrations and real implementation cases rather than through theoretical instruction alone.
- Collaboration across sectors. Successful carbon management depends on cooperation between vocational education providers, municipalities, SMEs, farmers, technology providers, researchers and civil society organisations.
- Innovation and entrepreneurship. Learners are encouraged to identify regional opportunities, develop innovative biochar applications and create new circular business models.
- Continuous learning. Since technologies, regulations and markets continue to evolve, competence development becomes a lifelong learning process supported by digital resources and European cooperation.

The long-term objective is therefore not only to train individual learners but to establish a European competence culture that supports the implementation of Circular Carbon Economy solutions in diverse regional contexts.

2.2. Mission Statement

The mission of B4C is to strengthen Europe's capacity for implementing Circular Carbon Economy solutions through competence-oriented vocational education, lifelong learning and multi-stakeholder cooperation.

To achieve this mission, the consortium has developed an integrated educational ecosystem combining competence frameworks, innovative learning methodologies, digital learning environments and practical implementation projects. Together, these elements support learners, trainers and organisations in acquiring the competences required to design and implement biochar-based carbon management systems.

The project pursues the following strategic objectives:

Developing Competence-Oriented Education

B4C promotes learning that focuses on the acquisition of competences rather than the transmission of information alone. Educational programmes therefore integrate knowledge, practical skills, problem-solving abilities and professional attitudes required for implementing Circular Carbon Economy projects.

Connecting Learning with Practical Innovation

Learning activities are directly linked to authentic implementation projects. Participants are encouraged to analyse regional challenges, develop practical solutions and evaluate their environmental, economic and social impacts. In this way, learning becomes an active contribution to local sustainability transitions.

Supporting Educational Professionals

Teachers, trainers and facilitators play a crucial role in competence development. B4C therefore provides learning designs, facilitation methods, assessment instruments and professional development opportunities enabling educators to create competence-oriented learning environments.

Promoting Digital Learning Ecosystems

Digital technologies complement face-to-face learning by providing open educational resources, collaborative learning spaces, competence assessment tools and communities of practice. The B4C Support Hub and Virtual Marketplace facilitate continuous access to learning materials, implementation examples and stakeholder networks.

Strengthening European Cooperation

The project recognises that the Circular Carbon Economy can only develop through cooperation between educational institutions, businesses, public authorities and civil society. B4C therefore supports the creation of transnational learning communities and encourages the exchange of experiences across regions and sectors.

2.3. Educational Values

The educational philosophy of B4C is based on a number of shared values that guide the development of all learning activities and project outputs.

Learner-centred competence development

Learning is understood as an active process in which learners construct competences through participation, experimentation and reflection. Trainers therefore act primarily as facilitators who create meaningful learning environments rather than simply transmitting information.

Challenge-based and project-oriented learning

Competences are best acquired through authentic challenges. B4C therefore promotes learning projects addressing concrete regional issues related to biomass utilisation, biochar production, circular resource management and climate mitigation.

Openness and knowledge sharing

Wherever possible, project outputs are provided as Open Educational Resources (OER), enabling educational institutions and practitioners throughout Europe to adapt and further develop the materials according to their own needs.

European cooperation

The consortium considers cooperation between regions, educational sectors and professional communities as an essential prerequisite for accelerating the Circular Carbon Economy. Exchange of experiences and joint learning therefore represent central elements of the B4C approach.

Continuous improvement

Competence development is viewed as a dynamic process. Learning resources, digital services and educational programmes will continue to evolve through feedback from learners, educators and stakeholders and through their integration into the wider THREE C community.

2.4. From B4C to the THREE C Community

The project is conceived as the educational pillar of the wider THREE C[1] initiative. While the broader THREE C network connects stakeholders involved in biochar production, biomass valorisation, climate services, carbon farming and regional innovation, B4C contributes the educational infrastructure required to build professional capacity across these domains.

Consequently, the long-term value of B4C does not lie solely in its individual project outputs but in their integration into a permanent European competence ecosystem. The competence framework, learning programmes, digital support services and practical implementation tools developed during the project will continue to support the activities of the THREE C network and contribute to the establishment of a European community dedicated to Circular Carbon Economy education and innovation.

3. The B4C Educational Philosophy and Competence Model

3.1. Building Competences for the Circular Carbon Economy

The transition towards a Circular Carbon Economy requires professionals who are able to combine scientific understanding with practical implementation, interdisciplinary collaboration and entrepreneurial thinking. Traditional vocational education often concentrates on individual technical disciplines, while the implementation of biochar systems requires cooperation across agriculture, horticulture, construction, environmental management, energy systems and regional development.

The B4C educational philosophy therefore places competence development at the centre of vocational learning. Competence is understood as the integrated ability to apply knowledge, practical skills and appropriate attitudes in authentic professional situations. Learners are expected not only to understand biochar technologies but also to analyse complex situations, cooperate with different stakeholders, evaluate environmental impacts and develop innovative solutions adapted to regional contexts.

This educational philosophy transforms learning from the acquisition of isolated facts into the development of professional capability. Learning therefore becomes an active process in which participants continuously connect theory with practice, reflection with experimentation and individual learning with collaborative problem-solving.

3.2. Competence-Oriented Learning

B4C follows a competence-oriented educational approach in which learning outcomes are expressed in terms of demonstrable competences rather than purely knowledge acquisition.

[1] Could also be translated „Circular Carbon Communities“

The Competence Framework developed within the project structures competences according to three complementary dimensions:

- **Knowledge** – understanding principles, technologies, processes and regulatory aspects related to biochar and Circular Carbon Economy.
- **Skills** – the ability to analyse situations, design solutions, operate technologies, facilitate projects and apply methods in practice.
- **Attitudes** – motivation, responsibility, systems thinking, collaboration and commitment towards sustainable innovation.

These three dimensions are continuously combined throughout the learning process. Educational activities therefore aim to develop balanced professional competences rather than isolated technical expertise.

The competence framework also enables educational providers to design modular learning pathways adapted to different learner groups, professional backgrounds and qualification levels.

3.3. The LEVEL5 Competence Model

A central element of the B4C methodology is the application of the **LEVEL5 competence development and validation approach**. LEVEL5 provides a structured methodology for describing, developing and assessing competences across the three dimensions of knowledge, skills and attitudes.

Instead of measuring learning exclusively through examinations, LEVEL5 focuses on observable competence development in authentic learning and working situations. Competence progression is described through five consecutive development levels ranging from basic awareness to strategic application and transfer.

This approach enables learners and trainers to monitor learning progress continuously while preserving the practical and project-oriented character of vocational education. It also provides transparent evidence of competence acquisition that can support professional development and lifelong learning.

Within B4C, the LEVEL5 methodology serves three complementary functions:

1. structuring the Competence Framework;
2. supporting competence-oriented learning design; and
3. facilitating meaningful competence assessment and validation.

Consequently, the competence framework, assessment patterns and learning pathways developed within the project form one coherent educational architecture rather than separate project outputs.

3.4. Integrating European Competence Frameworks

While B4C develops competences specifically for biochar and Circular Carbon Economy, the project also aligns its educational approach with existing European competence initiatives.

The project builds upon the principles of **GreenComp**, particularly in relation to systems thinking, future-oriented thinking, sustainability values and collaborative action. Entrepreneurial competences required for developing innovative circular carbon solutions are supported through elements of **EntreComp**, including creativity, opportunity recognition, mobilisation of resources and value creation.

Digital learning environments and online collaboration are informed by the principles of **DigComp**, enabling learners to use digital tools for communication, collaboration, information management and competence development.

Rather than treating these European frameworks independently, B4C integrates their relevant elements into one coherent competence model specifically adapted to vocational education for the Circular Carbon Economy.

3.5. Design-Based Collaborative Learning

The educational methodology adopted within B4C combines competence-oriented learning with **Design-Based Collaborative Learning (DBCL)**.

Instead of presenting learners with predefined solutions, DBCL encourages participants to explore authentic regional challenges, develop innovative approaches and evaluate their practical implementation together with stakeholders.

Learning therefore follows an iterative development cycle consisting of:

- identifying practical challenges;
- analysing regional conditions;
- generating possible solutions;
- designing implementation concepts;
- testing and reflecting upon proposed solutions; and
- improving the developed concepts through continuous feedback.

This methodology enables learners to acquire professional competences while simultaneously contributing to real innovation processes within their organisations and regions.

3.6. From Learning Design to Practical Implementation

One distinctive characteristic of B4C is the close integration of learning design and practical implementation.

The educational architecture developed within the project connects several complementary elements:

- the Competence Framework defines learning outcomes;
- the Learning Design structures learning pathways and educational activities;
- Assessment Patterns provide methods for competence validation;
- the Carbon Manager Course demonstrates the integrated application of these concepts in practice;
- pilot projects provide authentic learning environments; and
- the digital Support Hub offers continuous access to learning resources, collaborative tools and implementation guidance.

Together these components create a coherent learning ecosystem in which competence development is directly linked to practical application and continuous professional development.

3.7. The Carbon Manager as a New Professional Profile

One of the most innovative educational outcomes of B4C is the development of the **Carbon Manager** profile.

Rather than representing a completely new profession, the Carbon Manager functions as an interdisciplinary competence profile that can be integrated into existing occupations within

agriculture, horticulture, environmental management, construction, consultancy, education and public administration.

