D4.4 Update of Investor database

BOOST

Bioeconomy projects accelerator

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PROJECT INFORMATION

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Project acronym	BIOBOOST
Funding scheme	HORIZON Coordination and Support Actions European Research Executive Agency
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Project website	https://bioboost.cat/en/

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DISCLAIMER

Table of Content

0. Executive Summary

This document provides the final and updated list of bioeconomy investors identified at local and European level, and presents a more detailed analysis of financial risk and de-risking approaches developed within the BioBoost framework, focused in Catalonia.

Since the initial stages of the project, the investor database has been progressively expanded and refined. The preliminary list included 81 investors (D4.2), which was later updated to 145 investors in the innovative financing deliverable (D4.3), and has now reached a total of 164 investors in its final version. In parallel, a significant number of these investors were engaged through interviews, as reported in D4.3 and further detailed in the Annex (Page 13). These interviews focused on understanding investor perspectives and provided key inputs for the development of the BioBoost innovative financing framework and the definition of de-risking mechanisms. For this final update, a second round of targeted interviews was conducted with additional experts, specifically aimed at gathering insights on financial risk and de-risking strategies, including those engaging the public sector, across different European regions. The outcomes of these interviews have been incorporated into the BioBoost report *De-risking mechanisms for european bioeconomy projects and their replicability in catalonia* (see Annex 1), which provides a comprehensive overview of the suitability of risk-related innovation approaches into Catalonia's context.

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1. Investor Database

The aim of this activity is to collect stakeholders and their related information from the public and private funding sector that could finance bioeconomy projects, from early-stage development through to construction and operation. The information gathered is organized into a database that can be used by project promoters to identify suitable funding sources based on the characteristics of their project.

As outlined in the Executive Summary, this database represents the final version developed within the scope of the project. While it reflects a comprehensive effort to identify relevant investors across different geographies and sectors, it is not intended to be fully exhaustive. Instead, it should be understood as a robust and consolidated reference point for stakeholders seeking financing opportunities in the bioeconomy sector.

Potential investors were defined as any public or private institution that could invest in bioeconomy projects. This includes EU, national, and regional public instruments, as well as private sector actors such as investment funds, banks, utilities, and corporate players (Table 1). The selection criteria were intentionally broad, encompassing investors that have funded, or expressed interest in funding, bioeconomy, renewable energy, and similar infrastructure projects. The output of this process is a "Long List of Potential Investors" database in Excel format, including key data fields such as name, website, and fund type. The categories used to classify investors are defined below:

- Private Equity Fund: Investors that provide capital to companies in exchange for a share of ownership (equity). These funds are typically backed by institutional investors such as pension funds, insurance companies, or sovereign wealth funds, as well as high-net-worth individuals. Private equity investors often specialize in specific sectors and investment stages (e.g., growth or buyout) and usually seek medium- to long-term returns through value creation and eventual exit strategies such as sales or IPOs.
- Bank/Debt: Institutions that primarily provide financing in the form of debt (e.g., loans, credit lines, project finance). Financing is typically subject to strict credit assessments, requiring collateral, guarantees, or proven revenue streams. This can make access to debt financing challenging for early-stage or innovative infrastructure projects, which may lack operational history or sufficient assets to secure financing. However, banks play a key role in later-stage project development and scaling.
- Infrastructure Fund: Investment funds focused on financing large-scale infrastructure projects rather than companies. These investments are often made through equity stakes in Special Purpose Vehicles (SPVs) established for individual projects. Infrastructure funds generally target stable, long-term returns and tend to prioritize projects with predictable cash flows, often supported by public mechanisms such as guarantees, subsidies, or long-term concession agreements. Many have a strong focus on renewable energy and sustainable infrastructure.
- Venture Capital (VC): Funds that invest in early-stage, high-risk, and high-growth potential companies, often in innovative or technology-driven sectors. Venture capital investors typically acquire minority equity stakes and actively support business development through strategic guidance and networks. Investments are usually short- to medium-term, with exit horizons of

around 5–10 years, and are particularly relevant for emerging bioeconomy technologies and start-ups.

- Corporate Venture Capital (CVC): Investment arms of established corporations, including engineering firms, utilities, and Energy Services Companies (ESCOs). In addition to financial returns, these investors often seek strategic benefits such as access to new technologies, markets, or business models. CVC actors tend to play an active role in project development, which may include joint ventures, co-development agreements, or full ownership and operation of assets, particularly in the context of integrated bioeconomy value chains.
- Public Body: Public institutions and programmes that provide financial support to projects delivering environmental, social, or economic benefits aligned with policy objectives. Public funding can take the form of grants, concessional loans, guarantees, or equity participation, and is often used to de-risk projects and attract private investment. At the EU level, institutions such as the European Commission and the European Investment Bank (EIB) play a central role, complemented by national and regional programmes. All public support within the EU must comply with State aid regulations.
- Impact Fund: Investment funds that prioritize measurable social and environmental impact alongside financial returns. These funds often target sectors such as sustainability, climate action, and circular bioeconomy, and may focus on underserved markets or innovative solutions. Impact investors typically apply broader evaluation criteria, incorporating ESG (Environmental, Social, and Governance) metrics and impact indicators into their investment decisions, sometimes accepting lower financial returns in exchange for higher societal value.

Table 1. Final potential investors list for Bioboost project.

Investor name	Investor Type	Country	Website
Abac Capital	VC	ES	https://www.abaccapital.com
Acció	Public Body	ES	https://www.accio.gencat.cat
Acciona	Corporate	Global	https://www.acciona.com
Acciona Innovation	VC	Global	https://imnovation.acciona.com
ACDI/VOCA	Facilitators	Global	https://www.acdivoca.org/
Affin Capital	VC	EU	https://www.affincapital.eu
Agbar	CVC	ES	https://www.agbar.es
Agricultural and Bioeconomy Programme Loans	Public Body	EU	https://www.eib.org/en/publications/agriculture-and-bioeconomy-programme-loan-2020
Agroecology Fund	Impact Fund	Global	https://agroecologyfund.org/
Aldea Ventures	VC	EU	https://www.aldea.ventures
ALDI	Corporate	Global	https://www.aldi.com
Aquaservice	CVC	ES	https://www.aquaservice.com
Archipielago Eco Investors	VC	ES	https://acceleratingimpact.org/cohort/archipelago/
Argo capital Partners	VC	ES	https://argocapitalpartners.com/
Armilar	VC	EU	https://www.armilar.com/
Asterion Capital	Impact Fund	EU	https://www.asterionindustrial.com/

Axon	VC	Global	https://www.axonpartnersgroup.com
Axpo	CVC	EU	https://www.axpo.com
Baillie Grifford	Private Equity Fund	Global	https://www.bailliegifford.com
Banc de sabadell	Bank/Debt	ES	https://www.bancsabadell.com
BBVA	Bank/Debt	Global	https://www.bbva.es
Beyond Impact	Impact Fund	Global	https://beyondimpact.org/
Biobased Circular Growth Fund	Impact Fund	EU	https://en.biobasedcircular.com/
Biotech Booster	Facilitators	NL	https://www.biotechbooster.nl/
BIOTOPE VENTURES	VC	EU	https://www.biotope-incubator.com
BONVENTURE	Impact Fund	DE	https://www.bonventure.de
Bullnet	VC	ES	https://www.bullnetcapital.com
Caixa Enginyers	Bank/Debt	ES	https://www.caixaenginyers.com
Capital energy	CVC	ES	https://capitalenergy.com/
Capricorn Partners	VC	BE	https://www.capricorn.be
Cargill	CVC	Global	https://www.cargill.com
Cetaqua	Infrastructure Fund	EU, CL	https://www.cetaqua.com
Cienega Capital	Impact Fund	Global	https://www.cienegacapital.com
Clave capital	VC	ES	http://clave.capital
CocaCola	CVC	Global	https://www.coca-colacompany.com
Cohesion Fund (CF)	Public Body	EU	https://ec.europa.eu/regional_policy/funding/cohesion-fund_en
Colesco Capital	Impact Fund	EU	https://www.colescocapital.com/
Common Land	Impact Fund	EU	https://commonland.com/
COREangels Climate	Angel Investor	EU	https://www.coreangels.com/invest/climate
CREAS	Impact Fund	ES	https://creas.es
Criteria Venture Tech	VC	ES	https://www.criteriaventuretech.com/
DANONE	CVC	Global	https://www.danone.com
Draper B1	VC	Global	https://draperb1.vc
EARLYBIRD	VC	EU	https://earlybird.com/
EasoVentures	VC	ES	https://www.easoventures.com
ECBF	Impact Fund		https://www.ecbf.vc
Eden Corporate Finance	Corporate	EU	https://www.edencf.com/
Elecnor	CVC	ES	https://www.elecnor.com
Enagas Renovable	CVC	ES	https://www.enagasrenovable.es/
Endesa	CVC	ES	https://www.endesa.com
Enerfip	Private Equity Fund	FR	https://www.enerfip.fr
Engie - Engie new ventures	CVC	Global	https://www.engieventures.com

European Agricultural Fund for Rural development (EAFRD)	Public Body	EU	https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en
European Bank for Reconstruction and Development (EBRD)	Public Body	EU	https://www.ebrd.com
European Circular Bioeconomy Fund (ECBF)	Impact Fund	EU	https://www.eib.org/en/products/equity/funds/european-circular-bioeconomy-fund
European Commission Agriculture and Rural Development	Public Body	EU	https://agriculture.ec.europa.eu/
European Energy Efficiency Fund (EEEF)	Impact Fund	EU	https://www.eeef.lu/home.html
European Investment Bank (EIB)	Public Body	EU	https://www.eib.org
European Investment Fund (EIF)	Public Body	EU	https://www.eif.org
European Regional Development Fund (ERDF)	Public Body	EU	https://ec.europa.eu/regional_policy/funding/erdf_en
Faber VC	VC	PT	https://faber.vc
Farmland LP	Impact Fund	US	https://www.farmlandlp.com
Florette	Corporate	EU	https://www.florette.com
FomentInvest SGPS	Private Equity Fund	PT	https://www.fomentinvest.com/
Galam	Corporate	FR	https://www.galamgroup.com/
GAWA Capital	Impact Fund	ES	https://www.gawacapital.com
Genia Bioenergy	Infrastructure Fund	ES	https://geniabioenergy.com/
Global Greengrants Fund	Impact Fund	Global	https://www.greengrants.org/
Griffith foods	CVC	Global	https://griffithfoods.com/
Grinyo	Infrastructure Fund	ES	http://www.grinyo.com
Grow Venture Partners	Private Equity Fund	Global	https://www.growventurepartners.com
Grup Ham	CVC	ES	https://ham.es/
Grupo BIMBO	CVC	Global	https://www.grupobimbo.com
GRUPO FREIXENET	Corporate	ES	https://www.freixenet.com
GRUPO LACTALiS	Corporate	Global	https://lactalis.com/
Grupo Ortiz	CVC	ES	https://www.grupoortiz.com
Gupi Startup	Facilitators	ES	https://gupistartup.com/
Horizon Flevoland	Private Equity Fund	NL	https://www.horizonflevoland.nl
HUIJBREGTS GROEP	Corporate	NL	https://www.huijbregts.com/
Hummingbirds	Impact Fund	EU	https://hummingbirds.eu
Ibercaja	Bank/Debt	ES	https://www.ibercaja.es

ICO	Public Body	ES	https://www.ico.es
ICOS CAPITAL	VC	EU	https://www.icoscapital.com/
Idom	CVC	ES	https://www.idom.com
INCLIMO	Impact Fund	EU	https://inclimo.com/
Innovaion Fund	Public Body	EU	https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund_en
InnovaTion Fund	Public Body	EU	https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund_en
InnovationQuarter Capital	Public Body	NL	https://www.innovationquarter.nl
Institut Català de Finances (ICF)	Public Body	ES	https://www.icf.cat
Integra Capital SCR	Private Equity Fund	ES	https://www.integracapital.com/
InvestEU Programme	Public Body	EU	https://investeu.europa.eu/index_en
Invest-NL	Public Body	NL	https://www.invest-nl.nl
Invest-NL Business Development B.V	Impact Fund	NL	https://www.invest-nl.nl
Irish Bioeconomy Foundation	Facilitators	IE	https://bioeconomyfoundation.com/
Iroquois Valley Farms	Impact Fund	US	https://iroquoisvalley.com/
Italbiotec.it	Facilitators	IT	https://www.italbiotec.it/
Join capital	VC	EU	https://www.join.capital/
Kereon	VC	ES	https://kereon.es/
Ki Tua Fund	VC	EU	https://www.kituafund.com/global/en.html
Kibo Ventures	VC	ES	https://kibo.vc
Km0 Hub	Incubator	ES	https://www.kmzerohub.org/
La Finestra sul Cielo	Corporate	IT	https://www.lafinestrasulcielo.it/
LIDL	Corporate	Global	https://www.lidl.com
LIOF	Private Equity Fund	NL	https://www.liof.nl/
Lumo labs	Impact Fund	NL	https://lumolabs.io/impact/
Magfi	VC	ES	https://magfi.eu/
Meta Group	Facilitators	EU	https://www.meta-group.com/
Microbank	Bank/Debt	ES	https://www.microbank.com
Midsona	CVC	EU	https://www.midsona.com/
Miquel & Costas	CVC	ES	https://www.miquelycostas.com
Mirova	VC	FR	https://www.mirova.com
Nara Capital	Private Equity Fund	ES	https://www.nara.capital/
Natural Capital Financing Facility (NCFF)	Impact Fund	EU	https://www.eib.org/en/products/mandates-partnerships/ncff/

