Interreg
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EcoInn Danube

PACKAGES TO SUPPORT COOPERATION OF SMES AND R&D: FEASIBILITY STUDIES

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Contact: ecoinn.danube@cvtisr.sk

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Packages to support cooperation of SMEs and R&D: Feasibility studies

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Author	Centrum vedecko-technických informácií SR, SLOVENSKO (LP SCSTI) Energy Agency of Savinjska, Šaleška and Koroška Region, SLOVENIJA (PP2 KSSENA) Digitális Jólét Nonprofit Kft., MAGYARORSZÁG (PP3 Digitális Jólet)
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ABOUT THIS DOCUMENT

This document presents the following three feasibility studies developed as part of the Eco-innovatively connected Danube Region (EcoInn Danube) project:

1. Feasibility study on “Powerful composite sorbent for the removal of contaminants from water”
2. Feasibility study on “Ecological wastewater treatment using the constructed wetland technology”
3. Feasibility study on “Novel natural fibres for textile industry”

The original feasibility study documents can be found in the Annex of this document.

ABOUT THE ECOINN DANUBE PROJECT

The general objective of the EcoInn Danube project is to increase the cooperation of innovation actors in the field of eco-innovations with special emphasis on development and application of eco-technologies in the Danube Region.

Key aspects of cooperation are knowledge transfer and commercialisation of eco-technologies / solutions.

The aim is the introduction of any new or significantly improved product (good or service), process, organisational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and/or decreases the release of harmful substances across the whole life-cycle.

Information about the EcoInn Danube project can be found on the project website:

http://www.interreg-danube.eu/approved-projects/ecoinn-danube

DEFINITIONS USED

What Is a “Feasibility Study”?

A feasibility study is an analysis that takes a project's relevant factors into account—including economic, technical and legal considerations—to ascertain the likelihood of completing the project successfully[1]. A feasibility study is the evaluation and analysis of the potential of a project. A feasibility study therefore is a study that examines the viability and potential of a project according to specified criteria.

What is a “project”?

A project in this case is understood to be the (knowledge) transfer and commercialisation of a specific eco-innovation, eco-technology, eco-knowledge or eco initiative applied in a specific application or region.

[1] Investopeadia. https://www.investopedia.com/terms/f/feasibility-study.asp

What is knowledge transfer?

University of Cambridge defines knowledge transfer as a very broad range of activities to support mutually beneficial collaborations between universities (research centres), businesses and the public sector.

In terms of activities, knowledge transfer can be split into six forms[2]:

- *People:*
  The placement of people in companies or in the public sectors can be a more directed way of exchanging knowledge on a short-term basis.

- *Publication and events:*
  Knowledge is transferred through publication of research outputs, and through events and networking.

- *Collaborative research:*
  This is a means of creating opportunities for innovative knowledge exchange bringing together research centres, industry secondments, business acumen and manufacturing expertise to help those with exploitable concepts to achieve commercial success. Through research agreements, collaborative research creates new ideas and approaches to modern industrial practice – from understanding markets and technologies, through product and process design, to operations, distribution and related services.

- *Consultancy:*
  The provision of specific expert advice and training to external clients by an organisation can be a very effective knowledge transfer mechanism – it can provide a platform for the exchange of both explicit and more tacit knowledge, and a window on areas of possible collaboration.

- *Licensing:*
  Licensing the right to use specific research outputs (IP such as patentable inventions) is an important knowledge transfer mechanism. Successful licensing arrangements are long-term relationships often leading to research collaborations and individual contacts.

- *New businesses:*
  Bringing research outputs to market through the formation of a new business can be particularly appropriate when the there isn't any obvious external partner to whom the idea could be licensed. New businesses based on research outputs often build their business models around collaboration with larger, established firms to access expertise, equipment and routes to market.

What Is Commercialization?

[2] University of Cambridge 2019

Commercialization is the process of bringing new products or services to market. The broader act of commercialization entails production, distribution, marketing, sales, customer support, and other key functions critical to achieving the commercial success of the new product or service[3].