Carbon Managers combine technical understanding with systems thinking, project management, stakeholder engagement and competence in planning Circular Carbon Economy projects. They act as facilitators connecting biomass producers, technology providers, municipalities, businesses, educational institutions and civil society organisations.

The Carbon Manager Course developed within B4C demonstrates how this competence profile can be translated into modular vocational education and continuing professional development, providing a scalable qualification concept that can continue beyond the project lifetime through the THREE C network.

3.8. Educational Principles for Long-Term Valorisation

The educational philosophy of B4C extends beyond the duration of the Erasmus+ project. The developed methodologies, competence frameworks and digital learning resources have been designed as open and transferable instruments that can be adapted to different sectors, educational levels and regional contexts.

This openness enables educational institutions throughout Europe to adopt individual components or the complete educational ecosystem according to their own needs. Through their integration into the THREE C network, these educational resources will continue to evolve and support future competence development activities in the Circular Carbon Economy.

Consequently, the lasting value of B4C lies not only in the individual educational products but in the coherent competence model that connects learning, implementation, digital support and European cooperation into one sustainable educational ecosystem.

4. The B4C Competence Framework and Valorisation Strategy

4.1. From Project Results to Long-Term Value

The B4C project has produced a comprehensive portfolio of educational resources, digital tools, learning methodologies and implementation examples that together support competence development for the Circular Carbon Economy. While these outputs represent important achievements in their own right, their greatest value lies in the way they complement one another and create an integrated competence ecosystem.

The objective of the B4C Valorisation Strategy is therefore not merely to disseminate individual project results but to ensure that they continue to generate educational, environmental and societal value after the end of the Erasmus+ funding period. Valorisation is understood as the systematic process of transferring project outcomes into long-term educational practice, professional development and regional innovation.

Unlike conventional dissemination strategies that primarily focus on communication, the B4C approach combines dissemination, exploitation, further development and institutional embedding. This ensures that project results remain accessible, relevant and continuously updated through practical application and collaboration within the wider THREE C network.

The project therefore shifts the focus from temporary project outputs towards a sustainable European competence ecosystem supporting the implementation of Circular Carbon Economy solutions.

4.2. The B4C Competence Framework

The educational ecosystem developed within B4C consists of mutually reinforcing components that together support competence development throughout the entire learning and implementation process.

The ecosystem begins with the identification of educational needs through stakeholder surveys and competence analysis. These findings formed the basis for the development of the European Competence Framework, which defines the competences required for biochar and Circular Carbon Economy professionals.

Building upon this framework, the consortium developed competence-oriented learning designs, modular curricula, assessment methodologies and practical pilot projects. These educational resources are supported by digital learning environments, including the Support Hub, Learning Suite and Virtual Marketplace.

Finally, all components are embedded within the THREE C network, ensuring continuous exchange of knowledge, implementation experiences and future educational developments.

This integrated architecture enables learners, trainers and organisations to move seamlessly from competence development to practical implementation and continuous professional learning.

4.3.The B4C Project Logic

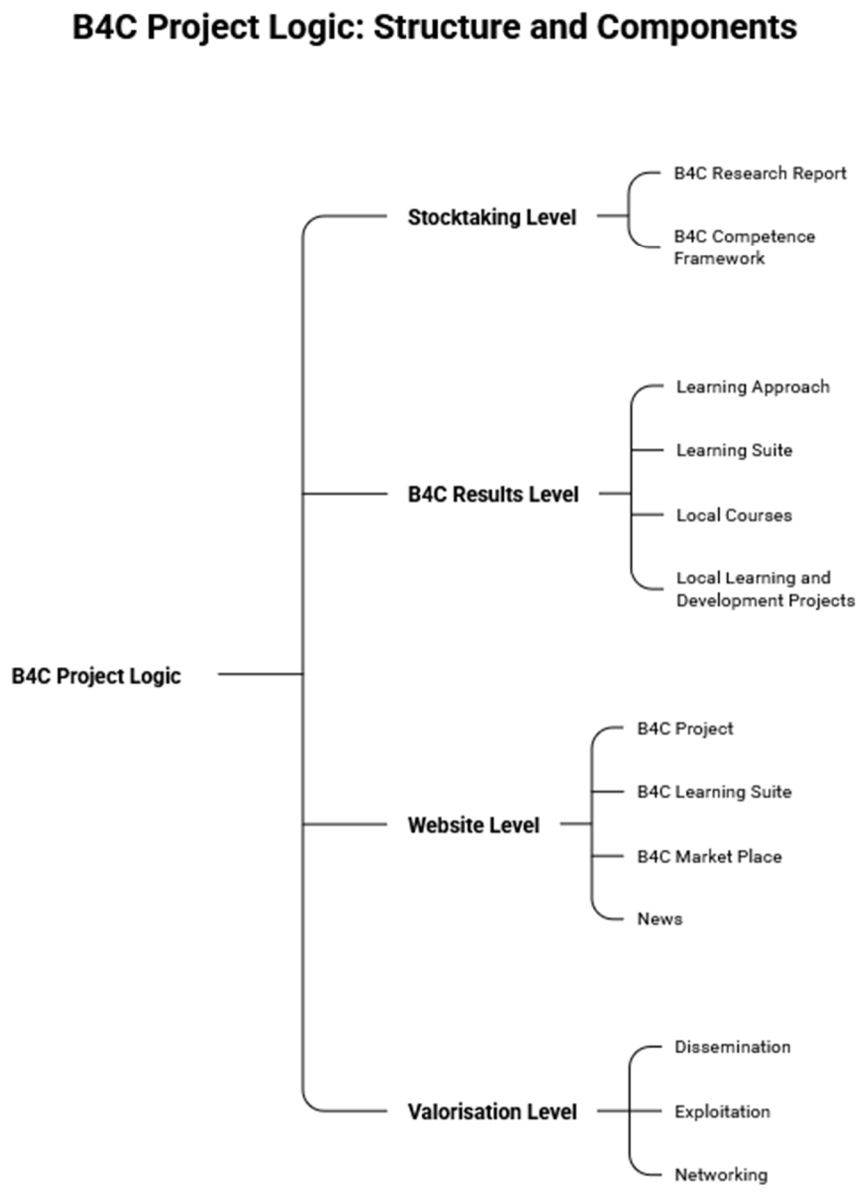


Fig. 01: B4C Project Logic

The project logic illustrates the systematic relationship between the different work packages and project outputs. Rather than viewing each deliverable independently, the diagram demonstrates how research, competence development, learning design, digital infrastructure and practical implementation contribute to a common objective: establishing a European competence ecosystem for the Circular Carbon Economy.

The project logic also illustrates the progression from educational development towards practical implementation. Educational resources are transformed into learning programmes, these are

supported by digital services and practical pilot projects, and eventually become permanent elements of the THREE C community.

Consequently, the project logic provides the conceptual framework for the entire valorisation strategy presented in this report.

4.4. Levels of Valorisation

To ensure long-term sustainability, B4C differentiates between five complementary levels of valorisation. Each level contributes to a different aspect of the project's long-term impact while remaining closely connected to the others.

Level 1 – Evidence Base and Competence Development

The foundation of the ecosystem consists of the project's educational evidence base. Stakeholder surveys, competence analyses, educational research and pilot evaluations have generated valuable insights into competence needs across different vocational sectors.

These findings have been consolidated in the European Competence Framework, which provides a common language for describing learning outcomes and supports future curriculum development beyond the project partnership.

The evidence base therefore remains an important reference for future educational initiatives within the Circular Carbon Economy.

Level 2 – Educational Products

The second level comprises the educational resources developed throughout the project.

These include:

- the European Competence Framework;
- the Learning Design methodology;
- Assessment Patterns;
- modular learning units;
- the Carbon Manager Course;
- Continuing Professional Development (CPD) concepts;
- practical learning templates; and
- pilot implementation materials.

These resources are designed as Open Educational Resources wherever possible and may be adapted to different educational contexts throughout Europe.

Level 3 – Digital Infrastructure

Educational innovation increasingly depends upon accessible digital services. B4C therefore established an integrated digital learning environment that supports competence development before, during and after formal learning activities.

The digital ecosystem consists of:

- the B4C website;
- the Support Hub;
- the Learning Suite;
- the Resource Repository;
- the Virtual Marketplace; and
- digital collaboration tools.

Together these services enable continuous access to learning resources, facilitate collaboration between stakeholders and support the dissemination of practical implementation examples.

Unlike many Erasmus+ platforms that become inactive after project completion, these services will continue as part of the digital infrastructure of the THREE C network.

Level 4 – Practical Innovation and Demonstration

The fourth level focuses on practical implementation.

Throughout the project, learners and educational institutions developed pilot projects demonstrating innovative biochar applications within agriculture, horticulture, construction and environmental management.

These pilots fulfil several important functions:

- validating educational approaches;
- demonstrating practical feasibility;
- encouraging regional innovation;
- supporting stakeholder engagement; and
- providing authentic learning environments.

Rather than ending with the project, these implementation cases provide a growing collection of demonstration projects that can inspire future learners and organisations.

Level 5 – Community and Network Development

The highest level of valorisation concerns the establishment of a sustainable European community.

