European Investment Bank

The EU bank

Access-to-finance conditions for Investments in Bio-Based Industries and the Blue Economy

June 2017

InnoVFin Advisory

European Commission

Study on Access-to-finance conditions for Investments in Bio-Based Industries and the Blue Economy

Prepared for:
DG Research and Innovation
European Commission

By:
Innovation Finance Advisory
European Investment Bank Advisory Services

Authors: Jason Leoussis, Paulina Brzezicka

Contributors: Julia Taddei (EC), Marco Francini (EIB)

Supervisor: Shiva Dustdar

Contact: innovfinadvisory@eib.org

Consultancy support: EY Business Advisory Services S.à.r.l.

Luxembourg, June 2017

Disclaimer:

This Study on Access-to-Finance Conditions for Investments in Bio-Based Industries and the Blue Economy (the "Report") should not be referred to as representing the views of the European Investment Bank (EIB), of the European Commission (EC) or of other European Union (EU) institutions and bodies. Any views expressed herein, including interpretation(s) of regulations, reflect the current views of the author(s), which do not necessarily correspond to the views of the EIB, of the EC or of other EU institutions and bodies. Views expressed herein may differ from views set out in other documents, including similar research papers, published by the EIB, by the EC or by other EU institutions and bodies. The contents of this Report, including views expressed, are current at the date of publication set out above, and may change without notice. No representation or warranty, express or implied, is or will be made and no liability or responsibility is or will be accepted by the EIB, by the EC or by other EU institutions and bodies in respect of the accuracy or completeness of the information contained herein and any such liability is expressly disclaimed. Nothing in this Report constitutes investment, legal, or tax advice, nor shall be relied upon as such advice. Specific professional advice should always be sought separately before taking any action based on this Report. Reproduction, publication and reprint are subject to prior written authorisation of the authors.

European Investment Bank

Abstract

The study collects information on the investment and access-to-finance conditions for Bio-based Industries (BBI)[1] and Blue Economy (BE)[2] projects and companies in the European Union (EU), and evaluates the need and potential for dedicated public (risk-sharing) financial instruments (PFI)[3] as well as for other policy actions at the EU and Member State (MS) levels that can catalyse (crowd-in) private sector investments in BBI and BE. The study concludes the following: BBI and BE projects face issues accessing private capital. Regulation and market and demand framework conditions are perceived as the most important drivers and incentives but also present the biggest risks and challenges for both BBI and BE project promoters (PP) as well as financial market participants (FMP) to invest in the Bioeconomy. The main funding gaps in financing the Bioeconomy exist in (i) BBI and BE projects scaling up from pilot to demonstration projects and (ii) particularly in BBI, moving from demonstration to flagship/first-of-a-kind (FOAK) and industrial-scale plants. Existing public financial instruments are utilised but their catalytic impact could be further enhanced. Policy actions and/or new or modified public financial instruments could de-risk BBI and BE investments and catalyse (crowd-in) private capital. The study recommends the following: Establish an effective, stable and supportive regulatory framework for BBI and BE at the EU level, which is essential. Further reinforce awareness about InnovFin and the European Fund for Strategic Investments (EFSI), which can match the funding needs of certain BBI and BE projects. Develop a new EU risk-sharing financial instrument dedicated to BBI and BE, potentially taking the form of a thematic investment platform that can meet the needs of BBI and BE projects and mobilise private capital. Explore the creation of an EU-wide contact, information exchange and knowledge sharing platform or other channels to facilitate relationships between BBI and BE project promoters, industry experts, public authorities and financial market participants active or seeking to become active in the Bioeconomy.

[1] For the purposes of this study, the focus is placed on bio-based industries producing innovative bio-based products, with the latter defined as: "(innovative) bio-based products refer to non-food products derived from biomass (plants, algae, crops, trees, marine organisms and biological waste from households, animals and food production). Bio-based products may range from high-value added fine chemicals such as pharmaceuticals, cosmetics, food additives, etc., to high volume materials such as general bio-polymers or chemical feedstocks (i.e. building blocks). The concept excludes traditional bio-based products, such as pulp and paper, and wood products, and biomass as an energy source.

[2] For the purposes of this study, the scope of Blue Economy includes five categories: Food, nutrition, health and ecosystem services; Raw materials (non-living), Marine renewable energy combined with other marine activities; Marine (environmental) technologies; and Coastal protection.

[3] For the purposes of this study and throughout the document the term "PFI" encompasses financial support mechanisms such as equity or quasi-equity investments, loans, guarantees and other risk-sharing instruments, including grants. In the context of the study's recommendations, the scope of PFI emphasises implicitly risk-sharing financial instruments (i.e. excluding grants).

Foreword

The Bioeconomy relies on renewable biological resources from land and sea to produce food, feed, materials and energy and as such is a key contributor to Europe's growth, offering substantial opportunities for innovation and jobs. At the same time, its development supports the EU's transition to a Circular Economy, helping to address major societal challenges, such as greening the economy and addressing climate change. Economic and environmental objectives go hand in hand. With this in mind, financing the Bioeconomy can foster an innovative business environment in Europe, in which environmentally friendly technologies and business solutions can flourish, supporting growth and employment.

Investments in the Bioeconomy help reduce Europe's dependence on non-renewable natural resources, transform the production of food and manufacturing of bio-materials, and promote sustainable and resource-efficient production and the use of renewable resources from land, fisheries and aquaculture, while at the same time creating new jobs and developing new industries. Nevertheless, many segments of the Bioeconomy are characterised by high market volatility and inherent risks, which adversely affect its competitiveness, leading to sub-optimal levels of private investment. Access to finance is key for Bioeconomy projects, so a better understanding of the risks that act as barriers to finance and restrict investment is not only necessary, but also very timely.

I am therefore pleased that the EIB and the EC joined forces and commissioned this underlying study conducted by our Innovation Finance Advisory services. The study provides an in-depth analysis of the challenges and opportunities faced by Bioeconomy projects in attracting financing and mobilising investment. It also provides further impetus to the EIB's growing role in tackling sustainable economic development, greening the economy and addressing climate change by financing investments in the Bioeconomy and other climate-related sectors with increasing lending volumes in recent years, building on its existing lending and advisory services.

Examples of the EIB supporting the Bioeconomy include financing investments in Research, Development and Innovation (RDI) and production facilities for new functional bio-materials and food ingredients, such as (i) Novamont's investments in developing innovative bio-plastics and bio-chemicals based on renewable resources, (ii) Biochemtex's R&D investment programme focusing on biomass conversion technologies, (iii) SAICA's investments in the upgrading of recycled paper facilities for the production of new recycled carton board products on the basis of new previously unused recovered paper materials, and (iv) Royal FrieslandCampina's RDI activities in the areas of nutrition, food structuring, packaging, process technology, sensory and dietary demand aspects for dairy products.

The EIB is the largest multilateral provider of climate finance worldwide, committing at least 25% of its lending portfolio to low-carbon and climate-resilient growth in Europe and even more outside. The findings of this study offer a unique opportunity to go the extra mile in mobilising higher levels of investment in environment and climate-related areas to contribute towards the overarching goals of greening the economy.

Being the EU bank, the EIB is mandated to provide finance and expertise for sound and sustainable investment projects which contribute to furthering EU policy objectives, such as the Bioeconomy. In practice, this translates into making available the right financing solutions and providing targeted advisory support to innovative Bio-based Industries and Blue Economy projects in order to help them mobilise investment.

It is my belief that the actions resulting from the recommendations of this study will become valuable additions to the EU's toolkit in its goal of transitioning to a low-carbon, environmentally friendly and climate-resilient economy.

Vazil Hudak

Vice-President
European Investment Bank

European Commission's perspective

A dynamic, innovative and sustainable bioeconomy underpins our attempts to address major global challenges such as population growth, food security, climate change and resource scarcity. We will be able to meet the UN Sustainable Development Goals only if we invest in the better management and use of biological resources from land and sea. Europe's ambitions for a circular economy depend amongst other things on unlocking the potential of the innovative bioeconomy. At local and regional level, the bioeconomy can generate new jobs and growth, especially in Europe's rural and coastal areas.

For all these reasons, public support for research and innovation in the bioeconomy remains critically important. But private investment in innovations, infrastructure and new business models is ultimately what will determine our success. In short, the European Union still needs to attract more private investment to scale-up innovations in its bioeconomy, notably in bio-based industries and in the blue economy where our full potential remains untapped.

I therefore welcome this timely study from the European Investment Bank and its recommendations. It sets out concrete ideas for improving access-to-finance and mobilising private capital for research and innovation in Europe's bioeconomy. I look forward to working with the European Investment Bank to bring these ideas to fruition and drive forward our agenda of open innovation for a thriving and sustainable bioeconomy.

Carlos Moedas

European Commissioner for Research, Science and Innovation

Table of Contents

EXECUTIVE SUMMARY

Setting the Scene

Developing a Bioeconomy is key for Europe's future and sustainable development

The transition to Bioeconomy is Europe's response to today's key environmental challenges. It can ensure food and energy security, promote alternatives to our fossil-based economies, reduce the dependence on natural resources, transform manufacturing, promote sustainable production of renewable resources from land, fisheries and aquaculture and their conversion into food, feed, fibre, bio-based products and bio-energy, while developing new jobs, business models and industries.

The competition for limited and finite natural resources is expected to increase substantially in the coming decades. It is estimated that a 70% increase in global food supply will be required by 2050 to feed the world's population. Oil and liquid gas production is expected to decrease by around 60% by the same year. Finally, primary production systems (e.g. agriculture, forestry, fisheries and aquaculture) will be impacted by climate change. Agriculture accounts for about 10% of EU greenhouse gas emissions and while declining in Europe, global emissions from agriculture alone are still projected to increase by up to 20% by 2030.[4] For Europe to maintain its competitiveness it will need to ensure sufficient supplies of raw materials, energy and industrial products under conditions of decreasing fossil carbon resources.

To this end, there is a need to address the international commitments on Sustainable Development Goals 2030 and Climate Action (COP21 Paris Agreement) and the recent G7 declarations on the future of the oceans, and to foster economic growth and social prosperity. EU Member States (MS) and regions are encouraged to develop their national/regional Bioeconomy strategies, in synergy with their smart specialisation strategies. Access to finance for research and innovation should be improved in the EU through various funding schemes and sources (e.g. Horizon 2020 grants, ESIF, InnovFin, EFSI, private funds) in a holistic, complementary and synergistic way. In addition, tools and framework conditions should be further promoted for the uptake of the Bioeconomy in the EU.

The European Commission (EC) has defined a Bioeconomy strategy which encompasses these dimensions. Bioeconomy is framed under the Horizon 2020 Work Programme, "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy[5]" (Societal Challenge 2). Bio-based Industries (BBI) and the Blue Economy (BE) are key focus sectors to mobilise for the development of a European Bioeconomy.

*"**BBI** are defined as a segment of the Bioeconomy where renewable biological resources (i.e. biomass) are used for the production of bio-based products and bio-fuels. Production usually takes place in bio-refineries."*[6]

[4] Source: European Commission.
Article URL: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/Bioeconomy#Article

[5] Horizon 2020 Work Programme 2016 – 2017; 9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy; (European Commission Decision C(2017)2468 of 24 April 2017).
URL: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-food_en.pdf

[6] In the context of this study, the focus is placed on bio-based industries producing innovative bio-based products, with the latter defined as: (innovative) "(innovative) bio-based products refer to non-food products derived from biomass (plants, algae, crops, trees, marine organisms and biological waste from households, animals and food production). Bio-based products may range from high-value added fine chemicals such as pharmaceuticals, cosmetics, food additives, etc., to high volume materials such as general bio-polymers or chemical feedstocks (i.e. building blocks). The concept excludes traditional bio-based products, such as pulp and paper, and wood products, and biomass as an energy source

*"**BE** generally refers to a number of economic activities that directly or indirectly take place in marine environments, such as oceans, seas and coastal areas, using outputs from the ocean, putting goods and services into ocean activities and, through those activities, contributing to economic growth and social, cultural and environmental well-being."*[7]

Managed in a sustainable manner, the development of the Bioeconomy can:

- ✓ Sustain a wide range of public goods, including biodiversity and ecosystem services;
- ✓ Reduce the environmental footprint of primary production and the supply chain as a whole;
- ✓ Increase competitiveness;
- ✓ Enhance Europe's self-reliance (security of supply of food and raw materials for industrial products and energy); and
- ✓ Provide jobs and business opportunities, especially in rural and coastal areas.

Finally, the Bioeconomy, encompassing the entire biological material cycle and flows, contributes to the Circular Economy as mentioned in the Circular Economy Package[8] adopted by the EC in December 2015. Thus, the promotion of BBI and BE can at the same time support Europe's transition to a more circular business model.[9] Investments in research and innovation will notably enable Europe to demonstrate technological leadership in the markets concerned and play a role in achieving the goals of the Europe 2020 strategy and the Open Innovation concept.[10]

This study presents an overview of the investment and access-to-finance conditions for Bio-based Industries and the Blue Economy

The EU dedicates significant resources to the development of the Bioeconomy, first and foremost under Horizon 2020. In particular, the Societal Challenge of "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy" of Horizon 2020 is making available around EUR 3.8bn of funding in support of research and innovation in the Bioeconomy over 2014-2020, with part of it being dedicated to BBI and BE.

Despite the EU budget dedicated to BBI and the BE under various EU programmes, such as Horizon 2020, as well as the respective national budgets, the results of this study suggest that a large number of BBI and BE projects and companies in the EU appear to face difficulties raising finance.

The main objective of this study is to collect information on the investment and access-to-finance conditions for BBI and BE projects and companies in the EU and to evaluate the need and potential for dedicated public (risk-sharing) financial instruments (PFI)[11] as well as for other policy actions at the EU and Member State levels that can catalyse (crowd-in) private sector investments in BBI and BE.

Fulfilling this objective includes analysing the financing bottlenecks that impede the further development of BBI and the BE in the EU. This analysis assesses the need for EU intervention and makes recommendations for modified or new (risk-sharing) PFI mechanisms and other policy actions that can address identified funding gaps.

[7] For the purposes of this study the scope of BE includes five categories: Food, nutrition, health and ecosystem services; Raw materials (non-living); Marine renewable energy combined with other marine activities; Marine (environmental) technologies; and Coastal protection.
[8] COM(2015) 614 – 02/12/15 – Closing the loop - An EU action plan for the Circular Economy
URL: http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52015DC0614
[9] See also the access-to-finance study dedicated to the Circular Economy transition by the EIB's Innovation Finance Advisory division.
URL: http://www.eib.org/attachments/press/innovfin-advisory-report-on-circular-economy-full-report-public.pdf
[10] "Open innovation, Open science, Open to the world – a vision for Europe"
[11] For the purposes of this study and throughout the document the term "PFI" or "public financial instruments", encompasses financial support mechanisms such as equity or quasi-equity investments, loans, guarantees and other risk-sharing instruments, including grants. In the context of the study's recommendations, the scope of PFI emphasises implicitly risk-sharing financial instruments (i.e. excluding grants).

The study addresses the following analytical aspects:

- Describes the key issues and risks related to the financing of investments in BBI and the BE;
- Identifies and analyses the market conditions as well as the potential need and justification for further public intervention at the EU level;
- Assesses and formulates recommendations to remove the identified financing bottlenecks.

Key Findings

(1) BBI and BE projects face issues accessing private capital

The majority of BBI[12] and BE[13] projects surveyed (77% or 33 out of 43 projects in total, 20 out of 27 in BBI and 13 out of 16 in BE) face access-to-finance issues. Moreover, 79% of all respondents reporting access-to-finance issues indicate that the lack of interest from private financial market participants is related to the specificities and associated lack of understanding of the BBI and BE industries. Across the sample, data collected from project promoters indicates that no significant correlation can be concluded between the variables (i) project investment size (average interviewed project size for BBI is EUR 124m and for BE EUR 16m), Technology Readiness Levels (TRL, sample covered TRL between 6-9), and (ii) the existence or not of access-to-finance issues, suggesting that there are systemic barriers to financing as explained below.

(2) Regulation and market and demand framework conditions are perceived as the most important drivers and incentives but also present the biggest risks and challenges for both BBI and BE project promoters as well as financial market participants to invest in the Bioeconomy

According to project promoters, primarily active in BBI, regulation and market and demand framework conditions can act as the most important drivers and incentives for more sponsor and private sector investments. Specifically, they mention (i) regulation, primarily at the EU level and the national level, (ii) growing markets and demand and (iii) EU financial incentives, such as grant funding for BBI and BE projects, being the top three drivers for investing in the Bioeconomy.

However, project promoters also cite regulation and market and demand framework conditions as the biggest risks and challenges for investments in the Bioeconomy. In particular:

1. **Market and demand risks rank as the highest business risk factor for investments in BBI and BE for groups of project promoters.** These risks relate to the lack of developed markets and insufficient demand for BBI and BE outputs and products, largely affected by regulation.

2. **Regulatory risks rank as the second highest business risk factor for investments in BBI and BE** and as the top **challenge for conducting business activities for both BBI and BE project promoters**. These risks and challenges are primarily related to the lack of an effective, stable and supportive EU regulatory framework.

3. **Financial market participants recognise the role of a stable and supportive regulatory** framework but are cautious about its potential market distortion effects.

4. **Operational and technological risks primarily for BBI projects**, mainly related to risks during the demonstration phase of BBI projects and when scaling them up to flagship/FOAK operations (TRL 8-9) and the innovative nature of technologies in BBI and BE. **Legal regime risks mainly for BE** promoters,

[12] In BBI, the majority of projects produce outputs such as bio-materials, bio-chemicals and bio-products, some of which co-generated with bio-fuel. The remaining three projects are bio-energy-producing bio-fuels as sole output.
[13] In BE, all electricity-generating projects were excluded from the scope with the exception of multi-use offshore platforms (combining energy with other activities).

primarily related to complex and lengthy licensing procedures and overall BE legislation in the countries in which they operate.

5. **Financial risks** are mentioned by both BBI and BE promoters and relate primarily to the risks that both BBI and BE projects demonstrate low or volatile profitability and cash flow generation, driven by volatilities in volumes and prices of both inputs/feedstock and outputs/products. These risks occur especially at the earlier stages of projects, leading to potential liquidity issues. The large size of capital expenditures required, especially relevant to BBI projects and, to a lesser extent, to BE projects, ranks as the second highest financial risk.

6. **Other risks and challenges** mentioned primarily relate to societal issues that affect access-to-finance such as public perception of the Bioeconomy and the issue of the green premium that can be attached to Bioeconomy products and outputs.

7. **Issues with public funding**, which, according to BBI and BE project promoters, relate to the fact that public funding targets mainly the R&D phase of projects and less the demonstration and commercialisation phases. Also, project promoters report complicated and lengthy application procedures for public funding. Finally, project promoters who manage to obtain public funding mention its small size relative to their needs and the unfavourable terms attached. As a result, the existing PFI do not seem to have a sufficient catalytic effect in mobilising private capital for the later phases of projects (demonstration, flagship and industrial-scale).

(3) The main funding gaps exist in (i) Bio-based Industries and Blue Economy projects scaling up from pilot to demonstration projects and (ii) particularly in Bio-based Industries, moving from demonstration to flagship/first-of-a-kind (FOAK) and industrial-scale projects

Data from the capital structure of BBI and BE projects suggests that push mechanisms such as grants are not sufficient in size or catalytic impact and need to be complemented by different public and private sector interventions to fill the BBI and BE funding gaps. Data on the capital structure of surveyed BBI and BE projects reflects the limited availability of private debt capital from financial market participants. As BBI and BE projects increase in size and technological maturity, project promoters appear to resort to own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects. Grants, primarily from EU programmes (e.g. under the BBI Joint Technology Initiative) are also available for more technologically mature projects (up to TRL 7-8). However, as BBI and BE projects increase in size and technological maturity, the relative presence of grants in the capital structure diminishes due to the large size of projects, especially in BBI. Instead, public debt capital appears to play a larger role in the capital structures of both BBI and BE projects. Yet the presence of both forms of public capital does not manage to attract (crowd-in) sufficient private debt capital, which represents a small percentage of the capital structures of both BBI and BE projects. The reasons behind such an insufficient crowd-in effect are the perceived high industry-specific risks, which in the view of investors are not sufficiently absorbed by the current form, design and risk absorption capacity of public sector financing mechanisms.

Despite a degree of possible selection bias inherent in the sample (which was selected as a result of discussions between the consultant, EIB and the EC), the data suggests that the main funding gaps for both BBI and BE projects exist when:

(i) **Projects move from the pilot to the demonstration plant phase (TRL 6-7)** either for technology licensing or commercial production purposes. According to BBI and BE project promoters, this phase of the project cycle is marked by high technological risks, which non-specialist private investors (sector-agnostic) are not well equipped to assess. As a result, funding from private investors in general is overly expensive for promoters and the attached funding conditions cannot

be met by many projects. From the public side, grant funding is available but this is often restricted to the R&D phase and conditional on lengthy and complicated application procedures, which deter promoters from applying. The existence of public funding both in the form of grants and debt instruments does not manage to cover this funding gap, which according to the capital structure analysis is filled with own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects.

(ii) **Particularly for BBI projects, moving from demonstration to flagship/FOAK and industrial-scale phases (i.e. moving from demonstration to TRL 8-9)** presents additional challenges in attracting private capital. This phase refers to the up-scaling or ramp-up stage as projects move from demonstration to the commercialisation phases (TRL 8-9) with the expectation of selling to customers and, in the case of TRL 9, making a profit. While scale-up requires large investments, projects in this phase face unfavourable market and demand and regulatory framework conditions, which hamper investments. As a result, even projects that enter the TRL 9 phase continue to face revenue uncertainty, low or volatile profitability, and cash-flow and liquidity issues. As a consequence, private market participants are reluctant to invest. From the public side no dedicated support for industrial-scale (TRL 9) projects is available, which prevents a large number of them from reaching this stage.

(4) Financial market participants are attracted by the growth potential of the Bioeconomy, but due to its high perceived risks and information asymmetries, identify two unaddressed funding gaps

To gather feedback from financial market participants (FMP) regarding their interest in investing in BBI and BE projects and to test their appetite for existing, new or modified PFI, a balanced sample of 16 European debt and/or equity providers, including banks, asset managers and private equity players, was interviewed. 13 of the interviewees had already invested in the Bioeconomy in the past.

1. **The key drivers of FMPs' interest and investment in the Bioeconomy are its sustainable features and large future growth potential.** When asked about their incentives for investing in BBI and BE projects, the interviewed FMP most frequently mentioned market and demand drivers, in particular those related to the sustainable and innovative dynamic of the Bioeconomy. As a result of the perceived high growth potential of the industry, FMP are equally motivated by the related profit prospects and the potential for early mover advantages (when investing early in an industry that is expected to grow significantly).

2. **FMP perceive investments into the Bioeconomy as very risky.** Despite the significant interest in the sector by the interviewed FMP, a number of risks were identified that play an important role in investor considerations.

(i) **Information asymmetry and technology risk limit FMPs' propensity to invest in BBI and BE, steering private capital towards more mature projects.** Irrespective of their profile, most of the interviewed FMP indicated a preference for more mature and technologically advanced projects. At the same time the strongly perceived operational and technological risks, coupled with information asymmetry and insufficient understanding of the sector and related risk assessment, were found to be the biggest investment hurdles within the interviewed sample.

(ii) **The perceived instability of the market and fluctuating demand for BBI and BE products hinder FMP from investing in the sector.** Off-take agreements play a crucial role in mitigating the perceived market and demand risks, ensuring stable revenues for the company's continuity and cash flow for the debt and equity holders.

(iii) **Regulation and market and demand framework conditions can be important drivers but can also present the biggest risks and challenges for financial market participants to invest in the**

Bioeconomy. Efficient regulation can play a "market-shaping" role by incentivising demand and supply of BBI and BE products and thus limiting the perceived market instability. On the other hand, heavy market intervention can also deter private investors who are discouraged by external factors they have no control over.

(iv) BBI and BE projects require a significant investment volume whilst generating unstable revenues and cash flows, increasing the financial risk for investors. These financial risks were also identified by project promoters, who confirmed that cash flow, liquidity levels and returns are volatile prior to having successfully commercialised the product.

3. FMP identify two funding gaps faced by BBI and BE project promoters. The analysis of FMPs' key hurdles that deter them from investing in BBI and BE projects as well as their assessment of business and financial risks largely coincides with that of project promoters. FMP identify the same two funding gaps as the interviewed project promoters: (i) scaling-up from pilot to demonstration projects and (ii) moving from demonstration to flagship/first-of-a-kind (FOAK) and industrial-scale projects.

(5) Existing public financial instruments are utilised but their catalytic impact could be further enhanced

1. Bioeconomy strategies are a key trigger for providing PFI, which are widely used both within and outside the EU

At EU country level the most advanced and targeted programmes supporting the BBI and BE sectors are those that have also developed a national and/or regional Bioeconomy strategy and the establishment of national/regional coordinating agencies. Beyond the institutional framework and financing available at EU level, in particular Germany, Finland, the Netherlands and Sweden are the most advanced countries in Europe in terms of the development of national and/or regional Bioeconomy strategies as well as providing a broad set of PFI to support the sector.

Especially in Europe, numerous funding programmes and PFI are available both at EU and national levels providing large amounts of funding. Some of the EU's key programmes for supporting the Bioeconomy include Horizon 2020 and notably its Societal Challenge of "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy" (with a EUR 3.8bn budget for the whole Bioeconomy, including BBI and BE, over 2014-2020). As an illustration, Horizon 2020 launched in 2014 its flagship initiative for BBI: the Bio-based Industries Joint Technology Initiative (BBI JTI, referred to in the related EU regulation as the BBI Initiative), a EUR 3.7bn Public-Private Partnership (PPP) between the EU and the Bio-based Industries Consortium (BIC), in which the mobilised Horizon 2020 contribution reaches nearly EUR 1bn[14] over 2014-2020[15], leveraging an expected EUR 2.7bn of private financing. The Bio-based Industries Joint Technology Initiative, which will be implemented by the Bio-based Industries Joint Undertaking (BBI JU, established in 2014) until 2024, aims to support the development of the EU's bio-based industries by awarding grants to research and innovation projects (ranging from lab projects to first-of-a-kind flagship commercial plant projects) and to coordination and support projects in this field.[16]

Next to grants and other initiatives (e.g. InnovFin) under Horizon 2020 (H2020), other EU-level programmes, such as the European Fund for Strategic Investments (EFSI) and the European Structural and Investment Funds (ESIF), can contribute to the Bioeconomy. EU-wide programmes are further complemented by national level funding and through various instruments offered by

[14] The Horizon 2020 contribution of EUR 975m to the Bio-based Industries Joint Technology Initiative comes from the Horizon 2020 Societal Challenge "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy" for ~EUR 825m (which is included in the aforementioned budget of EUR 3.8bn for this Societal Challenge) and from the "Leadership in Enabling and Industrial Technologies" part of Horizon 2020 for ~EUR 150m.
[15] Horizon 2020 funding devoted to this initiative over 2014-2020 will be used to implement it up until end 2024.
[16] More information available on BBI JU's official website, URL: http://www.bbi-europe.eu/participate/participate

national, regional and/or local development agencies (e.g. Tekes in Finland, Invitalia in Italy, the Netherlands Enterprise Agency, Innovate UK, and so on).

2. **Grants dominate the PFI landscape, while access to innovative financial instruments is limited**

Grant instruments are available in all countries analysed. Grants are used widely in the EU, especially at the R&D stages, where data suggests that they have the most impact in terms of their role in the capital structure as funding sources for projects (i.e. with a significant portion of the total funding at early development stages coming from grants). Nevertheless, BBI and BE project promoters cite lengthy and complex application procedures leading to difficulties in decision-making and financial planning, hence creating financing bottlenecks and project implementation delays.

Innovative financial instruments are under-represented in the EU, while non-EU countries provide a broader mix of PFI. Innovative debt finance instruments with appropriate risk tolerance and tailored to the specificities of BBI and BE projects are essential to fill funding gaps**.** Despite some risk-sharing PFI available in the EU for pilot and demonstration stage projects, the data suggests that such financing may not be sufficiently available as a pull factor for continuous and consistent funding beyond pre-commercial stages. EU funding instruments, primarily grants, focus primarily on supporting the R&D phase and less support is available for commercialisation while existing risk-sharing financial instruments under programmes such as InnovFin, EFSI or COSME may only meet limited demand of BBI and BE projects given their risk absorption profile.

Within the EU, the spectrum of available funding types is broader at the national level than at the EU level. There are also important differences between individual countries. While Finland and Germany, for instance, focus on grants and loans to support BBI and BE projects, France, Spain and the UK use a much wider set of public financial instruments, including equity and venture capital. The wider mix at the national level also reflects the varying maturity of the local BBI/BE projects, local availability of raw resources and differences in national public policies and development strategies.

Grants are direct financial contributions by way of donation. Risk-sharing financial instruments allow for the sharing of a defined risk between two or more entities (e.g. between the public and private sectors). They are complementary to grants and can have increased size, leverage and thus catalytic (crowd-in) effect. They can also introduce financial discipline and upside potential improving the quality of projects and likelihood of them achieving commercialisation and profitability. Finally, funds contributed to financial instruments have a revolving nature (i.e. certain portion can be recovered and reinvested) and can thus be put into future use and made available to other projects.

3. **EU initiatives focus primarily on supporting the R&D phase and less support is available for commercialisation**

The majority of EU funding for the Bioeconomy is R&D-driven and primarily focused on early stage innovations. Programmes such as Horizon 2020 provide funding to innovative companies with low to medium/high TRL levels (up to TRL 8). Similarly, at the level of individual MS, based on the mapping of available PFI prepared by the consultant, the majority of identified funding programmes support mostly the R&D and early innovation stages of the Bioeconomy. A comprehensive and continuous funding approach beyond the R&D and pre-commercial stages is missing, and more support is needed for companies to commercialise new products. Europe-wide, in particular the funding needs of the commercialisation stage (TRL 9) remain not fully addressed.

4. **Existing funding in the EU flows mostly to the bio-energy (including bio-fuels) and agricultural sectors, with less support for value-added product development**

Few European programmes exist to support the development of integrated value chains, e.g. from the agriculture/agro-food, forest-based and waste sectors to BBI, where they would have a larger

impact on economic growth and the generation of employment. To exemplify, bio-based materials can directly support 5 to 10 times more employment and 4 to 9 times the value added compared with energy use.[17]

The existing PFI at the EU level largely support the production of biomass and bio-energy and to a lesser extent the industrial bio-technology and bio-refineries. At the EU level the development of bio-energy (including bio-fuels) has been given high priority through the allocation of public financing and the introduction of critical regulations. On the other hand, the support for the high value added industrial bio-technology and bio-chemical sector is more limited (e.g. the EU Horizon 2020 contribution to the BBI JU amounts to around EUR 1bn, expected to mobilise around EUR 2.7bn of private funding).

At the individual MS level, as well as in the non-EU countries analysed, differences between national strategies are observed. It appears that resource-rich countries (e.g. USA, Canada) fund programmes promoting the primary production sector, while countries with fewer natural resources (e.g. Germany, France or Malaysia) focus on the development of related sectors such as biotech or bio-based chemicals. In those countries that have fewer natural resources, the construction of bio-refineries can act as a catalyst to support the further development of bio-based products and materials.

(6) Policy actions and/or new or modified public financial instruments could de-risk Bio-based Industry and Blue Economy investments and catalyse (crowd-in) private capital

1. **The evaluation of the existing financial toolbox of EU public programmes and instruments in support of BBI and BE projects highlights the importance of risk-sharing instruments as pull mechanisms to incentivise and attract private capital capable of filling funding gaps.** The study also shows that existing tools are primarily technology-push mechanisms incentivising industrial research and innovation and the deployment of new technologies. Their availability and impact however reduces as BBI and BE projects increase in size and technological maturity near commercialisation, leading to the creation of funding gaps. The study also indicates that project promoters and financial market participants alike would benefit from increased information dissemination and cooperation outlets which could strengthen their understanding of both the industry as well as the various stakeholders' needs.

2. **Demand side: In terms of funding, project promoters ask for adapted or new PFI, primarily loans and guarantees that can absorb the financial and business risks of BBI and BE and carry favourable conditions.** During the interviews, BBI and BE promoters asked for PFI that allow effective risk-sharing between the public and private sectors, which they expect to have a catalytic impact encouraging more private investors to participate in BBI and BE projects. Loans and guarantees are seen as the number one instrument to fill funding gaps, followed by hybrid mechanisms, in part for their non-dilutive impact, and equity investments. They also indicate the need for more favourable conditions for PFI such as longer grace periods and tenors, lower interest rates and simpler procedures.

3. **Supply side: In terms of funding, financial market participants ask for different and targeted PFI for each funding gap**

   Contingent loans, supported by 69% of interviewed FMP, could help fill both identified funding gaps by mitigating technology and operational as well as market and demand risks. Through the introduction of equity-like features (i.e. junior positioning in the capital structure), such loans have

[17] Carus, M. et al (nova-Institute) 2010: The development of instruments to support the material use of renewable raw material in Germany – Market volumes, structures and trends.

the potential of attracting additional private capital by effectively de-risking the investment profile of private investors.

Investment platforms were also supported by 69% of FMP. By pooling several investors' resources together (and partially backing them up with a public contribution) to invest into various projects, an investment platform could diversify investor risk and therefore attract private capital to riskier projects (e.g. at multiple TRL levels), which may otherwise be deemed too risky for FMP acting independently. A platform thus has the potential to mitigate technology and operational risk (Funding gap 1), market and demand risk (Funding gap 2), as well as regulatory risks through the potential positive signalling effect of a public backing, while also crowding in additional private capital.

Hybrid instruments (e.g. combining both debt and equity features), backed by 50% of interviewed FMP, have the potential of particularly addressing market and demand risks through their risk-absorbing and equity-like features and thus responding to the needs of the second funding gap (i.e. moving from demonstration to flagship and industrial-scale projects). Finally, 81% of interviewed investors were also in favour of the development of an information exchange platform which could help address the challenge of information asymmetry.