Naturgy	CVC	ES	https://www.naturgy.com
Innovahub – Naturgy	CVC	ES	https://www.naturgy.com/conocenos/innovacion
Nauta Capital	Private Equity Fund	ES	https://nautacapital.com
Nedgia		ES	https://www.nedgia.es
Nestle	CVC	Global	https://www.nestle.com/
Net Zero Ventures	VC	Global	https://net-zero.vc/
NNERGIX	Infrastructure Fund	ES	https://www.nnergix.com/
Noba Ventures	VC	EU	https://www.nobaventures.com/
NOON Ventures	VC	EU	https://www.noon-ventures.com/
Nutreco	CVC	Global	https://www.nutreco.com
OMNES	Private Equity Fund	FR	https://www.omnescapital.com
Oost NL	Public Body	NL	https://www.oostnl.nl/
Organic and Regenerative Investment Cooperative	Impact Fund	Global	https://www.oreic.org/
Pangea Giving for Global Change	Impact Fund	ES	https://laweb.pangea.org/es/la-asociacion/
PietroFiorentini	Infrastructure Fund	IT	https://www.fiorentini.com/
Pioneer Point Partners	Infrastructure Fund	EU	https://pioneerpoint.com/
Polestar Capital	Impact Fund	NL	https://polestarcapital.nl/
Portugal Ventures	VC	PT	https://www.portugalventures.pt
Puratos	CVC	Global	https://www.puratos.com
Removall Carbon	Impact Fund	EU	https://www.removall-carbon.com/en/
Renewal Funds	Impact Fund	CA	https://renewalfunds.com/
Repsol Ventures	CVC	ES	https://www.repsol.com/es/index.cshtml
Root Capital	Impact Fund	Global	https://rootcapital.org/
RSF Social Finance	Impact Fund	US	https://rsfsocialfinance.org/
Rumbo Ventures	CVC	ES	https://rumbo.ventures/es
S2G Ventures	Impact Fund	US	https://www.s2gventures.com/
SDGx	Impact Fund	EU	https://sdgx.io/
SE ventures	VC	Global	https://www.seventures.com/
Seastainable ventures	Impact Fund	EU	https://www.seastainableventures.com/
Sener	Infrastructure Fund	ES	https://www.group.sener/
SeedRocket	Angel Investor	ES	https://www.seedrocket.com
Ship2B Ventures	Impact Fund	ES	https://www.ship2bventures.com

SI Capital	Private Equity Fund	EU	https://www.sicapital.co.uk/
Sisener Signa Codesarrollo	Infrastructure Fund	ES	https://www.sisener.com/sigma-codesarrollo/
SLM Partners	Impact Fund	EU	https://slmpartners.com/
Small Planet Fund	Impact Fund	Global	https://smallplanetfund.org/
Smart City Infrastructure Fund	Private Equity Fund	EU	https://smart-cities-marketplace.ec.europa.eu/investors/smart-city-infrastructure-fund
Soil Capital	Impact Fund	EU	https://soilcapital.com/
Sonen Capital	Impact Fund	US	https://www.sonencapital.com/
Sorigué	Infrastructure Fund	ES	https://www.sorigue.com
Suma Capital	VC	ES	https://www.sumacapital.com
Suzano Ventures	Impact Fund	Global	https://suzano.com.br/en
Swen Capital Partners	VC	FR	https://www.swen-cp.fr
Triodos	Bank/Debt	EU	https://www.triodos.com
Unconventional Ventures	VC	EU	https://unconventional.vc
Veolia	Infrastructure Fund	Global	https://www.veolia.com
Verdalia Bioenergy	Infrastructure Fund	ES	https://verdaliabio.com/es/
VP Capital	Corporate	Global	https://vpcapital.eu/
Waga Energy España	Infrastructure Fund	ES	https://waga-energy.com/
Zubi Capital	VC	ES	https://zubicapital.com/
WA4STEAM	Angel Investor	ES	https://wa4steam.com/es/

Investment funds and public bodies have been included in this list because they are relevant actors within the investment ecosystem and may provide funding, support, or strategic opportunities for end-users. In addition, this list reflects the funds, platforms, and public or private investment-related actors that have been reviewed, researched, and analysed throughout the project. Therefore, even where certain opportunities are not currently open or available, they remain relevant as part of the broader mapping exercise carried out during the project. Nonetheless, it is important to note that this is a dynamic sector: investment funds, like many companies, may evolve, merge, close, or change their investment focus over time. Therefore, this list should be understood as a living resource that may fluctuate and require periodic updates.

Once this deliverable is approved, the list will be uploaded to the project website in Excel format, under the deliverables section. This will allow users to easily filter the information by type of investor, country, or other relevant categories, making the tool more practical and useful for end users who wish to consult and explore the investor landscape.

Annex 1. De-risking Mechanisms for European Bioeconomy Projects and their replicability in Catalonia

BIO BOOST

Acceleradora de projectes de bioeconomia

De-risking Mechanisms for European Bioeconomy Projects and their replicability in Catalonia

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Executive Summary

The bioeconomy is a key pillar of Europe's green and industrial transition, but many bioeconomy projects still struggle to progress beyond pilot and demonstration stages. This report shows that the main barriers evolve across the project lifecycle. In early phases, projects are mainly constrained by technical uncertainty, limited validation capacity, weak investment readiness, and lack of reliable data. During demonstration and scale-up, high capital expenditure, FOAK (first-of-a-kind) risk, infrastructure needs, and regulatory complexity become more pronounced. At commercial stage, demand uncertainty, low price competitiveness, and unstable policy signals become the main obstacles to market uptake and investment.

In this context, de-risking mechanisms are understood as tools that help reduce, redistribute, or stabilise risk so that projects become more bankable and better aligned with investor expectations. Building on previous BioBoost work, the report expands the analysis beyond financial instruments alone and groups the main responses into four categories: financial, technical and project-development, regulatory and permitting, and market and value-chain mechanisms. The assessment confirms that no single instrument is sufficient.

Traditional instruments, such as public guarantees, co-investment, subsidies, and tax incentives, must be complemented by shared pilot and demonstration infrastructure, targeted technical advisory support, regulatory facilitation, and broader market-shaping interventions. In this context, blended finance should not be viewed as a standalone instrument, but rather as a cross-cutting structuring approach that strategically combines multiple sources of capital and public support (including grants, guarantees, equity, and debt) to enhance project bankability, optimize risk allocation, and crowd in private investment at scale.

For Catalonia, the report finds that the region has a favourable starting point, with a clear strategic orientation through the Bioeconomy Strategy of Catalonia 2030, strong research and innovation capacity, an important agri-food and industrial base, and significant biomass potential. However, the key challenge is not only to generate promising projects, but to convert this potential into a stable pipeline of mature and investable initiatives. The analysis suggests that the most relevant opportunities for Catalonia lie in an integrated de-risking approach combining project-development support, regulatory facilitation, technical validation pathways, market creation measures, and targeted financial instruments. In particular, blended finance, subsidies for technical validation and Research and Development (R&D), advisory platforms, and regulatory support and permitting facilitation appear to offer the strongest potential for the regional context.

Overall, the report concludes that effective de-risking in the Catalan bioeconomy should not rely on stand-alone financial tools alone. Instead, it should be based on a coordinated package of mechanisms adapted to the region's ecosystem and project pipeline. The case study on the open-access plant for pre-scaling of alternative protein reinforces this conclusion, showing that governance, regulatory, legal, and coordination barriers can be just as decisive as access to finance in determining whether projects move forward.

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1. Introduction

The bioeconomy is increasingly recognised as a strategic pillar for Europe's green and industrial transition, contributing to climate neutrality, resource efficiency, rural development, and industrial resilience. Regions play a critical role in translating European bioeconomy ambitions into concrete projects, particularly in areas such as bio-based materials, industrial biotechnology, bioenergy, and circular value chains.

Despite strong policy support and growing technological maturity, many bioeconomy projects struggle to progress beyond pilot and demonstration stages. A persistent financing gap remains, especially for scale-up and first-of-a-kind (FOAK) projects, which are often characterised by high capital intensity, technological uncertainty, complex value chains, and immature markets. As a result, private investors frequently perceive bioeconomy investments as high-risk, limiting capital mobilisation at the stages where it is most needed.

In this context, de-risking and risk-sharing mechanisms are essential for mobilising private capital into bioeconomy projects, as they help reduce downside risks, improve project bankability, and strengthen investor confidence. In BioBoost deliverable D4.3, the main financial instruments currently used across Europe were identified and characterized, including public guarantees, blended finance structures, equity co-investment platforms, and emerging output- or performance-based financing models. Building on that groundwork, this report goes beyond the conceptual definition of these instruments by 1) examining which are the specific challenges over the different bio-based innovation development phases; and 2) Identifying concrete bioeconomy projects where those have been successfully overcome by implementing a de-risking strategy by both, public and private entities. Furthermore, the scope is broadened from financial instruments to a wider set of enabling measures, assessing both financial and non-financial de-risking approaches including market and enabling instruments. On this basis, the mechanisms that are most relevant, scalable, and suitable are identified for adoption in the region of Catalonia based on the knowledge and lessons learnt gathered along the delivery of services to the different BioBooster.

This report therefore aims to assess existing de-risking mechanisms applied to bioeconomy projects across Europe, identify successful practices, and evaluate their relevance and transferability to the Catalan context. The resulting analysis is intended to support regional policy design and inform initiatives such as BioBoost, which seek to accelerate the development and scale-up of bioeconomy projects through targeted financial and non-financial support.

Note: The insights presented in this deliverable are grounded in the experience of the BioBoost project, drawing on the analysis of the Bioboosters cases developed throughout the project, with a primary focus on Catalonia. As such, this document should not be interpreted as a definitive or one-size-fits-all framework, but rather as a context-specific reference informed by a particular regional ecosystem and an evolving implementation process. Replication in other regions would therefore require a dedicated, location-specific assessment, taking into account local market conditions, institutional capacity, regulatory environments, and the characteristics of the project pipeline. Why bioeconomy projects are perceived as high-risk.

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2. Risk drivers across the bioeconomy project lifecycle

Understanding why bioeconomy projects are often classified as high-risk is essential for designing effective investment support mechanisms and improving project bankability. Despite their strategic relevance for the green transition, **many bio-based initiatives face differentiated barriers or risks** from conventional industrial or renewable-energy projects. These risks are not static, but they evolve throughout the different phases of project development and often arise from the interaction between technological innovation, complex value chains, regulatory frameworks, and emerging markets. Each of these factors affects the various development stages to a different extent (see **Figure 1**):

In the **Feasibility (TRL 3-5)** phase, barriers are mainly linked to early-stage project development and limited maturity:

- **Concept development and early technical validation:** The technology is still being defined and tested at an early stage.
- **Feasibility assessment and business model design:** Projects need to assess whether the solution is technically and economically viable.
- **Strong dependence on R&D support and technical data:** Projects rely heavily on research activities and early technical validation.
- **Limited investor readiness and immature project structuring:** Projects are not yet sufficiently developed to attract investment.
- **Main challenges:** High uncertainty and low investment readiness, including low technological maturity, lack of data and validation, and limited early-stage capital.

In the **Demonstration (TRL 5-7)** phase, challenges are related to scaling and validation under real conditions:

- **Transition from lab/pilot proof to semi-industrial validation:** The solution must move beyond controlled conditions and be tested at a larger scale.
- **Testing of scale-up potential under real operating conditions:** Projects need to prove that performance can be maintained outside the lab.
- **Need for pilot/demo plants or shared infrastructure:** Access to appropriate facilities is critical.
- **Growing importance of permitting, coordination, and stakeholder access:** Regulatory and coordination aspects become more complex.
- **Main challenges:** Scale-up and demonstration risks, including FOAK and scale-up risks, high CAPEX, and permitting and infrastructure bottlenecks.