CONTEXT FOR DEVELOPING FEASIBILITY STUDIES WITHIN THE KNOWLEDGE TRANSFER ENVIRONMENT

Feasibility studies are a tool for innovation actors to confirm the viability of their project or technology according to various criteria (technological, economic/commercial, environmental and others).

Project managers use feasibility studies to discern the pros and cons of undertaking a project before they invest a lot of time and money into it[4].

Feasibility studies also can provide project managers with crucial information that could prevent the any stakeholder from entering blindly into risky businesses[5].

The aims of a feasibility study are:

- supporting the process of decision-making by objectively and rationally uncovering the project's strengths and weaknesses, opportunities and threats.
- identifying the steps and resources required to carry the project through and ultimately its prospects for success.

The feasibility studies are also a tool to communicate the quality of the eco-technology and its potential to stakeholders and especially commercialisation partners.

PURPOSE OF DEVELOPING FEASIBILITY STUDIES WITHIN THE ECOINN DANUBE PROJECT

The purpose of the three feasibility studies developed as part of the EcoInn Danube project is the validation of the virtual lab platform (more specifically one of its main tools, the matchmaking section for pairing offers and demands of existing eco-innovations) where the collection of several eco-innovations was established with the intent of facilitating matchmaking between technology/knowledge providers and beneficiaries/target groups/clients.

The aim of each EcoInn Danube feasibility study is:

[3] Investopeadia: https://www.investopedia.com/terms/c/commercialization.asp
[4] Investopeadia. https://www.investopedia.com/terms/f/feasibility-study.asp
[5] Investopeadia. https://www.investopedia.com/terms/f/feasibility-study.asp

- to support the decision of possible implementation of an eco-technology or solution by participants of the Virtual Lab with information and expertise and
- to facilitate the cooperation among the Virtual Lab´s participants and stakeholders.

BACKGROUND TO FEASIBILITY STUDIES WITHIN THE ECOINN DANUBE PROJECT

Three exemplary cases were selected by project partners to demonstrate and assess the functionality of the Virtual Lab and to provide a best practice guide to all stakeholders in the quadruple helix. The three eco-technologies were chosen within the process of internal voting on the level of the project partner consortium, which identified the subject of this feasibility study as one of the three most promising eco-innovations (from about 70 published) that demonstrated significant opportunity for implementation and notable positive impacts in terms of energy savings and other environmental considerations.

The cases were the subject of a feasibility study each.

The three eco-technologies selected for the feasibility studies were:

1. Powerful composite sorbent for the removal of contaminants from water
   More information is available from the Virtual Lab:
   http://ecoinnovative.eu/powerful-composite-sorbent-for-the-removal-of-contaminants-from-water/

2. Ecological wastewater treatment using the constructed wetland technology
   More information is available from the Virtual Lab:
   http://ecoinnovative.eu/1224-2/

3. Novel natural fibers for textile industry
   More information is available from the Virtual Lab:
   http://ecoinnovative.eu/novel-natural-fibers-for-textile-industry/

Each of the feasibility studies were developed by the following EcoInn Danube project partners and their respective external experts:

- Feasibility study on “Powerful composite sorbent for the removal of contaminants from water“ was developed by Centrum vedecko-technických informácií SR, SLOVENSKO (LP SCSTI) with the collaboration of Perpetuum Plus, s.r.o.

- Feasibility study on “Ecological wastewater treatment using the constructed wetland technology” was developed by Energy Agency of Savinjska, Šaleška and Koroška Region, SLOVENIJA (PP2 KSSENA) with the collaboration of STENG-nacionalni center za čistejšo proizvodnjo d.o.o.

- Feasibility study on “Novel natural fibers for textile industry” was developed by Digitális Jólét Nonprofit Kft., MAGYARORSZÁG (PP3 Digitális Jólet) with the collaboration of Bay Zoltán Nonprofit Ltd. for Applied Research.