Key Recommendations

(1) Establish an effective, stable and supportive regulatory framework for BBI and BE at the EU level, which is essential

The reduction of regulatory uncertainty can help mitigate market and demand risks typically faced by BBI and BE projects. Policy actions should demonstrate long-term regulatory commitment to support green alternatives to fossil-based products targeting the entire value chain while allowing free market forces to operate sufficiently. These policy actions should primarily aim to introduce price and volume stability and availability of biomass inputs/feedstock, as well as to trigger stable demand for BBI and BE outputs/offtake. Examples of regulatory actions can include the promotion of reliable access to feedstock for material uses (helping create a level playing field for material compared to energy use of biomass) through coherent biomass certification frameworks, structured supply chains (both upstream and downstream) that promote the ability to withstand market shocks, the harmonisation of labelling and certification standards for reliable BBI and BE technologies, processes and products and the overall promotion of the Bioeconomy to increase public awareness, perception and support. Other actions can include defined policy targets for the use of biomass in the material and chemical sectors, procurement programmes, mandatory use or prohibition of products based on their environmental footprint and perhaps even direct financial incentives such as tax schemes, targeted output subsidies, feed-in tariffs, preferential credits and others, in line with EU regulation. It is recommended that relevant and affected stakeholder groups be consulted and involved at all stages of the development of such a regulatory framework.

(2) Further reinforce awareness about InnovFin and the European Fund for Strategic Investments (EFSI), which can match the funding needs of certain BBI and BE projects

Existing programmes at the EU level, such as the BBI JTI (part of H2020), make available grant funding for BBI and BE projects up to flagship/FOAK level. EU programmes also make grant funding available for BE projects. Additionally, other EU funding tools exist for projects entering the demonstration and commercialisation phases, such as the EIB's existing mainstream instruments (e.g. InnovFin, EFSI), although not being Bioeconomy-specific. However, the interviews with project promoters and investors suggest that besides grant funding, there appears to be a certain lack of awareness on the part of project promoters about available risk-sharing funding tools at EU level. Specifically, the study indicates

that many Bioeconomy promoters are not yet sufficiently familiar with various risk-sharing EIB-EC financing schemes, including InnovFin and EFSI, hence suggesting the existence of certain information gaps and the need for a more targeted outreach to those promoters (this also applies to project promoters and investors in the Circular Economy, as shown in the earlier mentioned study).

The present study has already raised some awareness about EC-EIB risk-sharing instruments, while at the moment of its finalisation, the EIB Group (EIB and EIF) is already involved in a number of operations (loans and guarantees under EFSI and other schemes) supporting BBI and BE projects of various sizes (SMEs, mid and large-caps) that meet the risk absorption capacity, eligibility, bankability and other criteria of these schemes. While at this stage it is too early to assess whether instruments such as EFSI can sufficiently address BBI and BE funding gaps, the experiences gained from evaluating and financing BBI and BE projects can help address certain information gaps and create more awareness about currently available funding tools for projects that can be eligible under existing schemes (e.g. InnovFin, EDP thematic finance, EFSI).

This study therefore recommends the EC to consider addressing a number of information gaps through the implementation of an EU-wide contact, information exchange and knowledge sharing platform that improves awareness of existing public financing tools – as well as of advisory services available to project promoters under EFSI and InnovFin (e.g. the "6 simple steps to find your funding" online interface for InnovFin) – and facilitates relationships between BBI and BE project promoters, industry experts, public authorities and financial market participants active or seeking to become active in the Bioeconomy. The publication of this report will hopefully provide further impetus to continue raising awareness about the existing funding programmes and should be complemented with targeted awareness events and workshops that attract BBI and BE stakeholders. Here, the EIB's Advisory Services through its Innovation Finance Advisory will work closely with the relevant EIB and EC services in improving information flow and exchange. Efforts could include the increased presence of providers of risk-sharing funding tools, such as the EIB and the EC, in targeted sector (awareness-raising) events and stronger communication of messages about their contribution to the Bioeconomy (e.g. project financings, case studies) towards Bioeconomy stakeholders.

(3) Develop a new EU risk-sharing financial instrument dedicated to BBI and BE, potentially taking the form of a thematic investment platform that can meet the funding needs of BBI and BE projects and mobilise private capital

In the key findings section of this study, the feedback from BBI and BE project promoters and financial market participants indicates that there appears to be a need for public sector intervention beyond a supportive regulatory framework at the EU level. This intervention can take the form of a risk-sharing financial instrument, capable of addressing the multiple types of identified project risks (e.g. regulatory, technological, operational, market and demand, and others) of variable intensity (staged approach), across different stages of projects' technological maturity (throughout TRL 6-9 where funding gaps are identified), and be flexible in terms of size to cover both small and larger project capital needs. Eventually, it should lead to effective risk-sharing between the public and private sectors, in a way that renders BBI and BE projects bankable and financeable, thus mobilising (crowding in) private capital.

In terms of the form of such instrument, patient capital, ideally in the form of debt, appears most suitable. Specifically, project promoters express interest in debt features including long tenors, long grace periods, flexible terms and advantageous interest rates. Both project promoters and financial market participants simultaneously favour some equity-type characteristics, specifically high risk absorption acting as a first-loss piece or risk cushion for more senior forms of capital. However, at the same time, such instrument should be less dilutive than equity, as expressed by both project promoters and financial market participants.

In view of the above, the findings of the study make a compelling case for the development of a new pan-EU thematic investment platform dedicated to BBI and BE projects, which could combine all the desirable criteria outlined above. By way of definition, investment platforms are dedicated financing structures, and co-financing/risk-sharing arrangements that pool together several sources of financing from various investors in order to channel financing and investments in portfolios of projects. Investment platforms can provide various forms of capital (equity, quasi-equity, loans, guarantees etc) either directly to projects or to funds and other intermediaries, backed by a risk-absorption mechanism from the EU.[18]

The main advantages of investment platforms are their flexible investment criteria and the possibility of combining several sources of funding. Investment platforms can also introduce stage-based mechanisms whereby the level of risk-absorption is tailored to the stage and technological maturity of projects, thus filling both funding gaps identified in the study. Other features could include contingencies, such as coverage against unexpected increases in feedstock prices due to exogenous factors (e.g. adverse regulatory changes, weather conditions and others). Accordingly, other contingent features could provide coverage against unexpected revenue shortfalls by securing a minimum income stream for projects that face revenue risks, especially during the ramp-up period of operations. Finally, due to the pooling/aggregation effect, investment platforms can reduce transaction and information costs thus providing more efficient risk allocation between various investors.

The actual development, implementation and management of such dedicated instrument need to be evaluated and agreed upon by the appropriate stakeholders and agents of EU institutions.

(4) Explore the creation of an EU-wide contact, information exchange and knowledge sharing platform or other channels to facilitate relationships between BBI and BE project promoters, industry experts, public authorities and financial market participants active or seeking to become active in the Bioeconomy.

Such an EU platform could play an important role in facilitating the transition to a Bioeconomy by raising awareness amongst potential project promoters and investors, improving the bankability of projects, maximising the use of existing EIB instruments and analysing whether new financing mechanisms need to be established. The lead by the EC and its ongoing support by the EIB, NPBs and potential MS ministries would send strong signals, besides concrete policy actions, about the commitment of authorities to supporting green alternatives to fossil-based products.

Depending on the further articulation of the market needs such a platform to be assessed by the relevant EC services could ultimately, when up to speed, fulfil the following key functions:

1. **Coordination and communication**

   The platform could share and leverage the knowledge and experience of the BBI and BE community, bringing together all relevant stakeholders (i.e. project promoters/companies, financial investors, as well as regulators, feedstock producers and traders, and commercialisation and market representatives). Such a meeting point could help promoters and investors find partners, match various needs, and create business partnerships. It could also collect and make available BBI and BE-relevant data and analyse trends as well as monitor existing initiatives (e.g. on the socio-economic and financial impact). In this perspective, it would be important to make available, especially for investors, reliable market intelligence data and market forecasts, so as to raise their interest and knowledge of the BBI and BE sectors and of their market prospects in the years ahead. All of this would allow BBI and BE promoters and investors to receive reliable sector-related information

[18] Public capital from the EU would serve as first-loss piece or risk cushion, up to a certain percentage of the investment size of the portfolio of projects, thereby lowering the investment risk for investors.

(market, technical and financial), as well as tracking the progress of the Bioeconomy and coordinating, from a high-level perspective.

Proactive communication and knowledge sharing at EU-wide level can furthermore be a powerful means of raising awareness among multiple audiences (promoters, policy makers, investors, public, scientific community, citizens) about the merits of BBI and BE, as well as increasing awareness about the industry and its framework conditions.

2. Advisory support

An advisory function could provide tailored support to project promoters and financial market participants in assessing the technological, market and other risks of innovative technologies or innovative business models of BBI and BE projects, as well support in accessing suitable sources of financing (including EU funds). Such support would be particularly welcomed by financial market participants as a number of them, especially generalist/sector-agnostic investors, either struggle to assess specific BBI and BE risks (e.g. market, technological) or consider that the transaction costs for tailored-risk assessments are too high. These types of financial market participants, such as commercial banks (some of which may already be active as financial intermediaries in existing EU/national non-thematic financial products), could value the analytical input of public institutions on BBI and BE project risk assessment.

In addition, BBI and BE projects could be supported with respect to access-to-finance and technical project preparation, helping them to prepare a bankable business case. The mapping exercise showed that such advisory services are limited at EU level and that a few are only available in EU countries (i.e. Germany, Sweden and Finland). Depending on the type of support needed (which will vary by stage of the project development cycle) it has to be further considered which service providers should be involved. Existing advisory services of the EIB could form a part of the offering with respect to project preparation and access-to-finance support complemented by institutional support by other bodies. Such advisory services would be welcomed by BBI and BE project promoters, the large majority of which indicated a favourable stance towards such support, as was repeatedly highlighted during the interviews. Follow-up analysis and feasibility checks are necessary to determine the exact nature of the advisory support needed.

To avoid duplication it will be important to build on existing platforms in the same sector, such as the BIO-TIC industrial biotech partnering platform or the KIC InnoEnergy platform of the European Institute of Innovation & Technology (EIT), while looking for “smart” synergies with similar initiatives in other sectors, like the pillar II (Advisory) of the Circular Economy Finance Support Platform.

1 INTRODUCTION

1.1 The importance of the Bioeconomy for the European Union's economy

Definition of Bioeconomy

As defined by the European Commission (EC), the Bioeconomy[19] comprises those parts of the economy that use renewable biological resources from land and sea – such as crops, forests, fish, animals and micro-organisms – to produce food, materials and energy.

The Bioeconomy is a key contributor to European employment and economic growth. The EU Bioeconomy generates an annual turnover estimated at around 2 trillion euros and provides employment to more than 17 million people (representing around 8% of the total EU workforce).[20]

The continued development of the European Union's Bioeconomy can offer substantial benefits to the European Union's economy and society overall, in particular by reducing the dependence on fossil fuel, contributing to wiser management of natural resources and enhancing the environmental, social and economic sustainability of production processes. Furthermore, the transition to a Bioeconomy has the potential to contribute significantly to reducing greenhouse gas emissions, improving food and nutrition security and generating growth and employment, in particular in rural and coastal areas.

EU economies will witness a major transformation period moving from a fossil-based economy towards a bio-based and blue economy. To seize this opportunity, the EU can build on the momentum of the successful Paris climate conference (COP21). The current timing is appropriate given that 195 countries have adopted the first legally binding global climate agreement. This agreement includes an action plan to limit global warming to below 2°C and will take effect in 2020.[21]

The Bioeconomy in the European Union:

- Uses 1,600 to 2,200 million tonnes of biomass produced within the EU annually;
- …while another 450 to 680 million tonnes of produced biomass remain unused.

  Part of the unused biomass is needed to maintain soil fertility. A key question to be addressed is what are the necessary conditions to take advantage of the rest.
- Uses agricultural biomass as the first source of supply;
- Imports approximately 15% of all biomass consumed, including processed products; and
- Exports almost the same amount of biomass.

A sustainable Bioeconomy, coupled with blue growth, can be the green-blue engine of the Circular Economy that will boost new job creation and growth for the benefit of EU citizens.

Innovation and competitiveness in multiple sectors of the EU economy are additional potential beneficiaries of the transition to a Bioeconomy. In particular, recent and continuing progress in bio-technology, chemicals and life sciences makes the Bioeconomy one of the most dynamic sectors of the EU economy. Innovations in this field contribute significantly to the creation of new markets for a broad range of sectors – such as the expansion of new non-food markets for agriculture in the area of bio-based chemicals, bio-materials and bio-plastics and creation of new marine algae value chains – and make a vital contribution towards providing new high-skilled employment opportunities in the EU.

[19] Source: European Commission - https://ec.europa.eu/research/Bioeconomy/index.cfm
[20] 2013 figures, source: European Commission - https://ec.europa.eu/jrc/sites/jrcsh/files/JRC97789%20Factsheet_Bioeconomy_final.pdf
[21] Source: http://ec.europa.eu/clima/policies/international/negotiations/future/index_en.htm

Thus, the Bioeconomy has the potential to play a critical role in contributing to a smarter, more sustainable, competitive and inclusive EU economy that makes better use of the already utilised resources but also taps resources that have so far remained under- or unutilised on both land and sea.

The European Bioeconomy Strategy

The EC launched the European Bioeconomy Strategy in February 2012.[22] The strategy seeks to address the production of renewable biological resources and their conversion into vital products and bio-energy. It is based on the earlier EU 2020 climate goals formulated in 2008 and the EU 2020 strategy for smart, sustainable and inclusive growth. By 2025, the goal is to trigger 10 euros of added value for each euro invested in EU-funded Bioeconomy research and innovation.[23]

As shown in **Figure 1**, the EC's Bioeconomy strategy reflects its willingness to place the Bioeconomy at the core of the European public policy agenda in order to achieve three objectives:

1. Ensure food security;
2. Move from a fossil-based economy to a Bioeconomy;
3. Unlock the potential of seas and oceans.

Furthermore, the EC has structured and organised the Bioeconomy sector in terms of EU policy initiatives, as defined by DG Research & Innovation (R&I) at the Vilnius Innovation Forum held on 3 and 4 September 2015.[24] The key policy initiatives are summarised in **Figure 2**.

Figure 1: Bioeconomy strategy of the European Commission
Source: European Commission

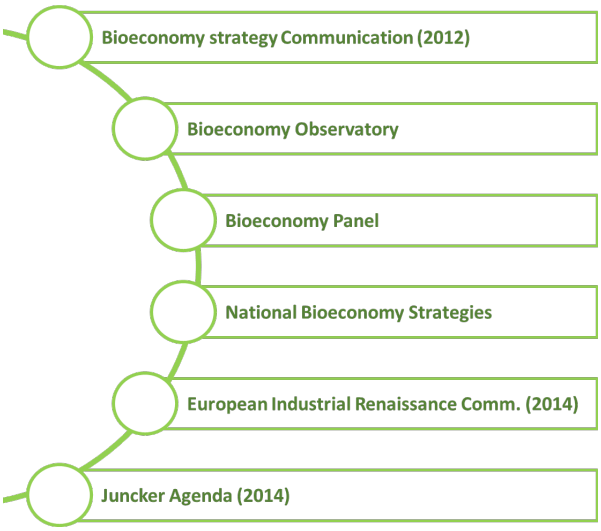


Figure 2: Bioeconomy policy initiatives of the EC
Source: European Commission

[22] European Commission (2012), Innovating for Sustainable Growth: A Bioeconomy for Europe; COM (2012) 60 final; European Commission: Brussels, Belgium https://ec.europa.eu/research/Bioeconomy/index.cfm?pg=policy&lib=strategy
[23] Source: "Commission proposes strategy for sustainable Bioeconomy in Europe", EC press release, 2012
[24] Source: http://innovationdrift.com/wordpress/wp-content/uploads/2015/09/European-Bioeconomy-policies_Waldemar-Kutt.pdf

The Bioeconomy has also been recognised as one of the societal challenges and Horizon 2020 (H2020) policy priorities under the Europe 2020 strategy, specifically:[25]

- "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy."

This societal challenge is particularly relevant for this study as it relates amongst others to "the transition from fossil-based European industries towards low carbon, resource efficient and sustainable ones".[26] The societal challenge entails the transformation of conventional industrial processes and products into environmentally friendly bio-based ones, the development of integrated bio-refineries and the opening of new markets for bio-based products, as well as the unlocking of the potential of the Blue Economy, as explained under the Horizon 2020 framework.

European Investment Bank's Innovation Finance Advisory (IFA) also completed a study on access-to-finance conditions for projects supporting the Circular Economy[27], with the final report published in December 2015 and launched at the "Financing the Circular Economy" conference organised within the framework of the Luxembourg Presidency of the Council of the European Union. While the key focus area of the present study is that of Bio-Based Industries and the Blue Economy, linkages and parallels are drawn to the Circular Economy throughout the study, as the two areas are interconnected, while some of its recommendations are built on those found in the Circular Economy report.

Bio-based economy and the Circular Economy

Alongside the 2012 European Bioeconomy Strategy, the EC adopted in December 2015 an ambitious package of legislative proposals – focusing primarily on waste – and set forth an action plan to promote the transition of Europe towards a Circular Economy (CE). The CE Package[28] makes clear links to the Bioeconomy and specifically to the efficient use of biomass and bio-based materials. In particular "The bio-based sector has also shown its potential for innovation in new materials, chemicals and processes, which can be an integral part of the CE. Realising this potential depends on investment in integrated bio-refineries, capable of processing biomass and bio-waste for different end-uses. The EU is supporting such investments and other innovative Bioeconomy-based projects through research funding."[29] The CE package indicates that "the Commission will examine the contribution of its 2012 Bioeconomy Strategy to the circular economy and consider updating it if necessary". In addition, in June 2016 the ENV Council requested that the Commission "assess the contribution of bioeconomy to circular economy and update the bioeconomy strategy accordingly".[30]

Cascading use of resources

On the use of biomass and bio-based materials, the package highlighted that "In a CE, a cascading use[31] of renewable resources, with several reuse and recycling cycles, should be encouraged where appropriate. Bio-based materials, such as for example wood, can be used in multiple ways, and reuse and recycling can take place several times. This goes together with the application of the waste hierarchy (including for food) and, more generally, options that result in the best overall environmental outcome. National measures such as extended producer responsibility schemes for furniture or wood packaging, or separate collection of wood can have a positive impact. The Commission will work on identifying and sharing best practices in this sector and promote innovation; the revised legislative proposals on waste also include a mandatory EU-level target on recycling wood packaging waste. In

[25] Source: http://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges
[26] Source: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water
[27] The full report is available on the EIB's website: http://www.eib.org/infocentre/events/all/financing-the-circular-economy.htm
[28] Circular Economy Strategy (http://ec.europa.eu/environment/circular-economy/index_en.htm)
[29] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions | Closing the loop - An EU action plan for the Circular Economy | Brussels, 2.12.2015 COM(2015) 614 final
[30] Source: Council of the EU press release 367/16 - http://www.consilium.europa.eu/en/press/press-releases/2016/06/20-envi-conclusions-circular-economy/
[31] Cascading use is defined as the subsequent and sequential transformation of biomass into several products, going from a first bio-based product via several recycling steps to additional applications, substituting several petrochemical products, with energy usage only at the end of the life cycle (Source: nova-Institute)

addition, the Commission will promote synergies with the circular economy when examining the sustainability of bio-energy under the Energy Union."[32]

CE/Bioeconomy policy actions

In terms of the actions that the EU will undertake to promote the Bioeconomy, "The Commission will promote efficient use of bio-based resources through a series of measures including guidance and dissemination of best practices on the cascading use of biomass and support for innovation in the Bioeconomy. The revised legislative proposals on waste contain a target for recycling wood packaging and a provision to ensure the separate collection of biowaste."[33]

It becomes clear that the two concepts, Bioeconomy and CE, are interconnected and have a strong intersection (the Circular Bioeconomy) with significant parts of the Bioeconomy being key contributors to the CE by representing the entire biological material cycle and flows, to which reference is also made in Innovation Finance Advisory's access-to-finance conditions report on the Circular Economy. **Figure 3** depicts visually how the bio-based sector and the Circular Economy are related and how the understanding and awareness of both concepts has to be increased.[34]

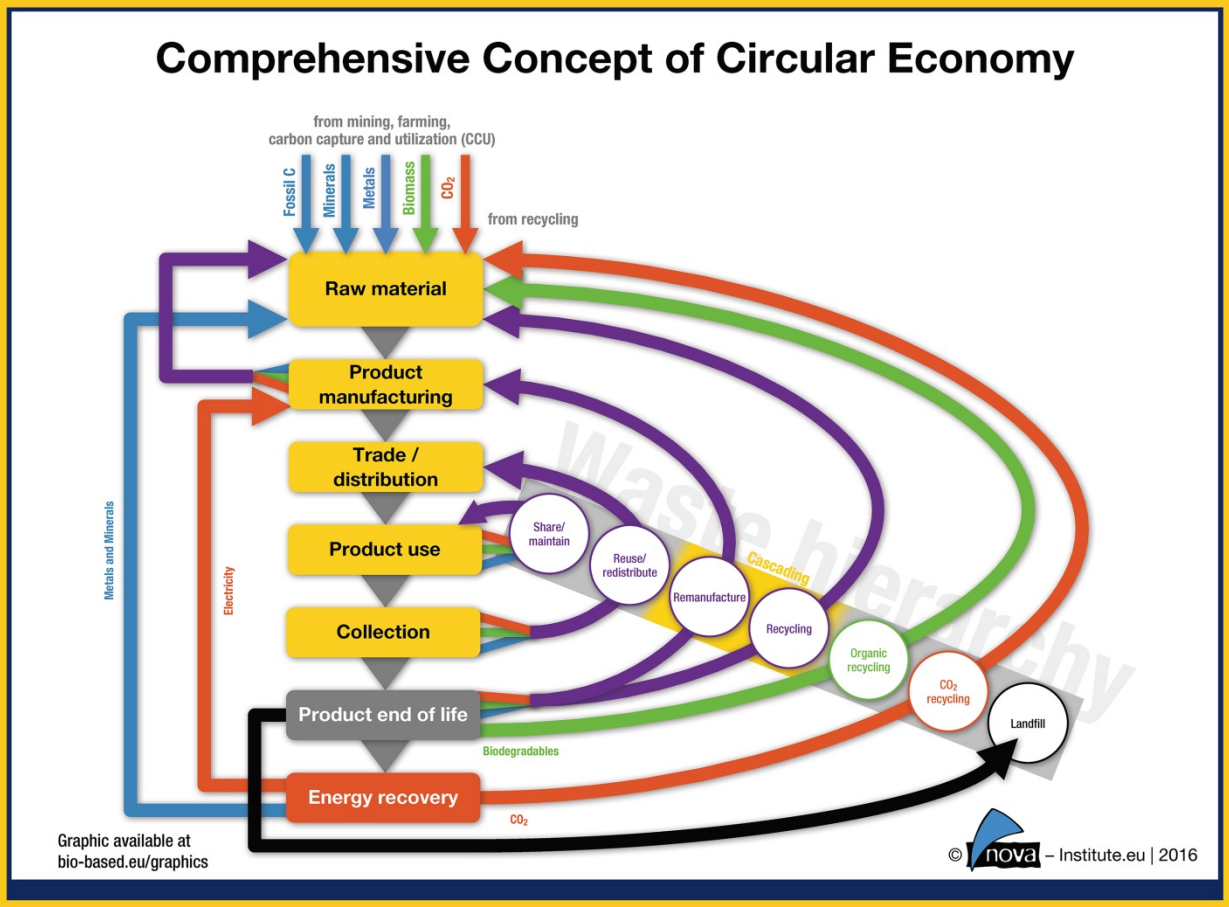


Figure 3: Comprehensive concept of the CE
Source: nova-Institute

[32] *Ibid*
[33] http://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF "Closing the loop - An EU action plan for the Circular Economy"
[34] "How to shape the next level of the European bio-based economy?" by Michael Carus, Achim Raschka, Kerstin Iffland, Lara Dammer, Roland Essel, Stephan Piotrowski (2016) (http://bio-based.eu/?did=40097&vp_edd_act=show_download)

1.2 Objective of the study

The EU dedicates significant resources to the development of the Bioeconomy, first and foremost under Horizon 2020. In particular, the Societal Challenge of "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy" of Horizon 2020 is making available around EUR 3.8bn of funding in support of research and innovation in the Bioeconomy over 2014-2020, with part of it being dedicated to BBI and BE.

Despite the EU budget dedicated to BBI and the BE under various EU programmes, such as Horizon 2020, as well as the respective national budgets, the results of this study suggest that a large number of BBI and BE projects and companies in the EU appear to face difficulties raising finance.

The main objective of this study is to collect information on the investment and access-to-finance conditions for BBI and BE projects and companies in the EU and to evaluate the need and potential for dedicated public (risk-sharing) financial instruments (PFI) as well as other for policy actions at the EU and Member State levels that can catalyse (crowd-in) private sector investments in BBI and BE.

Fulfilling this objective includes analysing the financing bottlenecks that impede the further development of BBI and the BE in the EU. This analysis assesses the need for EU intervention and makes recommendations for modified or new (risk-sharing) PFI mechanisms and other policy actions that can address identified funding gaps.

The study addresses the following analytical aspects:

- Describes the key issues and risks related to the financing of investments in BBI and the BE;
- Identifies and analyses the market conditions as well as the potential need and justification for further public intervention at the EU level;
- Assesses and formulates recommendations to remove the identified financing bottlenecks.

2 SCOPE AND METHODOLOGY

2.1 Definition of Bio-Based Industries and the Blue Economy

2.1.1 Bio-Based Industries

Definition of Bio-Based Industries

Bio-based industries represent a key segment of the Bioeconomy. Bio-based industries are usually defined as industries which use renewable biological resources (i.e. biomass) for the production of bio-based products and bio-fuels. Production usually takes place in bio-refineries and often relies on bio-based processes.

In the context of this study, the focus is placed on bio-based industries producing innovative bio-based products, with the latter defined as: *"(innovative) bio-based products refer to non-food products derived from biomass (plants, algae, crops, trees, marine organisms and biological waste from households, animals and food production). Bio-based products may range from high-value added fine chemicals such as pharmaceuticals, cosmetics, food additives, etc., to high volume materials such as general bio-polymers or chemical feedstocks (i.e. building blocks). The concept excludes traditional bio-based products, such as pulp and paper, and wood products, and biomass as an energy source".*[35]

BBI have a central role to play in accelerating the sustainable transformation of fossil-based European industries into ones based on renewable biological resources including bio-waste. In this transformation, research and innovation (R&I) is crucial for businesses to adapt their value chains to improve environmental sustainability and resource efficiency, for instance via the development of new bio-refining technologies and processes.[36]

BBI have the potential to contribute to the European Union's growth, for instance in rural areas. Taken as a whole, innovative and traditional BBI generate an EU annual turnover of EUR 600bn and 3.2 million jobs[37], in which innovative BBI – on which this study focuses when it comes to BBI – have an EU annual turnover estimated at EUR 57bn[38], with 300,000 people employed through direct and indirect jobs.[39]

From a policy perspective, the EC Bioeconomy strategy has notably recognised since 2012 the importance of supporting the development of BBI in the European Union and contains a series of actions towards that end. These actions relate to public and private investments in R&I and the reinforcement of policy interaction and stakeholder engagement, as well as to the enhancement of markets and competitiveness in this field.

[35] Source: the European Commission's Lead Market Initiative report "Taking bio-based from promise to market: Measures to promote the market introduction of innovative bio-based products"- November 2009.
URL:http://bookshop.europa.eu/en/taking-bio-based-from-promise-to-market-pbNB3109225/downloads/NB-31-09-225-EN-C/NB3109225ENC_002.pdf;pgid=GSPefJMEtXBSR0dT6jbGakZD0000CB6e8Gdb;sid=9xXbhmhilmjbyjC2gMNFIQpHVdan1sqhi0U=?FileName=NB3109225ENC_002.pdf&SKU=NB3109225ENC_PDF&CatalogueNumber=NB-31-09-225-EN-C
[36] See Strategic Innovation and Research Agenda (SIRA), Bio-based and Renewable Industries for Development and Growth in Europe – March 2013
[37] 2013 figures (incl. bio-energy, excl. food/beverage and tobacco industries and primary biomass production/extraction) – Source: European bioeconomy in figures (Nova & BIC, 2016) – http://biconsortium.eu/sites/biconsortium.eu/files/news-image/16-03-02-Bioeconomy-in-figures.pdf
[38] Source: "European Bioeconomy: policies, research and innovation, investments, markets and regulations, Waldemar Kütt, European Commission, 2015
[39] *Ibid*

Bio-refineries[40] in particular are at the heart of the development of European BBI. Their function is analogous to petrochemical refineries and plants that use fossil-based resources as feedstock and convert them into products and fuel. The difference lies in the fact that bio-refineries use renewable biological resources (i.e. biomass, including bio-waste) as feedstock and through the application of industrial processes and technologies (e.g. mechanical, chemical, thermochemical or biotechnological) convert them, for instance in a cascading approach, into one or multiple innovative bio-based products (e.g. bio-based chemicals, bio-based materials) and possibly into bio-fuels and/or bio-energy.

Bio-refineries can operate within a wide spectrum of industrial processes and at various degrees of scale, complexity and technological maturity. The latter denomination, the Technology Readiness Levels (TRL), provides a helpful framework for analysing various types of bio-refineries and industrial projects in various environments around Europe, ranging from small-scale plants in remote rural areas to large industrial hub-plants that source feedstock on a regional level.

Value chain approach

For the purposes of this study, BBI were structured into value chains based on the source of the relevant feedstock used. Three value chains (VCH) were identified, as shown below in **Figure 4**, and used to group BBI projects and companies in this study.

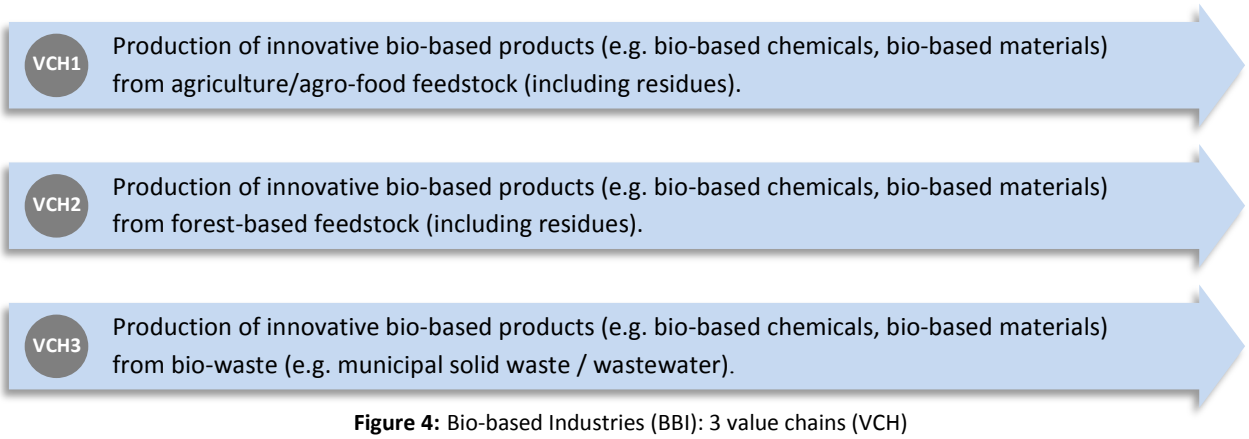


Figure 4: Bio-based Industries (BBI): 3 value chains (VCH)
Source: EIB, EY

- Value Chain 1 (VCH1) covers the production of innovative bio-based products (e.g. bio-based chemicals, bio-based materials) from agriculture/agro-food biomass (including residues);
- Value Chain 2 (VCH2) covers the production of innovative bio-based products (e.g. bio-based chemicals, bio-based materials) from forest-based biomass (including residues);
- Value Chain 3 (VCH3) covers the production of innovative bio-based products (e.g. bio-based chemicals, bio-based materials) from bio-waste (e.g. municipal solid waste / wastewater).

Furthermore, it should be noted that as part of the BBI VCH methodology:

- *Innovative bio-based products could be both intermediary and final products.*
- *Production of 2nd generation (or higher) bio-fuels is also included in the scope of this study although it is not its main focus, except if combined with the production of innovative bio-based products (e.g. in a cascading approach).*
- *The production of innovative bio-based products from aquatic biomass or from "CO_2 from bio-based operations" is also part of BBI, but, since none of the projects surveyed in this study uses these types of biomass, these were not included in the value chain approach described above.*

[40] Source Image: www.venturecenter.co.in

2.1.2 Blue Economy

Definition of the BE

The BE generally refers to a number of economic activities that directly or indirectly take place in marine environments, such as oceans, seas and coastal areas, using outputs from the ocean, putting goods and services into ocean activities and, through those activities, contributing to economic growth and social, cultural and environmental wellbeing.[41] As a result, the BE includes various maritime sectors ranging from shipbuilding and maritime transport, to fisheries, aquaculture, seabed mining, offshore energy and sea-related leisure activities.

For the purposes of this study the scope of BE includes five categories: Food, nutrition, health and ecosystem services; Raw materials (non-living); Marine renewable energy combined with other marine activities; Marine (environmental) technologies, and; Coastal protection.

The main objective of the BE[42] is to unlock the potential of oceans, seas and coastal areas in a sustainable way to provide scarce and vulnerable resources like food, energy and materials, and act as drivers for the European economy with great potential for innovation and growth. BE is composed of traditional and emerging sectors facing many technological and environmental challenges and also offering new opportunities. There is a need for de-risking of the necessary investments for technology to be tested, demonstrated, scaled up and commercialised and for related infrastructure to be developed. This requires dealing with complex interrelations, including land-sea interactions, and looking for synergies between various maritime activities (food, energy, transport, tourism, health, etc.) and technologies.