In the **Scale-up (TRL 7-9)** phase, barriers are primarily financial and infrastructural:

- **Construction of first industrial or flagship facility:** Projects require major investment to move into industrial-scale operation.
- **Shift from technical validation to commercial and financial credibility:** The focus moves from proving the technology to proving the business case.
- **Large infrastructure and industrial CAPEX requirements:** Significant investment is needed to build industrial or flagship facilities.

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- Need for blended finance, guarantees, and private co-investment: Financing structures become more complex.
- Main challenges: Financing the first industrial deployment, including very high industrial CAPEX, financing gaps and long ROI, and limited risk-sharing mechanisms.

In the Market deployment (TRL 9) phase, constraints are mainly related to market uptake and competitiveness:

- Full commercial operation and market entry: The project enters the market and must operate at commercial scale.
- Focus on revenue stability, customer uptake, and competitiveness: Long-term viability depends on stable sales, customer adoption, and competitive positioning.
- Dependence on demand creation and stable policy frameworks: Market conditions and policy support are critical.
- Broader exposure to market, regulatory, and social conditions: Projects must operate under real market dynamics.
- Main challenges: Creating stable market demand, including weak demand and market pull, low price competitiveness, and unstable policy and revenue conditions.

Understanding these phase-specific challenges is critical for designing targeted de-risking mechanisms that respond to the actual needs of projects along the bioeconomy lifecycle.

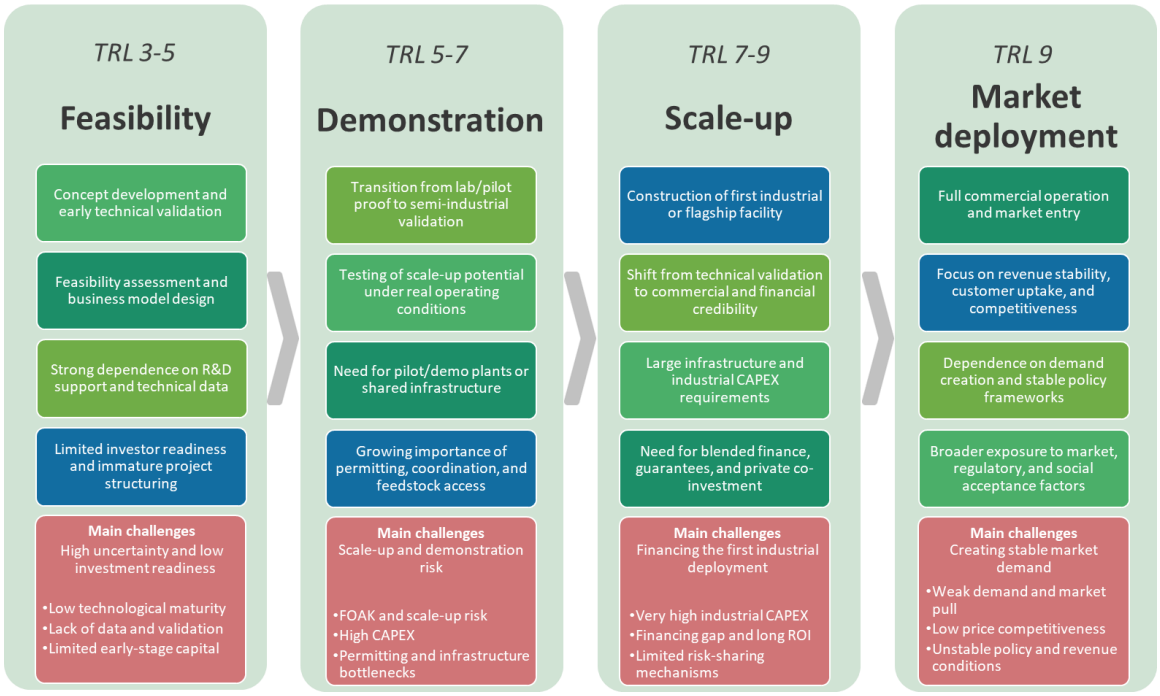

Figure 1. Bioeconomy Project Lifecycle: Main Characteristics and Challenges

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3. What is a de-risking mechanism

De-risking mechanisms are processes employed to lessen the probability or impact of adverse outcomes associated with sustainability initiatives. These mechanisms function by identifying, assessing, and mitigating potential impediments to project viability or investment returns. They commonly involve financial instruments, policy interventions, or technological solutions designed to reduce uncertainty for stakeholders. Effective implementation aims to facilitate the progression of environmentally beneficial projects that might otherwise face prohibitive barriers.[1]

De-risking does **not** eliminate risks; rather, it reallocates, mitigates, or stabilizes them so that they fall within the risk-return expectations of investors, financial institutions, and industrial stakeholders.

Based on prior analytical work from **Deliverable D4.3** (Innovative Financing Solutions Report), a **set of de-risking and risk-sharing mechanisms** was identified as particularly relevant for addressing the financing challenges faced by bioeconomy projects, not only **financials** but also **market** and **enabling instruments** as shown in Figure 2

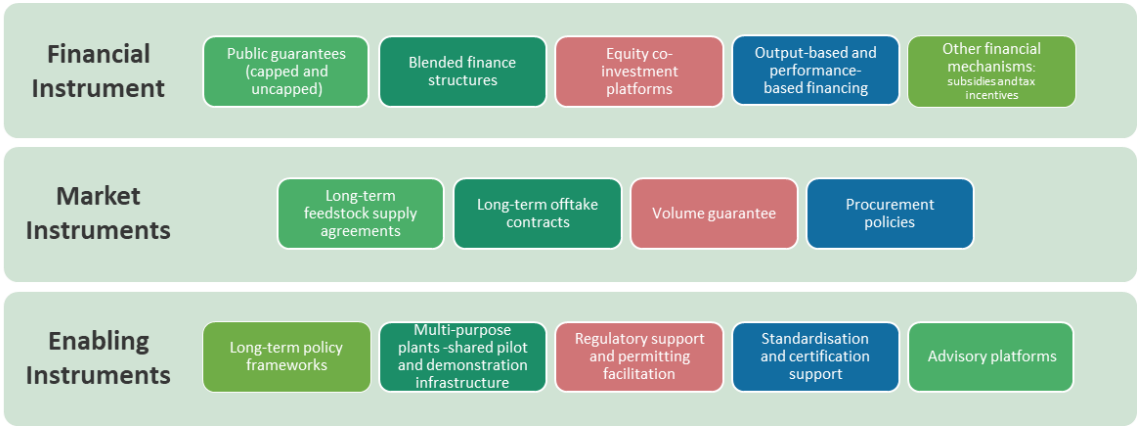

Figure 2. De-risking and risk-sharing mechanisms by category

Building on the previous analysis, de-risking mechanisms should be understood as practical responses to the main **technical, financial, regulatory, and market barriers** affecting bioeconomy projects across their development lifecycle as identified in the previous section. Because these risks evolve from early feasibility to commercial deployment, the relevance of each mechanism also changes over time. Table 1 and Figure 3 therefore provide an initial typology of de-risking mechanisms, organised according to the main risk categories they address and the project phases where they are most relevant. Rather than presenting these instruments as stand-alone tools, the table should be read as a framework for linking specific project barriers with the most appropriate forms of public support, risk-sharing, market creation, and enabling measures.

[1] https://news.sustainability-directory.com/news/risk-de-risking-mechanisms/

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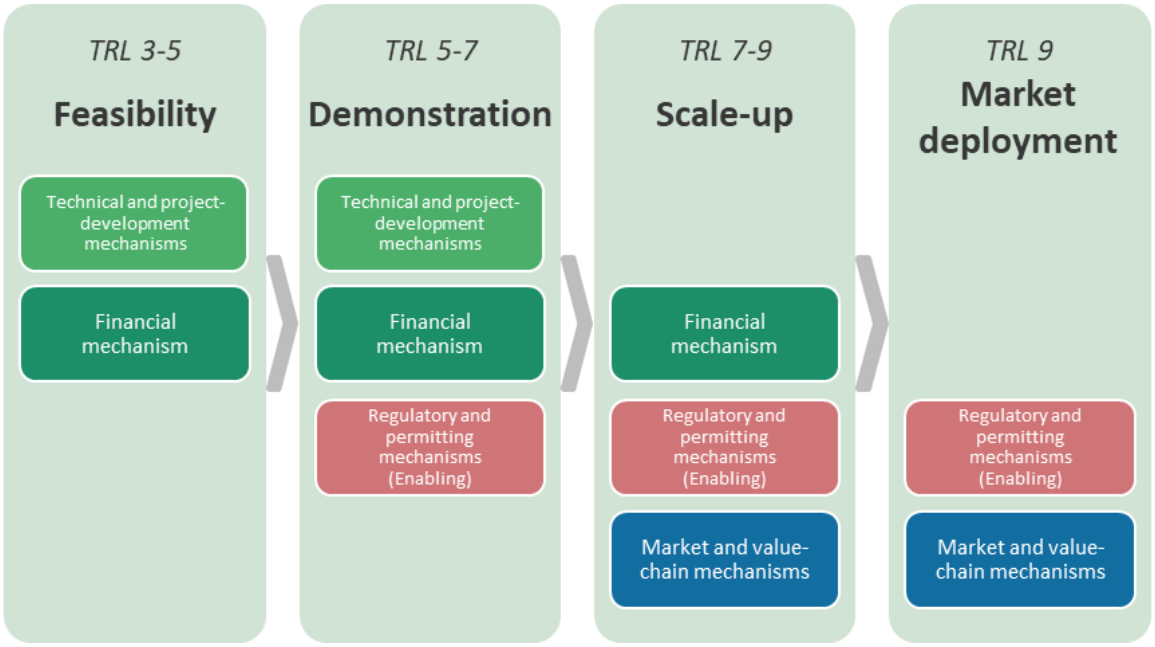

Figure 3. Typology of de-risking mechanisms relevant to each project phase.

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Table 1. Typology of de-risking mechanisms relevant to each project phase.

De-risking category	Main bioeconomy risks addressed	Typical mechanisms	Most relevant project phases
Technical and project-development mechanisms (Enabling)	Low technological maturity, lack of validation environments, scale-up uncertainty, weak investment readiness, lack of data and project structuring	Funding for pilot and demonstration facilities; access to shared testing and validation infrastructure/multi-purpose plants; technical guarantees; advisory platforms	Feasibility (TRL 3-5) and demonstration (TRL 5-7)
Financial mechanisms	High upfront CAPEX, financing gaps, long payback periods, FOAK risk, limited access to private capital	Public guarantees; blended finance; equity co-investment; output- and performance-based financing; subsidies; tax credits and tax reductions	Demonstration (TRL 5-7) and scale-up (TRL 7-9), but some instruments are also relevant at early stage
Regulatory and permitting mechanisms (Enabling)	Permitting delays, unclear regulatory pathways, land-use uncertainty, sustainability and compliance risks, weak policy predictability	Clear permitting procedures; regulatory support; long-term policy frameworks; one-stop-shops/permitting facilitation	Demonstration (TRL 5-7) and scale-up/(TRL 7-9), but also relevant for commercial deployment
Market and value-chain mechanisms	Feedstock insecurity, weak offtake, demand uncertainty, low price competitiveness, weak market-pull	Feedstock agreements; offtake agreements; green public procurement/public procurement policies (enabling mechanism)	Scale-up (TRL 7-9) and market deployment (TRL 9)

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4. Stakeholder perceptions and evaluation of de-risking mechanisms

The previous section outlined the main or typical categories of de-risking mechanisms that can be mobilised to address the technical, financial, regulatory, and market risks affecting bioeconomy projects. Building on this framework, the present section examines how these mechanisms are perceived by relevant stakeholders and how they are being implemented across Europe, specifically focusing on how the financial instruments are perceived from the financial and investing community. The analysis is intended to provide a more practical understanding of which instruments are regarded as most effective, where important gaps remain, and how these mechanisms contribute to improving the bankability and scalability of bioeconomy investments.

4.1. Methodology

The analysis is based on a qualitative research design combining desk research with semi-structured interviews conducted with key stakeholders involved in the financing, support, and implementation of bioeconomy initiatives. The objective was not to compile an exhaustive inventory of existing instruments, but rather to gather practical, experience-based insights into which mechanisms are currently being used, how they function in practice, and under which conditions they are considered effective in reducing technical, financial, regulatory, and market risks. In this sense, the methodology was designed to complement the conceptual typology presented in the previous section with evidence drawn from stakeholder experience and real project contexts. Interviewees included representatives from:

- Public financing institutions and advisory services (e.g. EIB-related initiatives, CINEA GreenAssist, Circular Bio-Based Europe)
- Publicly backed investment platforms and development banks (e.g. Invest-NL)
- Venture capital and equity investors active in clean tech and bioeconomy (e.g. ECBF)
- Regional development agencies and bioeconomy clusters (e.g. IBF)
- Project developers and technical intermediaries (e.g. Biotech Booster)
- Business consulting and companies (e.g. Magfi)
- Other European projects (e.g Italbiotec)

Geographically, the interviews focused primarily on **the Netherlands, Belgium, France, Italy, and EU-level institutions**, reflecting regions with relatively advanced bioeconomy ecosystems and active experimentation with de-risking mechanisms.