Educational resources only create lasting value when they are embedded within active communities of practice. B4C therefore contributes to the development of the THREE C network by providing the educational infrastructure necessary for continuous competence development.

Within this community, vocational education providers, higher education institutions, municipalities, farmers, companies, NGOs, technology providers and public authorities collaborate in developing and implementing Circular Carbon Economy solutions.

The educational outputs of B4C thus become shared resources supporting continuous innovation and cooperation across Europe.

4.5. Value Creation through Integration

One of the distinctive characteristics of B4C is that the project outputs are not designed as isolated deliverables but as interconnected components of one competence ecosystem.

The Competence Framework informs the Learning Design; the Learning Design structures the Carbon Manager Course; the Carbon Manager Course is supported by the digital Support Hub; the Support Hub connects learners with the Virtual Marketplace; and the Marketplace facilitates collaboration among the stakeholders of the THREE C network.

This integrated architecture creates considerably greater value than any individual deliverable could achieve independently. It also ensures that future educational developments can build upon an existing ecosystem rather than starting from scratch.

The long-term value of B4C therefore lies not only in its educational products but in the sustainable competence ecosystem that continues to connect learning, implementation, innovation and collaboration beyond the project lifetime.

5. Educational Services: Building Competences for the Circular Carbon Economy

5.1. Introduction

The primary outcome of the B4C project is not a single training course or educational resource but a coherent portfolio of competence-oriented products and services supporting vocational education, continuing professional development and lifelong learning in the emerging field of the Circular Carbon Economy.

These educational services were developed to address the growing need for qualified professionals capable of implementing biochar-based solutions across different sectors. Together they provide educators, trainers and learners with a comprehensive educational architecture that supports competence development from introductory learning to advanced professional practice.

Unlike many educational projects that focus on isolated learning materials, B4C deliberately developed interconnected products and services that can be combined, adapted and continuously extended according to the needs of different learner groups and regional contexts.

5.2. The European Competence Framework

The Competence Framework represents the educational foundation of the B4C ecosystem. Developed through stakeholder consultation, educational research and pilot validation, it defines the competences required for implementing Circular Carbon Economy solutions in vocational practice.

The framework is based on the LEVEL5 competence methodology and describes competences across the three dimensions of knowledge, skills and attitudes. It enables educational providers to formulate transparent learning outcomes, design competence-oriented curricula and assess learner progression in authentic learning situations.

Beyond its immediate application within the B4C project, the Competence Framework provides a common European reference that can support curriculum development, qualification design and professional development activities across different vocational sectors.

Its modular structure also allows educational institutions to adapt competence profiles to regional priorities, occupational profiles and emerging technological developments without changing the underlying educational philosophy.

5.3. Learning Design and Educational Methodology

Building upon the Competence Framework, the consortium developed a comprehensive Learning Design methodology that translates competence requirements into structured educational programmes.

The learning design follows a systematic sequence beginning with the identification of practical challenges and desired competences, continuing through the organisation of learning fields, learning objects and learning pathways, and culminating in competence assessment and reflection.

Special emphasis is placed on project-based and challenge-based learning, allowing participants to acquire competences while working on authentic implementation projects. This methodology strengthens learner motivation, facilitates interdisciplinary cooperation and supports the transfer of acquired competences into professional practice.

Because the learning design is modular, educational institutions may implement complete programmes or select individual learning units according to their own educational objectives.

5.4. Assessment and Validation

Meaningful competence development requires equally meaningful assessment methods.

The Assessment Patterns developed within B4C therefore complement traditional examinations by providing a wide range of competence-oriented assessment approaches. These include structured observation, learner portfolios, reflective practice, interviews, project documentation, peer assessment and LEVEL5 competence validation.

Assessment is viewed primarily as a learning process rather than solely as a mechanism for certification. Continuous feedback enables learners to understand their own competence development and encourages self-directed professional growth.

The validation methodology also supports educational transparency by documenting competence acquisition in a structured and transferable manner.

5.5. The Carbon Manager Programme

One of the project's most visible educational products is the Carbon Manager Programme.

Developed as an advanced Continuing Professional Development programme, it combines domain knowledge, competence-oriented learning methodology and practical implementation experience into a coherent qualification pathway.

Rather than focusing exclusively on biochar production technologies, the programme addresses the broader implementation of Circular Carbon Economy systems. Participants learn to analyse regional biomass resources, identify application opportunities, evaluate environmental and economic impacts and facilitate cooperation among diverse stakeholder groups.

The programme therefore prepares professionals to act as facilitators of regional carbon management projects, bridging technical, organisational and educational perspectives.

The modular structure enables flexible delivery in different educational contexts and allows continuous further development as new technologies and policy frameworks emerge.

5.6. Pilot Projects as Learning Environments

The pilot projects implemented throughout the B4C partnership represent an essential educational resource rather than simply project demonstrations.

Each pilot provided learners with opportunities to apply newly acquired competences in authentic professional situations. The projects addressed practical challenges within agriculture, horticulture, construction and environmental management while simultaneously generating valuable implementation experiences for future learners.

The documented pilot reports now constitute a growing collection of implementation examples that can be integrated into future teaching, professional development and regional innovation activities.

In this way, practical experience becomes a reusable educational resource that continues to generate value beyond the original project duration.

5.7. Open Educational Resources and Transferability

A central principle of B4C is the broad accessibility of educational resources.

Wherever possible, learning materials, templates, methodological guidance and educational concepts have been developed as Open Educational Resources (OER). This enables vocational education providers, universities, adult education organisations and professional associations throughout Europe to adopt and adapt the materials according to their own needs.

The modular organisation of the educational products facilitates transfer to additional vocational sectors, regional implementation contexts and future European projects.

Consequently, the educational outputs of B4C are not regarded as fixed products but as continuously evolving resources that can be enriched through future collaboration within the THREE C community.

5.8. Long-Term Educational Value

The long-term value of the educational products lies in their integration into a coherent competence ecosystem.

The Competence Framework provides the educational reference; the Learning Design transforms competences into structured learning; Assessment Patterns validate learning outcomes; the Carbon Manager Programme demonstrates integrated application; and the pilot projects connect learning with real-world implementation.

Together these products provide a robust educational infrastructure that can support vocational excellence in the Circular Carbon Economy well beyond the duration of the Erasmus+ project.

Through their integration into the THREE C network, the educational products will continue to evolve, supporting new learner groups, emerging technologies and future regional initiatives while contributing to the establishment of a European competence community for biochar and Circular Carbon Economy.

6. The B4C Digital infrastructure

6.1. Digital Transformation of Circular Carbon Education

Digital technologies play a central role in extending vocational learning beyond traditional classroom environments. Professionals working in the Circular Carbon Economy require continuous access to up-to-date knowledge, implementation examples, collaborative learning opportunities and stakeholder networks. Consequently, the digital infrastructure developed within B4C is not merely intended to support individual courses but to establish a permanent European learning environment for competence development.

Unlike many project websites that primarily serve communication purposes during the funding period, the B4C digital ecosystem has been designed as an operational infrastructure that continues to support learners, educators and practitioners after the completion of the project.

The digital system therefore complements face-to-face education while simultaneously enabling lifelong learning, transnational cooperation and continuous exchange of knowledge within the wider THREE C community.

6.2. The B4C Support Hub

The B4C Support Hub forms the central digital entry point into the educational system. It combines learning resources, competence development tools and practical implementation guidance within an integrated online environment.

Rather than functioning as a conventional Learning Management System alone, the Support Hub provides access to educational resources throughout the complete learning cycle. Learners can prepare themselves before attending courses, continue learning afterwards and return whenever additional information or support is required during practical implementation.

For trainers and educational institutions, the Support Hub provides reusable teaching materials, methodological guidance and examples of good practice that facilitate the delivery of competence-oriented learning programmes.

The modular architecture also enables the continuous expansion of resources as new educational materials, implementation examples and project results become available through future initiatives.

6.3. The Learning Suite

The Learning Suite provides the digital environment for delivering competence-oriented learning programmes.

Building upon the educational philosophy presented in previous chapters, the Learning Suite supports different learning scenarios, including self-directed learning, tutor-supported courses, blended learning and collaborative project work.

The Learning Suite accommodates modular learning pathways corresponding to different competence levels and professional backgrounds. Individual learning units can therefore be combined flexibly to create programmes for vocational learners, educational professionals, public authorities or private companies.

This modularity ensures that future educational offers developed within the THREE C network can reuse and extend existing learning resources without redesigning complete curricula.

6.4. The B4C Website as Knowledge Gateway

The project website constitutes the public gateway to the B4C ecosystem.

Beyond communicating project information, it provides permanent access to the principal project results, educational resources, publications, newsletters and implementation examples. Visitors are introduced to the educational philosophy of the project while also being guided towards practical learning opportunities, digital resources and the wider THREE C community.

As the project evolves beyond the Erasmus+ funding period, the website will increasingly function as a portal linking educational activities with stakeholder services, the Support Hub and the Virtual Marketplace.

Consequently, the website represents the visible public face of the B4C educational ecosystem.

6.5. The Virtual Marketplace

One of the most innovative components of the digital infrastructure is the Virtual Marketplace.