From a policy perspective, sea-related economic activities had traditionally been dealt with in a fragmented way. The deterioration of the quality of the seas and oceans and the need to create a sustainable environment for the future required a holistic view and a coordinated approach. This was recognised by the EU in 2007, when the Integrated Maritime Policy for the European Union (IMP) was adopted. This policy covers five cross-cutting policies (aquaculture, coastal tourism, blue bio-technology, ocean energy and seabed mining) under the name of Blue Growth.[43]

In 2011, the EC further highlighted the potential contribution of Blue Growth to the Europe 2020 strategy.[44] In its 2011 communication[45] the EC emphasised how Europe's coasts, seas and oceans have the potential to be a major source of new jobs and growth[46] that can improve the way we harvest the planet's resources. The communication singled out particular emerging industries warranting special attention and grouped them under the broader Blue Growth strategy, as summarised in **Table 1** below. Finally, in 2014, the EC issued a communication in which the need for innovation across all sectors of the BE is emphasised.[47]

[41] Pauli G., (2010), The Blue Economy, 10 Years, 100 Innovations, 100 Millions of Jobs. Report to the Club of Rome, Paradigm Publications, Taos
[42] See Communication from the Commission "Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth" – COM(2014) 254/2 (13/05/2014) and Communication from the Commission "Blue Growth opportunities for marine and maritime sustainable growth" – COM/2012/0494 final (13.09.2012)
[43] Source: "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – An Integrated Maritime Policy for the European Union", 2007
[44] Source: "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Blue Growth opportunities for marine and maritime sustainable growth", 2007
[45] European Commission (2012), Blue Growth opportunities for marine and maritime sustainable growth
[46] European Commission (2012), Blue Growth Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts, Final Report, Call for tenders No. MARE/2010/01, August 2012
[47] Source: "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth", 2007

Development of **sectors** that have a high potential for sustainable jobs and growth, such as:	Essential **components** to provide knowledge, legal certainty and security in the Blue Economy:	Sea basin **strategies** to ensure tailor-made measures and to foster cooperation between countries:
• Aquaculture • Coastal tourism • Marine bio-technology • Ocean energy • Seabed mining	• Marine knowledge to improve access to information about the sea • Maritime spatial planning to ensure efficient and sustainable management of activities at sea • Integrated maritime surveillance to give authorities a better picture of what is happening at sea	• Adriatic and Ionian Seas • Arctic Ocean • Atlantic Ocean • Baltic Sea • Black Sea • Mediterranean Sea • North Sea

Table 1: EC's Blue Growth strategy for Europe[48]
Source: European Commission

The BE offers smart, sustainable and inclusive economic and employment growth based on economic activities linked to oceans, seas and coasts. In terms of economic and societal impact for the European economy, the BE represented 5.4 million jobs[49] and an annual turnover[50] of over EUR 485bn in 2012. The BE presents major opportunities for economic development provided that appropriate investments and research are made. For example, aquaculture is today the fastest growing global food sector, providing more than 50% of fish for human consumption[51] and is expected to increase to over 60% by 2030.[52] However, it is foreseen that several factors will affect productivity increases in aquaculture, such as the availability of and accessibility to land and marine spaces, financial resources, improvements in technology and accessibility to feed.

As the competition for space in our seas increases, BE activities are moving further offshore with growing pressure to use offshore resources in a smarter and more sustainable manner. The multi-use of the offshore space is a new type of activity in the BE area recently examined by EU-funded projects, such as H2OCEAN[53], MERMAID[54], TROPOS[55] and MARIBE[56]. These projects have proved the potential and technical and commercial viability of multi-use offshore business models.

Sector approach

For the purposes of this study the scope of BE includes five categories, which in turn comprise a range of sectors and sub-sectors, as illustrated in **Figure 5**.[57] The application of such a sector approach allows the study to cover a diverse range of BE economic activities.

[48] Source: European Commission (2012), Blue Growth Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts, Final Report, Call for tenders No. MARE/2010/01, August 2012
[49] Source: European Commission, DG MARE, "Blue Growth – Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts"
[50] Source: European Commission, DG MARE, "Blue Growth – Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts"
[51] FAO (2010) The State of World Fisheries and Aquaculture. Rome. FAO
[52] World Bank report FISH TO 2030: Prospects for Fisheries and Aquaculture, 2013
[53] More info on http://www.h2ocean-project.eu/
[54] More info on http://www.vliz.be/projects/mermaidproject
[55] More info on http://www.troposplatform.eu/
[56] More info on https://maribe.eu/
[57] The sectors covered as part of the BE were specified with the EIB during the kick-off meeting held on 28 May 2015.

Blue Economy (BE): 5 main categories

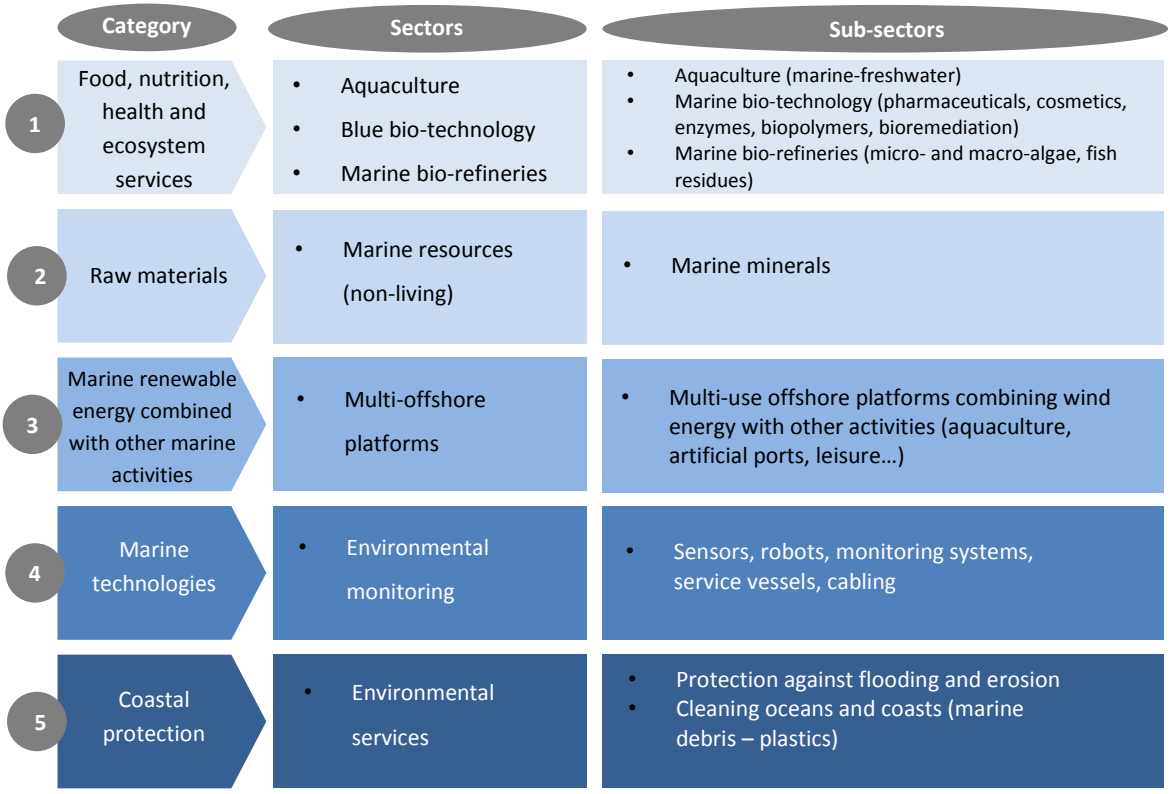


Figure 5: BE: five sectors
Source: EY, EC, EIB

As depicted in **Figure 5**, the five sectors/categories included in the scope of the study are (i) food, nutrition, health and ecosystem services, (ii) raw materials, (iii) marine renewable energy combined with other marine activities, (iv) marine technologies, and (v) coastal protection. The first three categories are well represented in this study's sample of interviewed BE project promoters, while it proved difficult to identify relevant representatives of the latter two categories that could meet the selection criteria of the study.

2.2 Methodology

2.2.1 Project Promoters

An initial sample of 85 projects was reviewed, and after the selection process **43 projects** from 34 project promoters were found to fit the scope of the study and were selected for interviews, of which:

- 27 projects in BBI; and
- 16 projects in the BE.

Figure 6 below illustrates the approach taken in the process of selecting BBI and BE projects. The bottom-up approach included desk research and consultations between the EIB and DG Research & Innovation (DG RTD) of the EC, leading up to the final project selection for interviews.

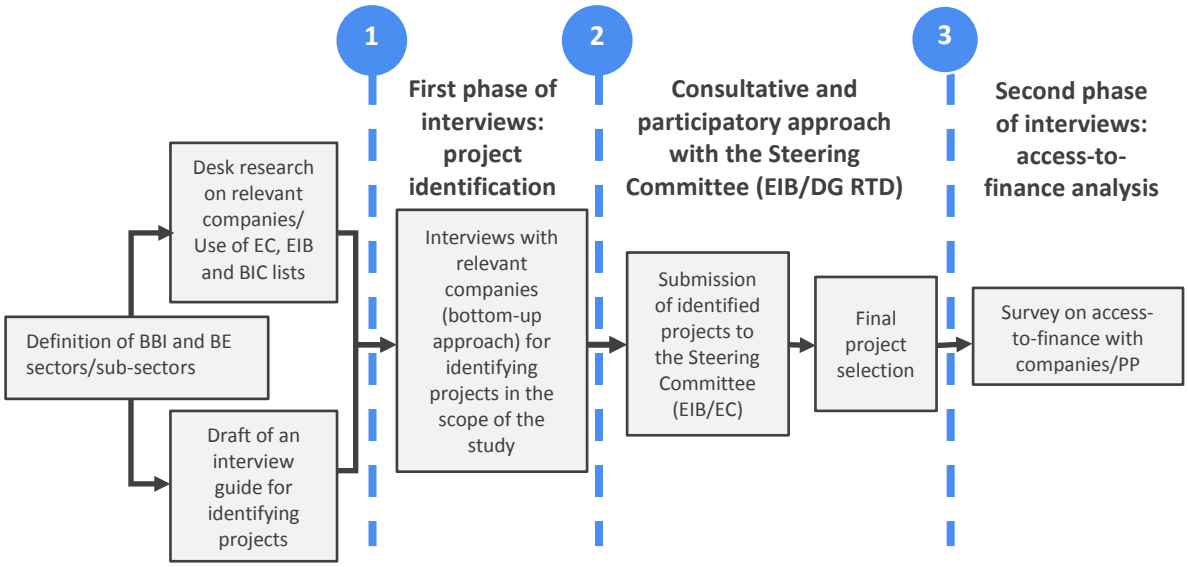


Figure 6: Flowchart illustrating approach and selection process for the project promoter sample
Source: EIB / EY.

A series of criteria were applied to the selection of projects to ensure relevance and breadth in scope while taking into account that only a limited number of projects could be interviewed. It led to the identification of 43 final interviewees from the initial set of 85 projects. The criteria applied are set out below:

- Investment size:
  - > Minimum EUR 15m per project/investment for BBI projects[58];
  - > Minimum EUR 5m per project/investment for BE projects;
- TRL from 6 to 9 (with the exception of one BE project in TRL 5);
- High market opportunities (perceived market opportunities in BBI and BE as confirmed by project promoters during the selection process);
- Sustainability and capacity to address upstream and downstream activities; and
- Environmental footprint (projects that ensure efficient use of biomass and limited land resources).

[58] Except for one interviewed BBI project where investment was below EUR 15m.

NB: In addition, please note the following sectoral restrictions to BBI and the BE in the selection of projects:

- In BBI, the majority of projects (24 out of 27) produce innovative bio-based products, some of which co-generated with bio-fuels. The remaining three projects produce 2nd generation/higher bio-fuels as their sole output;
- In the BE, all electricity-generating projects were excluded from the scope. Only multi-use offshore platforms were included (for example, platforms combining the production of energy with aquaculture, etc.).

2.2.2 Financial Market Participants

A series of criteria were applied to the selection of financial market participants (FMP) to ensure a balanced sample in terms of sectoral focus, type of financial activity, geography and size. As a result, 16 FMP were selected for interviews:

- The sample of 16 FMP covers mainly banks and lenders (6), private equity and venture capital providers (6), asset managers (3) and one co-operative.
- Most FMP (14) are from Western EU Countries (France, Germany, Netherlands, Belgium and UK).
- FMPs' main financial activity is the provision of private equity, followed by lending and long-term investments.

The criteria applied to the selection of the FMP sample are set out below:

- Geography: Active in the EU, providing financing to European target companies and projects;
- Financial activity to include:
  - Lending: Commercial and investment banks, able to provide loans to BBI and BE project promoters;
  - Private equity or venture capital: Funds or dedicated investment vehicles, able to bring equity-type capital to BBI and BE project promoters;
  - Asset management (long-term investments): Institutional investors, able to take long-term financial positions in BBI and BE project promoters, using various instruments;
- Target sectors and/or subsectors: Targeted sectors for investments included, but were not limited to, BBI and BE. Preference was shown for confirmed and explicit involvement in BBI and BE; and
- Size: Criteria applied were assets under management (funds and other investment vehicles), and size of balance sheet (banks). No target size of investments, but the "lower bound" for investment size was set at EUR 10m.

Figure 7 below presents an overview of the interviewed financial institutions in terms of assets under management (AUM), average ticket size, and the type of capital provided to the Bioeconomy sectors.

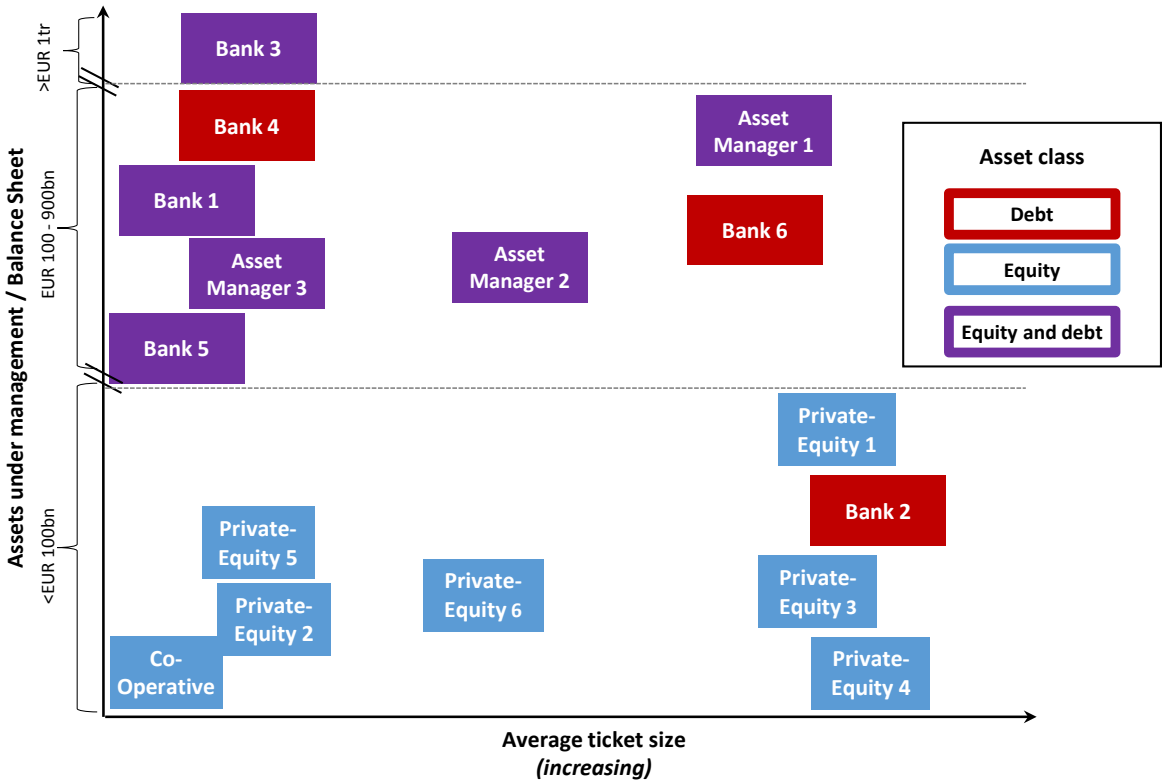


Figure 7: Overview of interviewed financial market participants by assets under management, average ticket size, and type of capital provided to BBI/BE
Source: EY, Company websites

The sample is balanced in terms of both ticket size and assets under management. The majority of the sample consists of lenders such as commercial banks (38%, 6 FMP) and private equity and venture capital providers (38%, 6 FMP). The remaining three are asset managers and one is a co-operative institution. The largest tickets are typically provided by banks (loan size range up to a maximum of EUR 400m in the sample), with most interviewed private equity players investing up to EUR 50m per project, and asset managers placed in between. Please also note that while the focus is placed primarily on lending, some of the banks in the sample are also expanding into private equity and venture capital activities.

2.2.3 Mapping of existing PFI[59]

Geography

A series of criteria were applied to the selection of countries included in the PFI mapping sample. As a result, 15 individual countries were selected for further analysis, complemented by the review of EU-level funding available. The mapping of PFI covers:

- The EU as a whole (EU level);
- Nine EU countries (Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, UK);
- Six non-EU countries (Brazil, Canada, China, India, Malaysia, USA).

[59] For the purposes of this study and throughout the document the term "PFI" encompasses financial support mechanisms such as equity or quasi-equity investments, loans, guarantees and other risk-sharing instruments, including grants. In the context of the study's recommendations, the scope of PFI emphasises implicitly risk-sharing financial instruments (i.e. excluding grants).

- **European Union**-level PFI are a key focus area of this study and therefore fully covered in its scope.
- **EU countries** included in the scope of the PFI mapping were selected on the basis of the size and importance of the local Bioeconomy, assessed on:
  - Nominal GDP size of BBI and BE and related sectors in the economy;
  - Share of the Bioeconomy-related GDP originating from the transformation sector;
  - Level of investment in research and innovation;
  - The presence of national policies aimed at developing the Bioeconomy.

As a result of this assessment, the following nine EU countries were selected as the representative sample for further analysis of the local PFI landscape: **Finland, France, Germany, Italy, the Netherlands, Poland, Spain, Sweden and the United Kingdom.**

- **Non-EU countries** were selected based on the existence of a national strategy or policies in support of BBI and the BE, in order to identify exemplary case studies which may be relevant in the context of the existing EU-level PFI assessment. The criteria used for this selection included the existence of:
  - National strategies or policies to support BBI (either a holistic Bioeconomy strategy or targeted sector-specific policies such as those focused on bio-refining or bio-tech);
  - Significant biomass resources (agriculture, forestry);
  - Visible BBI or BE incentives (tax stimulus, seed financing support, access to public R&D funding capacities, standards and certifications for bio-based products).

As a result of this assessment, the following six non-EU countries were selected as the representative sample for further analysis of the local PFI landscape: **Brazil, Canada, China, India, Malaysia, USA.**

Funding Type

In order to obtain the broadest possible overview of the available type of PFI, no particular instruments were specifically excluded from the study's scope.

As such, the mapping takes into account the following:

- National Bioeconomy strategies and policies (that support the development of related PFI);
- Financial instruments:
  - Grants;
  - Equity (direct and indirect equity, venture capital);
  - Debt (loans, including subsidised or zero interest loans);
  - Contingent loans (including repayable advances);
  - Guarantees.
- Tax Incentives
  - Included only in the assessment of non-EU countries, given their incompatibility with EU Community law[60] as well as methodological restrictions in the identification of BBI/BE-specific tax incentives at Member State level.[61]
- Non-financial tools (e.g. technology or knowledge transfer, coaching, business development).

[60] The Commission Communication of 22 November 2006 on the compatibility of tax incentives with Community law also explains that "territorial restrictions" are the main reason for incompatibility of tax incentives with Community law
Source: Commission Communication of 22 November 2006 to the Council, the European Parliament and the European Economic and Social Committee

[61] Few tax incentives are likely to be specifically dedicated to the BBI and BE sectors at EU Member State level; they are rather a part of R&D tax credits or other wider programmes, which creates methodological complexities for their direct identification.

2.3 Limitations of the study

Sample size

- 43 projects from 34 project promoters (some project promoters overseeing more than one project) and 16 FMP is a small sample in absolute terms for conducting statistical analysis. Therefore, the extraction of conclusions from statistical findings required the incorporation of qualitative factors and the exercise of judgement.

Sample diversity

- For projects, the size of the sample and the selection criteria introduce a degree of selection bias in terms of similarities in TRL and average project sizes.
- For FMP, despite the small sample size, the sample was fairly diverse across sectors, sizes, activities and interest in BBI and the BE. This required exercising judgement in interpreting quantitative and qualitative data and assigning weightings to the responses.

Survey

- Despite the thorough structure of the questionnaires, some PP and FMP responded to and filled out questionnaire sections selectively, leading to an uneven response rate distribution and level of quality. This required exercising judgement in interpreting quantitative and qualitative data in certain cases.
- Various degrees of sectoral and topical knowledge and understanding among interviewees (PP and FMP) led to various amounts of information being provided and therefore used from the more knowledgeable or active interviewees. This was mitigated by manually qualifying the weighting of responses across different questions, i.e. the answers provided were reviewed in their entirety to ensure that in the case of qualitative responses, or quotes, the report does not reflect a bias but rather the broadest possible view.
- The length, quality and depth of interviews and responses were influenced by factors such as the availability and willingness of interviewees to disclose information.

Data

- While all efforts were made to use the most recent and relevant data, in particular the desk research was constrained by data quality, availability and consistency factors.
- The definition of BBI and BE sectors varies across countries, leading to different data aggregation methods.

Confidentiality

- Project promoter interviews were performed by the contractor under non-disclosure agreements (NDAs) limiting the data available for analysis by the EIB.
- While the EIB participated in all FMP interviews, at the request of the interviewees the relevant FMP data will be only made available to the public in an anonymised and aggregated format.

3 ANALYSIS AND FINDINGS – PROJECT PROMOTERS

3.1 Finding 1: BBI and BE projects face issues accessing private financing

3.1.1 Sample overview

Key section takeaways:

1. The project promoter sample is balanced across the EU.
2. 77% (33 out of 43) of all respondents report access-to-(private) finance issues, of which 79% relate to the specificities of BBI and BE industries.

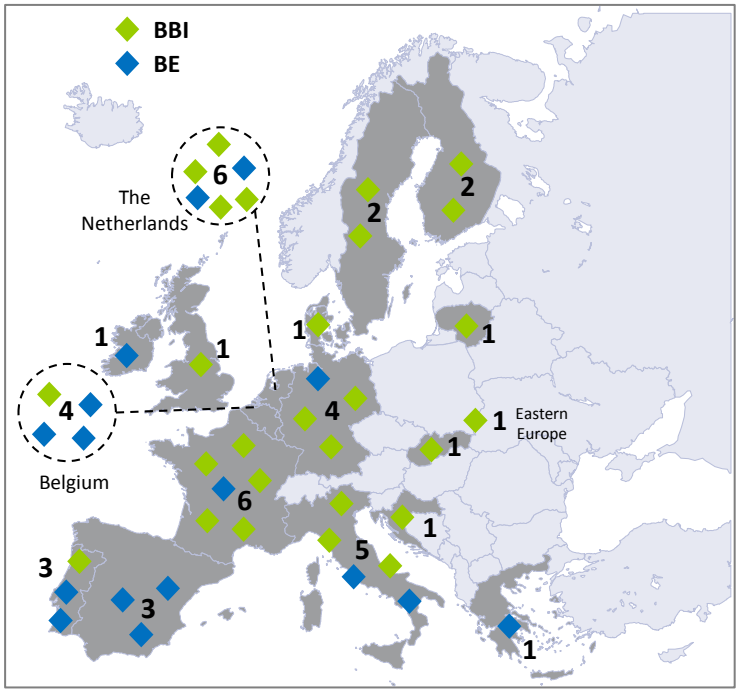


Figure 8: Geographical distribution of BBI and BE projects
Source: EY

The study surveyed 43 projects from 34 project promoters active in both BBI and BE. The sample consists of 27 BBI and 16 BE projects around Europe.

In terms of geographic distribution, the **project sample is balanced across EU regions** spreading across Western European countries (22), Southern Europe (13), followed by Northern Europe (five) (Nordics) and Central and Eastern Europe (three).

Specifically, the Netherlands (six), France (six) and Italy (five) feature most projects, followed by Belgium and Germany with four each. Spain and Portugal each have three projects, primarily in BE, and from the Nordics, Sweden and Finland each have two BBI projects followed by Denmark with one BBI project. The remaining sample comprises single projects from various other countries such as the UK, Ireland, Lithuania, Slovakia, Croatia and Greece. Finally, there is one BBI project to be implemented in Eastern Europe.

Table 2 and **Table 3** below list all BBI and BE projects by region, CAPEX size, TRL range, value chain (BBI) or sector (BE), duration of the investment programme and finally, whether the project promoter reported access-to-finance issues or not. They also provide a short description of each project.

BBI Project initials	Region	Short project description	CAPEX (EURm)	TRL range	VCH	Duration (months)	Access-to-finance issues?
BBI1	SE	Full-scale plant producing 2G ethanol for fuel based on energy crops	200	8 - 9	VCH2	48	N
BBI2*	SE	Full-scale plant producing 2G ethanol for fuel based on energy crops	200	8 - 9	VCH2	48	N
BBI3	WE	Demonstration plant of sugar bio-refinery producing bio-chemical building blocks	22	6 - 7	VCH1	18	Y
BBI4	WE	Full-scale plant extracting HTC coal and phosphates from waste sewage sludge	20	6 - 7	VCH3	24	Y
BBI5*	WE	Full-scale plant converting biomass into chemicals used in bio-based polymers	100	8 - 9	VCH1	48	Y

BBI6	WE	Flagship/FOAK plant converting sugar into bio-chemical building blocks and products	100	7 - 8	VCH1	24	N
BBI7	WE	Full-scale 2G bio-refinery converting forest-based biomass into sugar and lignin	250	8 - 9	VCH2	48	Y
BBI8*	WE	Full-scale dual-feed bio-refinery using both lignocellulosic and glucosic biomass	100	8 - 9	VCH1&2	42	Y
BBI9	SE	Demonstration plant of biomass residues (agricultural, forestry) bio-refinery for bio-fuels and eventually bio-chemicals	120	6 - 7	VCH1&2	108	Y
BBI10	CEE	FOAK plant producing cellulosic ethanol and energy from non-food biomass	100	7 - 8	VCH1	36	Y
BBI11	WE	Full-scale plant producing biogas and organic fertiliser from swine manure and slaughterhouse sludge	73	8 - 9	VCH3	12	Y
BBI12	WE	Full-scale plant transforming glucose into bio-plastic building blocks	120	8 - 9	VCH1	36	N
BBI13*	WE	Full-scale plant transforming glucose into bio-plastic building blocks	70	8 - 9	VCH1	36	N
BBI14	WE	Full-scale brownfield plant converting lignocellulosic biomass into 2G ethanol, biogas, lignin (and bio-chemical building blocks)	100	8 - 9	VCH1	30	Y
BBI15*	CEE	Full-scale brownfield plant converting lignocellulosic biomass into 2G ethanol, biogas, lignin (and bio-chemical building blocks)	90	8 - 9	VCH1	30	Y
BBI16*	NE	Full-scale brownfield plant converting lignocellulosic biomass into 2G ethanol, biogas, lignin (and bio-chemical building blocks)	150	8 - 9	VCH1	30	Y
BBI17	CEE	Full-scale plant converting lignocellulosic biomass into 2G bioethanol and/or bio-plastics	120	8 - 9	VCH1&2	24	Y
BBI18	WE	Demonstration plant transforming municipal solid waste and sludge into complex and high-value chemicals	48	7 - 8	VCH3	24	Y
BBI19	SE	Full-scale brownfield plant processing agricultural raw material and vegetable scraps into bio-chemicals	200	8 - 9	VCH1	72	N
BBI20	NE	Full-scale plant transforming straw, municipal solid waste and sludge into advanced bio-fuels (ethanol, gas), bio-chemicals, bio-plastics and energy	419	8 - 9	VCH1&3	24	Y
BBI21	WE	Full-scale bio-refinery converting agricultural and food residues into higher-value chemicals and products	40	7 - 8	VCH1	15	Y
BBI22	SE	Demonstration plant converting sugar into bio-chemical building blocks and bio-plastics (develops and licenses patents)	65	8 - 9	VCH1	48	Y
BBI23*	WE	Full-scale plant converting sugar into bio-chemical building blocks and bio-plastics	100	9	VCH1	48	Y
BBI24	NE	Full-scale plant converting forestry residues into bio-fuels, bio-chemicals and other materials	500	8 - 9	VCH2	24	Y
BBI25*	NE	Full-scale plant converting forestry residues into bio-fuels, bio-chemicals and other materials	4	6 - 7	VCH2	24	Y
BBI26	NE	FOAK plant for wood-based textile fibre production	35	7 - 8	VCH2	30	N
BBI27	WE	Demonstration plant producing bio-chemical building blocks from bio-waste	15	7 - 8	VCH3	48	Y

CEE: Central & Eastern Europe; NE: Northern Europe; SE: Southern Europe; WE: Western Europe
Note: Asterisk (*) denotes that project belongs to the same project promoter as the project above it. Projects of the same promoter feature the same colour background (light grey or white).

Table 2: Summary description of 27 interviewed BBI project promoters
Source: EY, EC, EIB

According to **Table 2** above, the average investment size (CAPEX) per interviewed BBI project is in the order of EUR 124m, while the majority of BBI projects have a TRL between 7 and 9. **Table 3** below summarises the key information on the BE projects that were part of this study, followed by a brief review of the sample.

BE Project initials	Region	Short project description	CAPEX (EURm)	TRL range	Sector	Duration (months)	Access-to-finance issues?
BE1	WE	Multi-use offshore energy project located in Western Europe currently at permission stage	1,300	8 - 9	3&4	132	Y
BE2	SE	Demonstration project to improve micro-algae production	35	7 - 8	1	48	N

BE3*	SE	Demonstration project to produce micro-algae from contaminated water	22.5	5 - 6	1	18	N
BE4	SE	Demonstration project producing bio-fuels from microalgae	15	7 - 8	1	60	Y
BE5*	WE	Demonstration project to convert microalgae into high-value products	7.1	7 - 8	1	48	Y
BE6*	SE	Demonstration project to convert microalgae into bio-chemicals, feed and bio-fuels	15	7 - 8	1	48	Y
BE7	SE	Demonstration projects to develop various microalgae applications	19	7 - 8	1	48	Y
BE8	WE	Pilot/demonstration project using land unsuitable for agriculture for fish production	7	5 - 6	1	48	Y
BE9	WE	Demonstration project for search and rescue technologies used in sea environments	19	6 - 7	4&5	48	Y
BE10	WE	Demonstration project for deep sea mining	15	6 - 7	2	48	Y
BE11	SE	Full-scale project for vertically integrated aquaculture	26	8 - 9	1	60	Y
BE12	WE	Full-scale project to convert micro-algae into food ingredients	25	7 - 8	1	96	N
BE13	WE	Full-scale project concerning innovative algae production	22.5	8 - 9	1	24	Y
BE14*	WE	Full-scale project concerning innovative algae production	5	8 - 9	1	24	Y
BE15	WE	Full-scale project for seaweed cultivation and harvesting	3.4	8 - 9	1	60	Y
BE16	WE	Demonstration project for aquaculture management tool	4	6 - 7	1&4	35	Y

SE: Southern Europe; WE: Western Europe
BE sectors: (1) Food, nutrition, health and ecosystem services, (2) Raw materials, (3) Marine renewable energy combined with other marine activities, (4) Marine technologies, (5) Coastal protection.
Note: Asterisk (*) denotes that project belongs to the same project promoter as the project above it. Projects of the same promoter feature the same colour background.

Table 3: Summary description of 16 BE projects
Source: EY

According to **Table 3** above, the average investment size (CAPEX) per interviewed BE project is markedly lower than that of BBI projects, in the order of EUR 16m and above, while the majority of interviewed BE projects also have a TRL of between 7 and 9.

Specifically in relation to the access-to-finance issues column, BBI and BE project promoters were asked to report if they experienced a general lack of interest from private financial market participants in investing in and allocating funds to their BBI and BE projects. 20 out of 27 BBI (74%) and 13 out of 16 BE (81%) project promoters responded positively, leading to an **overall 77% (33 out of 43) of all respondents reporting access-to-finance issues**. Moreover, 79% of all respondents reporting access-to-finance issues indicate that the **lack of interest from private financial market participants is related to the specificities and associated lack of understanding of the BBI and BE industries**. These specificities are presented in more detail later in the study in order to determine the main BBI and BE funding gaps.

Figure 9 below summarises some key metrics of the BBI and BE sample in terms of project distribution across value chains (VCH) and sectors (as defined in the project tables) and across investment sizes, the average project size and the average sample TRL.