4.2. Stakeholders' perception

4.2.1. Financial instruments

Here below are presented the **financial mechanisms** identified in D4.3, along with the qualitative feedback gathered from the investor community.

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Public guarantees (capped and uncapped)

Public guarantees were widely recognised by investors as one of the most effective tools to increase confidence and mobilise private capital. By covering part of the potential downside risk, guarantees can significantly improve the risk-return profile of bioeconomy investments, particularly for debt providers.

Evidence from interviews suggests that public guarantees are indeed being used across Europe, mainly through EU-level instruments linked to the EIB Group and InvestEU, as well as national schemes. However, several stakeholders highlighted that these instruments often lack transparency from the investor perspective: while investors are aware that guarantees exist and "work well", they are not always clear about the public entities involved, eligibility conditions, or risk coverage structures.

A recurring gap identified through the interviews is the limited availability of guarantee instruments specifically to early-stage or first-of-a-kind bioeconomy projects, particularly at regional level. While guarantees are more accessible for mature infrastructure or energy projects, their application to emerging bio-based value chains remains constrained.

From a financial structuring perspective, guarantees are only effective where debt financing is viable. As such, they are not suited to early-stage or highly experimental projects, but rather to those that have reached a certain level of technological validation and are entering capital-intensive scale-up phases.

A critical bottleneck therefore arises at the first commercial or scale-up stage: projects that have successfully demonstrated their technology but still face barriers in accessing bank financing due to perceived technology, market, or execution risks. In these cases, well-designed guarantee instruments can play a catalytic role by improving the risk–return profile for lenders, enabling debt mobilisation, and facilitating the transition from pilot to commercial deployment. This suggests a need to refocus guarantee schemes away from fully mature assets and towards near-bankable, FOAK projects with significant CAPEX requirements, where they can have the greatest additionality.

Blended finance structures

Blended finance has emerged as one of the most widely applied and effective approaches for de-risking investments in the bioeconomy. It should not be understood as a standalone financial instrument, but rather as a structuring approach that involves the strategic deployment of public and other non-commercial capital to mobilise private sector investment into projects that would otherwise not be commercially viable due to high risks or non-commercial returns. Rather than relying solely on grant funding, blended finance enables the structured combination of public and private capital, typically through instruments such as subsidies, concessional loans, guarantees, and equity, to address specific risk profiles, enhance capital efficiency, and improve overall project bankability. From a policy perspective, blended finance represents a critical opportunity for governments to deploy capital more strategically and efficiently,

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crowding in private sector funding and expanding access to finance for bioeconomy projects beyond what public resources alone could achieve. In practice, it involves tailoring a mix of financial tools, such as grants, guarantees, concessional debt, equity co-investment, and technical assistance, to address the specific barriers preventing projects from accessing commercial finance. When applied effectively, this approach strengthens bankability, optimizes risk allocation, and enables the mobilisation of private capital at scale while ensuring that public resources are used in a targeted and catalytic manner.

Evidence from the Netherlands illustrates how blended finance structures can successfully support demonstrator and flagship facilities. In these cases, public funding mechanisms, such as partial CAPEX grants and low-interest loan, are combined with private equity participation to reduce upfront risk exposure and attract commercial investors. Interviewees consistently emphasised that grants alone are rarely sufficient, particularly when they are not complemented by rigorous due diligence processes and well-defined scale-up strategies (see specific examples in Table 2).

Blended finance mechanisms appear to be most effective when deployed within coherent, long-term industrial strategies that provide clear market signals and demand visibility. Under these conditions, public capital plays a catalytic role, crowding in private investment rather than substituting for it, and enabling the development of scalable, commercially viable bioeconomy projects.

Equity co-investment

Publicly backed equity co-investment is already operational in several European countries and were identified as an important source of patient capital for early-stage bioeconomy ventures. In countries such as the Netherlands and Belgium, regional development agencies and government-owned investment vehicles co-invest alongside private investors, sharing both financial risk and governance.

These platforms play a key role in signalling public commitment, strengthening investor confidence, and building project pipelines. However, interviewees noted that while equity co-investment mechanisms are well suited to early-stage and emerging sectors, they often face limitations when addressing the large CAPEX requirements associated with industrial-scale bioeconomy projects.

Despite these constraints, equity co-investment is widely regarded as an essential preparatory mechanism, helping projects mature to a stage where they can access larger-scale financing instruments.

Output-based and performance-based financing

In contrast to other mechanisms, output-based and performance-based financing remains less mature in the bioeconomy sector. While such mechanisms are well established in renewable energy and infrastructure sectors, their application to bio-based products is still limited.

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Output-based approaches can, in principle, include revenue streams linked to verified outcomes such as carbon credits, biodiversity gains, or other ecosystem services. For example, emerging EU initiatives around carbon removals and carbon farming aim to create frameworks where projects can generate revenues based on certified CO_2 sequestration. However, these markets are still evolving and lack the depth and standardisation required to underpin large-scale project financing. Interviewees identified existing examples of performance-based grants and conditional loans, particularly in France, where repayment is linked to the achievement of predefined KPIs (e.g. production capacity, technology validation milestones, or environmental performance targets).. Beyond this, similar mechanisms are being explored in segments such as:

- Biomethane production, where support schemes can be linked to verified volumes of gas injected into the grid.
- Advanced biofuels (e.g. SAF), where incentives or contracts-for-difference are tied to actual production and emissions savings.

Circular bio-based materials, where public procurement or subsidies may be contingent on meeting sustainability or recycled content thresholds.
A key constraint highlighted is the lack of standardised metrics and market frameworks for bio-based products. This limits investor confidence and hinders the broader deployment of output-based mechanisms beyond energy-related applications. As a result, revenue streams linked to carbon credits or ecosystem services are still viewed cautiously and rarely form the core of project bankability.

Subsidies

In addition to the financial instruments discussed above, interviews also highlighted the role of more traditional public support mechanisms such as subsidies as complementary tools to reduce investment risk in emerging bioeconomy projects. Subsidies remain widely used to support early-stage development, demonstration plants, and FOAK facilities. Stakeholders noted that grants can play an important catalytic role, particularly in the early phases of technology development, by helping projects reach technical validation and attract private investors. Nonetheless, several interviewees stressed that subsidies alone are rarely sufficient to mobilise private capital, especially when they are not embedded within broader financing structures that include due diligence, scale-up planning, and private co-investment.

Tax incentives

Interviews further noted the role of tax or fiscal incentives, such as R&D tax credits or investment tax deductions, as effective mechanisms to improve the financial attractiveness of innovative projects. Example of tax incentives can be found in the Dutch WBSO for R&D tax reduction (see Table 2), which demonstrates how it can significantly lower the cost of research and development activities for companies.

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4.2.2. Market instruments

Beyond financial instruments, stakeholders emphasised the importance of market instruments that can significantly influence the bankability and scalability of bioeconomy projects.

Market-based mechanisms primarily aim to reduce revenue uncertainty for emerging bio-based value chains. Long-term feedstock supply agreements and long-term offtake contracts were repeatedly highlighted as key tools to provide stability to investors and lenders. By securing access to biomass inputs and guaranteeing demand for bio-based products, these contracts help reduce market risks and improve the predictability of project revenues. Interviewees noted that such arrangements are often essential for securing project finance, particularly for capital-intensive industrial facilities.

4.2.3. Enabling instruments for regulatory and permitting uncertainty

Several enabling mechanisms were also identified as critical to support investment readiness in the bioeconomy. In particular, shared pilot and demonstration infrastructures were widely recognised as valuable assets that allow companies to test and validate technologies at scale without requiring large upfront capital investments. Facilities such as Bio Base Europe or the Pilots4U network were cited as examples of infrastructures that help bridge the gap between laboratory research and industrial deployment. In addition, interviewees stressed the importance of regulatory clarity and efficient permitting processes. Long and uncertain administrative procedures can significantly delay project development and increase investment risk. As a result, regional authorities can play a key role by providing regulatory guidance, facilitating permitting procedures, and offering advisory services that connect project developers with potential financiers and technical experts. Initiatives such as the EU-level GreenAssist advisory platform illustrate how structured advisory support can help improve project credibility, strengthen business models, and enhance investor confidence.

5. Evaluation of European de-risking mechanisms

5.1. Comparative assessment of de-risking instruments

Based on the feedback gathered from the different stakeholders interviewed and presented in the previous section, Table 2 provides an overview of the main de-risking mechanisms currently available in Europe to unlock bioeconomy deployment and investments, along with their key characteristics, advantages, and limitations. It highlights how different instruments, ranging from financial to enabling instruments, can address specific investment barriers across project stages. At the same time, it illustrates that each mechanism has inherent constraints, reinforcing the need of an effective strategy to be built around an integrated package of instruments. All the instruments mentioned hereunder must be based on clear conditions, in particular the direct involvement of promoters, disbursements based on milestones linked to key performance indicators, and a strict requirement for a credible and investable business model.

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Table 2. Overview and assessment of de-risking mechanisms.

Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
Public guarantee (Capped & uncapped)	Financial de-risking instrument	Public guarantee covering losses up to a cap at portfolio or project level, typically via EIB/EIF/InvestEU or national bodies.	Reduces risk for banks/investors, mobilises private debt; efficient use of public funds. Can unlock very risky/strategic projects	Limited access for early-stage, pilot plant projects, lack of clarity on eligibility/ structuring. High public exposure, requires strong governance and strict criteria	EIB/EIF (InvestEU, EIB Guarantees) across EU, guarantees covering part of loan risk to improve bankability of innovative projects. Invest-NL, Green Hydrogen Import (Port of Amsterdam) as an example of project (combination of guarantees, public support and private capital)
Blended finance	Financial de-risking instrument	Package combining grants + debt/guarantees + equity to close the financing gap.	Attracts private capital, flexible by phase, improves bankability	Complexity, structuring costs, multi-actor coordination	Netherlands Enterprise Agency (RVO) CAPEX subsidies combined with private investment and loans for demonstration plants.
Equity co-investment	Financial de-risking instrument	Publicly backed equity vehicles that co-invest alongside private investors (VCs, business angels, corporates), sharing risk and governance. Commonly operated by regional development agencies or public investment funds.	Provides patient capital at early stages, crowds in private investors, supports pipeline development	Limited capacity to address industrial scale	RVO Seed Capital scheme (NL) - Under the scheme, the Dutch government provides an interest-free loan to venture capital or seed investment funds, which must be matched by private investors (at least three independent shareholders contributing the same amount). These funds then invest in innovative start-ups, effectively doubling private capital and sharing

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
					risk between public and private actor; ROMs – Regional Development Agencies (NL); EIIS - Equity Investment Incentive Scheme (IE).
Output-based and performance-based financing	Financial de-risking instrument	Financial support linked to verified outputs (e.g. carbon credits) or performance-based financiang (e.g. ecosystem service payments, etc	It can provide additional revenue or risk mitigation	Cannot serve as the primary investment driver, works only as a complementary top-up and remains constrained by weak standardisation and market uncertainty.	Bpifrance innovation loans with KPI-based repayment; ETS-linked mechanisms for energy-related projects; SDE++ scheme in the Netherlands (OPEX support for renewable technologies).
Subsidies	Financial de-risking instrument	CAPEX grants (pilot/demo) or temporary support for incremental operating costs (where applicable).	Accelerates validation and TRL, reduces early CAPEX	Risk of dependency and market distortion, potentially inefficient use of capital when not highly targeted	RVO innovation and scale-up grants (NL); regional CAPEX subsidies for demonstration plants; EU innovation funding (Horizon Europe, Innovation Fund).
Tax reductions	Financial de-risking instrument	Tax incentives for R&D (e.g tax deductions, accelerated depreciation, or targeted VAT relief for pilot and demonstration assets).	Powerful for early stage, reduce effective project costs and improves R&D cashflow	Does not solve market ready solutions/high CAPEX on its own	WBSO - R&D Tax Credit (NL) – Which is a scheme demonstrate how tax reductions can significantly lower the cost of research and development activities for companies. Similarly, tax deductions

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
					for investments in innovative start-ups, implemented in countries such as Italy, Ireland, or Malta, can encourage private investors to participate in early-stage ventures by improving expected returns.
Long-term offtaker agreements[2]	Market instrument	Long-term purchase agreements between producers and industrial, commercial, or public buyers securing demand for bio-based products.	Reduces commercial risk, stabilises revenues	Although such contracts are a standard feature of industrial projects, they remain particularly challenging for early-stage or FOAK and bioeconomy ventures, which often lack the track record required to secure long-term commitments from counterparties and	Purchase agreements between bio-based producers and large industrial buyers (chemicals, packaging, energy companies).