TARGET GROUP OF ACTIVITY

The primary target groups for this activity and Output are the organisations that developed the eco-technologies that are the subject of the three feasibility studies, and also their current and potential transfer and commercialisation partners within the Virtual Lab or others.

The secondary target groups are other developers of eco-technologies (eg. universities, R&D institutions) and other commercialisation actors (eg. SMEs, governmental) that may use the best practice, networks and frameworks developed within this output.

SUSTAINABILITY

The feasibility studies share the same framework and serve as best practise and methodology guides for similar studies. Other actors and stakeholders may also utilise the networks provided by the three feasibility studies, to develop similar studies in the future.

FRAMEWORK FOR FEASIBILITY STUDIES

The studies developed within the EcoInn Danube project are basic exploratory type feasibility studies. Each Study provides a basic examination of the viability and potential of a project or solution from one or more of the following perspectives:

1. Technological feasibility – the determination and or validation of whether a project or solution is technologically possible and worthwhile,
2. Economic / commercial feasibility – the determination and or validation of whether a project or solution is viable from an economics and commercial point of view, and top what degree the project or solution is feasible from a business perspective.
3. Environmental feasibility – the determination and or validation of whether a project or solution has a beneficial environmental impact.
4. Legal feasibility – the determination and or validation of whether a project or solution complies with legislation in the area of utilisation.

The perspectives examined within an “EcoInn Danube” feasibility study necessarily build upon each other; they are also highly interdependent; all perspectives being equally important in the success of a project.

For example, feasibility from a technological viewpoint is the first perspective that needs to be studied, followed by feasibility from the commercial, environmental and legal perspectives. However, without a study of the environment and economic perspectives for example, a technological feasibility, in our view is not sufficient.

The need for development of each perspective is required according to the Technology Readiness Level (TRL) of the eco-technology, solution or the entire project.

Technology readiness levels (TRLs) are a method for estimating the maturity of technologies during the acquisition phase of a program. The use of TRLs enables consistent, uniform discussions of technical maturity across different types of technology.

Technology readiness level (TRL) of a technology within a project is determined by the following scale.

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies)

The TRL of a project determines which of the feasibility study perspectives are useful for or required at that particular stage in its development.

For example, it may be too early in the solution or project's life cycle to conduct a study of technological feasibility before it reaches TRL level 4 or 5.

SCOPE AND CONTENT OF THE FEASIBILITY STUDIES

Each study follows a similar framework and structure, as outline below:

1. Introduction, overview, definitions

This section could include:

- Background information, general overview
- Description of project, specific eco-innovation, eco-technology, eco-knowledge or eco initiative that is the subject of the feasibility study
- Introduction to the properties of the eco-innovation
- Overview of the technology and background to the project
- Process overview
- Overview of the present environment
- Overview of trends and changes in the technology area

- Specific proposed application
- Specific region of application
- Case study
- Summary

2. Technological feasibility

This section could include:

- Background information, General overview
- Review of the technology
- Current state of the technology
- What is the novelty? Introduction to the novelty
- Technological steps used in the project/solution
- Technology strengths, weaknesses, opportunities and threats of the technology or project
- Feasible technological alternatives already available
- Value proposition that the given eco-innovation, eco-technology, eco-knowledge or eco initiative offers
- Technological steps
- Evaluation of the TRL level
- Experimental part: measurements on individual parameters - helps the validation of the technology
- Determination and or validation of whether a project or solution is ***technologically*** possible and worthwhile
- Summary

3. Economic / commercial feasibility

This section could include:

- Background information, General overview
- Defining unique selling point (USP) for the technology
- Review of the economic / commercial aspects of the project
- Market analysis
- Trends on the market
- Competition analysis
- Review of the economic feasibility modelling
- Application of financial metrics
- Economics / commercial strengths, weaknesses, opportunities and threats of the technology or project
- General considerations including economic capacity and efficiency
- Scenario testing (economic): eg. base scenario, reconstruction scenario
- Assessment of demand for the products, processes or services of the given eco-innovation, eco-technology, eco-knowledge or eco initiative from the point of views of key stakeholders