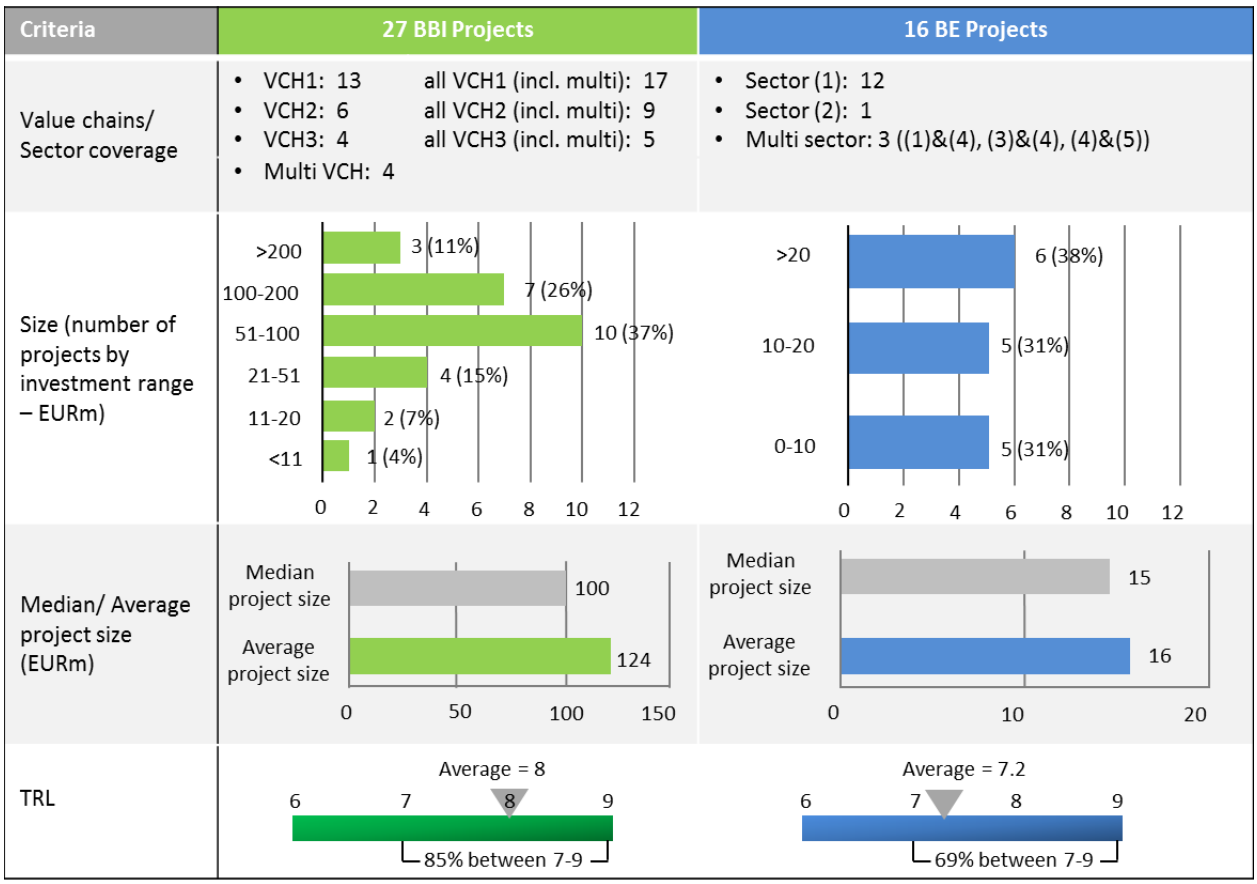


Figure 9: BBI and BE sample data
Source: EY, EC, EIB

In terms of value chains, interviewed BBI projects are grouped mainly in the agriculture/agro-food biomass value chain (VCH1) but with some projects in the other value chains (including projects covering multiple VCH). In terms of sectors/categories, BE projects are mainly in sector (1) food, nutrition, health and eco-system services. In terms of investment size (CAPEX) the project distribution for BBI shows that nearly three quarters (74%, or 20 out of 27) of all BBI projects are in the order of EUR 51m and above.

In contrast, the BE sample is markedly smaller compared to BBI projects, with the majority of the sample of the identified BE projects coming under sector (1) Food, nutrition, health and ecosystem services. In terms of project size, the BE sample has a balanced distribution around an average investment size of EUR 16m per project. Conversely, the average investment size of BBI projects is EUR 124m, denoting the larger capital asset deployment and infrastructure. In terms of TRL, the average TRL for BBI is slightly higher (8) compared to BE (7), indicating that the selected BBI projects are on average more in the flagship/FOAK and commercialisation phases. This is also because BE sectors are largely emerging new sectors with high innovation potential. Still, both samples demonstrated similarities in terms of technological maturity, with 85% of BBI and 69% of BE projects having a TRL of between 7 and 9.

3.1.2 Do BBI and BE projects face increasing access-to-private funding issues as projects increase in size and become more technologically mature?

Key section takeaway:

- No significant correlation can be concluded between the variables (i) project investment size, TRL, and (ii) the existence or not of access-to-finance issues.

Figure 10 below presents the distribution of 42 BBI and BE projects[62] along the TRL scale (horizontal x-axis) and whether access-to-finance issues were reported or not (above the x-axis projects reported access-to-finance issues, below no access-to-finance issues were reported). BBI projects appear in light blue and BE projects in dark blue. The size of each bubble indicates the investment size (CAPEX) of each project in EURm.

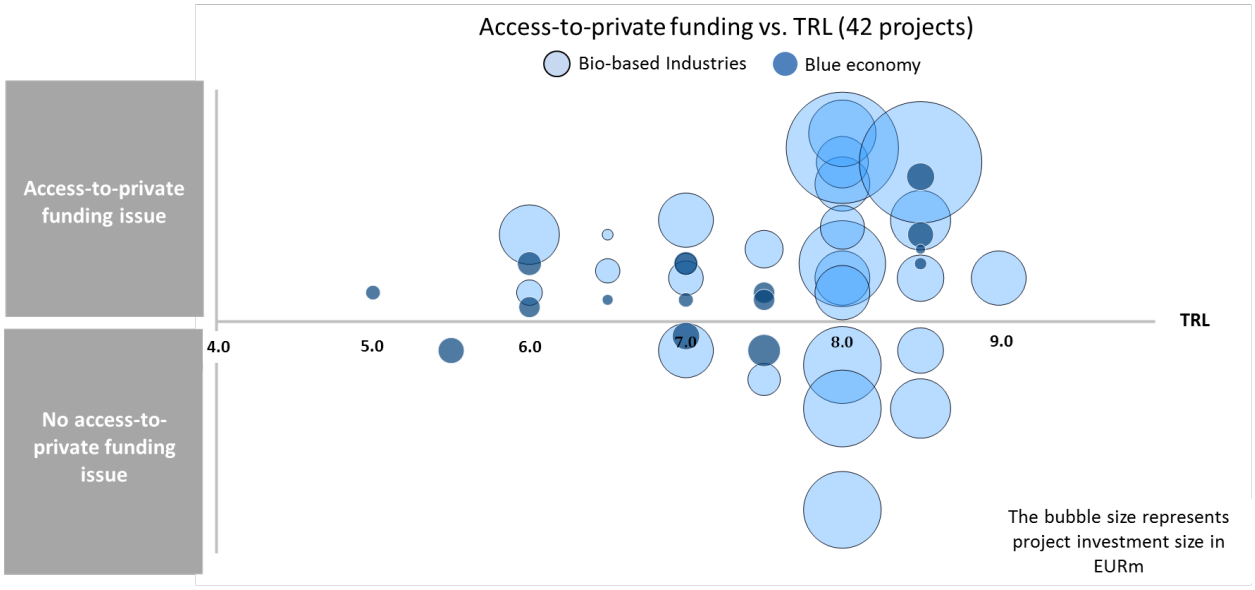


Figure 10: Access-to-private funding vs. TRL range (sample: 42 BBI and BE projects)
Source: EY

Some preliminary observations relate to the BBI sample, which appears as light blue bubbles clustered around TRL 8 (flagship/FOAK projects), while the BE sample (dark blue bubbles) appears to have a more balanced distribution across TRL. In addition, the average investment size for BBI projects across TRL suggests a positive correlation between the two variables, which is consistent with the expectation that project/plant sizes typically increase when moving from pilot to industrial-scale.

Furthermore, a useful finding from this figure is the visual comparison of projects in terms of their respective sizes and technological maturity, and access-to-finance issues. Such a comparison helps with the investigation of potential correlations between these variables and answering the question in the heading of this section. According to the sample distribution, the data collected from project promoters indicates **no significant correlation between the variables (i) project size, TRL, and (ii) access-to-finance issues**, suggesting that there systemic barriers to financing as analysed further below. This observation is partly explained by the samples' characteristics, with high average investment size for BBI projects (EUR 124m, with 74% of projects above EUR 51m), and high average TRL for both BBI and BE projects (85% of all BBI and 69% of all BE projects have a TRL of between 7 and 9), both of which are shown in **Figure 9**.

[62] Please note that the figure excludes the BE project with an investment volume of EUR 1.3bn, which due to its relative size is treated as an outlier for the purposes of this figure. The project has a TRL of 8 and indicated access-to-private funding issues

3.2 Finding 2: Regulation and market and demand framework conditions are perceived as the most important drivers and incentives but also present the biggest risks and challenges both for BBI and BE project promoters as well as financial market participants to invest in the Bioeconomy

3.2.1 Drivers and incentives from regulation and market and demand framework conditions for investments in the Bioeconomy

Key section takeaway:

- According to project promoters, primarily active in BBI, regulation and market and demand framework conditions are important drivers and incentives for more sponsor and private sector investments.

Table 4 below presents the top three drivers and incentives according to BBI and BE project promoters, which influence their decisions to invest in the Bioeconomy. In the same question project promoters indicate the geographical levels where these drivers/incentives exist, namely: international drivers, drivers available at the level of the EU, national drivers available across Member States and sub-national drivers available at local and regional level. The top two drivers are regulation and market and demand framework conditions, followed by financial incentives such as grants, primarily offered at the EU level.

Type of driver	International level (Non EU)			EU level			National level			Local level			Total
	BBI	BE	Total	BBI	BE	Total	BBI	BE	Total	BBI	BE	Total	
Regulation	1	0	**1**	8	0	**8**	7	0	**7**	6	0	**6**	22
Growing markets/demand	4	0	**4**	6	0	**6**	6	0	**6**	4	0	**4**	20
Grants	0	0	**0**	9	0	**9**	4	0	**4**	1	2	**3**	16
NB: The table shows the number of responses per type of incentive provided by BBI and BE PP.													

Table 4: Summary table of incentives[63] (sample: 68 answers provided by 43 BE and BBI projects)
Source: EY

1. Drivers related to regulation

Regulation as a driver is identified by the majority of BBI promoters primarily at EU, national and local levels (22 responses in total). However, this driver is not mentioned by any BE promoter. At the EU level, BBI promoters mention that **strategic goals of the EU which translate into official policies and regulatory frameworks, such as for climate, environment and energy like the Renewable Energy Directive (RED), can act as drivers** for them to become active in particular BBI segments. This finding suggests that tangible support and encouragement of certain policy priorities by public authorities can influence the decisions by industries to implement investment plans. However, it should be noted that one BBI project promoter highlighted the skewing effect of currently existing regulation which promotes bio-energy projects (energy use of biomass) over bio-materials (material use of biomass). On the other hand, regulation was not mentioned by any BE promoter, which may suggest that existing BE regulatory frameworks, either at EU or national levels, appear not to have the same "pulling" or driver/incentive effect as their BBI equivalents.

[63] The figures shown in the table correspond to the number of BBI and BE projects which have responded "yes" to the type of incentive (regulation, demand, grants, etc.) per level (international, EU, national or local). Please note that one type of incentive can be chosen on several levels.

Related Quotes

"We are driven by the EU's environmental ambitions." (BBI14)
"The key driver is government regulation for lowering the emission of greenhouse gases." (BBI1)
"Without incentives, competing with the existing fossil fuels on the market is economically not viable." (BBI10)

2. Drivers related to market and demand

Growing demand and market-related incentives are reported by a large number of promoters (20 responses). Concerning this driver, again only BBI project promoters identified market and demand-related drivers and incentives being applicable to their industry. The key factors that drive BBI projects relate to a generally **growing demand for bio-based products motivated by sustainable resource management** as is the case for bio-based chemicals or the treatment of municipal wastewater, as reported by two promoters. In this regard, one promoter active in the chemicals industry states *"Chemicals companies are also increasingly committing to sustainable development: […] an international chemicals group wants to increase the share of raw materials it uses from natural sources from 11% in 2010 to 20% in 2020."* (BBI10).

The abovementioned growing demand is observed by promoters at the international level, associated to increasing global awareness about sustainability, but more actively at the level of the EU and individual countries. While at the international level the existence of strong policy frameworks is noted as an explanation for growing demand by one promoter, another promoter mentions that the growing demand for bio-based products is seen as a long-term driver.

At the EU and local levels, incentives such **as blending mandates for bio-fuels and public support for R&D** activities are market drivers. In this regard, the benefit of local clusters for the development of BBI R&D activities has been reported by one promoter: *"Our biggest driver is R&D support from public funding. On the local level, the city has dedicated a new industrial area to the Bioeconomy […]" (BBI21).*

On the same question, BE promoters do not specify geographical levels at which growing demand and related incentives can act as drivers for their investments. Instead they mention that the quality and benefits (environmental, health) of marine-based products can themselves act as drivers for increasing demand in the future.

Related Quotes

"A driver which encourages our company to develop its activities is the growth of the general demand for bio-based chemicals, at the European and international level." (BBI3)
"Markets for bio-fuels and other bio-chemicals are projected to grow significantly towards 2020 and 2030." (BBI20)

3. Drivers related to EU financial incentives such as grants

Grants rank third among drivers and incentives mentioned by both BBI and BE project promoters. In this context it is important to note that promoters mainly refer to grants at the EU level (9 responses), which highlights the **importance of PFI available by the EU**. At the EU level, the programmes frequently mentioned include **Horizon 2020, and particularly the BBI Joint Technology Initiative (BBI JTI), and NER 300**.

Furthermore, the analysis in Section 3.3 indicates that grants represent an important funding mechanism for projects, particularly at the early and intermediary stages (TRL 6-7). However, in the same respect, project promoters highlight the fact that grants are mainly used to fund R&D activities and projects in the demonstration phases. Funding for the later stages of a project, i.e. the up-scaling

and industrial scale phases, appears to be less available, as explained by promoter BBI17: "*For our commercial-scale projects, funding with grants is not possible except in the case of flagship funding offered by the BBI Joint Undertaking*". However, BBI promoters mention that such incentives are **absent for large-scale bio-based projects, not sufficiently targeted at BBI, and not sizeable enough to meet the increased capital needs of larger BBI projects.**

Thus, **the message from BBI project promoters can be interpreted as a call for additional EU financial support schemes targeting larger-scale bio-based projects and new and specific renewable energy incentives to help render projects economically viable and bankable**.

At the national and local levels, promoters point out that funding is available, but again mainly for the R&D and demonstration plant phases of BBI projects. Providers of national and local-level grants are generally the respective ministries that manage EU funds (e.g. of Economy, Agriculture, Innovation). However, it should also be noted that promoters report substantial differences in terms of available subsidies at the EU level. For instance in Germany "there are subsidies available for bio-energy but not for the production of bio-materials" (BBI21). Further analysis of grant funding is included in Section 5 of this study, which maps public financial instruments for innovation finance.

Related Quotes

"At the EU level we mostly benefit from BBI JU grants for R&D and demonstration activities."
"(We are driven by)…public funding dedicated to R&D in the Bioeconomy and bio-technology" (BBI21)
"At the national and local level there are incentives which promote the benefits of new microalgae products and the development of the associated technology." (BE2)
"Our driver is the market pull for sustainable products." (BBI10)

3.2.2 Risks and challenges from regulation and market and demand framework conditions for investments in the Bioeconomy

Key section takeaways:

1. **Market and demand risks rank as the highest business risk factor for investments in BBI and BE for groups of project promoters**. These risks relate to the lack of developed markets and insufficient demand for BBI and BE outputs and products, largely affected by regulation.
2. **Regulatory risks rank as the second highest business risk factor for investments in BBI and BE** and as the **top challenge for conducting business activities** for both BBI and BE project promoters. These risks and challenges are primarily related to the lack of an effective, stable and supportive EU regulatory framework.
3. **Financial market participants recognise the role of a stable and supportive regulatory framework** but are cautious about its potential market distortion effects.

As part of the survey, BBI and BE project promoters were asked to rate risk factors according to their perceived negative impact on access-to-finance on a scale of **zero** (no negative impact on access-to-finance) to **five** (significantly negative impact on access-to-finance). Risk factors are divided into two broad categories, business and financial risks. The analysis below presents the top business risk factors: market and demand and regulation framework conditions.

1. Market and demand risks

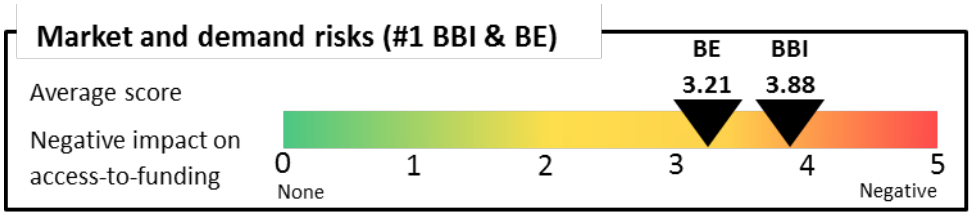


Table 5: No1 business risk for both BBI and BE projects and average score
Source: EY

Table 5 presents the average score that BBI and BE project promoters gave to market and demand risks. In the survey, 25 out of 27 BBI project promoters responded to the relevant section of the survey and ranked market and demand risk factors as the business risk with the most negative impact on access-to-finance, giving it an average score of 3.88 out of 5. Based on the feedback collected, market and demand risk factors relate primarily to **the competition of BBI with fossil-based alternatives, due to, among other reasons, the lack of regulation supporting the development and competitiveness of a BBI market**.

Related Quotes

"The lack of a clear commitment from the public side for bio-based products through favourable regulation for BBI products and the lack of off-take agreements in light of competitive fossil-based alternatives present a significant risk" (BBI6,BBI20,BBI21,BBI24,BBI25)
"We are driven by the growing demand for bio-based alternatives in the long term; however low petrol prices make it complicated to emerge on the market in the short term." (BBI22, BBI23)
"Currently there are many subsidies in established petrochemical value chains, which make it difficult to establish new bio-based products on the market." (BBI21)

Specifically, most BBI outputs and products compete directly with fossil-based products and to an extent aim to substitute them with bio-based ones (e.g. bio-plastic, bio-chemicals or bio-materials). The competitiveness of BBI products is highly dependent on their quality and price, both of which are crucial determinants of market demand, and both of which should be at least comparable to that of fossil-based products. As BBI are advancing technologically, their bio-based outputs increase in quality and their properties become comparable to, if not better than, those of fossil-based alternatives. As a result, the price of BBI products remains one of the most important factors driving demand for BBI outputs.

In market terms, BBI products compete with their fossil-based substitutes in a market where demand is generally elastic to price changes, meaning that consumers and offtakers of BBI products will, ceteris paribus, choose those products that meet quality standards but are the most price-competitive. This automatically turns competition between fossil-based and bio-based market players primarily into one of margins and profitability, meaning (i) cost of inputs, (ii) operating costs and (iii) price of outputs. For EU-based BBI and BE projects, competition from non-EU bio-based producers is also a threat affecting sales and revenues, to the extent that non-EU producers can remain price-competitive after factoring in transportation, certification and other costs for their goods and outputs.

Related Quotes

"There is a lack of off-take agreements. Our products are not competitive enough compared to oil-based products" (BBI10, BBI17 and BBI21)

While BBI project promoters are constantly striving to reduce operating costs through technological improvements, economies of scale and other efforts (which relate to ongoing costs such as facilities,

utilities, staff and other costs), they have limited ability to compete with fossil-based substitutes on the two other fronts namely (i) cost of inputs and (ii) price levels of outputs. Regarding cost of inputs, meaning the price at which BBI project promoters can source feedstock and raw materials, the main competitive factor is the abundant availability of oil as an input at competitive prices compared to biomass, which is a finite resource in Europe and also sensitive to various supply risk factors, such as weather conditions. Oil prices have been declining over the past three years (from a historical peak) and after the historical lows of around USD 30 per barrel in Q1 2016, are gradually rebounding at the time of drafting this report. In terms of price of outputs, the direct link between oil price fluctuations and the price of fossil-based intermediary or end products (energy, fuel, chemicals, materials, etc.) also influences their competitiveness against bio-based alternatives. In contrast, BBI rely on various types of biomass as their main input/feedstock, the availability and quality of which are not as consistent by nature (geography, weather conditions, competing uses such as energy, certification, type and quality, etc.). These constraints can lead to large price fluctuations and even unavailability of feedstock, which is one of the most important components of BBI. In such cases, if BBI cannot use alternative feedstocks or absorb input/feedstock price increases, this reduces their competitiveness and demand for BBI products compared to fossil-based industry alternatives. As a result, BBI project promoters report the lack of interest from buyers and offtakers in BBI alternatives that are more expensive than their fossil-based substitutes as a structural competitive disadvantage. A more detailed reference to input factor risks is found later in this section.

Generally, BBI project promoters are pointing to an uneven playing field as the key reason for the competitive disadvantages compared to fossil-based industries, the lack of demand for BBI outputs and undeveloped BBI markets. The proposed mitigants involve a number of “push” and “pull” tools and interventions, which are analysed further in this study. The most important tool according to BBI and BE project promoters is **regulation**, which is mentioned as the main **factor behind both market and demand risks.**

Related Quotes

“Political interference can destroy whole markets or delay market entries and increase time to market (moratoria, new regulations/subsidies in favour of competing products)” (BBI20)

BE

In the survey, 14 out of 16 BE project promoters responded to the relevant section and ranked market and demand risk factors as the business risk with the most negative impact on access-to-finance, giving it an average score of 3.21 out of 5. In line with BBI feedback, BE project promoters also cite market and demand risks impeding the further development of the sector. Specifically, BE promoters highlight the **innovative technologies** introduced in BE products, which compete in relatively new sectors and niche market segments, where product demand is untested and uncertain. Similarly to BBI, BE project promoters also require “push” and “pull” tools and interventions in order to compete effectively with fossil-based or less sustainable alternatives.

They also cite **high competition in innovation by industry players outside Europe** (e.g. US and China) where regulations and processes concerning BE products are clearer and simpler. In order to compete on a level playing field, BE project promoters cite the quality of their BE products as a competitive advantage, which however needs to be **supported through certification and quality standards that will recognise and turn quality advantages of BE products into tangible market advantages**. Finally, BE project promoters highlight the need for an **integrated value-chain approach** when supporting BE projects, meaning that for any project to be successful it will require strong upstream and downstream value chains.

Related Quotes

"Seaweed cultivation is an emerging market in Europe that needs support which goes beyond only one part of the value chain but focuses on the development of the entire market including funding customers." (BE15)

"To mitigate market risk, companies need to offer certified high quality products, a certified and sustainable production process as well as high quality customer service." (BE11)

2. Regulatory risks

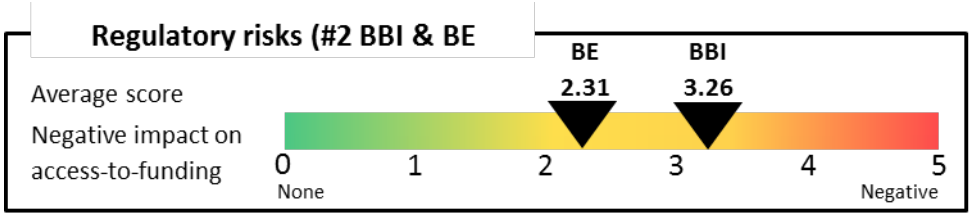


Table 6: No2 business risk for both BBI and BE projects and average score

Source: EY

Table 6 above presents the average score that BBI and BE project promoters gave to regulatory risks. In the survey, 25 out of 27 BBI project promoters and all 16 BE project promoters responded to the relevant section and ranked regulatory risk factors as the business risk with the second most negative impact on access-to-finance, giving it an average score of 3.26 out of 5 in BBI and 2.31 out of 5 in BE.

Based on the feedback collected from BBI and BE project promoters, risks and challenges from regulation can be grouped under a number of main themes such as **(i) the lack of a BBI and BE-specific supportive regulatory framework, (ii) uncertainty about existing regulation affecting BBI and BE, and (iii) the impact of regulation on feedstock and inputs, primarily for BBI.** Specifically:

(i) Lack of a BBI and BE-specific supportive regulatory framework

Several BBI project promoters indicate the lack of BBI-specific regulation as a key risk factor at EU level. They highlight that this factor also signals a lack of political commitment to promote sustainable and green alternatives to fossil-based industries, which acts as a deterrent for private investors. By regulation promoters mainly refer to "push" and "pull" tools, incentives and mechanisms that target the entire BBI and BE value chains from producers of biomass or marine-based inputs to consumers and end markets for BBI and BE products. BBI and BE project promoters mention that in the absence of regulation there is no viable framework for competition with fossil-based products and outputs.

Regulatory tools and mechanisms can take multiple forms, such as financial incentives and targets for biomass supply and use (feedstock push, material and energy use, cascade use) and incentives for new BBI and BE technological advancement and innovation (technological push, financial incentives and support). In terms of market pull mechanisms and tools, these can include targets and quotas related to environmental and sustainability targets (such as under the RED), mandates for bio-based content in BBI and BE products, and even direct and indirect financial incentives (either positive for BBI and BE such as grants, subsidies, tax incentives, public procurement, or negative directed at fossil-based industries). Finally, regulatory actions should also aim at raising public awareness about BBI and BE products to create further market pull for their outputs.

Related Quotes

"We are facing uncertain demand as there is no clear political commitment from the public side" (BBI20, BBI6, BBI24, BBI25)

"Currently there are many subsidies in established petrochemical value chains, which make it difficult to establish new bio-based products on the market." (BBI21)

"Currently there is no favourable regulation for bio-based plastics, hence there is uncertainty about the future market for the product." (BBI6)

"At the international level, there is no specific consumer demand for bio-based products, hence the premium customers are prepared to pay is small or non-existent." (BE12)

"The lack of a clear, long-term governmental vision focused on the use of fossil resources or on the place of green alternatives, favours the cheaper [fossil-based] solutions." (BE12)

(ii) Uncertainty about existing regulation affecting BBI and BE

A number of BBI and BE project promoters are already active in industries (bio-fuels, bio-chemicals, renewable energy, feed, food, cosmetics, etc.) where existing EU-level and national policies are in force (such as the Renewable Energy Directive (RED), EU sugar policies, GHG emission standards, novel food policies, cosmetics, etc.). Such policies are cited multiple times by project promoters as drivers for investing but also as sources of risks, challenges and uncertainties for their business activities. In particular, the observations about the RED appear to be in line with recent research that suggests that as a "market pull" instrument (in terms of spurring investments and market volumes), the RED is an important and effective policy tool in creating artificial demand for bio-energy and bio-fuels. However, as suggested in studies made by nova-Institute, the current framework has created very high demand for biomass (for energy use) leading to bottlenecks in the BBI materials sector and thus hampering the development of BBI. Furthermore, the RED does not take resource efficiency, cascading use and Circular Economy into account when it comes to the classification and usage of scarce biomass resources for energy use.[64] This point is developed further below under theme (iii). Specifically, BBI and BE project promoter feedback on uncertainties about existing regulation appears on **two levels**:

The first level concerns the lack of long-term stability and horizon of existing regulation, which can negatively affect the demand for products and investments in BBI and BE. Specifically, several BBI promoters indicate that the risk of changing regulation and introduction of new standards increases uncertainty and contributes to insufficient demand for BBI outputs from industrial offtakers. For example, unexpected changes in long-term renewable targets such as 1G ethanol consumption targets (originally mandated at 10% by 2020, revised downwards to 6% in 2013) can reduce visibility and increase uncertainty for entire sectors such as bio-fuels and the intermediary, high-value bio-based co-products (bio-chemical, bio-plastics, bio-materials). BBI project promoters report that under such circumstances, they cannot plan their production capacities in the long run, implement long-term investment plans and attract private capital. Furthermore, project promoters mention that clear EU regulation and targets concerning climate and energy do not cover the long-term horizon, extending only up to 2020. In addition, EU funding programmes that act as technology and innovation "push" mechanisms such as Horizon 2020, or specifically the BBI JTI, also provide visibility up to 2020. Beyond that, policies and support programmes spanning to 2030 are reported to be currently in the form of frameworks and not yet translated into clear targets that match project investment horizons that go up to 10 or even 20 years. In the absence of such clear targets, investment plans are held up while private investors are deterred from making long-term capital commitments. In order to mitigate such risks, project promoters ask for clear and stable long-term regulation extending as far as 2030 and even beyond, which could bring visibility and encourage long-term demand and offtake agreements for BBI and BE outputs, triggering more investments.

[64] "How to shape the next level of the European bio-based economy?" by Michael Carus, Achim Raschka, Kerstin Iffland, Lara Dammer, Roland Essel, Stephan Piotrowski (2016) (http://bio-based.eu/?did=40097&vp_edd_act=show_download)

Related Quotes

"The introduction of a blending mandate for advanced bio-fuels by 2020 and 2030 would be a mitigating factor […]" (BBI20, BBI14, BBI15, BBI16)
"There is no clear regulation regarding [bio-fuel] blending mandates after 2020." (BBI25)
"A mitigating factor would be to have a stable regulation spanning until 2030 or even 2040." (BBI14)
"Changing regulation is a business risk that impedes access to finance." (BE1)

The second level concerns <u>the lack of clarity and differences in the interpretation and implementation</u> of existing EU regulation in national policies. EU countries translate EU-level regulations into specific national targets and action plans, which can vary substantially in terms of ambition and implementation. The EC has monitoring mechanisms in place with countries reporting periodically on their progress towards implementing their targets. Specifically for the EU's 2020 renewable energy goals, project promoters report that the cascade of EU-level regulation into national targets, action plans and more specifically into tangible national tools and incentives for BBI industries are not concrete, consistent and clarified enough. For example, advanced bio-fuel targets under the RED have not yet been translated into concrete national action plans for most EU countries at the time of drafting this report (with the exception of Italy). Similarly, BE project promoters cite the need to clarify and simplify regulation that affects their industry and the ability to place their products, such as the EU novel food regulation.

Related Quotes

"A clarification on EU rules regarding thermo-chemical treatment of biomass to create a level playing field is required for long-term infrastructure investments in sewage sludge disposal and bio-based chemistry activities." (BBI4)
"The regulatory regime in southern Europe is still unclear about many points regarding Bio-Based Industries." (BBI9)
"The novel food regulations should be simplified at the European level, as is the case in the USA." (BE2, BE3)

(iii) <u>Impact of regulation on feedstock and inputs, primarily for BBI</u>

In terms of regulation impacting feedstock, primarily BBI promoters report that the introduction of regulations such as the RED or EU sugar policies have had an impact on the availability and price of feedstock for renewables as well as for BBI. According to project promoters, this has resulted in artificially high prices for BBI inputs and therefore outputs, as is the case with sugar according to one BBI promoter. In addition, biomass certification issues exist due to the lack of alignment between national policies, which causes issues with transportation and use of biomass across countries. This leads to a fragmented biomass supply chain within the European common market, with geographical concentrations and limitations for BBI activities.

On the other hand, the lack of regulation encouraging material use of biomass at the European level (as opposed to energy use, which is under the scope of the RED) has impacted BBI value chains by diverting scarce biomass resources towards renewables. Similarly, a BBI project promoter mentions issues with obtaining certification of biomass, which are burdensome and do not help BBI and BE gain a competitive advantage in the market according to promoter feedback.

Input factor risks

Despite being ranked as the fourth highest business risk for BBI promoters, the importance of both availability and costs of feedstock and associated factors (energy, chemicals, human resources) deserves special mention. Specifically, under the broad subject of feedstock supply, at least three BBI promoters reported that biomass, which is their key production component, is overly expensive due to their limited experience in efficient collection, while two more also mentioned the lack of long-term feedstock supply contracts as an important risk in their business model. An additional relevant factor pointed out by some promoters is the challenges they face due to the ongoing public debate about the use of agricultural land as feedstock for bio-based activities, for instance sugar. In a promoter's own words "*the public opinion about the use of our main feedstock [sugar]"* (BBI6) presents a challenge.

The analysis of project promoter feedback concerning risks related to feedstock supply can be summarised as follows:

1. Price volatility and affordability

The supply of feedstock in Europe is subject to strong volume and price fluctuations due to the heterogeneous nature of, primarily, agricultural supply chains (with small-scale producers) and also due to other external factors such as adverse weather conditions.

Related Quote

"The volatility of prices depends on the feedstock supply, which is linked to the size of the harvest and the weather." (BBI14)

2. Reliability

Feedstock supply in Europe is largely fragmented between small producers who can switch between production of different types of feedstock, which adds to volume and price volatility. Additionally, BBI promoters claim that supply chains are insufficiently developed or in some cases non-existent. Finally, there appears to be a lack of long-term arrangements for the supply of biomass between farmers and industrial off-takers.

Related Quote

"The supply chain for biomass is insufficiently developed or non-existent." (BBI10)

3. Feedstock-related regulation and transportation costs

Regulatory risks related to feedstock concern the dangers and adverse effect of existing or new regulations on the market for feedstock in terms of supply and price developments through factors such as eligibility, certification, availability, transportation, quality, etc. In this context, BBI promoters refer to the case of lignocellulosic feedstock in the EU, which runs the risk of losing competitiveness due to Brazilian 2nd and 1st generation sugar streams. Another relevant factor is high transportation costs, which may also discourage projects that rely on biomass sourced from radiuses exceeding 100 or 200 kilometres from their source. To protect the European market and remain competitive, promoters are asking for a dedicated regulatory framework that will apply to the entire supply chain and will clarify the above issues.

Related Quote

"Due to regulation we are obliged to look for feedstock in distant regions." (BBI10)

Furthermore, in order to mitigate risks induced by input factors related to feedstock, the general consensus emerging from the comments of promoters is the need for **off-take agreements with producers of feedstock, which would ensure a stable supply of feedstock, eliminating uncertainties and price fluctuations**. In this regard BBI promoters suggest **financial mechanisms** to help farmers invest into the biomass supply chains and to include key biomass suppliers directly in the project

promotion group of BBI projects. Additionally some BBI promoters suggest that BBI projects should not rely on one single but on **multiple types of feedstock that can help them hedge against the risks of insufficient supply, high prices or low quality of feedstock**.