[2] In this report, long-term feedstock agreements, long-term offtake agreements, and volume guarantees are treated as related but distinct mechanisms: the first primarily addresses supply-side risk, the second commercial demand risk, and the third a more specific public or publicly backed market-shaping instrument for reducing first-market deployment uncertainty.

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
				difficult for start-ups without track record.	
Long-term feedstock agreements[2]	Market instrument	Long-term contracts securing biomass/feedstock supply and pricing.	Reduces operational risk, improves bankability.	Difficult if the value chain is immature; indexation risk.	Industrial biomass supply agreements used in biorefineries and bioenergy projects to ensure long-term access to feedstock.
Volume guarantees[2]	Market instrument	Public or publicly backed mechanisms that guarantee a minimum purchase volume, or compensate for demand shortfalls, in order to reduce demand uncertainty for emerging bio-based products.	Reduces first-market deployment risk, improves revenue predictability.	Requires public budget commitment and careful design; applicability is sector-specific.	Potentially relevant in sectors linked to public procurement or anchor buyers.
Public procurement policies	Enabling instrument (market-creation function)	Green and bio-based public procurement to create early demand, including the use of public buyers as anchor customers and long-term offtake agreements. Particularly relevant for early-stage companies that	Market creation, revenue risk reduction, demonstration effect and improves bankability for early-stage projects	Requires political leadership and technical procurement capacity, however, applicability depends on sector and market structure, more readily deployable in areas such as bio-based construction but	Green Public Procurement, bio-based materials (Catalonia & Zeeland case).

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
		are not yet profitable, where large corporates (e.g. incumbent industrial or fossil-based players) or public entities act as offtakers without taking direct equity stakes.		challenging where public procurement has limited impact or in emerging or low-demand markets (e.g. certain food additives).	
Multi-purpose plants -shared pilot and demonstration infrastructure	Enabling instrument	Multi-purpose pilot and demonstration infrastructure available for rent, allowing companies to lease facilities to test and validate projects at early stages, thereby significantly reducing upfront CAPEX requirements.	Reduces CAPEX per company, accelerates scale-up (i.e. enables faster validation under semi-industrial conditions and therefore increases TRL quickly).	Complex governance, IP and cost structures, risk of overbuilding multipurpose facilities without sufficient demand (it is important to analyse the market first), not always efficient to mobilise companies across borders for testing (e.g. relocating a Spanish company to the Netherlands), highlighting the need for proximity and strategic selection	Bio Base Europe (BE, Ghent) Independent, multipurpose pilot facility allowing companies to test, scale and validate bio-based processes without building their own plants. Other examples: Pilots4U network (EU level) and Brightlands demo facility (NL, Limburg)

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
Regulatory support and permitting facilitation	Enabling instrument	Fast-track permitting, regulatory guidance, one-stop-shop, regulatory predictability. Including "Sandboxed" which allows controlled, temporary, and supervised environments for testing innovative bio-based products or processes under relaxed regulatory oversight.	Reduces time and cost, lowers execution risk	Requires cross-departmental coordination	Regional permitting support and regulatory guidance platforms; facilitation services by regional authorities. EU Biotech Acts for regulatory sandboxes.
Standardisation and certification support	Enabling instrument	Support for the development and uptake of standards, certification schemes, and recognised sustainability criteria for bio-based products and circular feedstocks, in order to improve compliance clarity, market credibility, and buyer confidence.	Reduces uncertainty for producers and buyers, facilitates market access, improves comparability and trust	Can be slow to develop, may create additional compliance costs, and is less effective where markets are still immature	EU work on sustainability criteria and certification for bio-based products and biomass value chains; national and sectoral certification schemes supporting market recognition

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Mechanisms	Type	Description	Pros	Cons	Examples across Europe / Potential implementation
Long-term policy frameworks	Enabling instrument	Stable, multiannual policy frameworks that provide predictable signals for investors and project developers, including sector roadmaps, long-term support schemes, and consistent regulatory objectives for bioeconomy deployment.	Improves predictability, strengthens investor confidence, supports market formation and long-term planning	Effects are indirect and depend on credible implementation; requires strong political commitment and cross-departmental coordination	National bioeconomy strategies and multiannual policy frameworks in countries such as the Netherlands, Finland, and Germany; Catalonia's Bioeconomy Strategy 2030 as a regional reference point
Advisory platforms linking project developers with financiers	Enabling instrument	Advisory platform including technical assistance, resource mapping, legal and governance support, and market development advisory to strengthen business models, due diligence and investment readiness (e.g. BioBoost Accelerator post-project, GreenAssist, EIB/EIF structuring).	Improves pipeline quality, reduces information asymmetries	No direct capital, risk of low traction without instruments	GreenAssist (InvestEU/CINEA) at European level.

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5.2. Alignment of challenges and de-risking mechanisms across bioeconomy project development phases

To address the multifaceted barriers identified across the bioeconomy project lifecycle, it is essential to align appropriate de-risking mechanisms with the specific challenges encountered at each stage of technological and market development. As projects evolve from early feasibility to full commercial deployment, the nature of risks shifts, from technical uncertainty and lack of data to scale-up constraints, financing gaps, and ultimately market and regulatory barriers. Consequently, no single financial instrument is sufficient. Instead, a combination of targeted tools is required to effectively mitigate risks and mobilise investment. The following tables present a structured mapping of the main challenges identified in Catalonia's bioeconomy ecosystem during the implementation of BioBoost project and the most suitable de-risking mechanisms for each project phase, illustrating how policy and financial instruments can be strategically deployed to support project maturation and market uptake.

This section presents a structured mapping between the key challenges identified across the bioeconomy project lifecycle and the most suitable de-risking mechanisms (described in Table 3-Table 6) to address them. By linking specific barriers to targeted financial, market, and enabling instruments, the analysis highlights how different tools can effectively mitigate risks at each stage of project development.

Rather than considering de-risking mechanisms in isolation, this approach adopts a problem-solution perspective, illustrating how tailored combinations of instruments can respond to the evolving needs of bioeconomy projects, from early-stage feasibility to full market deployment. This mapping also reflects the importance of selecting context-appropriate instruments, ensuring that public support and financial tools are deployed where they can generate the greatest impact in unlocking investment and accelerating the bioeconomy in Catalonia.

5.2.1. Feasibility (TRL 3-5)

Table 3. Challenges and suitable de-risking mechanisms for early-stage bioeconomy projects (TRL 3-5).

Main challenges	Suitable de-risking mechanisms
Low technological maturity and lack of validation environments	Subsidies, access to multi-purpose pilot and demonstration infrastructure
Lack of data for feasibility, business models, and permitting	Advisory platforms, regulatory support and permitting facilitation
Limited access to early-stage capital and high perceived risk	Equity co-investment, blended finance, capped public guarantees, seed funding (private investors)
Weak investment readiness and misalignment with investor expectations	Advisory support (mentoring and acceleration services), equity co-investment

Main challenges	Suitable de-risking mechanisms
Poor communication of value proposition (especially non-financial impacts)	Advisory platforms: capacity building, support for business modelling and impact measurement frameworks
Limited facilitation and stakeholder mapping capacity	Publicly funded facilitators, cluster support, regional bioeconomy hubs, advisory platforms (mentoring)

5.2.2. Demonstration (TRL 5-7)

Table 4. Challenges and suitable de-risking mechanisms for demonstration bioeconomy projects (TRL 5-7).

Main challenges	Suitable de-risking mechanisms
Scale-up risk and FOAK uncertainty	Blended finance (grants + loans + equity), subsidies, equity co-investment
High CAPEX requirements for pilot plants	Blended finance, capped public guarantees, subsidies, shared pilot facilities or multi-purpose plants.
Limited access to infrastructure	Multi-purpose pilot and demonstration infrastructure
Complex permitting and administrative delays	Regulatory support, permitting facilitation (e.g. fast-track permitting schemes)
Regulatory uncertainty	Regulatory support, permitting facilitation (e.g adaptive regulation frameworks, guidance documents, pilot regulatory regimes)
Resource availability constraints	Long-term feedstock agreements, advisory platform available for resource mapping.
Governance complexity (multi-actor projects)	Advisory platforms, legal advisory support
Limited public incentives to de-risk demonstration	Subsidies, blended finance

5.2.3. Scale-up/First commercial plant (TRL 7-9)

Table 5. Challenges and suitable de-risking mechanisms for scale-up bioeconomy projects (TRL 7-9).

Main challenges	Suitable de-risking mechanisms
Very high upfront investment needs (industrial CAPEX)	Blended finance, uncapped public guarantees, capped public guarantees.
Limited access to equity and financing gap	Equity co-investment, venture capital (private investors), dedicated bioeconomy funds
Long ROI horizons and high perceived risk	Public guarantees, output-based financing

Main challenges	Suitable de-risking mechanisms
Misalignment between financial returns and systemic value	Output-based and performance-based financing, tax reductions
Investor preference for mature sectors*	Equity co-investment, advisory platforms
Regulatory barriers and land-use constraints	Regulatory support and permitting facilitation (e.g. regulatory reform, harmonisation frameworks, planning support tools)
Administrative burden increasing costs and delays	Regulatory support and permitting facilitation (e.g. streamlined permitting processes, digitalisation of procedures)
Lack of risk-sharing mechanisms	Public guarantees, blended finance

**Investor appetite is typically skewed towards more mature, de-risked sectors, reflecting both risk-return considerations and capability constraints. Nevertheless, different investor classes have distinct preferences in terms of project maturity; however, limited participation in early-stage projects is generally driven by two key factors. First, from a risk–return perspective, early-stage opportunities are often perceived as unattractive due to high uncertainty, unproven technologies, and lack of predictable cash flows. Second, many investors lack the technical expertise required to adequately assess these projects, further constraining their ability to underwrite early-stage risk. As a result, capital tends to concentrate in later-stage, more bankable assets, leaving a persistent financing gap in earlier phases of project development.*

5.2.4. Market deployment (TRL 9)

Table 6. Challenges and suitable de-risking mechanisms for commercial bioeconomy deployment (TRL 9).

Main challenges	Suitable de-risking mechanisms
Limited market demand and weak market-pull mechanisms	Public procurement policies, volume guarantee
Low price competitiveness vs fossil alternatives	Tax reductions, output-based financing (e.g carbon credits), subsidies (targeted)
Lack of stable revenues and demand uncertainty	Volume guarantee, output-based financing
Demand uncertainty	Public procurement, off-take agreements
Public opposition and lack of awareness	Communication campaigns, stakeholder engagement strategies
Weak rural infrastructure	Blended finance, public support schemes
Barriers in primary sector engagement	Long-term feedstock agreements, and other incentives for primary producers

The rationale behind this mapping is that the instruments used to address market failures differ depending on the stage of the project lifecycle. For example, in the scale-up phase, where projects require significant CAPEX, credit guarantees or volume guarantees may be effective. However, in earlier stages such as feasibility, these instruments are typically not suitable; instead, grants or impact-linked financing mechanisms are more appropriate to address technical and early-stage risks

5.3. Examples of how blended finance can be used to catalyse private sector investment for the bioeconomy

As it has been mentioned in this report, blended finance is an approach, whereby public and other non-commercial capital are strategically deployed to mobilize private sector capital towards projects where private investments are not commercially viable due to high risks, long paybacks periods, or uncertains returns.

This approach offers governments a powerful tool to maximise the impact of public funding by crowding in private capital and improving access to finance for bioeconomy projects. In doing so, it helps bridge financing gaps, particularly in the transition from research and pilot stages to commercial deployment.