- Summary of the key operational and business model features of some existing solutions around the world that are already delivering (aspects of) the value proposition identified
- Determination and or validation of whether a project or solution is viable from an economics and commercial point of view, and to what degree the project is feasible from a business perspective
- An assessment of the value proposition that the given eco-innovation, eco-technology, eco-knowledge or eco initiative needs to offer to be successful
- Summary

4. Environmental feasibility

This section could include:

- Background information, General overview
- Determination and or validation of whether a project or solution has a has beneficial environmental impact
- Environmental impacts of the solution or the project including its potential, impact on resources etc
- Life cycle assessment (LCA) analysis
- Environmental strengths, weaknesses, opportunities and threats of the technology or project
- Analysis of carbon footprint of the eco-innovation
- Summary

5. Legal feasibility

This section could include:

- Background information, General overview
- Determination and or validation of whether a project or solution is feasible from a legal perspective
- Legislative background
- Analysis of the institutional conditions which influence the implementation
- Relevant legislation related to the solution and project, especially regarding its commercialisation
- Strengths, weaknesses, opportunities and threats of the technology or project from a legal perspective
- Summary

6. Next steps for successful transfer and commercialisation

This section could include:

- Options for the project owner to take forward
- Value proposition that the given eco-innovation, eco-technology, eco-knowledge or eco initiative needs to offer to be successful
- Indicative costings and resource implications
- Recommendations for further technical examination / testing to further the project.

- Commercialisation strategy

7. Conclusions/Summary

This section could include:

A summary of the context and core arguments for why the use of the given eco-innovation, eco-technology, eco-knowledge or eco initiative in the application or region specified makes sense and a set of underlying convictions.

8. Bibliography / Sources / Reference list

9. Annexes

SUMMARIES:

SUMMARY: FEASIBILITY STUDY FOR TECHNOLOGY „POWERFUL COMPOSITE SORBENT FOR THE REMOVAL OF CONTAMINANTS FROM WATER“

Feasibility study for technology „Powerful composite sorbent for the removal of contaminants from water“ was developed by Centrum vedecko-technických informácií SR, SLOVENSKO (LP SCSTI) with the collaboration of Perpetuum Plus, s.r.o.

Description of the technology

The technology relates to wastewater purification and water treatment.

Technology readiness level (TRL) of a technology / project is high.

Polymer Institute of the Slovak Academy of Sciences has developed and Water Research Institute has successfully tested a composite sorbent for the removal of contaminants from water. These are mainly heavy metals – As, Sb, Cr, Cd, Pb and others. The developed composite sorbent is significantly more effective than the top commercially available sorbent, often several times. In laboratory tests, residual concentrations of heavy metals were achieved that comply with the limits for drinking water. As the basic input material for the production of the sorbent cellulosic precursors, produced annually in billions of tons by the nature, are used. This results in a low cost of the sorbent.

An extensive use of the composite sorbent is assumed also in areas, where exists a problem with the contamination of drinking water, such as several countries in Asia. These are often areas where the input material poses a waste and by that an important ecological load on the environment. The composite sorbent can be also used in wastewater treatment, including wastewater from chemical and electronic industry. The original molecular structure of the sorbent facilitates the achievement of a synergy effect of carbon and iron

oxide, and provides not only a high efficiency but also a high rate of contaminant capture. The physical structure of the composite sorbent reduces the resistance to water flow, and its efficiency in removing contaminants is in the area of practical applicability independent from water pH.

Competitive advantages:

- high removal efficiency of heavy metals: arsenic 97.8% , antimony 97.6%, chromium 96.4%, cadmium 88.9%, lead > 98.9%,
- low production price achieved by using input raw materials from plant wastes,
- up to 163% more effective than commercial products, depending on the type of contaminant.