Related Quote

"The market for biomass needs to be further developed to diversify biomass and the supply channels." (BBI17)

Related Quotes

"The European market for feedstock is highly fragmented due to the existence of many small producers who may flexibly switch between the production of various types of feedstock. Consequently the supply and market price for feedstock is highly volatile." (aggregate quote)

"To mitigate the issues related to feedstock, incentives for producers of feedstock should be created to develop structured supply chains. Additionally, feedstock off-takes should not rely on only one source of feedstock." (aggregate quote)

"There are some certification issues for biomass, which represent more of a burden than competition assistance." (BBI1, BBI2, BBI3, BBI17)

"The certification process of the biomass is complicated, which leads to biomass being more expensive…the cascading principle is in theory efficient but in practice it complicates the certification procedures." (BBI17)

3.2.3 Financial market participant feedback confirms project promoter views

The feedback provided by financial market participants confirms the above findings of project promoters. As presented in Section 4, financial market participants mention that efficient regulation can play a (positive) "market-shaping" role by incentivising demand and supply of BBI and BE products and thus limiting the perceived market risks and instability. On the other hand, heavy market intervention can also deter private investors, who are discouraged by external factors they have no control over or visibility on.

Related Quotes

"We will not invest in a project that will have to rely on a decision by the EC about how much bio content needs to exist in a product." (Private Equity 2)

"One important business risk is the impact of regulation on business."

"We have avoided investing in products that rely on subsidies, because these are not sustainable." (two FMP)

3.2.4 Operational and technological risks

Key section takeaways:

- **Operational and technological risks rank as the third highest business risk factor for BBI projects**, primarily related to risks during the demonstration phase of BBI projects and when scaling them up to flagship/FOAK operations.

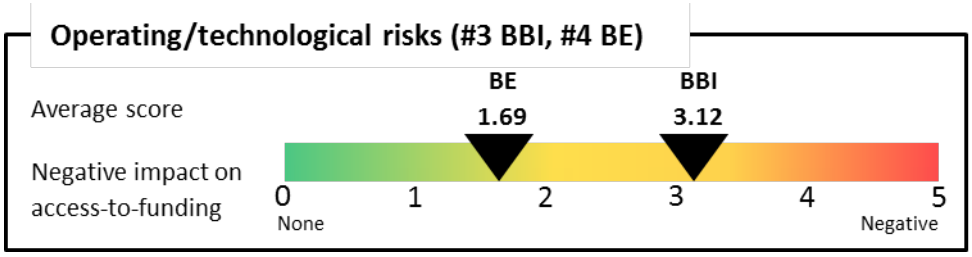


Table 7: No3 business risk for BBI projects and average score
Source: EY

Operational and technological risks rank third in order of importance for BBI project promoters. In the survey, 20 out of 27 BBI project promoters responded to the relevant section and ranked operational and technological risk factors as the business risk with the third most negative impact on access-to-finance, giving it an average score of 3.12 out of 5.

BBI promoters report that these risks are prevalent **mostly during the demonstration plant phase (TRL of 6-7), and also when scaling up to flagship/first-of-a-kind (FOAK) (TRL 8), when economies of scale are not yet achieved**. Specifically, innovative demonstration plants refer to the steps after successfully having implemented a pilot project. A project that passes the pilot stage usually involves innovative technologies and processes (such as mechanical, chemical, thermochemical or biotechnological) that have been successfully tested in multi-purpose (on-the-ground) equipment, which in most cases can be converted later to serve other purposes. In the demonstration stages (TRL 6-7) promoters test technologies and processes on a small/demonstration scale, resembling functions and processes that will be later used in full-scale industrial plants. During these stages, plants run technological and operational risks where technologies, processes and sub-processes might fail and require modification and improvements (implying long downtimes or going "back to the drawing board"). Demonstration plants can be later dismantled or converted for other purposes, but generally their commercial value as assets/collateral is low.

Projects by large and established industrial players, which have experience and a solid track record of building, owning and operating demonstration plants, or those involving previously tested and successful technologies, generally provide some comfort to potential private investors. However, for **smaller BBI players that have little or no such track record nor the ability to partner up with bigger players, or for unproven technologies, there appears to be a need for alternative tools to absorb and mitigate technological and operational risks**.

Related Quotes

"A major concern for us, which is related to the implementation of new technologies, is the access to debt financing." (BBI14, BBI15, BBI16)

"The sector consists of existing start-ups, which are developing new technologies and are the most active players in terms of innovation. Usually they licence their technology or get into partnerships with bigger companies." (BBI12, BBI13)

3.2.5 Legal regime risks

Key section takeaway:

- **Legal regime-related risks rank as the third highest business risk factor for BE projects**, primarily related to complex and lengthy licensing procedures and overall BE legislation in the countries in which they operate.

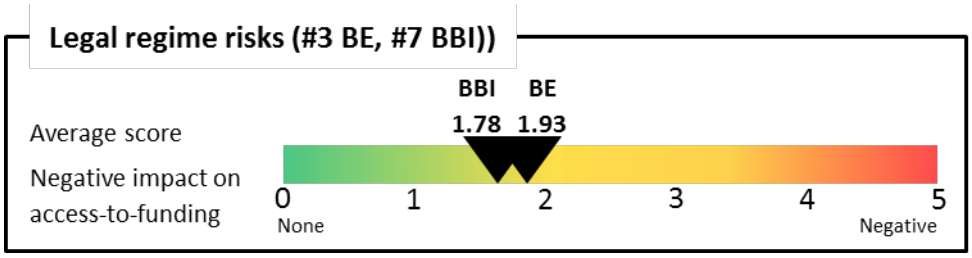


Table 8: No3 business risk for BBI projects and average score
Source: EY

Legal regime risks rank third in order of importance for BE project promoters. In the survey, 15 out of 16 BE project promoters responded to the relevant section and ranked legal regime risks as the business risk with the third most negative impact on access-to-finance, giving it an average score of 1.93 out of 5.

Legal regime risks relate primarily to legal procedures that BE projects undergo and have to face, primarily related to licensing and permits from national and international public authorities, concerning the location (marine or coastal areas), development and operation of projects (development, construction, operation, technologies, product certifications, environmental, health, etc.) as well as their products and outputs. BE project promoters report complex and lengthy licensing procedures and overall BE legislation in the countries in which they operate. Such risks can interfere with development and construction plans and result in challenges securing funding from investors, who require such processes to be completed as a prerequisite to funding. For example, one BE promoter mentioned the lack of exploitation legislation in international deep sea mining waters, which is a deterring factor for investors.

Related Quotes

"Procedures to obtain operating permissions and licences are very time consuming, which creates uncertainty. Additionally, regulation is frequently changing and very strict, for instance regarding environmental matters." (6 promoters)
"There is a need for simplified licensing procedures and timely handling of applications." (BE10)
"Business risks that make it difficult to access finance include long and complex licensing procedures and low accountability of public administrations. To attract serious investors a license is absolutely necessary." (BE10)

3.2.6 Financial risks behind access-to-finance issues

Key section takeaways:

- **Financial risks are mentioned by both BBI and BE promoters** and relate primarily to the risks that both BBI and BE projects demonstrate **low or volatile profitability and cash flow generation**, driven by volatilities in volumes and prices of both inputs/feedstock and outputs/products, especially at the earlier stages of a project, leading to potential liquidity issues, and also the **large size of capital expenditures required**, mostly in BBI projects and to a lesser extent in BE projects.

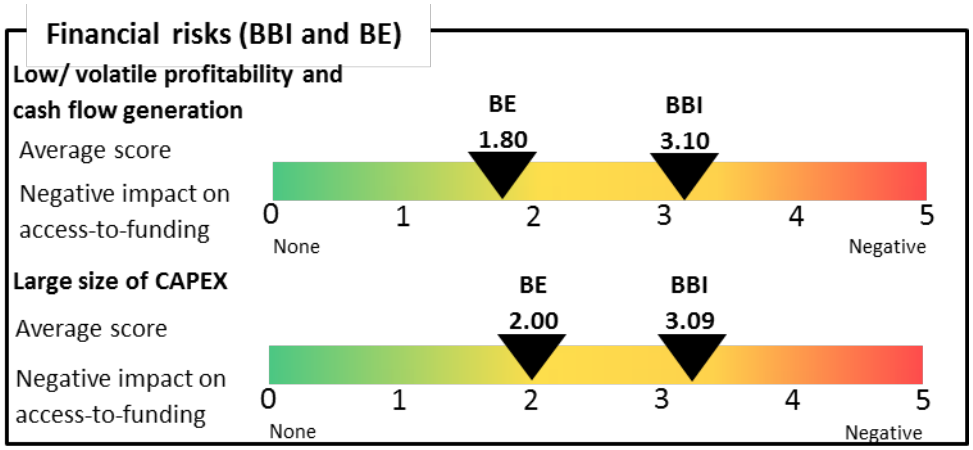


Table 9: Top financial risks reported by both BBI and BE project promoters
Source: EY

Financial risks, mentioned by both BBI and BE promoters, relate primarily to the risks that both BBI and BE projects demonstrate **low or volatile profitability and cash flow generation, especially at the earlier stages of a project, leading to potential liquidity issues**. The second most important financial risk comes from the **large size of capital expenditures (capex) required**, especially relevant to BBI projects and to a lesser extent to BE projects.

(i) Low or volatile profitability and cash flow generation

Profitability and cash flow generation, although conceptually different as financial terms, both share the same fundamental drivers, which are top line growth (sales volumes and prices) and costs (input, operating, financing and other costs), which translate into profit margins. Cash flow generation on the other hand, relies on the ability of project promoters to manage liquidity and cash inflows and outflows and convert profits into cash, which is essential for the viability of a project.

Both BBI and BE mention that during the development and construction phases of their projects, which can last up to three or four years (especially during up-scaling), revenues are virtually absent while cash flows are negative due to sunk costs made for investments and financing costs. During demonstration phases (TRL 6-7) production plants generally operate at medium utilisation rates and may be stopped numerous times for improvements. Revenues from products are low since sales are primarily for testing purposes both for promoters and potential offtakers, and can barely cover fixed and variable costs, without taking into account finance and other costs. Even flagship/first-of-a-kind (FOAK) projects (TRL 8), which may operate at higher utilisation rates, aim primarily at quality and performance improvements and not commercial profit. These stages between R&D and commercialisation are often described as the innovation “valley of death” for BBI and BE projects, where lack of profitability and cash

outflows can cause liquidity problems and render projects unviable leading them to fail to reach commercialisation.

For BBI and BE projects that reach commercialisation, profitability margins are primarily affected by availability and cost of inputs, and stable demand and prices for outputs. As mentioned in the business risk factors section above, the competition that BBI and BE face from fossil-based substitutes in terms of pricing and market shares and the lack of sufficient demand expressed in terms of offtake agreements, are the key factors behind profitability and cash flow pressures.

Related Quotes

"Additional cash reserves are needed, especially during the start-up of operations." (BBI17)
"For the first three years the project won't generate enough cash to cover OPEX, so there will be a need for extra liquidity." (BBI6)
"[In the up-scaling phase] there will be low or negative cash flow in the 3-4 first years." (BBI17)
"The ramp-up period for production […] is usually marked by low liquidity." (BE11)
"OPEX such as labour costs are a main risk due to low cash flow generation." (BE16)
"…while [CAPEX] is an asset, it is the OPEX that scares investors off." (BE8)

(ii) Large size of capex required

Primarily relevant for BBI, but also to some extent for BE projects, the large size of capital requirements, especially during up-scaling and commercialisation, presents promoters with financial risks. Generally, BBI and to an extent BE projects are highly capital intensive, especially as TRL increase. As projects increase in size and technological maturity, large capital needs emerge which, as described later in Section 3.3, are met to a large extent by promoters' own funds and increased equity capital from strategic/industrial partners and a few specialist investors.

With average BBI project investment sizes of EUR 124m (among the sample interviewed), the nominal amounts of equity required from investors and sponsors are disproportionately high, especially for smaller BBI players that do not have large asset bases and credit strength to pledge or guarantee debt financing. Partnering up can provide some additional scale, although certain BBI project promoters express concern about the fact that increasing numbers of investors/partners and the formation of consortia risk slowing down decision-making processes, create uncertainties due to diverging goals and priorities, and run into sensitivities about protecting proprietary technologies and intellectual property.

Related Quotes

"Being a demonstration plant, the size of the plant is not ideal and neither is the CAPEX." (BBI6)
"The aquaculture industry is relatively capital intensive." (BE10)
"Investment costs for plants are very high, which is a risk." (BE5)

3.2.7 Other risks and challenges mentioned

Key section takeaways:

- BBI and BE project promoters highlight a number of other risks and challenges, primarily related to societal issues (such as public perception of the Bioeconomy or green premiums), that can be attached to Bioeconomy products and outputs affect access-to-finance.

(i) Public perception

Public perception of the Bioeconomy has an important impact on both promoters and potential investors. For instance, the "*food versus fuel*" controversy is mentioned by several BBI promoters as potentially expanding the negative stigma of bio-fuels in BBI and bio-based activities and products. The controversy relates to farmland and crop use, and involves food-related biomass which instead for food purposes is used as feedstock (along with the agricultural land and surfaces necessary to produce it) for bio-based products, production processes and energy. In this context, BBI promoters fear that public opinion is currently not in favour of BBI, which is why "*the benefits of advanced bio-fuels derived from sustainable/non-food based feedstock need to be cleared of all kinds of controversy*" (BBI10) as explained by one promoter active in the production of bio-fuels. Apart from the debate around the use of land and food as feedstock, promoters also report a general negative image of large companies when they invest in innovative and sustainable bio-related technologies. This may be due to the negative portrayal by the media of biotech-related activities, which adds to the negative public and thus political perception of new technologies and innovation in the Bioeconomy.

(ii) Green premium

According to the feedback collected from a number of BBI and BE project promoters, the issue of whether a certain premium can be attached to products from these sectors is important for determining the success or not of their business models. Specifically, promoters generally categorise price premiums as (i) green premiums (i.e. applied to Bioeconomy products that substitute existing conventional, non-renewable, not sustainable alternatives) and (ii) quality premiums (based on superior properties, characteristics and quality of Bioeconomy products compared to their alternatives). BE project promoters, primarily active in food, nutrition and health, generally tend to classify their products and outputs under the second category, highlighting their quality and benefits, which allow them to target premium markets and customers (BE1, BE11).

On the other hand, BBI project promoters (with a few exceptions) utilise terms such as green premiums as their outputs generally compete with fossil-based alternatives. For example, one BBI promoter (BBI14) mentioned the pricing of cellulosic (2G) ethanol being similar to its 1st generation alternative (BBI14), therefore not offering any competitive advantages to the former. Two more promoters also active in the production of cellulosic ethanol (BBI10, BBI17), mentioned the importance of establishing a certain price premium for advanced bio-fuels in order to incentivise investments (R&D, innovation, capex) in this new market space, since otherwise competition with conventional fossil-based fuels will render them economically unviable. Another project promoter (BBI6) mentioned that owing to the high oil price break-even point needed for its bio-based outputs to be competitive with fossil-based alternatives, its output will carry a quality premium due to being superior to its conventional alternative.

While certain promoters are confident about the ability to successfully attach a quality price premium to certain bio-based and blue economy products without adversely affecting demand, the same cannot be said about a sustainability or green premium on products. In fact, as supported by numerous comments by project promoters in previous sections and also related to the point above about public perception of bio-based innovative technologies, there appears to be a certain lack of willingness by markets and consumers to absorb a green premium for bio-based products especially when these have commodity-type characteristics (such as fuels, chemicals, fertilisers, materials, etc.). This effect is generally stronger in countries with lower living standards as traditionally more affordable conventional, mostly fossil-based, alternatives are chosen over their Bioeconomy equivalents. In addition, one BBI promoter states that due to the fact that at the international level "there is no specific consumer demand for bio-based products" (BBI22), the premium customers are prepared to pay is small or non-existent.

3.2.8 Issues with public funding

Key section takeaways:

- According to BBI and BE project promoters, public funding is limited to the R&D phase of projects and not always managed properly.
- Also, project promoters report complicated and lengthy application procedures for public funding.
- Finally, project promoters who manage to access public funding mention its small size relative to their needs and the unfavourable terms attached.

Having analysed the challenges faced by BBI and BE projects and the issues encountered when accessing private funding, the final step consists of presenting and analysing the views of project promoters regarding public funding. From the surveys, three main aspects have been mentioned:

1. Public funding is limited to the R&D phase of projects and not always managed properly

BBI and BE project promoters have raised issues about the availability of public funding. According to a number of survey responses and comments, public funding is reported to be often focused on the R&D phase of projects (technology push), leaving out the pilot, demonstration and more importantly full-scale factory phase. For example, one BE promoter stated that *"there are no funds available for commercialisation" (BE10)*, while another BE promoter from the Benelux argues that, in its home country, there are no funds available above TRL 6. This issue also relates to the lack of continuity in funding as reported by three BE project promoters. The above feedback indicates that once projects complete the R&D phase, there appears to be no second or other subsequent rounds of funding dedicated to the application of the technology (pilot/demonstration) and the development of a business (commercialisation). This often means that projects that have passed the R&D phase never reach commercialisation and partnerships fail.

With the existence of the BBI JU, which makes available grant funding for BBI projects up to flagship/FOAK level, other EU programmes and also the various funding tools for projects entering the commercialisation stage, such as EIB funding tools (e.g. InnovFin, EFSI), the following conclusions can be drawn:

(i) First, there appears to be a certain lack of awareness about available funding tools at EU level. Second, for existing EU public funding tools and instruments, there appears to be a mismatch between their scope and applicability and the expectations of project promoters.

(ii) Furthermore, a number of project promoters report that public funding is at times inefficiently managed by national authorities, e.g. in the aquaculture sector: *"Funds made available to the aquaculture sector by the EC are poorly managed by national authorities" (BE11)*. The same BE promoter that benefited from FP7 funding also claims that EIB funding is not well advertised.

Related Quotes

"EU funding support focuses too much on research and stops whenever there is an insufficient amount of results." (BE13, BE14)

"Due to the lack of continuity in funding, projects often don't reach the commercialisation stage and partnerships fall apart." (BE4, BE5, BE6)

2. Project promoters often report complicated and lengthy application procedures for public funding.

An additional issue mentioned frequently by promoters is the complicated and lengthy application procedures for accessing public funding. According to one promoter the application process for EU funding requires expert knowhow, which makes *"EU financial instruments unattractive", (BE14)* and may even discourage promoters from applying at all. Additionally, the time between applying and receiving funds is reported to be too long according to a BE promoter who decided not to apply for this reason. Lastly, one BE promoter mentions that the application process is considerably more efficient in the USA with grants being paid out even within four weeks from the time of application.

Related Quote

"The application process for EU funds is too complicated and time consuming, which may deter promoters from applying altogether." (BE13, BE14)

3. Project promoters who manage to obtain public funding mention its small size relative to their needs and the unfavourable terms attached

In terms of available sources of public funding, one BBI project promoter states that in other countries and regions of the world, companies benefit from more public grants and less demanding loan conditions, allowing them to gain a competitive advantage over European companies. More specifically, another BBI promoter states that in the case of bio-based products that compete with fossil-based alternatives, there is a competitive disadvantage for bio-based products because there is insufficient funding available for these types of products in the EU.

Related Quotes

"Projects with a long R&D phase, which are years from generating revenues, do not match the financial health criteria necessary to receive commercial loans." (BE7)
"At the current R&D stage, there is no chance of getting funding for the commercialisation phase from private investors." (BE7)

3.3 Finding 3: The main funding gaps exist in (i) BBI and BE projects scaling up from pilot to demonstration projects and (ii) particularly BBI projects moving from demonstration to flagship/FOAK and industrial-scale projects

3.3.1 BBI and BE capital structure analysis reveals funding gaps

Key section takeaways:

- Data about the capital structure of surveyed BBI and BE projects reflects the **limited availability of private debt capital from financial market participants**. As BBI and BE projects increase in size and technological maturity, project promoters appear **to resort to own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects**.
- Some grants, primarily from EU programmes (e.g. under the BBI JTI), are also available for more technologically mature projects (up to TRL 7-8). However, **as BBI and BE projects increase in size and technological maturity, their relative presence in the capital structure of projects diminishes, especially in BBI**.
- Public debt capital appears to play a larger role in the capital structures of both BBI and BE projects. Yet the **presence of public capital does not manage to attract (crowd-in) private debt capital, and represents a small percentage of the capital structures** of both BBI and BE projects.

Figure 11 below presents the average weighted capital structure of 12 BBI projects – that have secured funding – with total investment size of around EUR 2bn (sum of both left and right-hand side charts), either completed or under development.

BBI capital structure of 12 projects that have secured funding

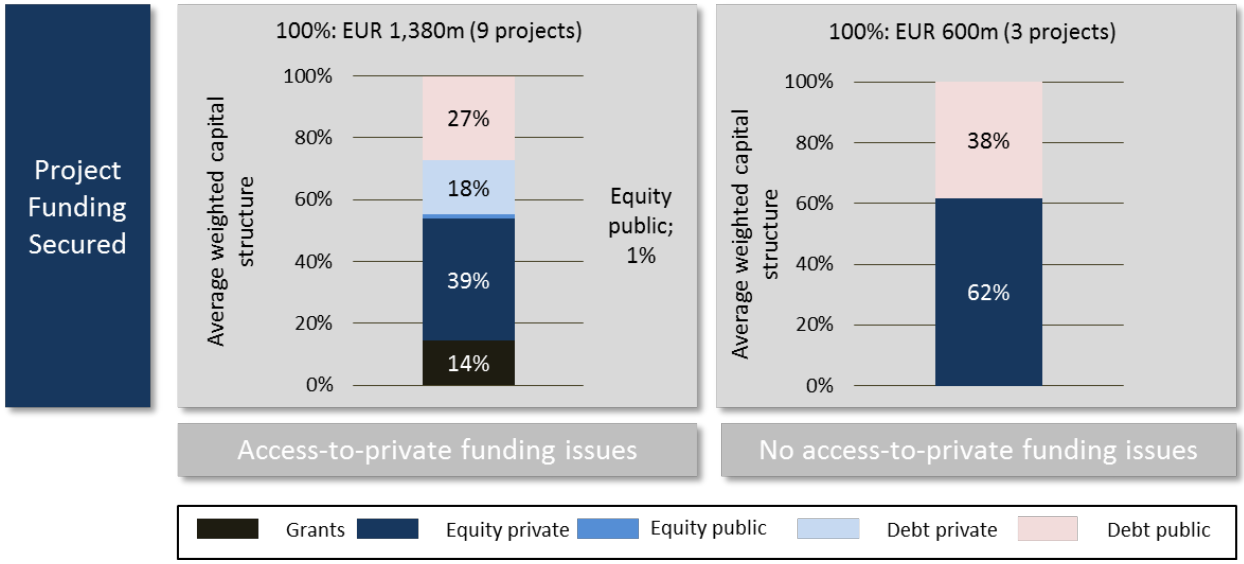


Figure 11: Average weighted capital structure by issues accessing private funding (sample: 25 BBI projects[65]). *Source: EY.*

All 12 BBI project promoters reported that **they managed to secure funding in order to implement their projects**. The group is split into two sub-categories, the first (left-hand side chart) showing the capital structure of projects the promoters of which reported access-to-(private) finance issues in the process

[65] Two projects (BBI14 and BBI15), for which no data on the capital structure was provided, are excluded.

of securing funding. The second (right-hand side chart) shows the capital structure of projects where promoters reported no access-to-finance issues. More specifically:

The **left-hand side chart** indicates that nine BBI projects, which managed to raise funding but faced access-to-finance issues, had relatively low leveraged capital structures (around 54% equity and 46% debt), dominated by equity capital (39%) primarily from own sources and funds of promoters/sponsors, equity from strategic/industrial partners and a few specialist investors (offering venture capital or mezzanine finance). Despite the existence of public debt capital (27%) from European and national financing institutions, as well as grant funding contributing (14%) to project costs, these sources were not capable of attracting (crowding-in) sizeable private debt capital, which represents less than (20%) of the total capital structure.

The **right-hand side chart** indicates clearly that the three BBI projects, which secured funding without access-to-finance issues were those where equity capital from private sources represented some 62% of the project's total capital structure, the remainder of which provided by public debt. This finding suggests that BBI projects require uneconomically high levels of equity from private sources in order to absorb project risks and allow for providers of public debt capital to participate and co-finance at levels of risks acceptable to them. Private debt capital is characteristically absent in these capital structures, signalling its inability to have a catalytic effect and attract (crowd-in) private debt capital and (partially) replace equity capital.

Figure 12 below presents the average weighted capital structure of 13 BBI projects with a total investment size of around EUR 1.2bn (sum of both left and right-hand side charts), either completed or under development, the promoters of which reported that **they have not yet managed to secure funding in order to implement their project**.

BBI capital structure of 13 projects that <u>have not yet</u> secured funding

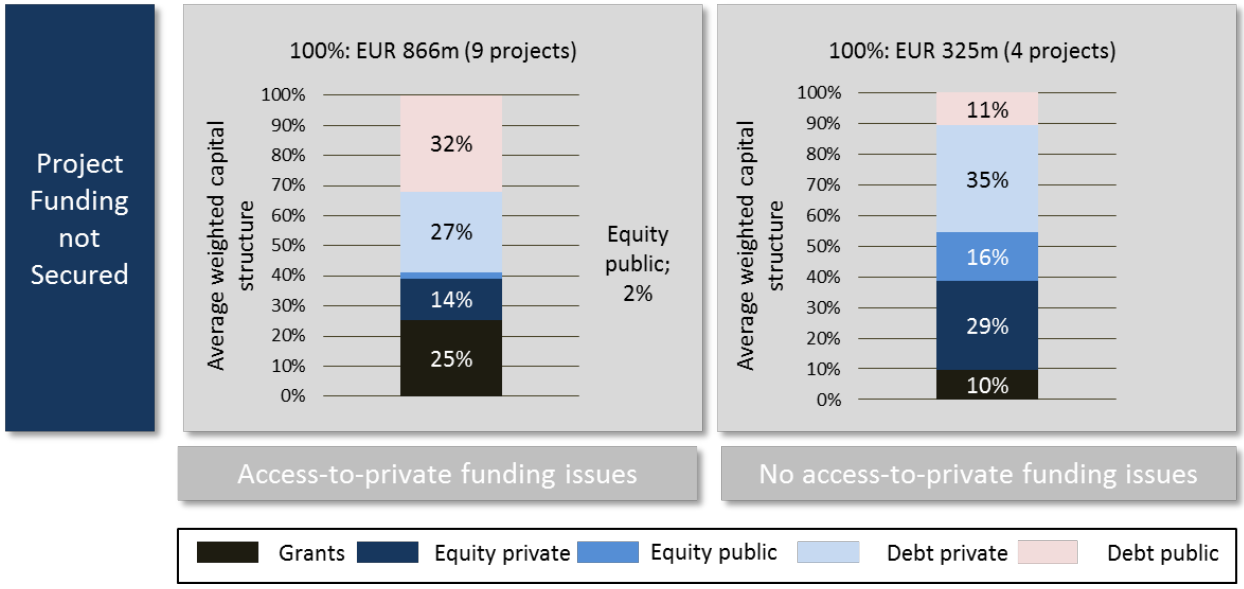


Figure 12: Average weighted capital structure by issues accessing private funding (sample: 25 BBI projects)
Source: EY.

The group is split into two sub-categories, the first (left-hand side chart) showing the capital structure of projects the promoters of which report access-to-finance issues in the process of trying to secure funding. The second (right-hand side chart) shows the capital structure of projects where promoters report that they expect no access-to-finance issues when searching for funding.

The **left-hand side chart** indicates that nine BBI projects facing access-to-finance issues appear to aim for a balanced capital structure (around 40% equity and 60% debt). These projects also appear to aim

for sizeable amounts of grant funding, which can make up to 25% of the total capital structure. In terms of their expectations about debt finance, they aim for a balanced participation of public and private debt capital (nearly 50-50 split).

The **right-hand side chart** presents the four BBI projects where their promoters do not expect to run into access-to-finance issues. This chart indicates that promoters believe that equity capital from private sources will eventually be a larger component of the capital structure.

On aggregate, the average sizes for BBI projects that experienced access-to-finance issues (sums of left-hand side charts of the two figures above) is EUR 125m compared to EUR 132m for BBI projects that had no access-to-finance issues (sums of right-hand side charts of the two figures above), indicating no significant correlation between average project/investment size and the existence of access-to-finance issues.

Figure 13 presents the evolution of the weighted average capital structure of 25 BBI projects[66] from TRL 6 to 9.

BBI capital structure by TRL

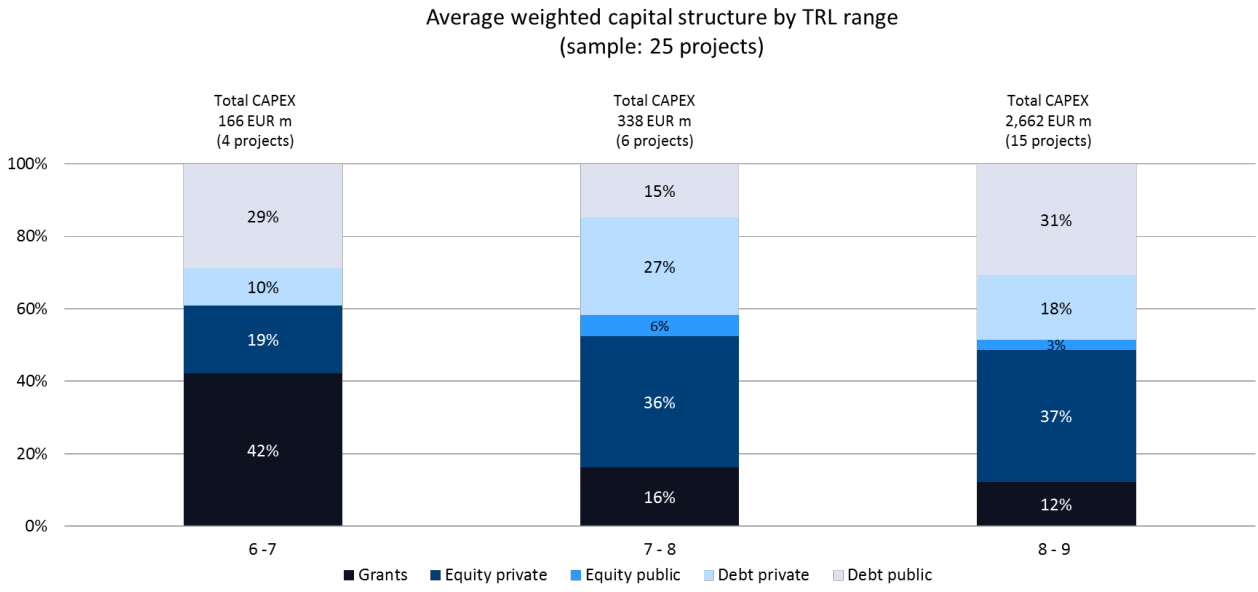


Figure 13: BBI: Average weighted capital structure by TRL range[67] (sample: 25 BBI projects)
Source: EY.

Each stacked bar shows the financing mix that BBI projects in their capital structure have under each TRL bucket. Dividing the total CAPEX per TRL category by the number of projects included reveals that the average investment size per project also increases proportionally to TRL. The figure suggests that as project investment sizes and TRL increase (i.e. projects become bigger and move to more technologically advanced stages towards commercialisation phases) the percentage share of grants in the capital structure decreases substantially. Specifically, the decrease is primarily identified when moving from demonstration scale plants of TRL 6 to larger plants of TRL 7 and flagship/FOAK plants of TRL 8. At this stage, project promoters appear to have to resort to equity from private sources (own funds).

In addition, an notable observation is the move from demonstration to FOAK/flagship and industrial-scale projects: the move from the middle to the right-hand stacked bar indicates that while public debt

[66] Two projects (BBI14 and BBI15), for which no data on the capital structure was provided, are excluded
[67] Please note that the TRL ranges are composed as follows:
6-7: TRL 6 and 6.5
7-8: TRL 7 and 7.5
8-9: TRL 8, 8.5 and 9

doubles in contribution to the capital structure (from 15% to 31%) to compensate for a reduction of grants its presence (of public debt) does not manage to attract (crowd-in) sufficient private debt capital. Finally, the increase to 27% of debt from private sources in the middle stacked bar, comes from one project (BBI10), which, based on the credit strength of its sponsor, plans to raise EUR 20m (20% of the project's capital structure) in the form of a corporate bond on the balance sheet of the promoter, which it then plans to contribute to the project as own funds. While, methodologically, in this figure this amount is treated as debt finance from private sources (capital markets), this data point supports the overall conclusion that project sponsors with an already strong credit profile can rely on their credit strength, raise debt from various private sources and finance their projects. Without this particularity, the level of private debt across various TRL buckets remains 20%.