Its purpose extends considerably beyond the presentation of educational materials. Instead, it establishes a digital meeting place where the diverse stakeholders of the Circular Carbon Economy can exchange knowledge, identify cooperation opportunities and develop new implementation projects.

The Marketplace supports interaction among:

- vocational education providers;
- higher education institutions;
- learners and Carbon Managers;
- municipalities and regional authorities;
- farmers and land managers;
- SMEs and technology providers;
- consultants and advisory services;
- NGOs and civil society organisations; and
- members of the THREE C community.

Through these interactions, educational activities become directly connected with practical implementation, innovation and regional development.

The Marketplace therefore represents the multi-stakeholder interface of the THREE C ecosystem and constitutes one of the principal mechanisms for the long-term valorisation of B4C results.

6.6. Digital Communities of Practice

Learning within the Circular Carbon Economy does not end with the completion of a course.

Digital communities of practice enable educators, learners and practitioners to continue exchanging experiences, discussing implementation challenges and jointly developing innovative solutions.

The digital infrastructure therefore supports the emergence of self-organising learning communities that contribute new implementation cases, educational resources and practical experiences.

Such continuous exchange is essential for maintaining the relevance of educational resources within a rapidly evolving technological and regulatory environment.

Through these communities, learners gradually become contributors to the educational ecosystem themselves.

6.7. Open Educational Resources

The digital infrastructure provides the technical basis for maintaining and distributing the Open Educational Resources developed throughout the project.

Educational materials can be updated, translated, adapted and recombined according to regional needs while preserving common educational standards established through the Competence Framework.

This openness considerably increases the transferability of project results beyond the original consortium and supports the widespread adoption of competence-oriented Circular Carbon education across Europe.

It also enables future European projects to build upon existing resources rather than duplicating educational development efforts.

6.8. Long-Term Digital Sustainability

One of the main challenges of European projects concerns the long-term maintenance of digital infrastructures after project funding has ended.

B4C addresses this challenge by embedding its digital ecosystem within the organisational structures of the THREE C network.

Rather than operating as an isolated project platform, the Support Hub, Learning Suite, website and Virtual Marketplace become permanent services supporting the activities of the wider community. Their continuous development will therefore depend upon ongoing educational activities, new European projects, professional training offers and the gradual expansion of the THREE C network.

In the longer term, these digital services may become part of the planned European Cooperative, providing stable organisational responsibility for maintenance, quality assurance and further development.

Consequently, the digital infrastructure evolves from a project deliverable into a permanent European infrastructure supporting competence development in the Circular Carbon Economy.

7. Practical Innovation and Demonstration Projects

7.1. From Learning to Implementation

One of the distinguishing characteristics of the B4C project is its strong emphasis on practical application. While competence development forms the educational foundation of the project, learning only creates lasting value when it is translated into real-world implementation. B4C therefore deliberately combined competence-oriented education with practical innovation projects that enabled learners to apply newly acquired knowledge and skills in authentic professional contexts.

Rather than treating pilot activities as isolated demonstrations, the project regarded them as learning environments in which participants developed solutions for real challenges related to biochar production, Circular Carbon Economy and climate action. In doing so, the pilot projects became both educational activities and innovation processes.

This close connection between learning and implementation represents one of the central principles of the B4C educational philosophy and significantly strengthens the long-term transferability of the project results.

7.2. Pilot Projects as Living Laboratories

The pilot projects implemented by the consortium functioned as living laboratories in which educational concepts, competence frameworks and learning methodologies could be tested and continuously improved.

Participants worked on practical challenges originating from their own professional environments and regional contexts. Depending on the participating organisation, these challenges addressed applications within agriculture, horticulture, construction, environmental management and community development.

The pilot projects therefore enabled participants to experience the complete innovation cycle:

- identifying practical challenges;
- analysing local conditions;
- designing potential solutions;
- implementing selected approaches;
- evaluating environmental, technical and organisational impacts; and
- reflecting upon lessons learned for future implementation.

This process transformed learners from passive recipients of knowledge into active contributors to regional innovation.

7.3. Diversity of Application Scenarios

One of the strengths of the B4C pilot programme lies in the diversity of application scenarios that were explored throughout the project.

The pilot projects demonstrated how biochar and Circular Carbon Economy principles can contribute to different sectors, including:

- sustainable agriculture and soil improvement;
- horticulture and growing media;
- urban greening and landscaping;

- circular construction materials;
- biomass valorisation;
- water management and environmental protection;
- regional climate action; and
- vocational education and awareness raising.

Although each pilot addressed specific regional conditions, together they illustrate the broad applicability of biochar-based solutions across different economic sectors and educational contexts.

The collection of pilot reports therefore represents a valuable repository of implementation examples that can inspire future learners and practitioners.

7.4. Learning Through Regional Challenges

The pilot projects demonstrate that competence development is most effective when learners address authentic challenges that are directly relevant to their professional environment.

Instead of following predefined laboratory exercises, participants analysed local biomass resources, stakeholder structures, technical opportunities and environmental objectives before developing their own implementation concepts.

This challenge-based approach strengthens several competence dimensions simultaneously:

- technical problem-solving;
- systems thinking;
- stakeholder communication;
- project planning;
- teamwork;
- entrepreneurial thinking; and
- reflective practice.

Consequently, the learning outcomes extend well beyond technical knowledge and prepare learners for the complexity of real Circular Carbon Economy projects.

7.5. Pilot Projects as Educational Resources

The practical value of the pilot projects extends far beyond the original project duration.

Each pilot generated documentation, implementation experiences, teaching materials and lessons learned that can be reused within future educational activities. These implementation cases enrich the educational portfolio of B4C by providing authentic examples for classroom teaching, project-based learning and Continuing Professional Development.

The pilot reports also demonstrate how competence-oriented learning can be adapted to different learner groups, institutional settings and regional priorities.

Together they form a continuously growing knowledge base that complements the Competence Framework, Learning Design and Carbon Manager Programme.

7.6. Estimating Environmental and Societal Impact

An innovative aspect of the B4C pilot programme is the systematic consideration of environmental impact alongside educational outcomes.

Several pilot projects were linked to the **B4C Carbon Handprint Tool**, enabling learners to estimate the carbon sequestration potential of different biochar application scenarios while simultaneously considering wider environmental and societal co-benefits.

Depending on the selected application, these benefits may include:

- long-term carbon sequestration;
- improved soil fertility and resilience;
- enhanced water retention;
- reduced nutrient losses;
- substitution of fossil-based materials;
- increased resource efficiency;
- biodiversity enhancement; and
- strengthened regional circular value chains.

This integration of competence development with environmental impact assessment helps learners understand the broader significance of Circular Carbon Economy solutions and supports evidence-based decision-making in future implementation projects.

7.7. Innovation Through Collaboration

The pilot activities also demonstrated the importance of collaboration across organisational boundaries.

Educational institutions worked together with municipalities, farmers, businesses, advisory organisations, NGOs and regional stakeholders to design and implement practical solutions.

These collaborations enabled participants to experience the interdisciplinary nature of Circular Carbon Economy projects and strengthened their ability to communicate across different professional cultures.

At the same time, the participating organisations gained access to new educational approaches, implementation experiences and European networks, thereby extending the impact of the project beyond individual learners.

7.8. From Demonstration Projects to Regional Innovation

The long-term value of the pilot programme lies in its ability to stimulate further regional innovation.

Many implementation concepts developed during the project can be refined, expanded or transferred to additional regions through future educational activities and collaborative projects. As new members join the THREE C community, the collection of implementation cases will continue to grow, providing an increasingly rich source of practical knowledge and educational inspiration.

The pilot projects therefore represent not only successful educational activities but also the beginning of a continuously evolving European knowledge base for biochar and Circular Carbon Economy implementation.

Through their integration into the Support Hub and the Virtual Marketplace, these practical experiences become accessible to educators, learners and practitioners throughout Europe, ensuring that the knowledge generated within B4C continues to create value well beyond the project lifetime.

Fig. 02: Design Based Collaborative Learning: From Challenge to OER-Case Study

8. Embedding B4C into the THREE C Community

8.1. Beyond the Project Lifetime

European projects often generate valuable educational resources and innovative methodologies that risk becoming underutilised once project funding ends. Although websites remain accessible and reports are publicly available, many outputs gradually lose visibility because no organisational structure exists to maintain, further develop and apply them in changing educational and professional contexts.

The B4C consortium has therefore adopted a different approach. From the outset, the project was conceived not as an isolated educational initiative but as the competence-development pillar of the emerging **THREE C (Circular Carbon Communities)** network. This strategic positioning ensures that the educational results generated by B4C become embedded within a wider European community dedicated to the implementation of Circular Carbon Economy solutions.

The objective is therefore not only to preserve project outputs but to establish a permanent competence infrastructure that continuously supports learning, innovation and collaboration throughout Europe.

8.2. The Role of B4C within the THREE C Network

The THREE C network brings together stakeholders who contribute to different aspects of the Circular Carbon Economy. These include educational institutions, municipalities, farmers, SMEs, technology providers, researchers, public authorities, NGOs and regional development organisations.

Within this broader ecosystem, B4C fulfils a clearly defined function: it provides the educational foundation that enables stakeholders to develop the competences required for implementing Circular Carbon Economy solutions.