More information is about the technology/project is available from the Virtual Lab:
http://ecoinnovative.eu/powerful-composite-sorbent-for-the-removal-of-contaminants-from-water/

Scope of feasibility study

The feasibility study concentrates on the economic / commercial feasibility of the given technology and commercialisation project.

The document content contains the following sections

1. Introduction
2. Background information provided by the submitter
3. Current state of technology
4. Market analysis
5. Trends on the market
6. Competition analysis
7. Defining USP for the technology
8. Commercialisation strategy

Results of the feasibility study

For comprehensive results of the feasibility study please:

- see Annex 1: Feasibility study for technology „Powerful composite sorbent for the removal of contaminants from water“
- enquire at EcoInn Danube project partner: Slovak Centre of Scientific and Technical Information, Slovakia, ecoinn.danube@cvtisr.sk
- enquire at Polymer Institute of the Slovak Academy of Sciences (contact details: http://ecoinnovative.eu/powerful-composite-sorbent-for-the-removal-of-contaminants-from-water/)

SUMMARY: FEASIBILITY STUDY ON “ECOLOGICAL WASTEWATER TREATMENT USING THE CONSTRUCTED WETLAND TECHNOLOGY”

Feasibility study on “Ecological wastewater treatment using the constructed wetland technology” was developed by Energy Agency of Savinjska, Šaleška and Koroška Region, SLOVENIJA (PP2 KSSENA) with the collaboration of STENG-nacionalni center za čistejšo proizvodnjo d.o.o.

Description of the technology

The technology relates to wastewater purification and water treatment.

Technology readiness level (TRL) of a technology / project is high (TRL9).

Constructed wetlands treatment systems are engineering structures designed to improve water quality, that use natural processes involving wetland vegetation, soils, and their associated microbial assemblages.

The complete service related to constructed wetland is offered – design, consultation, operation and service.

The offered technology is more economically and more environmentally friendly than most other wastewater treatment technologies. Innovative are especially new technological solutions, new materials and the use of new procedures.

Advantages

- improvement of water quality due to quality treatment technology
- use of nature-friendly materials and processes
- no need for a source of electricity
- economical solution – low operation costs
- smaller carbon footprint during construction and operation
- improvement of the water cycle and microclimatic conditions
- landscape-forming element

Current status of the technology: Already on the market and available for demonstration

More information is about the technology/project is available from the Virtual Lab:
http://ecoinnovative.eu/1224-2/

Scope of feasibility study

The feasibility study includes a study of the technological, economic / commercial, environmental, legislative feasibility of the given technology and commercialisation project.

The document content contains the following sections:

1. Technological feasibility
    a. Overview
    b. Wastewater definitions
    c. Wastewater treatment overview
    d. Suspended growth systems
    e. Attached growth systems

   f. Hybrid Systems
   g. Natural systems
   h. Eco-innovation technology review
   i. Process overview
   j. Case study Dražovice
2. Economic feasibility
   a. General considerations
   b. Identification of cost parameters
   c. Capital expenditures
   d. Operational expenditures
   e. Economic feasibility modelling
   f. Financial metrics applied
   g. Design parameters
   h. WWT technology treatment capacity
   i. WWT technology treatment efficiency
   j. Base scenario
   k. Reconstruction scenario
3. Environmental feasibility
   a. General overview
   b. Water as a resource
   c. The Danube river basin
   d. Wastewater and wastewater treatment environmental impacts
   e. Global warming potential
   f. Eutrophication Potential
   g. Acidification potential
   h. Abiotic resource depletion potential
4. Legislative background
   a. European legislation Legislative background
   b. Urban Wastewater Treatment Directive (UWWTD)
   c. Water Framework Directive (WFD)
   d. Other relevant EU legislation
   e. Country specific legislative background
   f. Conclusion
   g. Sources
   h. Annexes

Results of the feasibility study

For comprehensive results of the feasibility study please:

- see Annex 2: Feasibility study on “Ecological wastewater treatment using the constructed wetland technology”
- enquire at EcoInn Danube project partner: Energy Agency of Savinjska, Šaleška and Koroška Region, SLOVENIJA, niko.natek <at> kssena.velenje.eu

- enquire at Institute of Landscape Water Management of the Faculty of Civil Engineering at the Brno University of Technology (Czech Republic) (contact details: http://ecoinnovative.eu/1224-2/).