Several initiatives across Netherlands demonstrate how blended finance can effectively support the bioeconomy:

1. Bioprocess Pilot Facility (Delft, NL): This initiative provides pilot-scale infrastructure for industrial biotechnology, including fermentation processes, alternative proteins, and other bio-based products. Its financing model combines **public grants from the Dutch government** (e.g. Topsector Agri&Food, etc), **private investment** from companies such as DSM and biotech startups, and strong support from academic institutions like TU Delft. This combination enables shared access to infrastructure and technical expertise, reducing technological risks at TRL 5-7 and facilitating the transition from laboratory validation to pilot scale. As a result, it helps unlock further private investment in commercial-scale plants.
2. Chemelot Circular Hub (Limburg, NL): The Chemelot industrial cluster is taking bold steps to become Europe's first circular and climate-neutral chemical site, in collaboration with Hubs for Circularity (H4C). The Chemelot Circular Hub is a public-private alliance and a collective movement aimed at accelerating the transition to a circular society. Chemelot is a large-scale industrial cluster focused on circular materials and bio-based chemicals, acting as a major innovation hub in Europe. Its development is supported through a **combination of regional and national public funding, infrastructure financing from the EIB,** and substantial **private investment from major chemical companies**.[3] Hence, this blended finance structure enables the development of shared infrastructure and large-scale demonstration plants for chemical recycling and biomaterials. Chemelot is widely recognised as a flagship example of how coordinated public and private investment can accelerate industrial transformation in the bioeconomy.
3. Groene Chemie, Nieuwe Economie (GCNE) Programme (NL): This programme is a national platform designed to accelerate the development of green chemistry projects. It relies on a blended finance approach combining Dutch government subsidies, industrial co-investment, and mixed financial instruments such as grants and loans. By supporting projects across different stages of development, GCNE helps bridge the gap between pilot and first-of-a-kind industrial plants. It plays a

[3] https://ec.europa.eu/regional_policy/sources/funding/just-transition-fund/project-fiches/project-fiche-chemelot-circular-hub.pdf

key role in de-risking innovation and enabling the scale-up of sustainable chemical processes.

6. European de-risking mechanisms – examples and replicability for Catalonia

6.1. Catalonia-specific policy and ecosystem analysis

Catalonia, an autonomous community in Spain, is relatively well positioned to advance bioeconomy projects, both because of its resource base and because it already has a defined strategic orientation. As highlighted in the BioBoost project's deliverables ***D1.2 – Catalonia Bioeconomy Ecosystem Report*** and ***D2.3 – Catalonia Bioeconomy Potential Report***, the region combines abundant and diverse biomass resources, a strong agri-food and industrial base, recognised research and innovation capacity, and an existing public commitment to the bioeconomy, notably through the Bioeconomy Strategy of Catalonia 2030 (EBC2030) launched by the Department of Agriculture, Livestock, Fisheries and Food (*Departament d'Agricultura, Ramaderia, Pesca i Alimentació*, DARPA) of the Generalitat de Catalunya[4]. That strategy frames bioeconomy development as part of a broader transition toward decarbonisation, lower ecological footprint, and the strengthening of local value chains based on biological and renewable resources.

From the perspective of this report, however, the relevance of the Catalan context lies not only in its strengths, but also in the type of barriers that may constrain project implementation. The regional ecosystem already includes many of the core ingredients needed for bioeconomy development: public authorities with strategic and regulatory capacity, companies able to industrialise solutions, research actors generating knowledge and innovation, and a territorial base capable of supplying biological resources. This means that Catalonia's main challenge is less about the absence of potential and more about how to convert that potential into a stable pipeline of mature, investable projects. In de-risking terms, this is important because it suggests that the main bottlenecks may not be purely financial, but also relate to project structuring, coordination, validation capacity, regulatory clarity, and market formation.

This ecosystem diagnosis is especially relevant when considering the types of de-risking mechanisms that may be most useful in the Catalan case. The evidence points to a context where technical and project-development mechanisms remain important in order to strengthen investment readiness, facilitate access to demonstration and validation pathways, and improve the quality of project preparation. At the same time, regulatory and permitting mechanisms are likely to be highly relevant, given the role of public administration in enabling approvals, coordination, and alignment with policy priorities. Likewise, because the region already has industrial actors and biomass potential, market and value-chain mechanisms such as feedstock coordination, offtake support, and public procurement can play a major role in reducing uncertainty at later

[4] Government of Catalonia, Institutional system of self-government for Catalonia.

stages of deployment. Financial instruments remain necessary, particularly for demonstration and first commercial plants, but the Catalan case suggests that they should be embedded within a broader de-risking architecture rather than treated as a stand-alone solution.

At the same time, the ecosystem analysis also points to structural weaknesses that are directly relevant for de-risking design. Stakeholder engagement challenges identified in the regional assessment include biased representation or missing actors, information asymmetries and power imbalances, institutional fragmentation, and discontinuous participation. These findings are significant because they show that project risk in the Catalan bioeconomy is not only linked to technology or finance, but also to governance and coordination failures that can undermine implementation, delay decisions, and reduce the effectiveness of support mechanisms. For this reason, Catalonia's opportunity is not simply to replicate instruments already used elsewhere in Europe, but to adapt them to a context where facilitation, cross-departmental coordination, advisory support, and demand-side measures may be just as important as capital mobilisation.

In this sense, the Catalan policy and ecosystem context provides a strong foundation for de-risking but also confirms the central argument of this report: bioeconomy projects require an integrated package of mechanisms that responds to multiple barriers across the project lifecycle. For Catalonia, the priority is therefore likely to lie in combining its strategic policy framework and territorial assets with practical instruments that improve project maturity, reduce regulatory and coordination frictions, and strengthen market confidence. This provides the basis for identifying the most relevant de-risking opportunities for the region in the following subsection.

6.2. Main barriers found in the Catalan context

Throughout the delivery of PDA services to the different BioBoosters during the implementation of the BioBoost Project it has been observed that the Catalan context presents many of the barriers previously identified presenting a mix **of technical financial, policy-related and market barriers along the different development phases.** The following subsections unpack the main risks observed and explain their impact obtaining private funding to progress to subsequent development stages.

More detailed information about the challenges can be found in the deliverable, *D5.3. 2nd CCRI Policy Brief* and *D5.6 Lessons learnt & Best Practices* deliverable.

6.2.1. Technical barriers for scale-up (TRL 3-7)

Technical feasibility is one of the major challenge in bio-innovation projects in Catalonia as it has been observed in many of the BioBoosters, especially from the early feasibility stage (TRL 3-5) to the demonstration and pilot phases (TRL 5-7), where technologies must move beyond laboratory conditions and prove their performance at larger scale. At these stages, technical barriers such as low maturity, operational variability, and limited access to validation infrastructure are critical. As projects progress toward first commercial deployment (TRL 7-9), these technical uncertainties become closely linked to financial barriers due to high CAPEX and investor caution, as well as to regulatory

and market barriers related to permitting, feedstock availability, and uncertain demand. Scale-up feasibility is a challenge that evolves across project phases and affects the overall bankability of bioeconomy projects. Key technical risk drivers include:

- Technology readiness gaps: Many solutions operate at TRL 5-7, where industrial performance is not yet proven.
- Scale-up challenges: Biological systems (fermentation, enzymatic processes, biomass conversion) often behave differently at industrial scale, increasing operational uncertainty.
- FOAK risk: Demonstration plants face higher probabilities of cost overruns, delays, and performance deviations (technical risks and losses).
- Process integration risk: Biorefineries require integrating multiple process steps (pretreatment, conversion, separation), each with its own maturity level.
- Operational variability: Feedstock heterogeneity can affect yields, quality, and process stability.

Impact: These combined uncertainties result in lower investor confidence, greater demand for technical guarantees, and stringent requirements for participation by experienced industrial partners. In the absence of validated scale-up pathways or shared demonstration infrastructure, securing project finance becomes significantly more challenging.

6.2.2. Capital intensity and first-of-a-kind risk (TRL 5-9)

Capital intensity and FOAK risk become major barriers as projects move from pilot and demonstration (TRL 5-7) to first commercial deployment (TRL 7-9), when large industrial investments are required before performance and revenues are fully proven. These risks are not only financial: they are closely linked to technical uncertainty around scale-up, regulatory barriers such as permitting delays and unclear rules, and market uncertainty related to demand, offtake, and competitiveness. As a result, high upfront CAPEX, long return horizons, and uncertain commercial performance make it difficult for bioeconomy projects to attract private capital and reach financial close. FOAK risk should therefore be seen as a cross-cutting challenge that intensifies with project maturity and directly affects the bankability of industrial bioeconomy investments. Key risks:

- High upfront CAPEX requirements: Large investment is needed before any revenue-generating activity begins, increasing exposure for lenders and equity investors.
- Long payback periods: Biorefineries and industrial biotech assets often require longer revenue ramp-up periods compared to renewable energy or traditional petrochemical assets.
- FOAK cost uncertainty: FOAK plants frequently exceed budgeted CAPEX and timelines due to engineering refinement, procurement challenges, or unforeseen integration issues.
- Limited role for traditional project finance: In the absence of bankable technology and predictable cash flows, access to debt financing is severely limited, effectively concentrating risk on equity sponsors. This dynamic

underscore a clear opportunity for the strategic deployment of guaranteed instruments to catalyse capital formation. Impact: High capital needs combined with unproven commercial performance increase perceived project risk, reduce access to affordable financing, and often require large public grants or strategic industrial investors to move from design to construction.

6.2.3. Supply chain and feedstock and offtake risk (TRL 5-9)

Feedstock and offtake risk become particularly relevant from the demonstration and pilot phase (TRL 5-7) to commercial deployment (TRL 9), when bioeconomy projects depend on reliable biomass supply, efficient logistics, and stable market outlets. These barriers are not only market-related: they are also linked to technical constraints such as feedstock variability and infrastructure gaps, financial challenges due to unstable costs and revenues, and policy barriers affecting sustainability criteria, value chain organisation, and market creation. As projects move toward commercial scale, the absence of long-term feedstock and offtake agreements can significantly weaken bankability and limit project viability. Feedstock and market access risk are then challenges that intensifies with project maturity and affects the overall resilience of bioeconomy value chains. Key risks include:

- Feedstock availability and price volatility: Biomass sources such as agricultural residues, forest biomass, and organic waste streams fluctuate seasonally and annually, creating uncertainty in both supply and pricing.
- Competition for biomass: Multiple industries-energy, materials, food, and animal feed-draw from the same biomass resources, driving up prices and reducing availability for bio-based production.
- Logistical and infrastructure limitations: Many regions lack efficient systems for biomass collection, pre-treatment, storage, and transportation, increasing costs and operational complexity.
- Absence of long-term offtake agreements: Because markets for many bio-based products are still emerging, securing guaranteed demand is challenging, leaving project revenues exposed to market volatility.
- Dependence on multi-actor value chains: Each step-from feedstock collection and transport to conversion and distribution-relies on diverse actors. Disruptions anywhere in the chain can undermine project reliability.

Impact: Higher supply cost uncertainty, which directly increases project risk and destabilises revenue forecasts.

6.2.4. Regulatory and permitting uncertainty (TRL 5-9)

These types of barriers become particularly significant from the demonstration and pilot phase (TRL 5-7) to the scale-up and first commercial stage (TRL 7-9), when projects must move from technical validation to industrial implementation under real regulatory conditions. At these stages, complex and lengthy permitting procedures, unclear administrative pathways, and uncertainty around land-use, waste, renewable carbon, and sustainability rules can delay projects and increase development costs.

Delays and unclear compliance requirements can increase CAPEX, postpone financial close, and undermine investor confidence, especially in projects already facing scale-up and FOAK uncertainty. Regulatory barriers can also affect technical feasibility, for example when projects lack clear frameworks for testing innovative solutions, and they influence market deployment, since unstable incentives, weak policy signals, or fragmented standards can limit eligibility for market access and reduce demand certainty. Regulatory and permitting risk should therefore be understood as a cross-cutting challenge that intensifies as projects progress toward industrial and commercial deployment, directly affecting both bankability and implementation capacity.

- Complex and lengthy permitting processes: Industrial bioprocessing plants face unclear administrative pathways and long approval times.
- Uncertainty in waste, renewable carbon, land-use and sustainability regulations: Changes in classification or sustainability criteria can alter project feasibility.
- Lack of harmonised standards across regions, particularly for novel bio-based products and circular feedstocks.
- Policy dependency: Many business models require incentives (subsidies, green procurement, carbon pricing). Unstable or insufficient incentives reduce investor trust.
- Environmental compliance requirements (e.g., water use, emissions, waste management) create cost uncertainty during early planning stages.

Impact: Long timelines, unclear cost structures, and insecurity regarding eligibility for incentives or market access significantly erode project viability. These barriers could cause project delays, suspension, or complete cancellation.

6.2.5. Market immaturity and undefined demand (TRL 7-9)

These barriers become more relevant in the scale-up and first commercial phase (TRL 7-9) and especially at commercial deployment (TRL 9), when projects depend on stable revenues, buyer uptake, and market competitiveness. These risks are not only market-related: they are also linked to financial barriers, since uncertain revenues and limited offtake reduce bankability, and to policy barriers, because market uptake often depends on green procurement, subsidies, carbon pricing, or other long-term policy signals. In addition, weak value chain development and limited buyer commitment can further constrain commercialisation. Market immaturity is therefore a cross-cutting challenge in the later stages of project development, directly affecting the ability of bioeconomy projects to scale and compete in the market. The key risks are:

- Uncertain or emerging markets: Demand depends on voluntary corporate sustainability commitments or niche applications rather than mature commodity markets.
- Price competitiveness challenges: Bio-based products often struggle to match fossil-based prices without policy incentives or premium markets.
- Dependence on policy support: Market viability often hinges on green procurement, carbon pricing, mandates, tax credits, or consumer willingness to pay a premium.