Rather than creating a separate educational network, B4C strengthens the overall capacity of the THREE C community by providing:

- competence frameworks;
- vocational education and training programmes;
- Continuing Professional Development;
- competence validation methodologies;
- digital learning services;
- implementation guidance; and
- practical demonstration projects.

Education therefore becomes an enabling function supporting all other activities within the THREE C ecosystem.

8.3.A Multi-Stakeholder Community

One of the strengths of the Circular Carbon Economy is that successful implementation depends upon cooperation between many different stakeholder groups. No single organisation possesses all the competences required to establish regional circular carbon systems.

The B4C educational ecosystem therefore supports cooperation among a broad range of actors, including:

- vocational education and training providers;
- higher education institutions;
- learners and Carbon Managers;
- farmers and biomass producers;
- municipalities and regional authorities;
- SMEs and technology providers;
- construction and landscaping professionals;
- consultants and advisory services;
- NGOs and civil society organisations;
- research organisations; and
- funding bodies and development agencies.

Each stakeholder contributes specific expertise while simultaneously benefiting from the competence development opportunities provided by the B4C educational infrastructure.

This multi-stakeholder approach also ensures that educational activities remain closely connected to practical implementation challenges and regional innovation needs.

8.4.Communities of Practice

The educational philosophy of B4C extends beyond formal training programmes.

The project aims to establish communities of practice in which educators, practitioners and organisations continuously exchange experiences, discuss implementation challenges and jointly develop new educational resources.

Such communities create several important benefits:

- continuous professional learning;
- rapid dissemination of innovative practices;
- peer-to-peer support;
- joint development of educational materials;
- collaborative project development; and
- increased visibility of successful implementation examples.

Through regular interaction, members gradually become contributors to the competence ecosystem rather than merely users of educational resources.

The digital infrastructure presented in Chapter 6 provides the technological basis for these communities, while the THREE C network provides the organisational framework for their long-term development.

8.5. The Virtual Marketplace as Community Platform

The Virtual Marketplace plays a central role in connecting the different stakeholder groups of the THREE C community.

Rather than functioning as a conventional repository of documents, the Marketplace serves as an active cooperation platform that enables members to identify partners, exchange implementation experiences and discover educational opportunities.

Within this environment stakeholders can:

identify competence development opportunities;

- access educational resources;
- present demonstration projects;
- exchange implementation experiences;
- identify project partners;
- share funding opportunities;
- promote training offers;
- disseminate innovative solutions; and
- connect regional initiatives with European networks.

The Marketplace therefore transforms the educational outputs of B4C into living resources that continuously generate new collaborations and implementation projects.

8.6. From Association to European Cooperative

The long-term sustainability of the B4C results requires an organisational structure capable of maintaining educational services, coordinating cooperation and supporting future innovation.

The current THREE C Association provides an important first step by bringing together organisations committed to the development of Circular Carbon Economy solutions. However, the consortium recognises that future European cooperation may benefit from a more robust organisational model.

The long-term vision is therefore the gradual evolution of the THREE C Association towards a European Cooperative.

A cooperative structure would provide members with shared ownership of educational services, digital infrastructure and innovation activities while creating a sustainable organisational basis for future development.

Potential functions of the cooperative include:

- maintaining the Support Hub and Learning Suite;
- coordinating the Virtual Marketplace;
- organising Carbon Manager Courses;
- supporting competence validation;
- developing new educational resources;
- initiating collaborative European projects;
- facilitating regional competence centres; and
- promoting quality assurance across educational offers.

This organisational development represents an evolutionary process rather than an immediate organisational change. The B4C project therefore lays the educational foundations for future institutional growth within the THREE C community.

8.7. European Cooperation and Future Development

The integration of B4C into the THREE C community creates favourable conditions for continuous educational innovation beyond the original consortium.

Future partners will be able to contribute new learning resources, implementation examples and competence profiles while simultaneously benefiting from the existing educational infrastructure.

This open development model allows the competence ecosystem to evolve continuously as technologies, policies and regional priorities change.

Future educational activities may include:

- advanced Carbon Manager programmes;
- specialised sector-specific courses;
- transnational study visits;
- joint demonstration projects;
- regional competence centres;
- European conferences and workshops;
- online communities of practice; and
- collaborative curriculum development.

Through these activities the educational ecosystem created within B4C becomes a permanent European resource supporting competence development for the Circular Carbon Economy.

8.8. Long-Term Strategic Vision

The ultimate objective of the B4C valorisation strategy is not simply the continuation of existing project activities but the establishment of a self-sustaining European competence ecosystem that supports the implementation of Circular Carbon Economy solutions across multiple sectors and regions.

By embedding its educational products within the THREE C community, B4C ensures that competence development becomes an integral component of future innovation, regional cooperation and climate action.

The combination of competence frameworks, digital infrastructure, practical implementation experience and a growing European community creates the conditions for continuous learning and collaborative innovation long after the conclusion of the Erasmus+ project.

In this way, B4C contributes not only to the dissemination of educational resources but also to the establishment of a lasting European community capable of supporting the transition towards a Circular Carbon Economy.

9. Exploitation Strategy

9.1. From Dissemination to Exploitation

Dissemination and exploitation are complementary but fundamentally different processes. Dissemination aims to increase awareness of project activities and results, whereas exploitation seeks to ensure that these results are actively used, adapted and further developed after the completion of the project.

The B4C project has generated a comprehensive portfolio of educational resources, digital services and practical implementation experiences. The long-term impact of these results depends on their continued integration into vocational education, professional development and regional Circular Carbon Economy initiatives.

The exploitation strategy therefore focuses on embedding the project outputs within existing educational structures, the THREE C community and future collaborative initiatives. Rather than treating project deliverables as completed products, B4C regards them as evolving resources that will continue to generate value through continuous application, adaptation and improvement.

9.2. Exploitable Results

The project has produced a diverse range of exploitable results that address different target groups and implementation contexts.

These results can be grouped into five categories:

Educational Products

- European Competence Framework
- Learning Design methodology
- Assessment Patterns
- Carbon Manager Course
- Continuing Professional Development concept
- Learning modules and teaching materials
- Pilot project documentation

These products provide vocational education providers with ready-to-use resources that can be adapted to different educational contexts.

Digital Services

- B4C website
- Support Hub
- Learning Suite
- Resource Repository
- Virtual Marketplace

Together these services establish a permanent digital infrastructure supporting learning, collaboration and knowledge exchange.

Practical Implementation Resources

The documented pilot projects, implementation guidelines and case studies provide practical examples demonstrating how competence-oriented education can support the implementation of Circular Carbon Economy solutions in different sectors.

These implementation resources facilitate the transfer of educational concepts into authentic professional practice.

Professional Development

The Carbon Manager Programme represents a transferable qualification concept that can be delivered by educational institutions and professional organisations throughout Europe.

Its modular structure enables adaptation to different sectors, learner groups and regional priorities.

Community Assets

Perhaps the most important exploitable result is the emerging European community itself.

Through the integration of educational institutions, practitioners and regional stakeholders within the THREE C network, B4C establishes the social infrastructure necessary for continuous competence development and collaborative innovation.

9.3. Target Groups for Exploitation

Different project results address different stakeholder groups. The exploitation strategy therefore differentiates between several primary user communities.

Vocational Education and Training providers will integrate the Competence Framework, Learning Design and Carbon Manager Programme into their educational offers.

Higher Education institutions may adopt educational methodologies, implementation cases and digital resources within specialised programmes related to sustainability, environmental management and Circular Carbon Economy.

Professional organisations and training providers may use the CPD concept and modular learning resources for continuing professional development.

Municipalities, SMEs and advisory organisations benefit primarily from practical implementation examples, pilot projects and competence development opportunities.

Members of the THREE C network use the complete educational ecosystem as a common platform for competence development, networking and collaborative innovation.

9.4. Exploitation Pathways

The project distinguishes several complementary pathways through which its results will continue to create value.

Integration into Educational Programmes

Educational institutions will incorporate B4C resources into existing curricula, vocational qualifications and Continuing Professional Development offers.

Rather than replacing existing programmes, the educational products are designed to complement and enrich current vocational education.

Continuous Professional Development

The Carbon Manager Course provides a sustainable framework for regular professional training.

The consortium intends to continue delivering the programme through the THREE C network while encouraging additional educational providers to adopt and further develop the course.

Digital Access

The Support Hub and Virtual Marketplace ensure that educational resources remain accessible to learners, trainers and organisations after project completion.

These digital services also facilitate continuous updating and expansion of educational materials.

Practical Demonstration

Pilot projects continue to function as educational case studies demonstrating practical implementation of Circular Carbon Economy solutions.

Future implementation projects developed within the THREE C network will further expand this repository of practical experience.

European Cooperation

Future collaborative projects will continuously enrich the educational ecosystem by contributing new competence profiles, learning resources and implementation examples.

In this way exploitation becomes an ongoing process rather than a final project activity.

9.5. Roles and Responsibilities

Successful exploitation requires clear organisational responsibilities.

The project partners therefore commit themselves to continuing the promotion and further development of the educational ecosystem according to their institutional expertise.

Educational institutions will continue delivering competence-oriented learning programmes.

The THREE C network will provide the organisational framework for maintaining digital services, facilitating cooperation and coordinating future educational developments.