Overall, the figures presented in this section suggest that the capital structures of projects in the TRL ranges of 7-9 are dominated by equity from private sources, while grants are predominantly observed for demonstration projects with a TRL of 6-7. **Grant funding, primarily from EU** programmes like the BBI JU, appears to be **available for less technologically** mature projects (at the pre-commercial stage). However, **as BBI projects increase in size and technological maturity, the relative presence of grants in the capital structure of projects diminishes. Instead project promoters resort to equity and own funds, which comprise between 50% and 60% of their capital structure.**

Figure 14 below presents the weighted average capital structure for BE projects that indicated access-to-private funding issues and projects that did not experience such issues.[68]

BE capital structure of 15 projects with or without access-to-finance issues

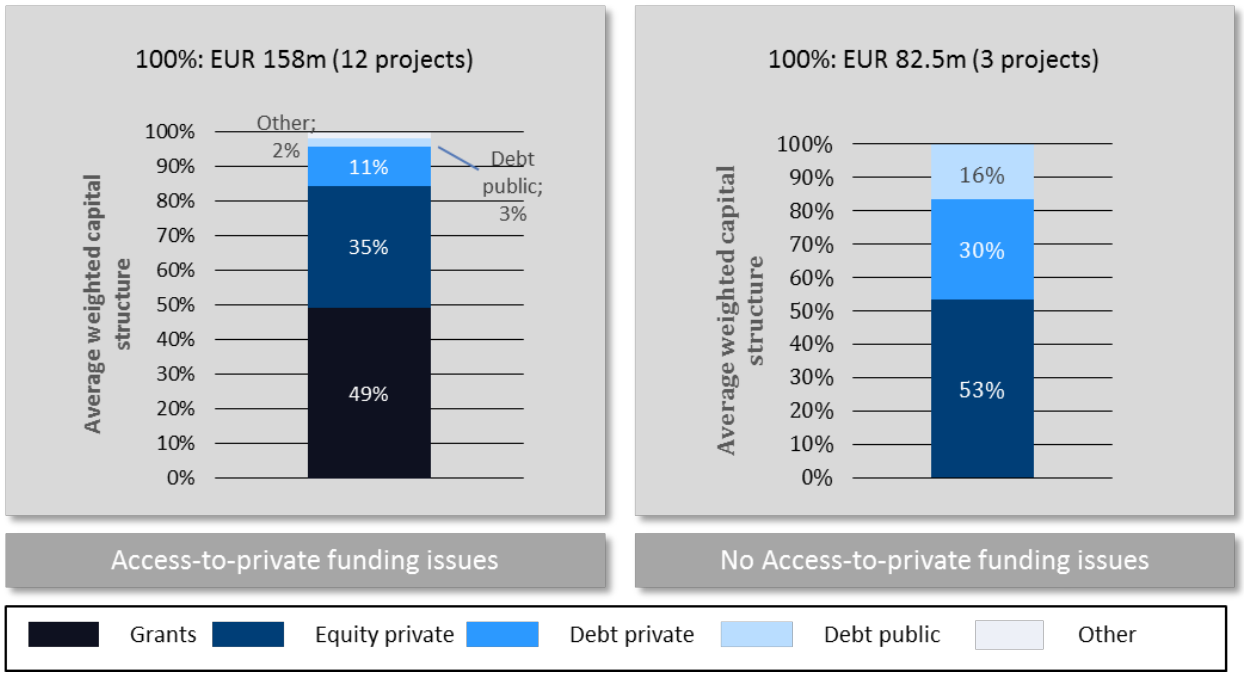


Figure 14: BE: Average weighted capital structure by issues accessing private funding (sample: 15 BE projects)
Source: EY.

The left-hand side chart indicates that BE promoters in the majority of projects (12 out of 15) indicated issues accessing private funding due to a lack of interest of private financial market participants in investing. With an average project size of around EUR 15m, the chart indicates that surveyed BE projects expected to rely to a large extent on grants (almost 50%) but also on equity capital from private sources (35%).

[68] Please note that the information whether funding has been secured or not was not provided in the BE sample

On the other hand, for the BE projects that did not face access-to-finance issues on the right-hand side chart, the disproportionately high level of equity/own funds from sponsors is notable. Please note that the 30% of private debt comes from one project (BE12) where the project promoter indicated that for the financing of this operational plant, it raised private debt on its balance sheet from capital markets which it then contributed 100% as own funds to the project. While, methodologically, this 30% is debt finance from private sources (capital markets), this data point confirms the overall conclusion that project sponsors with an already strong credit profile can rely on their credit strength, raise debt from various private sources and finance their projects without running into access-to-finance issues.

Figure 15 below presents the evolution of the weighted average capital structure of 15 BE projects from TRL 5 to 9.

BE capital structure by TRL

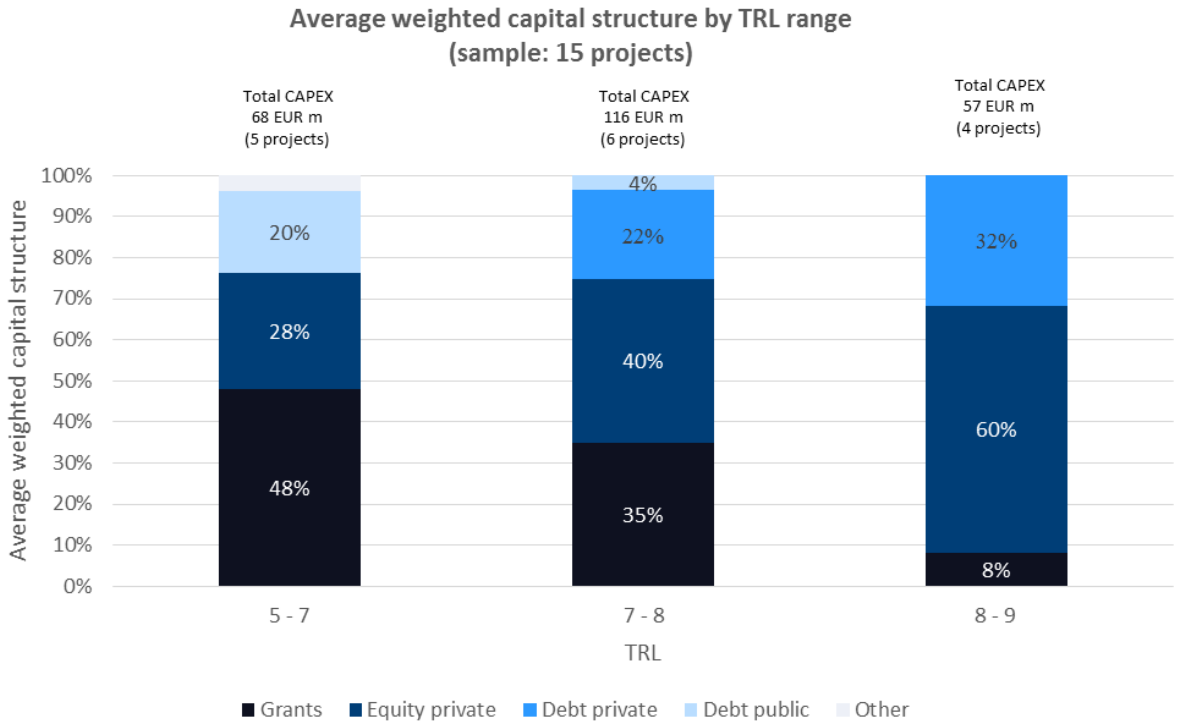


Figure 15: BE: Average weighted capital structure by TRL range[69] (sample: 15 BE projects)
Source: EY.

The figure shows that grants play a crucial role in the capital structures of demonstration-scale projects (TRL 6-7). Similarly to BBI projects, as BE projects increase in size and technological maturity, the relative presence of grants in the capital structure diminishes. Instead, grants are gradually replaced by equity capital (60%) primarily from promoters' own funds and equity from strategic/industrial partners and a few specialist investors (offering venture capital or mezzanine finance). The presence of private debt capital near commercialisation phases (TRL 8-9) signifies the growing interest of private sector investors in allocating debt capital to BE projects. However, this metric is somewhat distorted by the fact that it includes BE projects that both managed or are yet to secure funding. It should be noted that none of the promoters of projects in the commercialisation phases report having raised debt from public sources.

[69] Please note that the TRL ranges are composed as follows:
5-7: TRL 5 and 6.5
7-8: TRL 7 and 7.5
8-9: TRL 8, 8.5 and 9

3.3.2 Identifying the funding gaps based on BBI and BE project promoter feedback

Key section takeaways:

The analysis identifies **the following main funding gaps:**

<u>Funding gap 1</u> – BBI and BE projects scaling up from pilot to demonstration projects (TRL 6-7)

According to BBI and BE project promoters, this phase of the project cycle (either for technology licensing or commercial production purposes) is marked by high technological risks, which private investors (especially non-specialist or sector-agnostic) are not well equipped to assess. As a result, funding from private investors in general is overly expensive for promoters and the attached funding conditions including collateral, guaranteed levels of demand (e.g. through off-take agreements) and guaranteed revenues cannot be met by many promoters. From the public side, grant funding is available but this is often restricted to the R&D phase and conditional on lengthy and complicated application procedures, which deter promoters from applying. The existence of public funding both in the form of grants and debt instruments does not manage to cover this funding gap, which according to the capital structure analysis is filled by own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects.

<u>Funding gap 2</u> – Particularly for BBI projects, moving from demonstration to flagship/FOAK and industrial-scale (TRL 8-9) phases

This phase refers to the up-scaling or ramp-up stage as projects move from the demonstration to the commercialisation phases (TRL 8-9) with the expectation of selling to customers and, in the case of TRL 9, making profit. While scale-up requires large investments, projects in this phase face unfavourable market and demand and regulatory framework conditions and risks, which hamper investments. As a result, projects that enter the TRL 9 phase continue to face revenue uncertainty, low or volatile profitability, and cash-flow and liquidity issues. As a consequence private market participants are reluctant to invest. From the public side, no dedicated support for the industrial-scale (TRL 9) is available, leading to many projects never reaching this stage.

The analysis conducted in the previous sections reflects and explains the limited availability of private capital and the limited ability of public funding sources to catalyse more private sector investments in BBI and BE projects. In order to identify the main funding gaps that emerge from the analysis so far, it is useful to present the findings within a conceptual framework that takes into account the stages/phases of a project. For BBI and BE projects these phases (and more generally for all innovative projects that rely on the move from R&D and commercial application of innovative technologies) can be grouped under TRL categories as follows:

Technology Readiness Levels		PPP funding category	Examples of types and level of relevant project risk	Scale*	Duration of asset	Sales
9	Actual system proven (successful operation, production and final product/service)	Commercial – no funding	Traditional commercial and thus "bankable" risk • Feedstock supply risk • Plant utilisation • Product off-take risk	Commercial scale (after flagship project or "replication" of existing plant)	Plant will run for over 20 years	Product sold to customers (profit anticipated)
8	Whole process demonstration completed at scale and product qualified through test	Innovation action – Flagship	Non-bankable risk e.g. related to: • Potential need for plant modification • (Feedstock supply risk) • (Product off-take risk)	*Comparable to commercial scale/ 1st-of-a-kind in Europe	Flagship plant will run over 20 years and may be enlarged or improved after flagship project Utilisation rate is high	Product sold to customers with defined quality and performance characteristics (no profit anticipated during the Action)
7	Process demonstration in operational environment (integration) at demo scale	Innovation action – Demo	Non-bankable risk e.g. related to: • Risk that sub-processes fail to integrate • Risk that process fails at scale / in relevant environment • Potential need for technologies modification	*Small production unit / demo scale	Demo plant will run for 2-5 years/ reconverted after end of demonstration Utilisation rate is medium as plant may be stopped several times for improvements	Product sent to potential customers for testing ("sales of test lots") Product can be sold but sales do not usually cover more than fixed + variable costs
6	Sub-system or process step demonstration in relevant environment					
5	Pilot – process step validation in relevant environment (separate process steps)	R&D action	Non-bankable risk e.g. related to: • Risk that sub-processes fail at scale / in relevant environment	"On the ground" equipment	Pilot unit used for multiple projects or equipment reconverted after project	Product not sold / can be used for tests by potential customers
4	Process validation in laboratory environment	R&D actions	Non-bankable risk e.g. related to: • Risk that sub-processes fail at laboratory scale • Potential need for sub-process/ component modifications	"On the bench" equipment		

*Scale varies strongly with the sector, process or product, and thus scale of project must be compared with existing production of sale product (with e.g. different feedstock) or comparable product or production system.

Table 10: BBI JU illustration of projects moving from R&D and pilot phases (TRL 4-5) to demonstration plant phase (TRL 6-7) to flagship/commercial-scale plant phase (TRL 8-9)

Table 10 above is a helpful guideline tool developed by the BBI JU to assist project promoters in understanding the concept of TRL and how projects move through various stages. It confirms the analysis and project promoter feedback collected so far in the study by summarising the particular risks and investment needs for each phase.

1. Funding gap 1: Projects moving from pilot to demonstration plant phase (TRL 6-7)

(i) Technological and operational risks that financial market participants find difficult to assess

Projects aiming to move from the R&D phase (lab and pilot) are not bankable (i.e. lenders and other capital providers are not willing to finance), **primarily due to high technological and operational risks**. These risks relate to the specific technology(ies) implemented at the relevant (small) scale, or when integrating smaller processes in order to develop an operational system. Such projects are not expected to generate sufficient and recurring revenues (if any) for debt service.

During these phases, a tailored-made BBI and BE-specific assessment of technological and operational risks by private investors could lead to increased capital flows. However, due to the innovative new technologies involved in the relatively nascent BBI and BE sectors, industry-expert investors and sponsors appear better suited to assessing these risks rather than non-specialist/sector-agnostic investors. In this context, several BBI promoters point out that "*investors active in the specific sector, capable of assessing the risks could be willing to fund such projects*" (BBI4, BBI5, BBI10, BBI20).

Conversely, generalist and sector-agnostic private investors, such as commercial banks and asset managers, tend to apply conventional risk assessment frameworks for evaluating BBI and BE projects, based on which they select projects for financing. For example, a BE promoter active in the production of algae states that "*Banks are not interested in financing risky and innovative projects by SMEs […] so*

we had to get funding from US-based funds" (BE14). For those projects that undergo credit assessment, promoters report high expectations and requirements such as guarantees from creditworthy providers and types of collateral, which especially in the case of demonstration plants, equipment, technologies and intellectual property under development may not be available or carry limited value as credit covers and risk mitigants. The absence of risk mitigants leads to smaller funding tickets and high capital costs, at such high levels that sponsors determine that the use of own funds and equity is more suitable, or in most cases the only funding source, compared to expensive and restrictive third-party private funding, as indicated in the project promoter capital structure analysis.

The above points by BBI and BE project promoters are confirmed by the analysis of financial market participants' feedback in Section 4. Specifically, from the responses collected in financial market participant surveys, a key finding concerns **information asymmetries and technology risks, which limit the willingness of financial market participants to invest in BBI and BE, steering private capital towards more mature projects**.

(ii) Public funding is available but not optimally deployed to crowd-in private capital

As mentioned earlier, BBI project promoters mention that public funding is limited to the R&D phase of projects and not always managed properly. Also, project promoters report complicated and lengthy application procedures for public funding. Finally, project promoters which manage to access public funding mention its small size relative to their needs and the unfavourable terms attached. The points raised by project promoters can be viewed in light of Section 5, which presents a mapping of public financial instruments available to support BBI and BE.

The capital structure analysis earlier in this Section appears to corroborate the points raised by project promoters. Specifically, the data suggests that there is limited availability of private debt capital from financial market participants for BBI and BE projects. As BBI and BE projects increase in size and technological maturity, project promoters appear to have to resort to own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects. Some grants, primarily from EU programmes, are also available at the pre-commercial stage. However, as BBI and BE projects increase in size and technological maturity, their absolute and relative presence in the capital structure of projects diminishes, especially in BBI. Most importantly, public debt capital appears to play a larger role in the capital structures of both BBI and BE projects. Yet the presence of public capital does not manage to attract (crowd-in) sufficient private debt capital in the capital structures of either BBI and BE projects.

2. <u>Funding gap 2: Particularly for BBI projects, moving from demonstration to flagship/FOAK and to industrial-scale phases (TRL 8-9)</u>

(i) Unfavourable market and demand and regulatory framework conditions present risks and challenges for BBI and BE project promoters and financial market participants

According to project promoters, primarily active in BBI, regulation and market and demand framework conditions can act as important drivers and incentives for more sponsor and private sector investments. Market and demand risks relate to the lack of developed markets and insufficient demand for BBI and BE outputs and products, largely affected by regulation. Regulatory risks and challenges are primarily related to the lack of an effective, stable and supportive EU regulatory framework, the uncertainty about existing regulation that affects the entire BBI and BE value chains (from inputs/feedstock to outputs/products) and the translation and implementation of EU regulation into national policies. **Financial market participants recognise the role of a stable and supportive regulatory framework but are cautious about its potential market distortion effects**.

(ii) Additional perceived risks contribute to access-to-finance issues

A number of risks are prevalent at the flagship/FOAK and industrial-scale stages namely, legal regime-related risks primarily pertaining to complex and lengthy licensing procedures and overall BE legislation in the countries in which they operate. Financial risks are mentioned by both BBI and BE promoters and relate primarily to the risks that both BBI and BE projects demonstrate low or volatile profitability and cash flow generation, especially at the earlier stages of a project, and also the large size of capital expenditures required, mostly in BBI projects and to a lesser extent in BE projects. BBI and BE project promoters also highlight a number of other risks and challenges, primarily related to societal issues such as public perception and lack of a green premium for BBI and BE products that affect their access to finance.

(iii) Public funding is less available and not optimally deployed to crowd-in private capital

As mentioned in the analysis in Section 3, BBI project promoters mention that public funding is limited to the R&D phase of projects and not always managed properly. This finding is even more applicable to projects near commercialisation that have increased capital needs. The complicated and lengthy application procedures for public funding still apply. Project promoters who manage to access public funding mention its small size relative to their needs and the unfavourable terms attached. Finally, project promoters report that there are no public financial instruments particularly tailored and fit-for-purpose for the large capital needs and the risks that they face. The points raised by project promoters can be viewed in light of Section 5, which presents a mapping of public financial instruments available to support BBI and BE. The two funding gaps are represented in **Figure 16** under the TRL conceptual framework and project development cycle of BBI and BE projects:

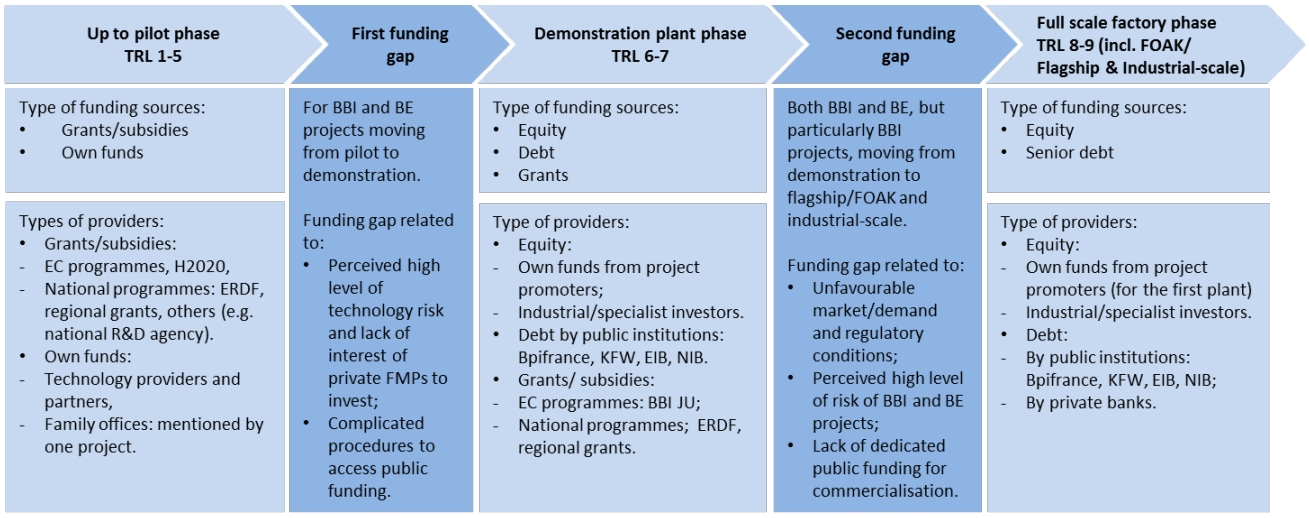


Figure 16: Funding gaps along BBI and BE project development cycle
Source: EY, EIB

3.4 Demand side: In terms of funding, project promoters ask for adapted or new public financial instruments that can absorb the business and financial risks of BBI and BE projects and carry favourable conditions

3.4.1 BBI and BE project promoters are aware of existing public financial instruments supporting the Bioeconomy and highlight their catalytic impact

Key section takeaways:

- Almost all BBI and BE project promoters reported having knowledge of existing public financial instruments offered both at EU and national levels, however important initiatives such as EFSI were not mentioned in survey responses.
- In terms of catalytic impact, BBI and BE project promoters highlighted that public financial instruments have the capacity to potentially fill funding gaps.

Table 11 below presents the responses that BBI and BE project promoters provided about their knowledge of existing PFI, including both grants, risk-sharing and others. It also presents their responses as to whether, in their opinion, PFI can in general, as supporting tools, fill funding gaps in BBI and BE investments. As with other questions, the responses were aggregated according to the geographical levels (EU, national, regional/local) at which PFI are made available.

BBI and BE project promoter feedback on PFI

	EU level	National level	Regional/local level
Promoters indicate **knowledge** of existing PFI	**30 (94%)** (total responses: 32)	**20 (83%)** (total responses: 24)	**6 (40%)** (total responses: 15)
Promoters consider that PFI (as supporting tools) are **capable of filling funding gaps**	**24 (100%)** (total responses: 24)	**13 (93%)** (total responses: 14)	**3 (60%)** (total responses: 5)
Promoters report **current PFI not capable of filling funding gaps** and **expect new future PFI**	**28 (100%)** (total responses: 28)		

Table 11: Knowledge of and capacity of PFI to fill funding gaps[70] (sample: responses provided by 43 project promoters)

EU level

At the EU level, promoters report the highest levels of knowledge of PFI with 94% of respondents reporting having knowledge of EU financial instruments (30 promoters). Compared to other PFI, one promoter states that *"EU instruments are more accessible than other public financial instruments"* (BE7). At the EU level, all respondents consider that EU instruments as tools can be capable of filling funding gaps (24 respondents). Examples of key instruments (grants and loans) and providers mentioned by promoters are amongst others: Horizon 2020 (including the BBI JU) and FP7, NER 300 as well as InnovFin instruments for SME offered by the EU and the EIB group. However, it should be noted that not a single project promoter mentioned the existence of the European Fund for Strategic Investments (EFSI), which reveals a certain lack of awareness of EU risk-sharing financial products.

[70] Please note that the percentages represent the share of BBI and BE project promoters that answered "yes". The percentage is calculated out of the total number of responses ("yes" and "no"). Project promoters that did not provide an answer (e.g. "n.a.") are not included in the calculation. For example, 30 project promoters answered "yes" to having knowledge about funding instruments at EU level, 2 answered "no", and 11 answered "n.a." Hence 94% of the responses for this category out of 32 responses indicate that promoters have knowledge about funding instruments at EU level.

National level

At the national level, knowledge of PFI remains high with 81% of respondents stating that they have a good knowledge of PFI (20 respondents). Promoters explain that funding support at national level is restricted by the conditions attached, such as a requirement that bank guarantees have to cover 100% of the grant amount (BE7). Additionally one promoter (BE8) mentions the existence of national programmes financed by the EU and tax credits for innovation. Similarly to the EU level, promoters consider that the PFI as tools are capable of filling funding gaps (93% of respondents). Examples of instruments mentioned include: repayable advances provided by municipalities, the former CENIT (now CIEN) programme and instruments offered by the NIB and instruments offered by UBA Deutschland and the Ministry of Economy of North Rhine Westphalia as well as the British Government.

Regional/local level

At the regional and local level, the knowledge of existing PFI is considerably lower as shown by the relatively low number of respondents (only six indicated that they have a good knowledge, which amounts to 40% of all respondents). One BE promoter is aware of public, regional investment companies in the Walloon region of Belgium, while one BBI promoter mentions regional public schemes in the Flemish region of Belgium and in the Netherlands. Consequently, only 60% of respondents (three responses) consider regional/local PFI to be capable of filling the funding gaps. Examples of key providers of PFI are regional banks (Flanders in Belgium) and local governments (Netherlands) investing in BBI projects.

Regardless of the level of knowledge of PFI and their capacity, as supporting tools, to fill funding gaps at various geographical levels, **Table 11** also emphasises a notable contrast. While most project promoters report knowledge of PFI and their capacity to fill funding gaps, **an important number of promoters (28) report that currently available PFI are not capable of filling funding gaps** and that a **potential future PFI can contain features that will manage to fill these gaps**. Relevant details about this finding can be found in the earlier section about issues with public funding where project promoters offer their feedback on the matter. Moreover, the above analysis gives further credence to one of the key findings of this study being that the majority of BBI and BE projects surveyed face access-to-finance issues (77% or 33 out of 43 projects in total, 20 out of 27 in BBI and 13 out of 16 in BE, see right-hand side columns of **Table 2** and **Table 3**). These issues affect promoters, irrespective of whether they use or have used PFI. This finding is substantiated by the capital structure analysis section where the **presence of public capital does not manage to attract (crowd-in) private debt capital**, **and represents a small percentage of the capital structures** of both BBI and BE projects. In the section below, the same project promoters elaborate on the nature and features that a potential future PFI can contain in order to fill funding gaps.

Related Quotes

<u>*EU-level*</u>

"We generally have a good understanding of existing PFI at all levels. However, it is often unclear how different measures [of financial support] can be combined. Also, access to attractive financing means specifically for innovative projects is lacking."(BBI10)

<u>*Belgium (Flemish region):*</u>

"The regional public bank invests in BBI programmes and the regional government issues loan guarantees." (BBI6)

<u>*Netherlands:*</u>

"Different regional public investment entities participate in projects with equity and the national government issues loan guarantees for BBI programmes." (BBI6)

3.4.2 BBI and BE project promoters ask for adapted/new PFI preferably involving loans, hybrid mechanisms and equity instruments designed to absorb business and financial risks of BBI and BE projects and carrying favourable conditions that can fill funding gaps and have a catalytic effect

Key section takeaways:

- BBI and BE project promoters, which reported that current PFI are not capable of filling funding gaps, rank loans as the most preferred type of new/adapted PFI, followed by hybrid and equity instruments designed to absorb business and financial risks that financial market participants are not capable of or willing to take on.
- BBI and BE project promoters ask for favourable conditions in adapted new PFI such as size, flexible reimbursement conditions, lower costs, flexible terms and other features.

1. Preferred types of new/adapted PFI

In order to gain a detailed view on the desirable PFI for BBI and BE project promoters, the survey asked for their feedback on the type[71] of PFI that would, in their opinion, be most suited to fill the identified funding gaps. **Figure 17** below presents the ranking according to the responses of BBI and BE project promoters. **Loans and guarantees** clearly rank as the most useful type of instrument according to promoters, followed by **hybrid instruments** (i.e. combinations of different financial instruments, mainly grants, equity and loans, which carry convertibility features such convertibility from debt to equity and vice versa) and **equity instruments**. In the **other** category project promoters were given the opportunity to mention any other instruments they find suitable, amongst which grants were mentioned by one BBI promoter and 3 BE promoters:

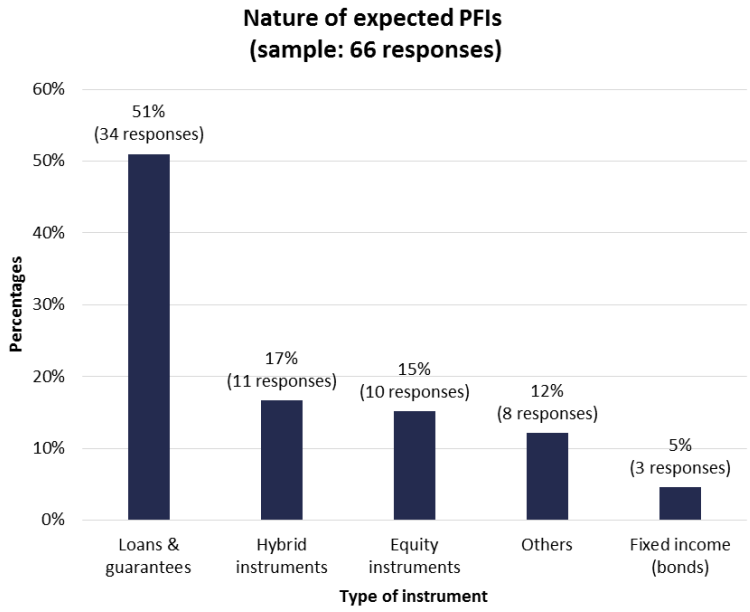


Figure 17: Nature of expected PFI[72] (sample: 66 responses provided by 43 project promoters)

[71] The questions asked concerned the following types of PFI: "loan instrument", "equity", "bonds", "guarantees", "hybrid", "other" (under "other" promoters were allowed to input any form of support").

[72] Please note that the percentages represent the share of "yes" regarding the type of PFI expected by the project promoters (loan, hybrid, equity, guarantee, bond and other). For example, the total number responses is 66; 27 responses out of 66 concern loan instruments, which represents a share of 41%.

Loan and guarantee instruments are considered to be the most useful type of PFI for supporting BBI and BE projects and are expected to cover both business and financial risks. Promoters consider that loans and guarantees from public institutions can have a catalytic effect, meaning that they generally help attract private investors (which is particularly important because technology-driven promoters are usually not successful in securing funding from private investors, as mentioned by one BE promoter). In this context, **public loans and guarantees** are seen as a means to **help fund demonstration plant projects**, for which private FMP are generally not willing to provide loans (funding gap 1) but also considered **very useful instruments to fund the commercialisation phases of new technologies** (scale-up, funding gap 2).

Hybrid instruments rank second (17% of respondents) after loans and guarantees. These instruments generally **refer to instruments that can carry both equity and loan features**. Specifically, reflecting the higher initial technological risks of BBI and BE projects at earlier TRL stages, the initial form of hybrid instruments could resemble that of equity capital, potentially provided by specialist private equity investors active in BBI and BE, thus potentially filling funding gap 1. Consequently, and as technological risks are reduced, hybrid instruments could demonstrate debt characteristics (e.g. through convertibility). In that regard, project promoters displayed interest in hybrid instruments also as a means to cover scale-up financing needs, i.e. when moving to the next scale plant (industrial scale) in the project cycle. As such, the key advantage of hybrid instruments are their risk absorption capacity since when used as an equity or debt layer to more senior capital they can act as cushions absorbing downside business and financial risks, and particularly in the case of equity or quasi-equity, benefiting from upside potential if certain positive performance criteria are met. In that regard, hybrid instruments appear to be also particularly relevant for funding gap 2 (i.e. commercialisation phases) where early participation in equity/ownership can be attractive for investors seeking upside reward for technological risks that were eventually overcome.

Other advantages of such instruments can be their adjustability and flexible nature in terms of size (i.e. accordion features that can regulate the size of the debt commitment according to the needs) as projects have various funding needs and "*no one size fits all*" (BE16), as mentioned by one BE project promoter.

Equity instruments rank third, with 15% of responses. Project promoters welcome these instruments as their equity risk absorption can help attract loans from commercial banks (which tend to ask for a share of at least 30% of equity in a project financing) to finance the remaining portion of project costs. Nevertheless, equity investments from external, non-specialist/sector-agnostic investors are seen as difficult and unlikely to obtain especially in the demonstration plant phases due to the lack of stable revenue flows, as explained by one BBI project promoter. Another BE promoter mentions that equity is important for covering operational costs, which in that particular project's case represented the largest funding gap.

Related Quotes

"We would need a public loan for our demonstration plant as private banks are not willing to provide loans to such projects." (BBI18)

"Loan guarantees would help mitigate the challenge of funding the commercialisation of new technology." (BBI10)

"Loans and guarantees from public institutions such as EIB should provide leverage for commercial banks to invest." (BBI10)

"As a hybrid instrument I would like to see scale-up financing, providing necessary funding for the next scale plant." (BBI4, BBI5)

"Equity funds are welcome as project partners but this is not probable for projects in the demonstration plant phase due to the absence of revenues." (BBI27)

2. Expected features (terms and conditions) of adapted new PFI

Based on the various comments provided by BBI and BE project promoters, **Table 12** below presents an overview of the expected features of adapted new PFI.

Expected features	# of responses	% out of 43 projects	Detailed feedback
Reimbursement conditions	19	44%	**Grace period** • "Expected grace periods range from 2-5 years in most cases" • "Grace periods of 2-3 years are needed to allow ramp-up and absorb cash flow volatility in the commercialisation phase and after operations have started" • "A long grace period of 5-10 years is necessary for certain industrial investments that require long lead times before achieving profitability" **Other reimbursement conditions** • "Refunding could be linked or partially linked to the success of the project, or on the starting a second plant. For loans, it can be hybrids: in case of no success, then no requirement to refund the entire principal amount of the loan" • "Funds should be partly non-reimbursable (at least 30%)" • "The non-reimbursable part could be applicable for innovative ventures, not for the commercial stage"
Costs: Interest rates / ROI	18	42%	**Interest rates** • "Lower interest rates than those proposed by private banks: the range covers 0% (risk free rate) to 4%" • "For riskier projects, even high interest rates would be acceptable, as long as there is a debt instrument that is accessible" **Expected features** • "Preferably fixed as with a long maturity base capital costs will rise substantially" • "Pricing conditions could be linked to the company's performance" • "Interest rates should be lower at the beginning then progressively increase towards the end of the project"
Others	17	40%	**Simple access and application process** • "Simplified application process; more flexibility. The most important criteria is the simplicity of the access" **Instrument types** • "For grants and subsidies: more clarity and more flexibility in terms of conditions" • "For equity, a separate EU or national body could take equity stakes and thus provide security to private investors" **Expected features** • "Different "menus" – options for high vs. low risk finance"
Terms (e.g. tenor, draw-down periods, voting/non-voting shares)	14	33%	**Tenor** • "Finance over 10 years at least, for loans 10-15 years" • "Long amortisation (payback) periods: 8-10 years" • "Long-term financing, 20-30 years similar to mortgages" **Expected features** • "Terms could be linked to specific conditions about the location of the second plant or linked to the number of jobs created"
Guarantees / collateral	9	21%	**Types of guarantees/collateral** • "Loan guarantees" • "Assets to be used as collateral" **Expected features** • "More flexibility regarding guarantees and collateral than that offered by private banks" • "Coverage of 50% of the private loan (guarantees)"
Seniority	1	2%	• "Preferably junior (or part subordinated) debt in the capital structure"

Table 12: Expected features of PFI[73] (sample: 43 BBI and BE projects)

- **Reimbursement conditions**

Reimbursement conditions for PFI are the most frequently mentioned feature (19 responses from project promoters corresponding to 44% of all projects). Promoters mainly ask for long grace periods ranging from two to ten years (longer for industrial investments that may run into difficulties post

[73] Please note that percentages represent the share of BBI and BE projects out of the total number of projects. For example, 19 project promoters mentioned reimbursement conditions, which represents a share of 44% out of the total number of projects.

project completion). These are particularly important for covering the long period of early investments before returns on operations and profitability can be achieved.