- Limited offtake agreements: Buyers hesitate to commit to long-term contracts for unproven products or markets still lacking standardisation.

Impact: Revenue projections become highly uncertain, making projects difficult to bank. Without predictable demand or a market-shaping instrument (e.g., contracts for difference, minimum price guarantees), many promising technologies cannot scale to commercial deployment.

6.3. De-risking opportunities for Catalonia

Based on the previous analysis, Catalonia has a favourable starting point for the development of the bioeconomy, with a defined policy framework, strong research and industrial capacities, and significant biomass potential. However, as the regional assessments carried out in BioBoost suggest, the main challenge is not only to generate projects, but to ensure that they can progress toward implementation under conditions of lower technical, regulatory, financial, and market risk. In this sense, the main opportunity for Catalonia is to design de-risking mechanisms that respond to the specific barriers affecting project development in the region, not only through financial instruments, but also through stronger advisory support, regulatory facilitation, coordination mechanisms, and market creation measures.

Building on this, Table 7 and Table 8 should be read as two complementary steps in the translation of the report's findings into practical de-risking options for Catalonia. Table 7 provides a challenge-based mapping, linking the main technical, financial, regulatory, and market barriers identified in Catalonia to the de-risking mechanisms that appear most relevant at each stage of project development. Its purpose is primarily analytical: it helps to understand which types of mechanisms respond to which challenges, and why an integrated mix of instruments is needed across the project lifecycle. Table 8, by contrast, provides a more strategic and operational perspective. Building on the challenge–mechanism links established in Table 7, it selects and prioritises those mechanisms that appear particularly relevant for Catalonia and assesses their practical opportunity and replicability based on European examples from Table 2. In this sense, Table 7 should be read as the diagnostic and matching table, while Table 8 should be read as the prioritisation and policy-orientation table, showing which instruments may be most realistic or valuable for regional adoption. Together, the two tables move from identifying barriers, to matching solutions, to assessing which de-risking mechanisms could most effectively support bioeconomy project development in Catalonia.

The levels of opportunity shown in Table 8 and illustrated in Figure 4 reflect the degree of alignment between each mechanism and the most recurrent barriers identified throughout the report. Mechanisms are considered very high opportunity where they cut across several phases of project development and respond to the most repeated constraints. A high opportunity level is assigned to mechanisms that address a broad set of recurrent implementation barriers in Catalonia. A medium level is used for mechanisms that are relevant but more targeted to specific contexts, phases, or sectors, or that depend on stronger public intervention and implementation capacity. A low opportunity level reflects mechanisms that are potentially useful, but mainly as

complementary tools rather than as core responses to the most frequent barriers observed in Catalonia.

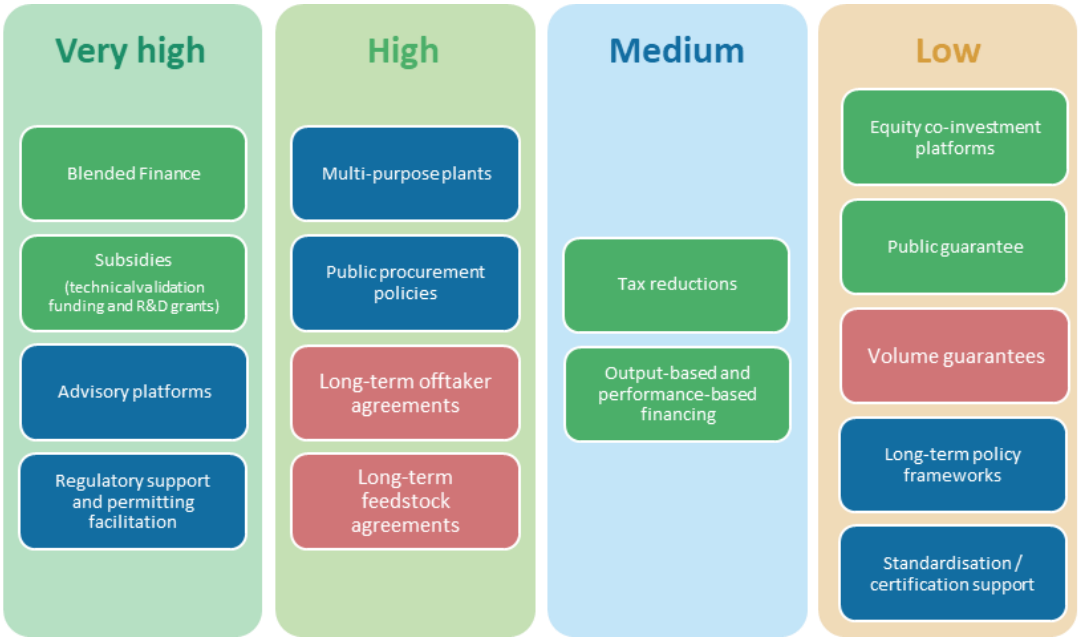

Figure 4. De-risking levels of opportunity for Catalonia context

For more clarity, Tables 1 and 2 provide the general analytical framework of the report, first by defining the main categories of de-risking mechanisms and then by detailing the principal mechanism families identified across Europe. Tables 7 and 8 build on this framework in a Catalonia-specific way. In this context, some of the entries used in Table 7 refer not to new stand-alone mechanisms, but to more operational forms or implementation variants of the broader mechanisms already presented in Tables 1 and 2. For example, technical validation funding and R&D grants can be read as forms of subsidies, while resource mapping, legal and governance support, and market-development advisory can be understood as components of advisory platforms, and one-stop-shops, guidance documents, or adaptive frameworks as forms of regulatory support and permitting facilitation. This clarification is important in order to read Tables 7 and 8 not as separate typologies, but as the Catalonia-specific application and prioritisation of the general mechanism framework developed earlier in the report.

Table 7. Relevant mechanisms for Catalonia's challenges

Type/TRL	Challenge faced in Catalonia	Relevant mechanisms	Contribution to risk reduction
Technical barriers for scale-up (TRL 3-7)	Technology readiness gaps	Subsidies, access to multi-purpose pilot and demonstration infrastructure or technical validation funding, R&D grants or blended finance.	Support projects to validate performance at pre-commercial stage and reduce early technical risk before private investors are willing to engage.
	Scale-up challenges	Access to multi-purpose pilot and demonstration infrastructure or technical validation funding, blended finance (grants, loans, equity), subsidies, equity co-investment	They reduce the cost and risk of moving from lab to semi-industrial scale while supporting the capital needs of demonstration.
	FOAK risk	Blended finance (grants, loans, equity), subsidies, equity co-investment, advisory platforms linking project developers with financiers and technical assistance	FOAK projects need both capital absorption and stronger project preparation because technical uncertainty is still high at this stage.
	Process integration risk	Multi-purpose pilot and demonstration infrastructure, technical assistance, advisory platforms	They support testing, troubleshooting and optimisation across interconnected process steps before industrial deployment.
	Operational variability	Long-term feedstock agreements, advisory support for resource mapping and supply-chain structuring	Uncertainty reduction linked to feedstock heterogeneity and reliability improvement of inputs needed for stable operation.
Capital intensity and first-of-a-kind risk (TRL 5-9)	High upfront CAPEX requirements	Blended finance, public guarantees, subsidies, public co-investment	They lower the amount of private capital exposed at early industrial stages and improve bankability for capital-intensive projects.
	Long payback periods	Public guarantees, output-based and performance-based financing, volume guarantee	They help stabilise expected returns and reduce the financing burden during long revenue ramp-up periods.

Type/TRL	Challenge faced in Catalonia	Relevant mechanisms	Contribution to risk reduction
	First-of-a-kind (FOAK) cost uncertainty	Blended finance, subsidies, public guarantees, advisory platforms, shared pilot and demonstration infrastructure	These mechanisms absorb part of the uncertainty linked to construction, commissioning and first industrial operation.
	Limited role for traditional project finance	Public guarantees, blended finance, equity co-investment, dedicated bioeconomy funds / public co-investment vehicles	They compensate for the lack of conventional debt by bringing in patient capital and public risk-sharing.
Supply chain and feedstock and offtake risk (TRL 5-9)	Feedstock availability and price volatility	Long-term feedstock agreements	Improve supply visibility and reduce input-price uncertainty over time.
	Competition for biomass	Long-term feedstock agreements, strategic planning, stakeholder coordination	They help secure access to biomass and reduce conflicts between competing uses of the same resource base.
	Logistical and infrastructure limitations	Blended finance, feedstock supply agreements	These mechanisms address the physical bottlenecks that increase costs and disrupt feedstock delivery.
	Absence of long-term offtake agreements	Long-term offtake agreements	They reduce demand uncertainty and make future revenues more predictable for investors and lenders.
	Dependence on multi-actor value chains	Advisory platforms, legal and governance support, long-term feedstock and volume guarantee	Help align actors across the chain and reduce coordination risk.
Regulatory and permitting uncertainty (TRL 5-9)	Complex and lengthy permitting processes	Regulatory support and permitting facilitation, one-stop-shop / fast-track permitting schemes	They shorten timelines and reduce the administrative uncertainty that delays investment decisions.
	Uncertainty in waste, renewable carbon, land-use and sustainability regulations	Regulatory support and permitting facilitation, guidance documents, adaptive regulatory frameworks, long-term policy frameworks	They improve regulatory clarity and reduce the risk that changing rules undermine project feasibility.

Type/TRL	Challenge faced in Catalonia	Relevant mechanisms	Contribution to risk reduction
	Lack of harmonised standards	Regulatory support, standardisation and certification support, long-term policy frameworks	These mechanisms improve market credibility and reduce uncertainty around compliance and product acceptance.
	Policy dependency	Long-term policy frameworks, public procurement policies, tax reductions, output-based financing	They provide more stable demand and incentive signals where market viability depends on policy support.
	Environmental compliance requirements	Regulatory support and permitting facilitation, technical assistance, advisory platforms	Help developers anticipate compliance costs and reduce delays in project preparation.
Market immaturity and undefined demand (TRL 7-9)	Uncertain or emerging markets	Public procurement policies, volume guarantees, advisory support for market development	Help create early demand and reduce uncertainty where private markets are still weak.
	Price competitiveness challenges	Tax reductions, output-based financing, targeted subsidies, public procurement policies	They improve the economic position of bio-based products against fossil-based alternatives.
	Dependence on policy support	Long-term policy frameworks, public procurement policies, output-based financing, tax reductions	These mechanisms reduce investor uncertainty by making policy support more predictable over time.
	Limited offtake agreements	Long-term offtake agreements, and volume guarantees where relevant	They reduce commercial risk by strengthening confidence in future sales volumes and revenue streams.