Individual partners will contribute through:

- delivery of Carbon Manager courses;
- maintenance of educational resources;
- dissemination through professional networks;
- organisation of workshops and conferences;
- contribution to future European initiatives; and
- continuous updating of implementation examples.

This distributed responsibility ensures that exploitation is shared across the community rather than depending on a single organisation.

9.6. Monitoring Exploitation

The long-term success of the exploitation strategy will be assessed through a combination of quantitative and qualitative indicators.

Potential indicators include:

- educational institutions adopting B4C resources;
- participants completing Carbon Manager programmes;
- downloads and use of Open Educational Resources;
- activity within the Support Hub and Marketplace;
- new implementation cases contributed by community members;

- collaborative initiatives emerging within the THREE C network;
- regional adaptation of educational resources; and
- new partnerships building upon B4C results.

These indicators allow continuous evaluation of how effectively the educational ecosystem continues to create value after project completion.

9.7. Long-Term Value Creation

The B4C exploitation strategy ultimately seeks to transform project outputs into permanent European educational assets.

Rather than preserving project deliverables in their original form, exploitation encourages continuous adaptation, improvement and application in changing professional environments.

The integration of educational resources within the THREE C community provides the institutional framework required for this continuous evolution.

Consequently, the long-term impact of B4C will be measured not only by the number of educational products developed during the project but by the extent to which these products continue supporting competence development, innovation and cooperation throughout Europe.

Exploitable Result	Main Target Groups	Exploitation Mechanism	Responsible Actors	Long-term Perspective
Competence Framework	VET, HE	Curriculum development	Educational partners	Continuous updating
Learning Design	Trainers	CPD, new courses	Training providers	Integration into new programmes
B4C for Trainers	Trainers	Annual course delivery	Training providers	European qualification
Carbon Manager Course	Professionals	Annual course delivery	THREE C members	European qualification
Support Hub	All stakeholders	Digital services	THREE C	Permanent platform

Exploitable Result	Main Target Groups	Exploitation Mechanism	Responsible Actors	Long-term Perspective
Virtual Marketplace	Community	Networking & cooperation	THREE C	European collaboration
Pilot Courses	Educators, learners	European courses	All partners	Continuous quality proven European course offers
Pilot Projects	Educators, learners	Case studies	All partners	Growing implementation database

10. Sustainability Roadmap

10.1. Ensuring Long-Term Sustainability

The sustainability of the B4C project is based on the conviction that competence development for the Circular Carbon Economy will remain an important European priority beyond the lifetime of the Erasmus+ project. Rather than considering the project outputs as finished products, the consortium regards them as the foundation of a continuously evolving educational ecosystem that supports vocational excellence, lifelong learning and regional innovation.

Long-term sustainability therefore depends not only on maintaining individual deliverables but on preserving the relationships between educational resources, digital services, stakeholders and practical implementation. These elements together constitute the B4C competence ecosystem described throughout this strategy.

The consortium has consequently developed a sustainability roadmap that combines educational continuity, organisational embedding and continuous innovation.

10.2. Educational Sustainability

The educational resources developed during the project are designed for long-term use.

The European Competence Framework, Learning Design, Assessment Patterns and Carbon Manager curriculum provide modular resources that can be continuously adapted to new learner groups, educational sectors and technological developments.

Future educational activities will include:

- regular delivery of the Carbon Manager Course;
- integration of B4C learning resources into vocational education and Continuing Professional Development;
- adaptation of learning units to regional contexts;
- further development of competence profiles;

- continuous updating of educational materials; and
- expansion through future collaborative initiatives.

Because these educational products are modular and competence-oriented, they can evolve without requiring fundamental redesign.

10.3. Maintaining the Digital Infrastructure

The digital ecosystem represents one of the most valuable assets created during the project.

The B4C website, Support Hub, Learning Suite and Virtual Marketplace will remain available after the completion of the Erasmus+ project and continue serving learners, trainers and members of the THREE C community.

The consortium intends to maintain these digital services by:

- regularly updating educational resources;
- integrating new implementation examples;
- providing information on training opportunities;
- supporting online communities of practice;
- promoting collaboration between stakeholders; and
- continuously improving the functionality of the digital platforms.

The digital infrastructure will therefore evolve from project communication tools into permanent services supporting competence development throughout Europe.

10.4. Continuous Development of the Carbon Manager Programme

The Carbon Manager Programme represents the flagship educational offer emerging from B4C.

The consortium intends to continue delivering and refining the programme after the project, responding to technological developments, emerging application fields and stakeholder needs.

Future editions of the course will incorporate:

- new implementation case studies;
- developments in biochar applications;
- updated educational resources;
- experiences from additional pilot projects;
- contributions from new members of the THREE C community; and
- evolving policy and market developments relevant to the Circular Carbon Economy.

In this way, the Carbon Manager Programme will remain a dynamic Continuing Professional Development offer rather than a fixed project output.

10.5. Strengthening the THREE C Community

Long-term sustainability ultimately depends upon active cooperation among organisations rather than the preservation of individual documents.

The consortium therefore considers the continued development of the THREE C community as the principal mechanism for sustaining the educational ecosystem created by B4C.

Within this community, members will:

- exchange educational experiences;
- contribute new implementation examples;
- organise collaborative learning activities;
- support regional competence development;
- identify future cooperation opportunities; and
- jointly develop new educational resources.

This collaborative model enables the educational ecosystem to grow continuously through the contributions of its members.

10.6. Towards a European Cooperative

The consortium recognises that sustainable European cooperation requires an organisational framework capable of coordinating educational activities over the long term.

The existing THREE C Association therefore represents an important first step towards establishing a permanent European competence community.

Looking beyond the current project, the consortium envisages the gradual development of a **European Cooperative** that could provide:

- shared ownership of educational resources;
- coordination of Carbon Manager programmes;
- maintenance of digital services;
- quality assurance;
- support for regional competence centres;
- organisation of European events;
- coordination of collaborative projects; and
- long-term governance of the educational ecosystem.

This organisational development will occur progressively as the THREE C community expands and new partners join the network.

10.7. Future Cooperation

The B4C ecosystem has been designed as an open educational infrastructure that welcomes continuous contributions from additional organisations.

Future cooperation may include:

- vocational education providers introducing new learning modules;
- universities contributing specialised expertise;
- municipalities providing demonstration projects;
- businesses supporting practical implementation;
- NGOs promoting community engagement;
- regional initiatives adapting educational resources; and
- European projects extending the competence framework into new application domains.

Such cooperation ensures that B4C remains responsive to emerging educational needs while preserving a coherent European competence model.

10.8. Sustainability Milestones

The sustainability strategy will be implemented progressively over the coming years.

Year	Strategic Milestones
2026	Completion of the Erasmus+ project; publication of all educational resources; continuation of the B4C website and Support Hub; first post-project Carbon Manager Course; integration of B4C into the THREE C Association.
2027	Expansion of the Carbon Manager Programme; further development of the Virtual Marketplace; new implementation case studies; enlargement of the THREE C educational community.
2028	Mature European competence ecosystem supporting Circular Carbon Economy education through the THREE C network and preparing the organisational transition towards a European Cooperative.

This roadmap should be regarded as a strategic orientation rather than a fixed implementation schedule. It provides a common direction for the continued development of the educational ecosystem while allowing flexibility to respond to future opportunities and emerging stakeholder needs.

10.9. Conclusions and Outlook

10.10. Building Europe's Competence Capacity for the Circular Carbon Economy

The transition towards a climate-neutral Europe requires more than technological innovation and supportive policy frameworks. It depends equally on people who possess the competences to translate innovative concepts into practical solutions. Biochar and the Circular Carbon Economy represent rapidly evolving fields that require new knowledge, interdisciplinary collaboration and a workforce capable of operating across traditional sectoral boundaries.

The B4C project has addressed this challenge by developing a comprehensive educational ecosystem that combines competence frameworks, innovative learning methodologies, digital learning environments and practical implementation experiences. Together these elements provide a coherent foundation for vocational education and lifelong learning in the Circular Carbon Economy.

Rather than creating isolated educational products, the project has established a transferable competence model that supports learners, educators and organisations throughout the entire learning and implementation process.

10.11. From Project Results to Lasting Impact

The value of B4C extends beyond the immediate achievements of the Erasmus+ project.

During its implementation, the consortium developed educational resources, digital services and collaborative approaches that are designed to continue evolving long after the completion of the funded activities. Through their integration into the THREE C community, these resources become part of a living competence ecosystem that can continuously adapt to technological innovation, changing educational needs and emerging implementation challenges.

This approach transforms project outputs from static deliverables into dynamic educational assets that generate value through continuous application, collaboration and further development.

The project's long-term success will therefore be measured not only by the number of courses delivered or publications produced, but by the extent to which its educational concepts continue to influence vocational education, professional development and practical implementation across Europe.

10.12. The Educational Dimension of the THREE C Network

One of the most significant strategic outcomes of the project is the positioning of B4C as the educational pillar of the THREE C network.

While the broader THREE C initiative brings together stakeholders involved in biomass valorisation, biochar production, climate action and Circular Carbon Economy implementation, B4C provides the competence development infrastructure that enables these activities to grow sustainably.