In addition to long grace periods, project promoters also expressed their views on the general reimbursement conditions and especially conditional repayment features. These may be linked to the success of a project (technical or commercial) or the starting of a second plant as expressed by one BBI promoter. Another BE promoter would like to see partly non-reimbursable funding (at least 30%) in the financing package. This could be applicable to the funding of innovative technologies (projects in their early stages, e.g. demonstration plant phases) but not to the commercial stage. The features described by promoters can be applied to conventional loans and guarantee instruments, which will essentially give them hybrid characteristics (i.e. debt with equity-type risk-absorbing capacity, long tenor and grace period that resembles equity capital, etc.).

- **Costs**

Financing costs for all types of instruments are the second most important feature mentioned by project promoters (18 responses corresponding to 42% of all projects). Project promoters mainly ask for lower interest rates than the ones available from commercial banks and capital markets. An indicative range spans from 0% to 4%. In spite of this, one BBI promoter states that it would even accept higher interest rates as long as debt funding is available, referring to riskier projects that do not manage to obtain funding at all. This highlights the fact that commercial banks need to be further incentivised to fund BBI and BE projects at rates that make projects financially viable. One BE promoter from Southern Europe states that costs are a particularly difficult factor due to sovereign risks and the overall poor state of the industry that it is active in. When it comes to pricing conditions, promoters tend to favour fixed rates particularly in the case of long maturities, which provide predictability in corporate finance costs. In the case of variable rates, lower rates at the beginning of a project and higher rates towards the end are preferred, as mentioned by one BE promoter. Furthermore, loan conditions could be linked to factors such as the operational performance of the borrower, the location of the plant or the number of jobs created, as mentioned by a BBI promoter.

- **Other terms**

This category ranks third (17 responses corresponding to 40% of all projects). Within this category the two main points raised are:

1. Project promoters ask for **simpler access and application procedures for public funding**. This includes the overall application process and its flexibility, as promoters would like to see clearly defined funding conditions which also allow for a greater degree of flexibility. In addition, public institutions such as the EIB should be more open to funding BBI and BE projects and refrain from applying traditional loan evaluation criteria. Another important factor is the ease of access to public funding. To improve efficiency a BBI promoter asks for discussions between promoters and public financial institutions such as the EIB prior to submitting the funding application, which points to the usefulness of pre-appraisal stage advisory services from public financial institutions.
2. **Other expected features** mentioned refer to specific **conditions related to the location of a new plant or the creation of new jobs**. Furthermore different **"menus" for financing options** i.e. high versus low risk finance, with a reward or bonus for commercial banks willing to invest in high risk projects, are mentioned.

- **Terms, Guarantees/Collateral, Seniority**

Other expected features mentioned by project promoters involve funding terms such as long tenors (10 years, preferably 10-15 years, up to 20-30), which are mentioned by 33% of all BBI and BE projects. Guarantees and collateral provided by third parties in favour of projects are seen by 21% of BBI and BE projects as important features for an adapted new PFI. Promoters make a case for flexible guarantee and collateral arrangements as private banks ask for off-take agreements covering 60% of production

capacity over the entire investment period, stable supply agreements and construction guarantees. In respect of long-term investments with maturities of 10 to 15 years this may be difficult for promoters to provide. In terms of collateral, promoters would like to see financed assets being used as acceptable security/collateral to finance private loans. This, however, appears difficult for smaller projects where assets are not yet developed or for projects where the value of tangible/intangible assets under development is limited or difficult to assess. Seniority is the least frequently mentioned expected feature of the PFI and was reported by just one BBI promoter, who showed a preference for junior or subordinated debt that will crowd-in senior debt from private sources.

Related Quotes

"A grace period of 2-3 years would allow ramp-up and absorb cash flow volatility." (BBI14, BBI15, BBI16)

"The non-reimbursable part could be used to fund innovation rather than commercial activities." (BE11)

"Even higher interest rates would be acceptable, as long as there are accessible debt instruments." (BBI18)

"The application process should be simplified and offer greater flexibility." (BBI21)

"The PFI should offer different options for high and low risk finance and reward commercial banks willing to take on the risk." (BE13, BE14)

"The PFI should feature long amortisation periods (8-10 years) and interest rates below those asked by commercial banks." (BE7)

"Guarantees would help accessing commercial loans." (BE10)

4 ANALYSIS AND FINDINGS – FINANCIAL MARKET PARTICIPANTS

4.1 Sample Overview

Key section takeaways:

- A balanced sample of 16 European debt or equity providers, including banks, asset managers and private equity players, was interviewed.
- 13 of the interviewees had already invested in the Bioeconomy in the past.

To gather feedback from FMP regarding their interest in investing in BBI and BE projects and to test their response towards PPs' expectations for new or modified PFI, interviews were held with a sample of 16 FMP. 81% of them (i.e. 13 FMP) had already invested into BBI and/or BE in the past. **Figure 18** below provides an overview of the interviewed financial institutions in terms of assets under management (AUM), average ticket size, and the type of capital provided to the Bioeconomy sectors.

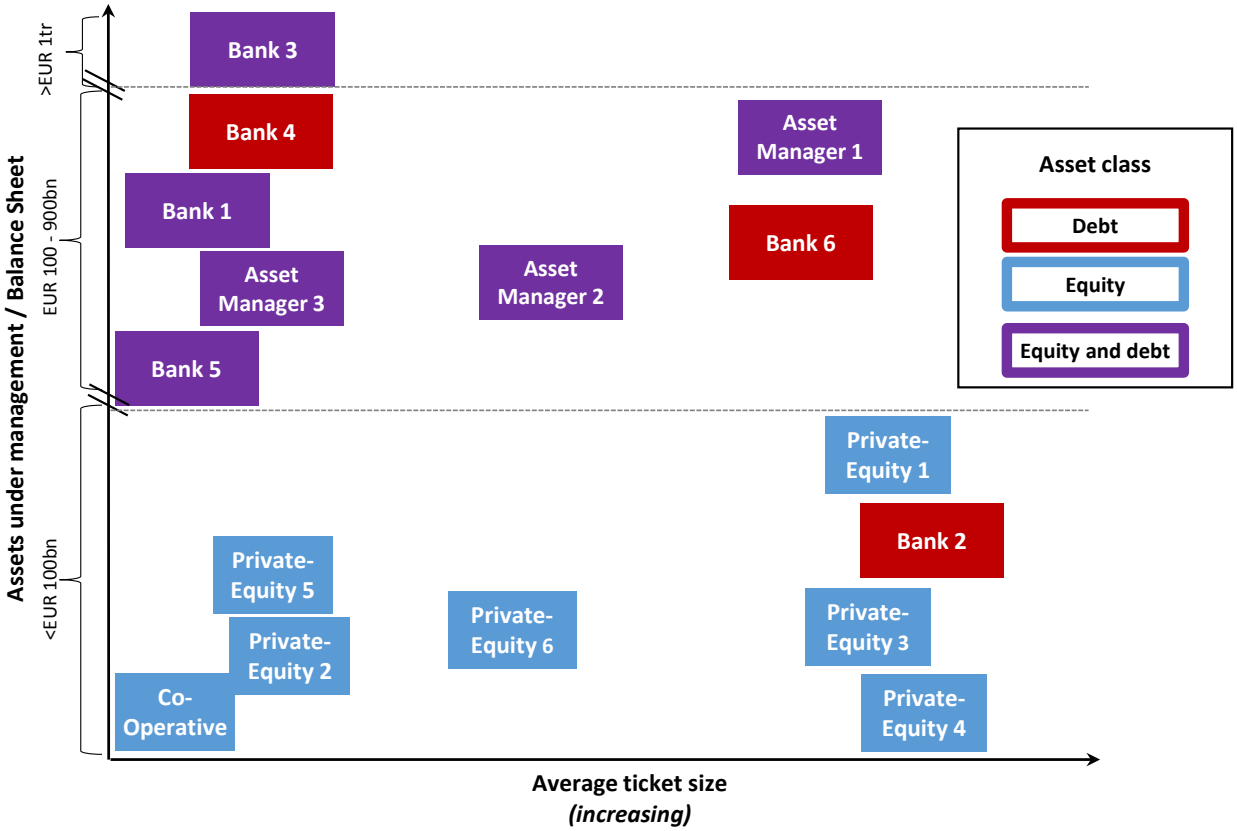


Figure 18: Overview of interviewed financial market participants by assets under management, average ticket size, and type of capital provided to BBI/BE
Source: EY, Company websites

Investor Type

The sample is well distributed both in terms of target ticket size and AUM. The majority of the sample consists of lenders such as commercial banks (38%, 6 FMP) and private equity and venture capital providers (38%, 6 FMP). Three asset managers and one co-operative make up the remainder of the sample. Seven (out of 16) FMP provide a mix of both equity and debt and seven FMP are pure equity players. Only two banks in the sample were exclusively focused on providing debt (to BBI/BE), indicating a certain equity-bias within the interviewed group.

Figure 19 below summarises the characteristics of the sample in terms of geography, TRL investing preferences, and investor type.

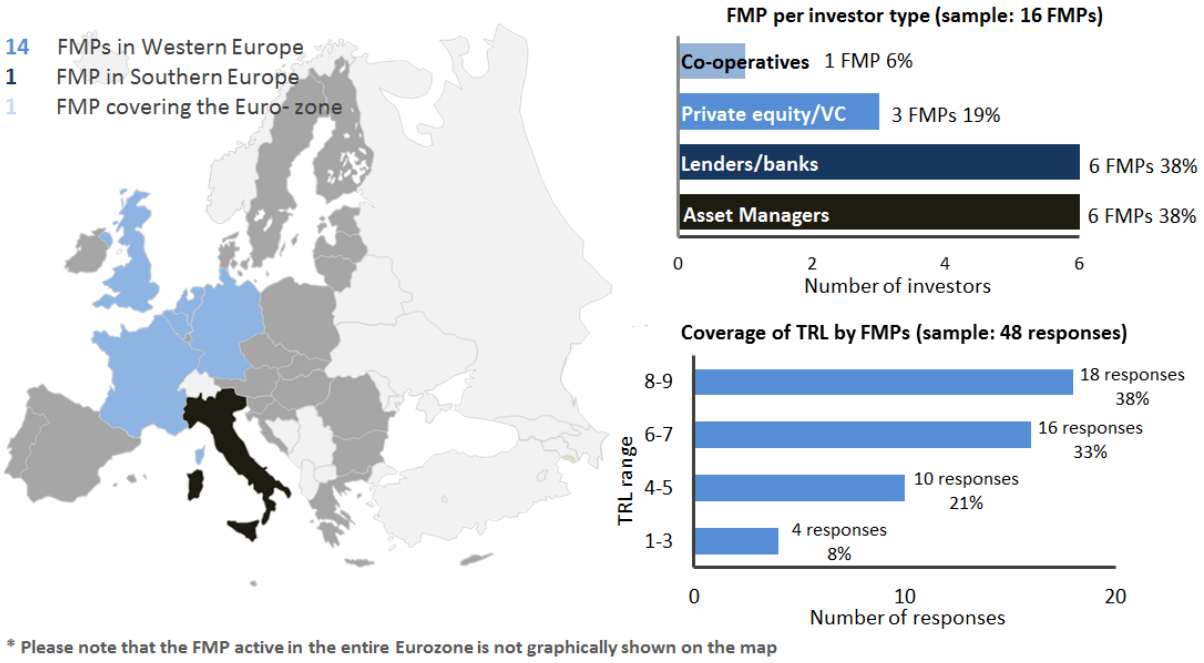


Figure 19: Overview of the FMP sample by geography, investor type, and TRL investment preferences (sample: 16 FMP) [74]
Source: EY

Geography

Most of the FMP interviewed (81%) have a pan-European investment focus without specific geographical restrictions when it comes to investing in BBI and BE. Two players (Bank 2 and the Co-operative) indicated a specific focus on France with selected global operations, while Bank 5, a German regional bank, exclusively invests in one federal state.

In terms of the FMPs' headquarters location, most of the institutions in the sample originate from Western Europe (France, United Kingdom, Belgium, Netherlands and Germany).The representativeness of the sample is thus limited by its geographical distribution, with fewer FMP from Northern, Southern and Central/Eastern Europe participating due to unavailability or lack of willingness of FMP to participate.

TRL

The surveyed FMP target projects with a higher TRL level (TRL 7-9) that are technologically more advanced and have already commercialised or are about to commercialise their products. In fact, most of the interviewed FMP (apart from two lenders/banks and two private equity/VC providers) and regardless of their type do not consider projects with a TRL below 5.

[74] Please note that percentages may not add up to 100% due to rounding of decimals. On TRL, one response refers to one FMP covering a given TRL (as FMP generally cover more than one TRL, the number of responses exceeds 16).

Ticket Size

Figure 20 below provides additional detail on the preferred ticket size.

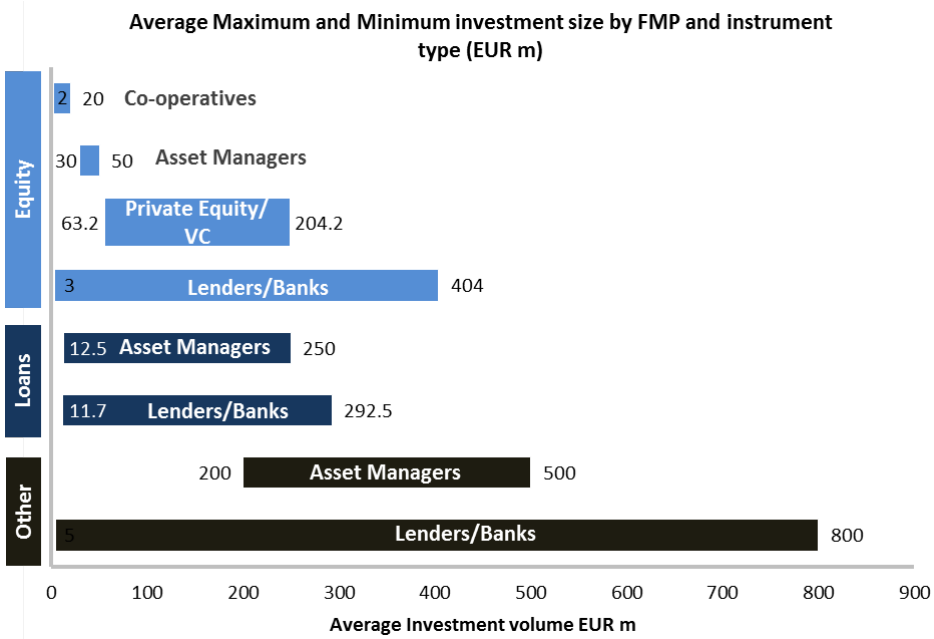


Figure 20: Average minimum and maximum investment volume (EUR m) of FMP (sample: responses provided by 12 FMP)
Source: EY

As shown in **Figure 20,** the ticket size varies depending on the type of investment instrument. Equity is provided by all four interviewed FMP types, whereas loans and other types of instrument are only provided by lenders/banks and asset managers. Equity investments show the highest variation in terms of the offered average investment size, ranging from EUR 2m to over EUR 404m in the case of banks acting as equity investors. Loans range from EUR 11m to nearly EUR 300m. The "Other" category includes the less common reimbursable advances and direct co-investments. For instance, the EUR 800m investment refers to reimbursable advances, covering up to 50% of project costs offered by one of the FMP.

Interest in BBI/BE

81% of the interviewed investors (i.e. 13 FMP) had already invested into BBI and/or BE in the past. Out of these, five had invested only in BBI and four in a mix of BBI and BE projects. Three did not specify which sector they had invested in, and only one FMP indicated a specific BE focus.

In terms of in-house expertise and proactive sourcing capabilities dedicated to the Bioeconomy, four of the interviewed FMP (25%) have dedicated teams/resources to investments in these sectors. To exemplify the nature of such a focus, two of the interviewed private equity players (Private Equity 2, Private Equity 5) were fundraising for dedicated Bioeconomy funds at the time of interview, while one asset manager (Asset Manager 3) was looking to raise up to EUR 20bn for a fund dedicated to climate, water, food and health.

The majority of the FMP sample (56%) invest in BBI and BE as part of their wider activities within the fields of innovation, renewables, biotech, chemicals, cleantech, etc. Two FMP in particular (Bank 1 and Bank 6) were planning to expand their Bioeconomy-related activities gradually via increased exposure to the chemicals sector. As mentioned earlier, three of the interviewed investors have contemplated investing, but not yet invested, in BBI/BE.

4.2 Finding 1: The key drivers for FMPs' interest and investment in the Bioeconomy are its sustainable features and large future growth potential

Key section takeaways:

- When asked about their incentives for investing in BBI and BE projects, the interviewed FMP most frequently mentioned market and demand drivers, in particular those related to the sustainable and innovative dynamic of the Bioeconomy.
- As a result of the perceived high growth potential of the industry, FMP are equally motivated by the related profit prospects and the potential for early mover advantages (when investing early in an industry that is expected to grow significantly).

Related Quotes

"We are attracted by the green dynamic of the underlying market." (Private Equity 3)
"Biomass, no longer pharma, is the future of the biotechnological revolution." (Private Equity 5)
We are looking at this new frontier through the lens of innovation, rather than simply as financial investors. We want to extract synergies between the Bioeconomy and the Circular Economy." (Bank 1)

As can be seen from the detail in **Table 13**, survey responses related to market and demand and the technological and innovative nature of projects can be interpreted together as incentives linked to high market growth expectations that result from the industry's sustainable nature. FMP feedback furthermore suggests that biomass (as opposed to pharma) is expected to play an increasingly important role in the evolution of bio-technology, as well as being an integral part of the Circular Economy – all fields with high expected growth prospects and future potential. One interviewed bank specifically mentioned synergies between the Bioeconomy and the Circular Economy. The bank already has a dedicated Circular Economy policy and is considering BBI/BE as part of this larger initiative.

Type of incentive	Number of responses	Detailed feedback/ driver
Market and demand	4	• Long-term prospects (sustainability) • Long term commitment • Market dynamic • Importance of biomass ("biotech revolution")
Technological and innovative nature of projects	3	• Innovation and support for innovation • Strategic and performance
Returns/profitability	4	• Yield • Financial returns / Profit-driven motivation • Profitability
Regulation	2	• Public and political drivers

Table 13: Types of incentive for investing in BBI/BE projects identified by FMP
(sample: responses provided by 10 FMP)
Source: EY

As a result of the perceived high growth potential of the industry, FMP are equally motivated by the related profit prospects, since being an early investor in a highly developing industry can yield first mover advantages, as mentioned by one FMP: "*We want to make a real impact by investing in innovative companies with a long-term perspective in a capital-intensive sector where it is difficult to find money for investments*" (Private Equity 2).

In terms of sector orientation, most of the FMP interviewed expressed a preference for BBI, rather than BE investments. Of the 10 FMP that provided information on their sector preferences and had already made investments in the Bioeconomy, 50% focused solely on BBI, 40% invested in a combination of BBI and BE, and only one investor focused on BE alone.

All interviewed FMP had a good understanding of the Bioeconomy, having either invested or contemplated investing in the sector. While only 25% of the interviewees had specifically dedicated resources and strong internal know-how of the segment (e.g. such as raising a dedicated Bioeconomy fund), the remainder of the surveyed investors had come across BBI/BE through other related activities, such as BBI/BE-related investments in biotech, cleantech, renewable energy, etc.

4.3 Finding 2: FMP perceive investments into the Bioeconomy as very risky

Key section takeaways:

- Information asymmetry and technology risk limit FMPs' propensity to invest in BBI and BE, steering private capital towards more mature projects.
- The perceived instability of the market and fluctuating demand for BBI and BE products hinder FMP from investing in the sector.
- Regulation and market and demand framework conditions can be important drivers but can also present the biggest risks and challenges for financial market participants to invest in the Bioeconomy.
- BBI and BE projects require significant investment volumes whilst generating unstable revenues and cash flows, increasing the financial risk of investors.

Related Quote

"We have contemplated investing in the industry several times. However, […] the risk turned out to be too high […] and we were unable to de-risk our investments." (Private Equity 4)

Table 14 and **Table 15** below provide an overview of FMP responses in terms of business and financial risk perceptions with regard to investing in BBI and BE, followed by a review of the analysis' findings.

Type of business risk	Lenders/banks		Private Equity/ VC		Asset Managers		Total	
	mentions	%	mentions	%	mentions	%	mentions	%
Operational and technological risks	**3**	33%	**3**	38%	**2**	50%	**8**	38%
Market and demand risk	**2**	22%	**2**	25%	**1**	25%	**5**	24%
Regulatory risk	**1**	11%	**1**	13%	**1**	25%	**3**	14%
Input factor risk	**2**	22%	**0**	0%	**0**	0%	**2**	10%
Tax policies	**1**	11%	**1**	13%	**0**	0%	**2**	10%
Project management/ project promoter risk	**0**	0%	**1**	13%	**0**	0%	**1**	5%
Total	**9**	**100%**[75]	**8**	**100%**[75]	**4**	**100%**	**21**	**100%**[75]

Table 14: Ranking of business risks by number of mentions, by investor type and for the entire sample
Source: EY

[75] Please note that percentages do not add up to 100% due to the rounding of decimals

Type of financial risk	Lenders/ banks		Private Equity/ VC		Asset Managers		Total	
	mentions	%	mentions	%	mentions	%	mentions	%
Risks of large size of CAPEX	1	100%	1	100%	0	0%	2	50%
Risk of low or volatile cash flow	0	0%	0	0%	2	100%	2	50%
Total	1	100%	1	100%	2	100%	4	100%

Table 15: Ranking of financial risks by number of mentions per investor type[76] and for the entire sample (sample: responses provided by 4 FMP)
Source: EY

Business risks were mentioned much more frequently than financial risks (i.e. 21 vs 4 mentions by FMP). Operational and technological risks were highlighted as the key risk to investing in BBI/BE, followed by market and demand risk and regulatory risk. The distribution of risk mentions between the different FMP types was relatively even, with no significant differences noted in the perceived ranking of risks between the different asset classes. Only two types of financial risk were mentioned by investors: the **risk of large size of CAPEX and that of low or volatile cash flows.**

4.3.1 Information asymmetry and technology risk limit FMPs' propensity to invest in BBI and BE, steering private capital towards more mature projects

As already mentioned in the sample overview, irrespective of their investor profile, most of the interviewed FMP clearly indicated a preference for more mature and technologically advanced projects (**Table 16**). Four interviewees explicitly mentioned that they preferred investing in BBI/BE companies that are at a later stage of development, early stage investments being considered too risky. One investor (Private Equity 2) stated that in order to get the attention of investors it is necessary to have a pilot plant or even a demonstration plant that is "up and running". The importance of such a plant to attracting investors has also been pointed out by PP, which in particular underlined the problem of attracting bank lending for demonstration plants, which hinders further financing efforts.

FMP type/ TRL	1	2	3	4	5	6	7	8	9
Lenders/banks	0	1	1	2	2	3	4	4	4
Private equity/VC	0	0	2	2	2	2	3	3	3
Asset Managers	0	0	0	0	1	1	1	2	2
Co-operatives	0	0	0	0	1	1	1	0	0

N.B.: Numbers shown in the table refer to the number of FMP covering each TRL. 48 responses were provided by 10/16 FMP.

Table 16: TRL preferences per FMP category shown by the number of FMP covering each TRL (sample: 48 responses provided by 10 FMP) [77]
Source: EY

Such favouring of later stage, technologically advanced investments goes hand in hand with the FMPs' lack of technological expertise and limited knowledge of the BBI and BE markets.

Related Quotes

"We only take commercial risk – we've never wanted to take any technological risk." (Private Equity 4)

"The more early stage the technology is, the more difficult it is to raise debt on plants." (Bank 6)

Operational and technological risk, with eight explicit mentions by FMP, is the highest ranking risk factor among the interviewed sample. As clearly explained by one private equity player*: "We do not invest in companies that we don't understand"* (Private Equity 6). The lack of technological expertise thus results

[76] The figure covers responses provided by the entire sample. Please note that only 4/16 FMP provided responses. Percentages show the share of total responses provided per FMP type.
[77] The table shows the TRL range for each FMP type according to the feedback provided by FMP.

in the FMPs' inability to evaluate their risk position when investing in the sector, deterring them from pursuing potential opportunities. The information asymmetry also impacts equity investors, who as a result find it difficult to assess the market value of BBI and BE companies correctly (Private Equity 2).
Operational and technological risks were perceived as less of an obstacle to project promoters, who ranked it third, after market and demand and regulatory risks. Project promoters perceived technology risks to have the largest impact on the demonstration plant phase (i.e. TRL of 6-7), which coincides with feedback of investors, who voiced a clear preference of investing at higher TRL levels, i.e. TRL 7 and above (see **Table 16** above).

Related Quote

"Any instrument that could mitigate the technology risk would help attract private capital to the projects." (Private Equity 4)

A potential mitigating factor for technological risk, as highlighted by one FMP (Private Equity 4), is co-investing (rather than being the sole investor) in projects with a higher perceived technology risk. FMP also frequently mentioned the need for co-investment products that would cover the technology risk, a gap that could potentially be filled by PFI.

Identified funding gap:	Moving from pilot to demonstration plant phase (TRL 6-7) – **Funding gap 1**.
Potential mitigants:	1. PFI/co-investors that absorb technology and operational risk; 2. Knowledge dissemination (minimising information asymmetry, i.e. increasing FMPs' understanding of the industry).

4.3.2 The perceived instability of the market and fluctuating demand for BBI and BE products hinder FMP from investing in the sector

Market and demand risk (five explicit mentions by FMP) is the second most frequently mentioned risk by FMP (after technology and operational risk). This risk predominantly refers to the ability of producers to secure reliable off-take agreements for their products and thus ensure stable demand for bio-based products. This is highlighted by a commercial bank that stresses the "*ability for projects to secure long-term supply and off-take contracts at fixed/managed volumes and prices with credible counterparties*" (Bank 6). Another commercial lender provides an example of market demand for bio-refinery products: "*When it comes to market risk from bio-refineries, we need to understand the demand for such a fragmented product*" (Bank 1).

Related Quotes

"We are keen to ensure that the revenues are made with reliable counterparts and that the company has a diversified and reliable customer base." (Private Equity 6)
"Market risk must be taken into account: indeed it is also […] related to the purchasing power of the client." (Asset Manager 1)

Off-take agreements thus play a crucial validating role for investors and project promoters alike, ensuring stable revenues for the company's continuity and cash flow for the debt and equity holders. On the one hand PP have asked for off-take agreements to mitigate market risk and the related financial volatility. On the other hand, the issue also relates to the need to ensure that the entire value chain for a given product is sufficiently developed to allow for sufficient off-takers and thus stable demand for the product. If an innovative BBI/BE product is developed but lacks an end-market, or simply there is no demand for it, then there are no potential customers that would be willing to sign off-take agreements. So there is a need not only for investments into one project or one part of the value chain but rather "global investments" targeted at the development of an entire market or value chain, which could be

facilitated by public bodies with the goal of strenghtening end-demand or balancing the demand-supply dynamics.

Feedstock supply

On the other side of the demand-supply axis lies input factor risk (two explicit mentions by FMP), which is mainly related to the availability of feedstock. In light of this, FMP also report that the lack of cooperation between the various stakeholders in BBI or BE supply chains poses a risk that no single party is willing to take on its own. This may either relate to feedstock such as biomass or end-products of one stage of a value chain serving as an input for another.

Identified funding gap:	Scaling up to flagship/FOAK and to industrial-scale phases (TRL 8-9) – **Funding gap 2**.
Potential mitigants:	1. PFI that absorb market and demand risk; 2. Knowledge dissemination (minimising information asymmetry, i.e. increasing cooperation of the entire value chain).

4.3.3 Regulation and market and demand framework conditions can be important drivers but can also present the biggest risks and challenges for financial market participants to invest in the Bioeconomy

Efficient regulation can play a "market-shaping" role by incentivising demand and supply of BBI and BE products and thus limiting the above-discussed perceived market instability. On the other hand, heavy market intervention can also deter private investors, who are discouraged by external factors they have no control over or visibility on.

Related Quotes

"We will not invest in a project that will have to reply on a decision by the EC about how much bio content needs to exist in a product." (Private Equity 2)
"One important business risk is the impact of regulation on business." (2 FMP)
"We have avoided investing in products that rely on subsidies, because these are not sustainable." (Private Equity 2)

Regulatory risk (three explicit mentions by FMP, third ranking business risk in the survey) relates to the Bioeconomy being perceived as highly regulated and subsidised, which affects the business environment of potential investee companies. Many FMP, as opposed to PP (who tend to see regulation as security for the future development of their market), appear to be not in favour of strongly regulated markets.

On the other hand, investors also report that uncertain and changing regulation may prevent investments (reported by Private Equity 1). Indeed this is backed by a commercial lender who reports that "*key risks are legal stability and a legal pull from regulators (i.e. market pull) such as a green guideline or regulation*" (Bank 2). This statement is in line with PPs' views on regulation as they also ask for a clear commitment by the regulator to green alternatives, for instance as a substitute and replacement for fossil-based products.

Tax Policies

Tax policies at the national level are another relevant business factor that is mentioned by two FMP. In this regard FMP consider the risk of changes in national tax policies on BBI and BE businesses as a potentially deterring factor: "*We do not like businesses that […]are sensitive to tax changes*" (Private Equity 1). FMP feedback on tax policies relates mostly to national-level regulation, suggesting a certain level of investor caution when assessing the risk-return level if it is linked to temporary incentives and therefore volatile.

Identified funding gap:	Entire TRL range considered (**Funding gap 1** and **Funding gap 2**): TRL 6-9
Potential mitigants:	1. Stable and balanced regulatory framework; 2. Knowledge dissemination (minimising information asymmetry, i.e. increasing private-public cooperation and mutual understanding).

4.3.4 BBI and BE projects require significant investment volumes whilst generating unstable revenues and cash flows, increasing the financial risk of investors

Related Quote

"We think that BBI is a very unstable industry, where start-ups generate no revenues, cash flows are uncertain and lead times are long." (Private Equity 4)

The risk of low or volatile cash flows and that of the large volume of capital expenditure required for BBI and BE projects were explicitly mentioned by two FMP each, who additionally pointed to the long lead times impacting the companies' financial health (i.e. the long time between the initial investment and the generation of returns). Payback periods may take five years or more, as pointed out by one private equity investor (Private Equity 1). These financial risks were also underlined by PP, who confirmed that cash flow, liquidity levels and returns are volatile prior to the product being successfully commercialised.

These identified financial gaps inherently underlie the technological and operational, market and demand, and regulatory risks. Uncertainties in these three fields are effectively mirrored in a volatile cash flow and revenue profile of BBI and BE companies.

Identified funding gap:	Entire TRL range considered (**Funding gap 1** and **Funding gap 2**): TRL 6-9
Potential mitigants:	All of the above

4.4 Finding 3: FMP identify two funding gaps faced by BBI and BE project promoters

The analysis of FMPs' key hurdles that deter them from investing in BBI and BE projects as well as their assessment of business and financial risks largely coincides with that of PP. The key difference between the feedback of PP and FMP is that FMP rank operational and technological risk higher than PP. The same funding gaps as those deduced from the PP analysis can be identified:

- **Funding gap 1**, moving from pilot to demonstration plant phase (TRL 6-7) is marked by high technological and operational risks.
- **Funding gap 2**, scaling up to flagship/FOAK and to industrial-scale phases (TRL 8-9) is marked by high market and demand risks.

4.5 Finding 4: Supply side: In terms of funding, financial market participants ask for different and targeted PFI for each funding gap

4.5.1 Investors are aware of existing public financial instruments supporting the Bioeconomy and highlight their catalytic impact

Key section takeaways:

- PFI are known, used, and perceived to have a catalytic impact on private investment. FMP ask for targeted public financial instruments to address each funding gap.
- The features of a contingent loan could help address both funding gaps, mitigating both technology- and market-related risks.
- By pooling both investors' resources and the companies' financial needs, an investment platform could invest at multiple TRL levels, thus also covering lower TRL and riskier projects, which appears more neglected by investors.
- Information asymmetry limits FMPs' propensity to invest in the sector. It could be mitigated with the help of an information exchange platform.
- Hybrid instruments have the potential to particularly address market and demand risks through their risk-absorbing and equity-like features, thus responding to the needs of the second funding gap.

Related Quote

"PFI products such as intermediate loans, guarantees and equity are an efficient system […] it brings comfort to investors and lenders." (Asset Manager 1)

Nine out of the 16 interviewed project promoters indicated knowledge of specific existing public financial instruments that are available for companies in the BBI and BE sectors. Investors also highlighted the reassuring effect of having a public institution's involvement in projects, i.e. validating the soundness and quality of the investment proposal. The EIB, Bpifrance, the World Bank and the CDC (Caisse des Dépôts et Consignations – Deposits and Consignments Fund) were expressly mentioned in this context. Guarantees, debt and equity were mentioned as the PFI with the strongest catalytic effect.