SUMMARY: FEASIBILITY STUDY ON "NOVEL NATURAL FIBERS FOR TEXTILE INDUSTRY"

Feasibility study on "Novel natural fibers for textile industry" was developed by Digitális Jólét Nonprofit Kft., MAGYARORSZÁG (PP3 Digitális Jólet) with the collaboration of Bay Zoltán Nonprofit Ltd. for Applied Research.

Description of the technology

The project is about an eco-innovation which concerns plant-based fibres as novel material for application in textile products. Their physical and biochemical properties render these fibres suitable as filling materials for textile products. Production and processing require only little energy input. Potential customers for fibres and derived textile products are environmentally-conscious persons. Furthermore, these plant-derived fibres have a better skin sensation and lower weight compared to synthetic fibres. European climate and soils are suitable for fibre production.

Advantages over currently used solutions:

- Fibres are renewable and can be produced in Europe.
- In contrast to (petrol-based!) synthetic textiles they have a better skin sensation, stronger insulation power and lower heat.
- No chemicals are required for fibre processing.
- Cultivation of fibre-producing plants would have a beneficial side effect on the environment (increased floral and insect biodiversity).
- The closes existent product, cotton fibres, has to be transported over long distances, is often produced under bad working conditions, using fertilizers and pesticides.
- "Our" fibre-producing plant species have very moderate growth requirements and are naturally disease-resistant.

Technology readiness level (TRL) of a technology / project is low.

More information is available from the Virtual Lab: http://ecoinnovative.eu/novel-natural-fibers-for-textile-industry/

Scope of feasibility study

The feasibility study concentrates on the technological feasibility of the given technology and commercialisation project and includes laboratory testing of specific technological aspects (insulation, water repellence).

The feasibility study includes a study of the technological feasibility and environmental feasibility of the given technology and commercialisation project. The study contains laboratory testing intended to establish the technological feasibility of the project, specifically the insulation properties of the fibres.

The document content contains the following sections:

1. Project description
2. The fibre overview
3. Technological steps
4. The evaluation of the TRL level, following steps
5. Experimental – insulation testing and water repellence testing in laboratory
6. Life cycle assessment
7. Summary
8. Bibliography
9. Feasibility study appendix, including measurement results
10. Water repellence test results
11. Appendix: Indicative suggestions on subsequent tests to determine the technological feasibility of the eco-technology

Results of the feasibility study

For comprehensive results of the feasibility study please:

- see Annex 3: Feasibility study on "Novel natural fibers for textile industry" (Feasibility study, Feasibility study appendix, Water repellence test, List of future testing suggestions)
- enquire at EcoInn Danube project partner: Digitalis Jolet Nonprofit Kft., Hungary, danube <at> djnkft.hu
- enquire at technology owner (contact details: http://ecoinnovative.eu/novel-natural-fibers-for-textile-industry/).

ANNEXES

ANNEX 1: FEASIBILITY STUDY FOR TECHNOLOGY „POWERFUL COMPOSITE SORBENT FOR THE REMOVAL OF CONTAMINANTS FROM WATER"

ANNEX 2: FEASIBILITY STUDY ON "ECOLOGICAL WASTEWATER TREATMENT USING THE CONSTRUCTED WETLAND TECHNOLOGY"

ANNEX 3: FEASIBILITY STUDY ON "NOVEL NATURAL FIBERS FOR TEXTILE INDUSTRY"