The Competence Framework, Carbon Manager Programme, Support Hub, Virtual Marketplace and pilot projects therefore represent more than individual educational products. Together they establish the knowledge and learning infrastructure required for a growing European community committed to Circular Carbon Economy solutions.

This close integration between education and practice significantly strengthens both the educational impact of B4C and the long-term development of the THREE C community.

10.13. Looking Ahead

The completion of the Erasmus+ project marks the beginning rather than the conclusion of the B4C initiative.

The educational ecosystem created during the project provides a robust foundation for future competence development, new learning programmes, collaborative innovation and regional implementation activities. As additional organisations join the THREE C community, they will contribute new expertise, educational resources and implementation experiences, ensuring that the ecosystem continues to evolve in response to emerging opportunities and societal needs.

The consortium also recognises that organisational development must accompany educational innovation. The planned evolution of the THREE C Association towards a European Cooperative offers a long-term perspective for maintaining digital services, coordinating educational activities and supporting collaboration among stakeholders. This organisational framework will help ensure that the educational resources developed within B4C remain accessible, relevant and continuously improved.

10.14. A Shared European Responsibility

The transition towards a Circular Carbon Economy cannot be achieved by individual organisations acting alone. It requires cooperation between education, research, business, public authorities and civil society, supported by a shared commitment to competence development and innovation.

B4C demonstrates that vocational education can play a pivotal role in this transition by equipping professionals with the competences required to design, implement and evaluate circular carbon solutions in diverse regional contexts. At the same time, the project illustrates the importance of combining educational excellence with practical application, digital innovation and transnational cooperation.

The consortium therefore invites educational institutions, professional organisations, municipalities, businesses and community initiatives to build upon the foundations established by B4C and to contribute actively to the continued development of the THREE C community.

10.15. Final Statement

The B4C project has laid the foundations for a European competence ecosystem supporting biochar and the Circular Carbon Economy. By integrating competence development, practical innovation, digital learning and collaborative networking, it demonstrates how vocational education can contribute directly to Europe's green transition.

The consortium believes that the true legacy of B4C will not be found in its individual deliverables, but in the people, organisations and communities that continue to use, develop and share its educational resources. Through the THREE C network, these results will remain active, evolve with future challenges and support a growing European community committed to climate action, circular resource management and sustainable regional development.

B4C therefore represents not the end of a project, but the beginning of a long-term European journey towards competence-based Circular Carbon Economy education.

11.Annex: Impact Table

In the following, the impacts of B4C on particpants, on different geographical levels and the results that will be maintained after the funding period

11.1. Impact on the participants organisations, stakeholders

- VET Learners
  - acquire future-oriented green competences related to Circular Carbon Economy
  - technical competences
  - transversal skills
  - system Thinking
- VETtrainers
  - Extended repertoire of themes
  - Better practical connection to STEM
  - How many per partner
- Educational organisations and networks
  - CFs and application fields of SDG in curricular and extracurricular contexts
  - Example per partner Astredhor, DEULA, IFSB
- Carbon Management (CCE networks, such as THREE C)
  - Potential new network members
  - New competent members
- Businesses
  - Better prepared clients

Partner	TG examples, incl. locations	Explanation/example
blinc	1. VET teachers/students Witzenhausen 2. Garden Networks Göttingen 3. RUZ Reinhausen 4. THREE C network members 5. Local businesses (plumbing and gardening, interns)	1. New learning offers & projects 2. Led to Practical biochar projects 3. New learning offers, incl. STEM 4. New practical learning offers, incl. STEM
DEULA	1. DEULA Nienburg (Nienburg, Germany) 2. Agricultural Apprentices (Lower Saxony	1. The project expanded the educational portfolio of DEULA through new learning offers on biochar, Circular Carbon Economy and climate-smart agriculture. 2. Apprentices acquired future-oriented green competences related to soil management,

	3. DEULA Trainers and Teachers (Nienburg) 4. Landwirtschaftskammer Niedersachsen (Lower Saxony) 5. Verband Garten-, Landschafts- und Sportplatzbau Niedersachsen-Bremen e.V. 6. Agricultural Training Farms operating with DEULA 7. Erasmus+ Partner Organisations and Mobility Participants	nutrient cycling, carbon sequestration and sustainable farming systems. 3. Trainers gained access to new teaching methodologies, competence frameworks and practical learning materials that can be integrated into future agricultural training programmes. 4. Increased awareness of biochar applications and Circular Carbon Economy approaches within agricultural advisory and training structures. 5. Dissemination of sustainability-related learning materials and promotion of innovative resource management approaches among member companies and apprentices. 6. Practical examples and pilot activities demonstrated the relevance of biochar for soil improvement, composting and manure management. 7. Strengthened cooperation in the field of sustainable agriculture and created opportunities for future mobility activities and educational projects.
IFSB	1. VET teachers / students IFSB Bettembourg 2. VET teachers / students => Centre de compétences – Bettembourg 3. Local construction companies (all Luxembourg) 4. Local businesses involved in sustainability and carbon management (all Luxembourg) 5. Companies involved in “Carbone Coaching” project - training courses held	1. new learning offers, while explaining the advantages of Biochar in construction 2. new learning offers, communicating to the Centre de compétences about advantages of Biochar to their members (craftsmanship companies) 3. regular communication to our network of construction companies about B4C (when meetings face to face) 4. new learning offers 5. “Carbone Coaching” is an ESF European project involving companies interested by

	in IFSB (Bettembourg) and Chambre des Métiers (Luxembourg City)	different tools related to decarbonization. A total of 17 trainings have been provided in 2025 and 2026 where the B4C has been mentioned and explained to these companies who are mainly involved in craftsmanship
Astredhor	1. Landscape professionals 2. Road Engineers 3. Technical advisors in ornamental productions 4. Municipalities stakeholders Ornamental growers	1. New learning offers 2. New learning offers 3. Learning concrete applications of Biochar for growers 4. New practical learning offers Learning Biochar potentials
FUU	1. VET teachers/students Folkuniversitetet 2. Sustainability InnoCentre 3. Uppsala Municipality 4. KTH Royal Institute of Technology (Stockholm) 5. European association of vocational institutions (EVBB)	1. New sustainability learning offers and teaching resources for VET teachers and learners. 2. Strengthened cooperation and innovation in sustainability education. 3. Increased awareness of biochar and circular carbon economy approaches. 4. Strengthened links between vocational education, sustainability research and innovation; increased visibility of biochar-related competences European-level dissemination and transfer of B4C results through VET networks.

11.2. What was the impact of the project at different geographical levels?

- strengthened cooperation between vocational education providers, sustainability initiatives, municipalities, businesses and community organisations
- Own organisations: enhanced the capacities of partner institutions to deliver innovative sustainability-oriented vocational education
- European level, B4C contributed to the growing community of organisations working on Circular Carbon Economy

Partner	TG examples, incl. locations	Explanation/example
blinc	1. VET school Witzenhausen, University Kassel, Climate farms in KS, 2. Blinc/BUPNET and locally associated partners 3. THREE C network members (associated partner list)	1. Collaborations at study days, joint projects related to local SD initiatives, biochar in new climate farming projects 2. New practical offers, e.g. also for Ukranian refugees 3. Practical biochar projects for transnational but also local projects
DEULA	1. DEULA Nienburg (Nienburg, Germany) 2. Agricultural Sector in Lower Saxony 3. Regional Agricultural Training Farms (Lower Saxony) 4. Landwirtschaftskammer Niedersachsen 5. European B4C Partnership (Germany, France, Luxembourg, Sweden) 6. B4C Network and THREE C Network 7. Final Conference Kassel (Germany)	1. Integration of biochar and Circular Carbon Economy topics into vocational education and training activities. 2. Increased awareness of carbon farming, sustainable nutrient management and climate-smart agriculture among learners, trainers and agricultural stakeholders. 3. Transfer of innovative approaches for soil improvement, composting and resource-efficient farming systems. 4. Strengthened exchange between vocational education, agricultural practice and sustainability initiatives. 5. Development of common competence frameworks, learning materials and innovative educational approaches. 6. Expansion of European cooperation in the fields of Circular Carbon Economy, sustainability education and biochar applications. 7. Dissemination of project results to approximately 120 participants from education, research, public authorities and industry.

IFSB	1. IFSB and partners 2. Centres de Compétences (CdC) and partners. 3. CDEC 4. Construction Companies	1. Raised awareness about Biochar possibilities in the construction sector 2. Raised awareness about Biochar possibilities in the construction sector, particularly within craftmanship in the construction sector (finishings) 3. Shows to Luxembourgish construction companies that the usage of Biochar is possible in order to achieve CO2 emissions targets. 4. Several Luxembourgish construction companies accepted the challenge to experiment with Biochar at the stage of production (cement/Biochar mix or asphalt/Biochar mix)
Astredhor	1. Ornamental professionals: technical advisors, growers 2. Landscape professionals: landscapers, municipalities Peripheral players in the ornamental sector: road engineers…	1. Better understanding on the uses of Biochar and its potentials for production; understand the value chain 2. Better understanding on the uses of Biochar and its potentials & practical possibilities for pollution mitigation Better understanding on the uses of Biochar and its potentials into concrete
FUU	1. Folkuniversitetet learners and VET educators (Uppsala, Sweden) 2. Sustainability InnoCentre (Sweden) 3. Uppsala Municipality (Sweden) 4. KTH Royal Institute of Technology (Stockholm, Sweden) 5. Ukrainian VET schools and colleges (e.g. Vinnytsia region and EVBB network members) 6. EVBB and associated European VET institutions	• Local level → Folkuniversitetet, Uppsala Municipality • Regional/National level → KTH, Sustainability InnoCentre • European level → EVBB and associated VET institutions International level → Swedish-Ukrainian VET cooperation and transfer of project results across countries.