Table 8. Financial, market and enabling de-risking mechanisms for bioeconomy investments and their potential replicability in Catalonia

Mechanisms	Type	Opportunity/replicability for Catalonia	Illustrative European example
Blended finance	Financial de-risking instrument	Very high. Methodology (financing gap analysis & blended package) is directly transferable to bio-based pilot plants in Catalonia.	Netherlands Enterprise Agency (RVO)
Subsidies (technical validation funding and R&D grants)	Financial de-risking instrument	Very high. Grants can support early-stage validation and demonstration plants, particularly when combined with private investment within blended finance structures.	RVO innovation and scale-up grants (NL); EU innovation funding (Horizon Europe, Innovation Fund).
Advisory platforms or a Generalitat de Catalunya owned BioBoost Accelerator	Enabling instrument	Very high. A regional advisory platform could help structure projects, improve business models, and connect developers with investors.	GreenAssist (InvestEU/CINEA) at European level
Regulatory support and permitting facilitation (One-stop-shop / fast-track permitting, guidance documents, and adaptive regulatory frameworks)	Enabling instrument	Very high. Catalonia could establish a dedicated regulatory support desk to accelerate permitting processes for bioeconomy projects.	EU Biotech Acts for regulatory sandboxes.
Multi-purpose plants - shared pilot and demonstration infrastructure	Enabling instrument	High. Shared demonstration infrastructure could accelerate scale-up for regional bioeconomy start-ups.	Bio Base Europe; Pilots4U network (EU level) and Brightlands demo facility (NL, Limburg)
Public procurement policies	Enabling instrument (market-creation function)	High. Public procurement can create demand for bio-based products and reduce market risk for emerging industries.	Green Public Procurement

Mechanisms	Type	Opportunity/replicability for Catalonia	Illustrative European example
Long-term offtaker agreements	Market instrument	High. Public or large corporate buyers could act as anchor customers for early bio-based products, helping to reduce demand uncertainty and improve bankability for first commercial projects.	-
Long-term feedstock agreements	Market instrument	High. Particularly relevant for Catalonia given its agricultural and forestry biomass potential, as well as the need to reduce supply uncertainty and improve value-chain stability for bio-based projects.	-
Tax reductions	Financial de-risking instrument	Medium. Catalonia could explore regional tax deductions or incentives for investors and companies engaged in bioeconomy R&D and scale-up.	WBSO - R&D Tax Credit
Output-based and performance-based financing	Financial de-risking instrument	Medium. Could be explored for bioenergy or bio-based chemicals where measurable outputs (emissions reductions, production volumes) can be clearly defined.	Bpifrance; SDE++
Volume guarantees	Market instrument	Low. Relevant for selected sectors where public or anchor-buyer demand can be mobilised to reduce demand uncertainty for first commercial bio-based projects, especially where normal market uptake remains weak.	-
Long-term policy frameworks	Enabling instrument	Low. Catalonia already has a strategic base and could strengthen investor confidence through more stable, coordinated and operational long-term policy signals.	-
Equity co-investment (public co-investment and dedicated bioeconomy funds)	Financial de-risking instrument	Low. A Catalan co-investment fund (TRL 3-6) could attract private VC and business angels in bioeconomy sectors.	-

Mechanisms	Type	Opportunity/replicability for Catalonia	Illustrative European example
Public guarantee (Capped & uncapped)	Financial de-risking instrument	Low. Capped: Catalonia could create a regional "Guarantees Desk" to structure projects and channel them towards EIB/EIF instruments via local banks or regional vehicles. Uncapped: Could be applied to large-scale industrial bioeconomy infrastructures (biorefineries, large demonstration plants) through collaboration with national and EU financing institutions.	EIB/EIF (InvestEU, EIB Guarantees); Invest-NL, Green Hydrogen Import (Port of Amsterdam)
Standardisation / certification support	Enabling instrument	Low. Regional support could facilitate market uptake by improving compliance clarity, product credibility and buyer confidence, especially in emerging bio-based markets.	-

6.4. Stakeholder engagement and institutional alignment

As part of the project activities, several bilateral meetings have been held with representatives of the Generalitat de Catalunya to discuss the development of the bioeconomy framework and the applicability of the proposed de-risking mechanisms (described in this report). During these exchanges, the main findings of the report were presented, including the analysis of barriers across the project lifecycle and the corresponding set of financial, enabling (including regulatory), and market-oriented instruments.

At this stage, the next steps regarding the adoption of the proposed measures depend on the internal assessment by the Generalitat de Catalunya, particularly regarding the institutional, legal, and budgetary feasibility of integrating these mechanisms within existing frameworks. This includes evaluating the compatibility of the proposed instruments with current public funding structures, governance models, and regulatory constraints.

Overall, these discussions represent an important step towards aligning the proposed de-risking architecture with regional priorities and institutional realities, while identifying the conditions under which it could be effectively implemented. Although discussions are still ongoing, significant progress has already been made, and the Generalitat has shown strong openness to advancing the initiative in the near future. However, as with most public-sector processes, implementation timelines are inherently gradual due to administrative and procedural requirements. Importantly, budget availability has been identified as a supporting factor, reinforcing the feasibility of moving forward once the necessary processes are completed.

6.5. Case study - Open access plant for pre-scaling of alternative protein

The industrial pre-scaling of alternative protein production plant BioBooster was one of the projects in Bioboost Accelerator pipeline. Despite its strong strategic potential for the Catalan bioeconomy, the project ultimately did not advance to implementation. The analysis revealed that the factors that led to its discontinuation were not primarily financial, but stemmed from a combination of regulatory, governance-related, legal and public-private coordination risks that were not sufficiently addressed at an early stage.

In this sense, it became clear that the project could have progressed further and achieved implementation had appropriate de-risking mechanisms, both financial and non-financial, been in place from the outset.

BioBooster description

The project involved the development and acceleration of an open access plant dedicated to the industrial pre-scaling of alternative protein extraction, production and transformation processes. It was promoted by the Area of Economic Strategy within the Secretariat of Economic Affairs and European Funds of the Government of Catalonia (Public Administration).

At the time, the alternative protein market was largely dominated by soy and yellow pea protein, while many companies were exploring new and emerging protein sources. The plant aimed to address this growing need by offering a shared technological space that would facilitate industrial investment and innovation in Catalonia's bioeconomy.

The project foresaw a financing structure in which, during the first five years, funding would be provided jointly by the Public Administration (49%) and private investors (51%).

Challenges found

However, as mentioned above, the project did not progress to this stage, as it ultimately collapsed due to a mix of barriers:

- Regulation of public-private relations concerning the management and governance of the plant. The absence of a clear institutional and legal framework defining how the plant would be managed, (operational decisions *ownership*, responsibilities *share* between public and private actors, *etc.)*, *represented one of the main barriers encountered by the project*. The later proposal for an independent operating structure confirm*ed* that governance design was one of the central unresolved issues.
- Intellectual and Industrial Property issues, particularly regarding shared equipment and multi-user operations. Particularly reflecting the difficulty of defining how intellectual property, confidential know-how, process data, and industrial results would be protected in a shared facility used by multiple companies. The multi-user operation on the same equipment or within the same infrastructure arise concerns over ownership of results, access to sensitive information, liability, and the risk of unintended spillovers between users. Without predefined rules on IP management, access conditions, and user rights, the plant became less attractive both for companies and investors.
- Unclear market interest, where stakeholder interest declined once real investment and operating costs became clear. On a first stage, the initial market interest was strong, particularly as access to shared pre-industrial or demonstration facilities was perceived as a strategic opportunity. Early-stage companies were attracted by the potential to reduce capital expenditure, test processes, and accelerate time-to-market within a shared environment. Nonetheless, as the project evolved, this initial interest declined significantly once the underlying economic conditions became clearer. As stakeholders were required to commit to concrete investment levels, operational costs, many potential users reassessed their participation. In this specific case, this drop-off reflected both the financial constraints faced by early-stage companies.
- Challenges in attracting private investors, due to both technological risk and the absence of a clearly established governance model. On the one hand, the facility was linked to technological and scale-up uncertainty, since it involved a multipurpose industrial pre-scaling plant in an emerging segment of the bioeconomy. On the other hand, the lack of a well-defined governance,

operational model and market willingness made it difficult for investors to assess the viability of the plant, how risks and returns would be allocated, and whether the project could operate efficiently over time. Together, these uncertainties reduced bankability and limited the willingness of private actors to commit capital.

- Need for well-defined evaluation and selection criteria for companies wishing to access and participate in the plant. The absence of transparent rules governing which companies could use the facility, under what conditions, and according to which technical, strategic, or economic criteria was another barrier encountered by the project. Without such criteria, uncertainty increases for both potential users and investors, as it becomes unclear how capacity would be allocated, how demand would be prioritised, and whether the plant could maintain a coherent and credible operating model.

De-risking mechanism proposal

During the BioBooster analysis, it has been identified that the main barriers were related to governance, business model viability, and investor confidence rather than purely financial constraints. In this context, a combination of targeted de-risking mechanisms could have supported the implementation of the project.

- Clear governance and operational model for the plant: Establishing an independent operating structure (e.g., a foundation or special-purpose vehicle) similar to models used by Bio Base Europe or Brightlands could have clarified roles between public authorities, investors, and users. In parallel, predefined rules on intellectual property management, access conditions, and company selection would have reduced legal and operational uncertainty.
- Project structuring and advisory support: A dedicated advisory platform, similar to the EU GreenAssist initiative or a Generalitat de Catalunya owned BioBoost Accelerator, could have supported the project during the preparation phase by addressing regulatory requirements, defining the governance model, and strengthening the business case, trough, for example, an early market validation. This type of support is particularly relevant for complex public–private infrastructures.
- Targeted financial de-risking instruments: Complementary financial instruments (e.g. blended finance structures combining public grants with private investment, public guarantees, or co-investment) could have improved the project's bankability and facilitated the mobilisation of private capital during the initial investment phase. Among these options, blended finance mechanism could have been particularly relevant for the BioBooster project, given the high capital expenditure and technological uncertainty associated with multipurpose industrial pre-scaling facilities. By combining public grants with private equity and concessional loans, public funding could have absorbed part of the early-stage risk while improving the overall bankability of the project. Similar approaches have been implemented in several European countries, such as the Netherlands, where demonstrator and pilot infrastructures are often supported

through a mix of CAPEX subsidies, low-interest loans, and private investment. In the case of this BioBooster, such a structure could have reduced the perceived risk for private investors and facilitated the mobilisation of capital during the initial investment phase.

Bridging the gap between pilot validation and commercial scale-up: market dynamics and demand-side constraints in alternative protein infrastructure

While these observations are grounded in the BioBooster case, they reflect broader structural challenges commonly observed across multi-purpose plants, or shared industrial infrastructure projects. This highlights the importance of securing robust early-stage market validation and ensuring demand-side visibility from the outset. Without a clear understanding of market demand, pricing conditions, and offtake potential, infrastructure projects risk being underutilised or misaligned with industry needs.

It also underlines the need for public support mechanisms capable of reducing risk in key areas such as logistics, governance structures, and market organisation. These elements are critical to enabling coordination between multiple users and ensuring the effective operation of shared infrastructure.

Therefore, a key bottleneck emerges in the transition from pilot validation to industrial scale-up. At this stage, technical feasibility may already be demonstrated, but commercial viability remains uncertain. Post-production planning and commercialisation strategies become decisive to ensure that: (i) sufficient and reliable market demand exists to justify increased production capacity; and (ii) product quality can be consistently delivered in line with the standards required by target markets. Hence, successful scale-up depends not only on production capacity, but on the early alignment of production capabilities, market demand, and quality requirements.

7. Conclusions and recommendations

Bioeconomy projects are exposed to a wide range of technical, financial, regulatory, and market barriers across their development lifecycle. While these challenges evolve from early-stage R&D to demonstration, scale-up, and commercial deployment, the analysis also shows that a broad set of tools already exists to address them, including financial instruments, regulatory support mechanisms, and project-development services. The key issue is therefore **not the absence of solutions, but how effectively they are structured, combined, and deployed.**

In the case of Catalonia, several specific bottlenecks emerge that may constrain the development of a robust and investable bioeconomy pipeline. These include **limited investment readiness, fragmented project structuring, insufficient access to demonstration and scale-up infrastructure, regulatory complexity, and persistent market uncertainty,** particularly in relation to demand creation and price competitiveness. Addressing these gating challenges is essential for the sector to move from potential to implementation.

Within this broader framework and from a financial perspective, blended finance emerges as a particularly relevant approach to improve the effectiveness of public intervention. Rather than being a single instrument, it allows the strategic combination of different financial tools, such as grants, guarantees, concessional loans, and equity co-investment, to target specific risks and mobilise private capital. When properly structured, blended finance can enhance capital efficiency and ensure that public resources deliver greater value for money by crowding in, rather than replacing, private investment.

Nevertheless, to respond effectively to the different nature of challenges that Catalonia presents, a holistic de-risking approach is required. This implies combining financial, technical, enabling, and market-oriented instruments in a coordinated way, rather than relying on stand-alone measures. In particular, project-development support, regulatory facilitation, and market-creation mechanisms, such as public procurement, feedstock coordination, and long-term offtake agreements, should be prioritised alongside financial tools. In parallel, strengthening early-stage activities, such as business model definition, stakeholder engagement, market analysis, and ecosystem networking, can significantly improve project structuring and investment readiness, especially for start-ups that often face difficulties in accessing key partners and decision-makers. Importantly, these mechanisms should not be interpreted as a one-size-fits-all solution. Instead, the appropriate mix of support measures will depend on the development stage of each project, with different instruments becoming more relevant as projects progress from early-stage validation to demonstration, scale-up, and commercial deployment.

Looking ahead, several next steps can be identified to strengthen the bioeconomy ecosystem in Catalonia. These include:

i. Further mapping and prioritisation of project pipelines with a focus on investment readiness;
ii. The design of a coordinated regional de-risking architecture, potentially including a BioBoost-type advisory platform with strong public backing;
iii. The development of targeted market-creation mechanisms to address demand-side barriers (e.g market analysis, business models, etc); and
iv. Continued alignment and coordination among existing support actors to ensure complementarity and avoid fragmentation.

Overall, the success of the bioeconomy in Catalonia will depend not only on the availability of financial resources, but on the capacity to integrate technical, financial, regulatory, and market dimensions into a coherent and credible support framework that responds to the real constraints faced by projects.


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