11.3. What are the activities and results that will be maintained after the end of the EU funding

- Network of B4C/THREE C

- Organisational development
- Fairs and conferences
- Application of modules & materials in schools or other learning offers will be maintained
- Quality label
- Holistic course structure COL&V + practical projects for ECVET areas between 4 and 5 (6 for trainers).
- Acquired funding of local projects and events via the THREE C and reveal networks (see https://b4c.threec.eu/funding-opportunities/

Collaboration partners in B4C

Partner	TG examples, incl. locations	Explanation/example
blinc	1. University Kassel 2. Local public agriculture and nature organisations (4 counties and 10 NGOs) 3. 11 private garden networks 4. 4 Resilient farms in Kassel (DE (2)), CZ, DK, IT 5. Q21, BUPNET/reveal, PROGRASS e.V. as central and also other locally associated partners 6. >30 THREE C network members	1. Collaborations in new joint SD project 2. Utilisation of materials in SD initiatives, and new climate farming projects 3. Using the very good materials, re-compiling them and applications for flexible offers. 4. Integration of practical projects in the local hub and reference to the carbon calculation, new angle of attack via VET
DEULA	1. DEULA Nienburg 2. Erasmus+ Mobility Consortium coordinated by DEULA 3. Landwirtschaftskammer Niedersachsen 4. Verband Garten-, Landschafts- und Sportplatzbau Niedersachsen-Bremen e.V. 5. Agricultural Training Farms in Lower Saxony 6. B4C Hub and Learning Suite	1. Continued use of the developed learning modules and training materials within agricultural vocational education and continuing training programmes. 2. Integration of B4C topics into future learner and staff mobility projects focusing on sustainability and climate-smart agriculture. 3. Transfer and dissemination of project results through existing advisory and training structures. 4. Continued dissemination of learning materials and sustainability concepts among apprentices, companies and trainers. 5. Practical demonstration and testing of biochar-related approaches within vocational training and farm-based learning activities. 6. Continued access to learning materials, competence frameworks

	7. B4C Network / THREE C Network 8. DEULA Teaching Staff and Internal Training Structures	and project examples for learners and trainers. 7. Future cooperation, networking activities and participation in new sustainability-related projects and initiatives. 8. Long-term integration of biochar, carbon farming and Circular Carbon Economy topics into existing agricultural courses and training programmes.
IFSB	1. Université de Lorraine 2. CDEC network organizations 3. Several Luxembourgish municipalities	1. Experience sharing with their students and professors. We will keep a close relationship regarding new materials and experiences related to the use of Biochar in construction 2. CDEC network is vast and mainly comprised of building companies. CDEC's aim is always to push forward sustainable materials such as Biochar. We will therefore regularly communicate about Biochar usage and advantages in the construction sector, especially as a tool to lower CO2 emissions. 3. Luxembourgish municipalities are very well aware of the necessity of lowering CO2 emissions and participate in the mitigation of climate change. They are a very strong partner in that regard for the future usage of green and sustainable materials such as Biochar. IFSB will provide support for future dissemination of Biochar.
Astredhor	1. ASTREDHOR regional units (5 sites) 2. Municipalities stakeholders	1. Disseminating the Biochar backgrounds and uses to advisor and growers. Demonstration planned in an open day event July/2026 2. Providing support to experiment the use of Biochar -in landscape management and concrete. Engage test and follow up the results
FUU	1. Folkuniversitetet (Uppsala, Sweden) 2. Sustainability InnoCentre (Sweden) 3. Ukrainian VET schools and colleges	Continued use of B4C learning materials in adult education, VET and green skills training.

	4. EVBB and associated European VET institutions 5. KTH Royal Institute of Technology and sustainability stakeholders in Sweden	Integration of project results into sustainability workshops and stakeholder activities through Sustainability InnoCentre (Sweden). Reuse of open-access learning units by VET schools and educators. Continued dissemination through EVBB, European VET networks and future Erasmus+ projects. Further cooperation on sustainability, circular economy and biochar-related initiatives within Excel4Housing project.

11.4. List of Associated Partners:

Name	Country	City	Connection (e.g. impact or cooperation or cooperation while developing B4C, internships etc.)
Klimahelden	Germany	Zierenberg	Gardening and biochar delivery
Neidel&Christian	Germany	Göttingen	Internships for greywater cleaning
Baumschnitt Sauer	Germany	Göttingen	Tree trimming and utilisation of stems and branches
Farm Tolle	Germany	Fürstenberg	Site of the climate farming projects
Uni Kassel	Germany	Kassel Witzenhausen	Collaboration in the final event, different faculties (agri, design, waste management) Excursions of the climate course
Landkreis Kassel and Waldeck-Frankenberg	Germany	Coounties KS and W-FB	Collaboration in and the local CCE projects, info days and involvement of stakeholders in the work groups of the climate manager course
Landwirtschaftskammer Niedersachsen	Germany	Oldenburg	Shareholder of DEULA Nienburg GmbH. Project results contribute to strengthening sustainability and Circular Carbon Economy topics within agricultural vocational education and training.

Verband Garten-, Landschafts- und Sportplatzbau Niedersachsen-Bremen e.V.	Germany	Bremen	Shareholder of DEULA Nienburg GmbH. Indirect dissemination of project results through the professional network and vocational training activities in the landscaping sector.
DEULA Nienburg Erasmus+ Mobility Consortium	Germany	Nienburg	Integration of B4C topics into future mobility activities, staff training and vocational education projects.
Agricultural Training Farms cooperating with DEULA	Germany	Nienburg/ Niedersachsen	Practical discussion and demonstration of biochar applications in soil management, composting and nutrient recycling.
Berufsbildende Schulen Nienburg	Germany	Nienburg	Exchange of educational approaches and potential use of B4C learning materials in vocational education.
B4C Network Members	European		Continued cooperation on Circular Carbon Economy, sustainability education and future project development.
THREE C Network	European		Cooperation on climate-smart agriculture, carbon farming and dissemination of B4C learning approaches.
Participants of the B4C Final Conference	Germany / Europe	Kassel	Dissemination of project results and establishment of new contacts for future cooperation and transfer activities.
DEULA Staff (approx. 80 employees, Nienburg)	Germany	Nienburg	Project results, pilot activities and sustainability concepts were disseminated internally through regular Morning Meetings, increasing awareness and uptake among teaching staff and project managers.
UNEP – National Union of Landscaping Compagnies	FRANCE	National	Collaboration in the organization of training sessions for landscapers
Terrafertilis	FRANCE	National	Biochar delivery for growers and landscape stakeholders

Regional Chamber of Agriculture - Normandie	FRANCE	North of France Normandie	Collaboration in the organization of the open day event Veget'hall (demonstration and workshop session on Biochar)
Public local school "Les Sillons de Haute Alsace »	FRANCE	Wintzenheim	Collaboration in the organization of training sessions for growers
COCERT	LUX	Bettembourg	Biochar promotion to different stakeholders by the energy efficiency agency Cocert
Bétons Feidt	LUX	Luxembourg City	Collaboration with IFSB and different stakeholders in Luxembourg and the greater region to promote the usage and experimenting in Biochar mixed with concrete to lower CO2 emissions
Cimalux	LUX	Esch-sur-Alzette	Collaboration with IFSB and different stakeholders in Luxembourg and the greater region to promote the usage and experimenting in Biochar mixed with concrete to lower CO2 emissions
Karp Kneip	LUX	Bertrange	Collaboration in the organization of pouring asphalt mixed with Biochar in IFSB premisses. The idea is to have a real test bed in the long term to measure how a road with Biochar behaves (heavy machinery, rain, cold and warm weather…)
Sustainability InnoCentre (SIC)	Sweden	Uppsala	Dissemination of B4C results through sustainability networks
KTH Royal Institute of Technology	Sweden	Stockholm	Exchange of knowledge on sustainability, circular economy and biochar-related innovations
Uppsala Municipality	Sweden	Uppsala	Promotion of biochar and circular carbon economy approaches among local sustainability and environmental stakeholders
European Association of Vocational Institutions (EVBB)	Belgium	Brussels	Dissemination of project results through European VET networks and

			support for transferability of B4C outputs.
Vinnytsia Vocational College of Civil Engineering and Architecture	Ukraine	Vinnytsia	Dissemination of open-access learning materials and promotion of green skills development in VET education.
Higher Vocational School No. 7 of Vinnytsia	Ukraine	Vinnytsia	Sharing B4C learning resources and supporting awareness of sustainability and circular economy topics among VET learners and educators.
Vinnytsia State Pedagogical University named after Mykhailo Kotsiubynskyi	Ukraine	Vinnytsia	Dissemination of project results through academic and educational networks, supporting sustainability education and future cooperation initiatives.