Guarantees (three explicit mentions) are ranked as the top (existing) instrument used by public institutions to finance BBI and BE projects. As such, one private equity investor mentions that through the help of regional governmental schemes in the form of loan guarantees, European projects are able to get the necessary funding to finance the first demonstration plants. In addition to that, EIB support was recognised as beneficial as it has allowed projects to get the necessary funding to move both from the R&D to the demonstration plant phase and from the demonstration plant phase to the commercialisation phase.

Debt funding (two explicit mentions) is another important public financial instrument, although it also received some criticism from FMP. As explained by the co-operative investor, debt instruments offered by the public sector are less flexible than the ones offered by private banks and are subject to more stringent and cautious pricing conditions (indicating that there is more room for negotiation of the various loan terms when dealing with private banks). This feedback has also been voiced by PP who have asked for more flexible funding schemes and the application of a less standardised approach when assessing BBI and BE projects.

Equity funding (two explicit mentions), as opposed to debt funding is perceived by FMP as more risk-absorbing, as by allowing the public party to take a minority stake in BBI and BE companies it also moves a large share of the risk to the PFI. In this regard, Bpifrance was mentioned (Private Equity 4) as an

important institution active in France: Bpifrance is able to invest in private equity funds, thus allowing them to increase their respective investments in BBI and BE companies.

FMP furthermore shared their views on new potential PFI that would be most likely to trigger their investment appetite for the industry. Results of this part of the survey are summarised in **Table 17** below.

Instrument/Mechanism	Lenders/ banks (n=6)		Private Equity/ VC (n=6)		Asset Managers (n=3)		Co-operatives (n=1)		TOTAL (n=16)	
	# Yes/Total	%	# Yes/Total	%	# Yes/Total	%	# Yes/Total	%	# Yes/Total	%
Policy tools or actions	4/6	67%	6/6	100%	2/3	67%	1/1	100%	**13/16**	**81%**
Investment platform	4/6	67%	4/6	67%	3/3	100%	0/1	0%	**11/16**	**69%**
Contingent loan	3/6	50%	5/6	83%	3/3	100%	0/1	0%	**11/16**	**69%**
Hybrid instrument	4/6	67%	2/6	33%	1/3	33%	1/1	100%	**8/16**	**50%**

N.B.: The table shows the support for each type of instrument/mechanism per FMP category. For each FMP category, the table shows the number of FMP in support of the instruments/mechanisms as well as the percentage for that category.

Table 17: FMP support for proposed PFI instruments/mechanisms

Source: EY

Investment platforms and contingent loans to support BBI/BE received strong support from FMP, with 69% of interviewees supporting the development of each mechanism.

Contingent loans are loans with certain terms and conditions (interest, grace period, repayment, amortisation schedule etc) that are dependent/contingent on certain trigger events or milestones. Investment platforms are dedicated financing structures, and co-financing/risk-sharing arrangements that pool together several sources of financing from various investors in order to channel financing and investments in portfolios of projects.

Contingent loans were more favoured by private equity players, with five out of six interviewed equity providers expressing an interest in such PFI, while the investment platform had additional support from banks and lenders. These two solutions were also the most favoured by all three interviewed asset managers.

81% of surveyed FMP indicated their support for policy tools and actions that could improve the understanding of the financial community concerning BBI and BE projects. Such tools and actions could include a contact platform, information exchange, tools and methodologies for risk assessment, or industry labelling standards (see Section 0). This solution was supported by all types of FMP, with in particular every single private equity player interviewed making this suggestion.

The development of hybrid instruments was supported by 50% of the interviewed FMP. Hybrids in this context were defined as schemes that combine different financial instruments, mostly debt and equity, as well as having flexible features (e.g. convertibility from debt to equity or vice versa). In particular, banks and lenders (67%) as well as the co-operative player were supportive of this type of solution, with private equity firms and asset managers displaying more caution.

4.5.2 Contingent loans could attract investors by mitigating both technological and operational as well as market risks, addressing both funding gaps

69% of surveyed FMP indicated their support for publicly-backed contingent loans. Features of contingent loans (e.g. longer grace periods, longer tenor) match the expectations of PP. Indeed, FMP seem to value the involvement of the public sector and the provision of loans. As explained by one asset

manager (Asset Manager 1), contingent loans provided by the EIB could serve as a catalyst to raise private investments by strengthening the credit rating of a company, as they would be treated more like equity by rating agencies.

As highlighted by FMP and PP alike, European programmes and funding schemes are very effective in funding the research and development stage of projects, but when it comes to supporting the more avdanced stages, and notably the commercialisation stages (TRL 8-9), there is insufficient funding available. This has serious implications for job creation. For instance, a European BBI project that received funding for its demonstration plant in Europe, had to move to Canada to get the necessary funding and market to build its commercial production plant (reported by Bank 6). The interviewee who mentioned this case stressed that while R&D funding appears to be well attainable and available in the EU, when it comes to larger capital requirements for the financing of plants, it is easier to secure this type of funding in North America or Asia. These non-EU investors appear to be less risk averse and a larger pool of capital is available for the construction of BBI/BE plants. As a result, both employment and technology are pushed outside of the European Union. It is therefore important to ensure that the direction of EU funding supports the maintenance and construction of plants inside of the EU.

Related Quote

"The EU finances the research and North America and China get the plants […] we believe that we are moving too slowly." (Bank 6)

The most desirable features of publicly-backed contingent loans are summarised in **Table 18** below.

Features	# Mentions/Total	%
Risk absorption	9/16	56%
Low seniority in the capital structure	8/16	50%
Flexibility of terms	7/16	44%
Size of the loans	3/16	19%

N.B.: The table shows the number of FMP for the proposed features of contingent loans as well as the percentage share of the entire sample of 16 FMP

Table 18: Expected features of contingent loans[78]

Risk absorption

Risk absorption is the most desired feature of contingent loans, mentioned by nine FMP. In particular, technology and operational and market and demand risk factors were mentioned explicitly by four FMP each, who wished for contingent loans to mitigate these risks.

Technological and operational risks are an important factor to take into account, as pointed out by a commercial lender (Bank 6) which claims that technology needs to be de-risked for the coming 5-10 years. High technological risk characterises in particular **Funding gap 1** when attempting to raise funds for building a demonstration plant.

Market and demand risks were ranked as equally important factors. FMP expect a contingent loan to be able to mitigate the risk of market shortfalls or fluctuations in prices. In this regard three FMP ask for a guarantee to cover the risk of non-performance of a business – a risk the private sector is less able to cover according to investors. High market and demand risk characterises **Funding gap 2** when commercialising a new product**.**

[78] Please note that the percentages show the share out of 9 FMP

Related Quote

"With a contingent loan from the EIB a market shortfall due to price movements or other risks can be financed. This would improve the risk analysis and be catalytic." (Asset Manager 1)

Junior positioning in the capital structure

In terms of seniority of the instrument, eight FMP mentioned a desired junior positioning of the contingent loan, similar to that of equity or venture debt (i.e. subordinated, having a lower repayment priority). Such equity-type features would allow for the absorption of market and demand risks which result in the volatile financial profile of BBI and BE projects that is particularly impacting **Funding gap 2**. A junior position in the capital structure could thus have a catalytic effect, attracting more senior capital from private sources.

Flexibility

In terms of flexibility of the contingent loan, FMP particularly expect specific reimbursement conditions such as lower costs and longer tenors than the ones currently on offer. Furthermore, specific conditions (covenants) attached to the contingent loan were mentioned by two FMP. These conditions should be less stringent than the ones asked for by commercial lenders, or be linked to the achievement of project milestones (e.g. loan repayment dependent on milestone achievement). Such flexible structuring would particularly address market and demand risks, filling **Funding gap 2**.

Funding gaps covered:	**Funding gap 1** **Funding gap 2**
Risk mitigated:	1. Technology and operational risk; 2. Market and demand risk.

4.5.3 An investment platform could attract investors by mitigating technological and operational, market and demand, as well as regulatory risks, addressing both funding gaps

69% of surveyed FMP indicated their support for a publicly-backed investment platform. Such a platform could pool BBI and BE projects' financing needs using a dedicated vehicle partially supported by public capital[79]. An investment platform could offer structured products (e.g. participation in loan/bond portfolios with a diffused risk) tied to investments in BBI and BE projects ensuring that risks are absorbed by the public side.

By pooling investors' resources as well as pooling the companies' financial needs, an investment platform could invest at lower TRL levels (e.g. TRL 6) which are otherwise often deemed too risky for FMP to invest in on their own (due to the high technology and operational risk characterising **Funding gap 1**). Through the pooling mechanism an investment platform could simultanously invest at higher TRL levels (e.g. TRL 8-9), which might otherwise face different issues attracting funding especially due to market and demand risks, as well as the large capex requirements (especially in BBI projects), both characterising **Funding gap 2.** Furthermore, a dedicated investment platform could be expected to signal to the market tangible support for BBI and BE activities that are still suffering from the reluctance of policy makers (reported by Bank 6), thus also mitigating regulatory risk.

From the perspective of FMP, the presence of public capital (e.g. from the EU) serves as a first-loss absorber, reducing the risk exposure of indivual private investors participating in the scheme. Both the first-loss piece mechanism and the participation of a reputable financial institution could provide an additonal level of credit enhancement (potentially in the form of guarantees) and thus improve the capital ratios of FMP investing in it (Asset Manager 1). Addditional benefits to investors include reduced

[79] Public capital from the EU could serve as first-loss absorber, up to a certain percentage of the investment size of the portfolio of projects, thereby lowering the investment risk for investors.

(shared) investment costs, such as transaction and information costs as well as risk diversification across a portfolio of sectors, TRL levels and geographies.

FMP that expressed support for the creation of an investment platform are in some cases already participating in other similar mechanisms. A commercial bank interviewed (Bank 1) for example is a member of an investment platform dedicated to the agribusiness sector, while a private equity player (Private Equity 2) even offered to act as a fund manager for public funds.

In terms of key features of an investment platform desired by FMP, three characteristics can be distinguished: investment size, cost and risk-sharing, as per below.

Investment Size

The investment size required from participating FMP is an important factor, as one interested commercial bank mentions that the size cannot be too big in terms of debt. This highlights the fact that the platform should allow for various sizes of investor contribution to the scheme so as to not exclude potential interested FMP. A ticket range of EUR 10-30m per investors was mentioned as adequate (reported by Private Equity 2).

Cost

The cost of funding provided by an investment platform should be below that offered by private equity providers, as explained by one FMP (Private Equity 2). The funds should, however, be dedicated to covering specific risks. Once the interest/yield range has been set (the investor expects a yield range of between 5% and 10%), additional warrants or other methods of remuneration could be introduced. Pension funds could be key participants and providers of private capital, given that such actors are motivated by structured products and yield.

Risk absorption

Risk-sharing among investors (both public and private) and between projects is welcomed by investors as *"this would provide access to finance to projects that may be too risky for investors on a stand-alone basis [and] it would save investors' time and due diligence costs and spread the risk"* (Asset Manager 3). However, the risk-sharing mechanism needs to be clearly understood by participants to prevent investors from being exposed to projects that are out of their control.

Investment platform design

FMP also provided valuable feedback on the design of a potential investment platform, with the goal of maximising crowding-in effects. In particular, the need for simplicity in design and avoiding over-complicating the investment process was pointed out. The other most frequently mentioned point was to avoid crowding out private investors. A private equity player (Private Equity 5) argued that direct investments by investors into projects (i.e. outside a platform) could allow for a more direct and less complex investment process. This point is also highlighted by an asset manager who sees the need to define boundaries for the platform as *"[…] some projects would be better off funded by a single investor"* (Asset Manager 3).

Funding gaps covered:	Entire TRL range considered (**Funding gap 1** and **Funding gap 2**): TRL 6-9
Risk mitigated:	1. Technology and operational risk; 2. Market and demand risk; 3. Regulatory risk.

4.5.4 An information exchange and knowledge sharing platform connecting investors could catalyse additional investment by mitigating information asymmetry

81% of surveyed FMP indicated their support for policy tools and actions that could improve the understanding of the financial community concerning BBI and BE projects. This appears particularly relevant in light of the reported lack of private FMPs' knowledge and understanding of BBI and BE projects that may for instance lead to a lack of interest in investing or high funding costs (as FMP have

difficulties assessing BBI and BE-specific risks). **Table 19** below presents FMPs' feedback on four different types of potential tools and actions.

Interest in tools and actions	# Mentions/Total	% (16 FMP)
Contact platform	8/16	50%
Methodologies or tools	7/16	44%
Labelling standards	3/16	19%
Awareness campaign	2/16	13%

N.B.: The table shows the number of FMP interested in "tools and actions" as well as the percentage for each category

Table 19: FMPs' interest in tools and actions [80]

Source: EY

Contact platform

50% of FMP were in favour of an interface allowing PP and industry experts as well as financial market participants to create relationships and leverage on an exchange of information. One investor mentioned that such services are much appreciated by operating teams and banks (Co-operative 1). Additionally, five FMP stated that such a platform would allow them to strengthen relationships with market participants and find partners as well as sharing investment opportunities. More specifically a commercial investor (Bank 6), pointed out that a contact platform could help to discuss two constraints faced by BBI projects: "*Firstly the misunderstanding about bio-fuels and food security and secondly the concern around bio-technology.*" Finally, a contact platform could allow for the mitigation of some of the regulatory risk by increasing the information flow by means of networking.

Methodologies and tools

44% of FMP were in favour of methodologies and tools that could include assistance in assessing the economic and financial risks faced by innovative BBI and BE projects through technology transfer providers as well as public financial institutions. This appears particularly important in light of both PP and FMP reporting a general lack of understanding of the industry among investors (information asymmetry). FMP also expressed their interest in the expertise of public financial institutions regarding specific markets and sectors, as well as the need to educate relevant market participants.

Related Quotes

"We are interested in the analysis made by experts at public institutions. For example we frequently rely on Bpifrance's expertise in the commodities sector." (Private Equity 6)

"Banks should be educated. Lending teams should liaise with the PE coverage teams to gain a better understanding of lending in the private equity context." (Private Equity 3)"

Funding gaps covered:	Entire TRL range considered (**Funding gap 1** and **Funding gap 2**): TRL 6-9
Risk mitigated:	1. Information asymmetry: a. Increasing FMP understanding of the industry; b. Increased cooperation of the entire value chain; c. Increased private-public cooperation and mutual understanding.

[80] Please note that the percentages show the share out of 9 FMP.

4.5.5 Flexible hybrid instruments attract investors by absorbing equity-type risk and mitigating market and demand risk, especially in the second funding gap

50% of surveyed FMP indicated their support for hybrid instruments, which in this context have been defined as schemes that combine different types of financing, mostly debt and equity, as well as having flexible features (e.g. convertibility from debt to equity or vice versa) [81]. Such flexibility combined with the equity-type risk absorption would mitigate the market and demand risk as well as addressing the needs of **Funding gap 2**. The equity features (i.e. low positioning in the capital structure and no repayment of principal/interest as in the case of debt) allow for more flexibility in terms of stable cash flow generation requirements of investors than in the case of debt, thus presenting a more patient type of capital, with a higher tolerance for demand fluctuations.

Most support for this type of PFI was expressed by banks who would wish to see their debt investments balanced by stable hybrid/equity capital. Furthermore a private equity investor (Private Equity 2) points out that funding beyond the R&D stage requires more instruments than just equity to fund the first pilot (demonstration plant) and at a later stage the industrial full-scale plant. In this regard, the investor claims that "*there is a real need to be creative and find ways to finance these steps – from lab to pilot and to industrial scale*." This feedback is also mirrored by PP, who have asked for a specific hybrid instrument dedicated to funding the "up-scaling process".

Avoiding the crowding-out effect

In terms of the expected features for the hybrid instrument, the conversion flexibility was welcomed by FMP in the context of providing downside protection. Equity investors, however, stressed the importance of maintaining a fair risk-return profile, allowing the early risk-taking equity investors to benefit from the full upside potential. The undesirable potential impact of dilution effects was mentioned by four FMP. To illustrate, an instrument (e.g. convertible bond) that is deployed as debt at the early investment stages, if converted to equity once the risk is reduced, would crowd out (i.e. decrease the relative ownership) of existing shareholders, thus reducing their total return on investment. Thus, it is suggested that PFI should be designed in a way that protects some of the downside, but doesn't cap the upside potential of private investors.

Related Quote

"One vehicle should not be investing in equity and debt simultaneously because other equity holders don't want to be crowded out" (Private Equity 5)

Funding gaps covered:	**Funding gap 2**
Risk mitigated:	1. Market and demand risk

[81] As such, hybrid instruments (also contingent loans) are a type of capital along the spectrum of debt and equity. In contrast, in the context of this study an investment platform is defined as an overarching mechanism. It pools FMP investments, while the type of capital provided to the end beneficiary (project or company) can take different forms (i.e. including debt, equity, contingent loans, and hybrid instruments).

4.5.6 Summary recommendations of FMP

Table 20 below summarises the FMP feedback received on the design of new or modified PFI.

Instruments/Tools proposed	FMP support	Funding gaps covered	Risks mitigated
Contingent loan	69% (11 FMP)	Funding gap 1 Funding gap 2	• Technology and operational risk • Market and demand risk
Investment platform	69% (11 FMP)	Funding gap 1 Funding gap 2	• Technology and operational risk • Market and demand risk • Regulatory risk
Information exchange platform	81% (13 FMP)	Entire considered TRL range	• Information asymmetry
Hybrid instrument	50% (8 FMP)	Funding gap 2	• Market and demand risk

Table 20: FMP feedback received on the design of new or modified PFI
Source: EY/EIB

Contingent loans, suggested by 69% of interviewed FMP, could help fill both identified funding gaps by mitigating technology and operational, as well as market and demand risks. Through the introduction of equity-like features (i.e. junior positioning in the capital structure), such loans have the potential to attract additional private capital by effectively de-risking the investment profile of private investors. Flexible structuring of the loans (e.g. repayment linked to the achievement of certain milestones) could additionally address market and demand risk, directly linking the projects' cash flow to market demand.

The features of an investment platform, put forward by 69% of FMP, could address the needs of the entire TRL range considered, helping to mitigate both the first and second funding gaps. Projects in these funding gaps feature particularly high technology and operational risks and/or high demand and market risks, as well as regulatory risks. By pooling both investors' resources and the companies' financial needs, this mechanism could invest across a wide TRL range, which may otherwise be deemed too risky for individual investors who usually focus on a more narrow range of the market. The capital provided through the investment platform mechanism can equally take a junior position in the capital structure, triggering similar crowding-in effects as in the case of contingent loans.

81% of interviewed investors were in favour of the development of an information exchange platform. Such a mechanism could help address the challenge of information asymmetry. By providing investor-relevant information as well as an outlet for exchange (between PP, FMP and regulators), effectively all identified risks could be mitigated, given that the increased flow of information could limit perceived industry uncertainties of all stakeholders.

Finally, hybrid instruments, backed by 50% of interviewed FMP, have the potential to particularly address market and demand risks through their risk-absorbing and equity-like features. As per FMP feedback, any convertible instrument (e.g. convertible from debt to equity or vice versa) should be carefully designed to ensure downside protection of private investors, without however limiting its upside potential.

5 ANALYSIS AND FINDINGS – PUBLIC FINANCIAL INSTRUMENTS TO SUPPORT BBI AND BE

Sections 3 and 4 highlighted the multiple factors that have led to a significant funding gap in the Bioeconomy sector. In spite of the high market growth expectations, both project promoters and financial market participants have expressed the view that the sector remains relatively immature due to the nascent character of most BBI and BE-related technologies, high market and demand fluctuations and the uncertainty about existing regulatory frameworks. Furthermore, investments in the sector are capital-intensive, with substantial technology, financial, operational and regulatory risks. The findings have shown that while the sector is very dynamic, the majority of European funding programmes remains focused on the R&D and early innovation stages. The analysis has highlighted the funding gap in support for the scale-up of early innovations from pilots to demonstration/first-of-a-kind plants and the final step towards the industrial production and commercialisation of Bioeconomy products and services. Due to these factors and the existing lack of financing from the private sector, the BBI and BE sectors are highly dependent on support from public financing.

The importance of public financing for the BBI and BE sectors is further highlighted by the high degree of knowledge of PFI both among project promoters and financial market participants interviewed. 42% of the 43 project promoters surveyed have used a public financial instrument in the past. Awareness of existing funding instruments among project promoters is very high: 94% of interviewees knew that (in general) funding for the Bioeconomy on the EU level existed, while 83% indicated some degree of knowledge of national level funding. Of the 16 FMP interviewed, nine (56%) indicated knowledge of existing PFI (in particular private equity players and banks).

5.1 Scope and overview

Key section takeaways:

- In terms of geography:
  - Of the EU countries analysed, Finland, Germany and Sweden appear to have the most developed local Bioeconomy sectors, with strong national strategies, the existence of important biomass resources and visible government-led incentives that encourage the development of the Bioeconomy.
  - Outside of the European Union, the USA and Canada have well established national strategies, abundant biomass resources and corresponding incentives.
  - The Netherlands and Malaysia stand out as economies with limited local biomass resources but strongly developed national Bioeconomy strategies.
- In terms of funding type:
  - Grants are the principal mechanism used to support the BBI and BE sectors. In fact, each of the 15 countries analysed has a relevant grant programme.
  - There is more limited availability of financial instruments, including loans, venture capital and equity financing in both EU and non-EU countries.
  - Non-EU countries have developed a broader mix of financial instruments, including subsidised loans, guarantees and tax incentives to support the BBI and BE than in EU countries and at the pan-EU level.

Methodological Notes

This chapter summarises the findings of the mapping of public financial instruments to support the Bioeconomy prepared by the consultant. It analyses to what extent the existing PFI provide sufficient financing for all stages of development of the BBI and BE sectors at the pan-EU level, in EU countries and in non-EU countries.

Every effort has been made to apply equal weight to the review of both Blue Economy and Bio-based Industries, but it should be noted that EY's review of the existing toolbox was geared towards BBI, which may thus result in a mapping overview predominantly reflecting BBI, and to a lesser extent BE, policies within the scope analysed.

Please also note that the financing mechanism of NER300 has been analysed but is not extensively detailed in this section, given its focus on only innovative "renewable energies" demonstration projects (e.g. bio-energy, bio-fuels) and CCS demonstration projects.

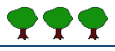
The presented analysis of the different national policies/regulations assesses their impact on the availability of PFI at the European, EU country and non-EU country levels and provides a set of findings about the main access-to-finance issues faced by the Bioeconomy sector.

5.1.1 Geography

As discussed in Section 2 (Methodology), a series of criteria were applied to the selection of countries included in the mapping sample. As a result, the mapping of PFI covers:

- Nine EU countries (Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, UK);
- Six non-EU countries (Brazil, Canada, China, India, Malaysia, USA);
- The EU as a whole.

Table 21 below summarises the findings of the country assessment performed by EY in terms of the relative strength of the national Bioeconomy sector based on the following criteria: (i) existence of a national Bioeconomy strategy, (ii) important biomass resources, and (iii) visible incentives in the BBI and BE sectors.

EU Countries	a. National Bioeconomy strategy	b. Important biomass resources	c. Visible incentives in BBI/BE
Finland			
Germany			
Sweden			
Netherlands			
Italy			
France			
Spain			
United Kingdom			
Poland			
Non-EU Countries	**a. National Bioeconomy strategy**	**b. Important biomass resources**	**c. Visible incentives in BBI/BE**
Canada			
USA			

Brazil			
India			
China			
Malaysia			
Legend for (ac) and (c):  : well established  : under construction  : starting  : abundant resources  : moderate resources  : limited resources			

Table 21: Country assessment in terms of the strength of the national Bioeconomy sector and existing PFI instruments, performed by EY.
Source: EY

Of the EU countries analysed, Finland, Germany and Sweden appear to have the most developed local Bioeconomy sectors, with strong national strategies, the existence of important biomass resources and visible government-led incentives that encourage the development of the Bioeconomy. Outside of the European Union, the USA and Canada have well established national strategies, abundant biomass resources and corresponding incentives. The Netherlands and Malaysia stand out as economies with limited local biomass resources but strongly developed national Bioeconomy strategies.

5.1.2 Funding type

In order to obtain the broadest possible overview of the available types of PFI, no particular instruments were specifically excluded from the study scope, except for a limitation on tax incentives.

- Tax incentives are included only in the assessment of non-EU countries, given their incompatibility with European Community law as well as methodological restrictions in the identification of BBI/BE-specific tax incentives at Member State (MS) level.

Table 22 below provides an overview of the principal funding mechanisms available at the pan-EU level, EU country and non-EU country levels in support of the Bioeconomy.

# of countries where PFI is identified (/ out of # countries analysed)	EU Countries	Non-EU Countries	Total	EU Level
Grants	9/9	6/6	15/15	√
Loans	7/9	6/6	13/15	√
Subsidised loans	2/9	3/6	9/15	n/a
Equity	3/9	2/6	6/15	√
Venture capital	4/9	2/6	6/15	√
Guarantees	n/a	2/6	2/15	√
Tax incentives	n/a	4/6	5/15	n/a
Cooperative agreements	n/a	2/6	2/15	n/a
Royalty agreements	n/a	1/6	1/15	n/a
Hybrid schemes	n/a	3/6	3/15	n/a

Table 22: Summary of the mapping exercise of public financial instruments performed by EY
Source: EY Data.

Notes:
EU countries include: Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, UK.
Non-EU countries include: Brazil, Canada, China, India, Malaysia, US.
Loans identified in: Finland, France, Germany, Netherlands, Italy, Spain and UK and all non-EU countries.
Subsidised loans identified in: Italy, Spain, Canada, China and India (zero interest loans for Canada and India).

Subordinated loans identified in: Germany, Finland. Guaranteed loans identified in Brazil, US.
Venture capital identified in: France, Spain, Poland, Netherlands, China and US.
Equity identified in: France, UK, Spain, Netherlands, Canada and China.
Guarantees identified in: Brazil, US.
Tax incentives identified in: Canada, China, India, and Malaysia. Tax incentives not included in the scope of the study at EU level.
Hybrid schemes identified in: Canada, Malaysia and India.
Cooperative agreements identified in: Canada and India.

The table shows that grants are the principal mechanism used to support the BBI and BE sectors. In fact, each of the 15 analysed countries has a relevant grant programme. The table furthermore shows the somewhat limited availability of financial instruments, including loans, venture capital and equity financing in both EU and non-EU countries. It highlights the fact that non-EU countries have developed a broader mix of financial instruments, including subsidised loans, guarantees and tax incentives, to support the BBI and BE than in EU-countries and at the pan-EU level. As found by the analysis completed by EY, not only do most of the countries covered in the scope of the mapping have either a well-established national Bioeconomy strategy or are currently developing such a strategy, but these are furthermore supported by both public funding as well as non-financial assistance.

5.2 Finding 1: Bioeconomy strategies are a key trigger for providing PFI, which are widely used both within and outside the EU

Key section takeaways:

- At EU country level the most advanced and targeted programmes supporting the BBI and BE sectors are those that have also developed a national and/or regional Bioeconomy strategy and the establishment of national coordinating agencies.
- Numerous funding programmes and PFI are available both at pan-EU and at national levels in EU countries that provide larger amounts of funding.
- Some of the EU's key programmes for the support of the Bioeconomy include Horizon 2020 and notably its Societal Challenge on "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy" (with a EUR 3.8bn budget for the whole Bioeconomy, including BBI and BE, over 2014-2020).
- Within Horizon 2020, programmes such as InnovFin, SME Instrument, and Fast Track to Innovation (FTI) can contribute to the Bioeconomy. Other relevant EU-level programmes include EFSI and ESIF.

Advanced and targeted funding programmes supporting the BBI and BE sectors are found in those countries that have also developed a national Bioeconomy strategy and established coordinating agencies. In this regard, EU-level policies and the EU institutional framework (policy support and provision of PFI) have particularly strong visibility and impact. The critical role that the EU plays in providing public financing for the Bioeconomy sector was also confirmed during the interviews, since 100% of project promoter respondents consider EU-level incentives to be instrumental in triggering the provision of financing to BBI and BE, in particular in the form of grants to support R&D-intensive activities.

At the MS level, Germany, Finland, the Netherlands and Sweden are among the more advanced countries in Europe in terms of having developed a specific Bioeconomy strategy and supporting PFI, as shown in Table 21. In comparison, outside of Europe, the US and Canada are the countries with the more advanced national Bioeconomy strategies and PFI.

5.2.1 EU's Bioeconomy strategy

In 2012 the European Commission adopted the EU Bioeconomy Strategy[82] called "Innovating for Sustainable Growth: a Bioeconomy for Europe"[83] . The EU Bioeconomy Strategy reveals the European Union's significant commitment to support the development of a Bioeconomy (including Bio-Based Industries (BBI) and part of the Blue Economy (BE)), at the EU, national and regional levels. It aims to "*pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection*"[84]. **The EU Bioeconomy Strategy** consists of two documents:

- (1) A communication document presenting the strategy and the action plan to achieve the following three identified priorities: (i) investing in research, innovation and skills, (ii) reinforcing policy interaction and stakeholder engagement, and (iii) enhancing markets and competitiveness in the Bioeconomy.
- (2) An accompanying document presenting a detailed version of the action plan. It also presents background information, facts and concrete examples that demonstrate the importance of the EU Bioeconomy Strategy in addressing some of the EU's major societal and economic challenges.[85]

Regarding the **Blue Economy (BE)**, the European Commission has set out The Blue Growth Strategy[86] to contribute to the Europe 2020 Strategy, based on three pillars:

  - Develop sectors that have a high potential for sustainable jobs and growth: aquaculture, coastal tourism, marine bio-technology, ocean energy, seabed mining;
  - Essential components to provide knowledge, legal certainty and security in the Blue Economy: marine knowledge, maritime spatial planning, integrated maritime surveillance (excluded from the scope of this study);
  - Sea-basin strategies to ensure tailor-made measures and to foster cooperation between countries: Adriatic and Ionian Seas, Arctic Ocean, Atlantic Ocean, Baltic Sea, Black Sea (excluded from the scope of this study).

At EU level, the main EU **public funding schemes from which research and innovation projects in BBI and/or BE can benefit are the Horizon 2020 programmes/initiatives dedicated to these sectors, amongst which notably:**

- **The Work Programmes related to the Societal Challenge "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy" of Horizon 2020**:
  This Societal Challenge is strongly related to the implementation of the EU Bioeconomy Strategy, making available around EUR 3.8bn of funding for the Bioeconomy over 2014-2020 (including a contribution of around EUR 825m to the BBI JTI, accounting for most of the Horizon 2020 EUR 975m contribution to this initiative, see below), mainly via grants awarded following calls for proposals. In the case of Research and Innovation Actions or Coordination and Support Actions, grants cover up to 100% of a project's total eligible costs. In the case of Innovation Actions[87], grants cover up to 70% of a project's total eligible costs (except for non-profit legal entities, where they cover up to 100% of these costs).

[82] Under the lead of the European Commission's Directorate-General for Research and Innovation, the strategy was co-signed by the European Commission's Directorate-Generals for: Agriculture and Rural Development; Environment; Maritime Affairs and Fisheries; Internal Market, Industry, Entrepreneurship and SMEs.
[83] Innovating for Sustainable Growth: A Bio-economy for Europe, 13/02/2012
URL: http://ec.europa.eu/research/bioeconomy/pdf/201202_innovating_sustainable_growth_en.pdf
[84] *Ibid*
[85] The seven societal challenges addressed by the Europe 2020 strategy are: Health, demographic change and wellbeing; Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, environment, resource efficiency and raw materials; Europe in a changing world - inclusive, innovative and reflective societies; Secure societies - protecting freedom and security of Europe and its citizens.
European Commission, official website: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges
[86] Commission Communication: Blue Growth opportunities for marine and maritime sustainable growth COM(2012)0494 final, and Commission Communication: Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth COM(2014)254/2.
[87] The definitions of the types of action (e.g. Innovation Actions) are included in the General Annexes of Horizon 2020 Work Programmes.

The following initiatives/programmes should be understood as being partly funded by the Societal Challenge "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy", but also by other parts of Horizon 2020.

- **The Bio-based Industries Joint Technology Initiative (BBI JTI), implemented by the Bio-based Industries Joint Undertaking** (only relevant for BBI):
  This is the flagship initiative under Horizon 2020 for BBI. It is a EUR 3.7bn **Public-Private Partnership** (PPP) between the EU and the Bio-based Industries Consortium (BIC). Nearly EUR 1bn (EUR 975m, of which around EUR 825m come from the EUR 3.8bn budget of the aforementioned Societal Challenge, and EUR 150m from the Leadership in Enabling and Industrial Technologies (LEIT) part of Horizon 2020) of EU funding from Horizon 2020 will be mobilised for this initiative over 2014-2020[88], which is expected to leverage (at least) EUR 2.7bn of private financing. Its goal is to support the development of bio-based industries in the EU by awarding grants, via calls for proposals[89], to research and innovation projects (ranging from lab projects to first-of-a-kind flagship commercial plant projects) and to coordination and support projects in bio-based industries. The **Bio-based Industries Joint Undertaking (BBI JU)** was established in 2014[90] to implement this initiative up until end 2024. Under this initiative, grants are available for projects in the range of TRL 3 to TRL 8. In the case of Research and Innovation Actions or Coordination and Support Actions, grants cover up to 100% of a project's total eligible costs (except for large industries that are not eligible for reimbursement for such Actions). In the case of Innovation Actions, grants cover up to 70% of a project's total eligible costs (except for non-profit legal entities, where they cover up to 100% of these costs).

- **Funding supporting the Blue Economy** including: the "Sustainable Food Security" and "Blue Growth" calls, which made available EUR 74m and EUR 272m respectively to relevant companies and projects (including contributions from other parts of Horizon 2020) in the years 2014-17. In the Blue Growth cross-cutting area of Horizon 2020, the trend was to move from unlocking the potential of seas and oceans to demonstrating technologies close to the market for jobs in high-value sectors of the economy – the number of Innovation Action topics has increased from 5% to 25% and the budget allocated to SMEs has increased from EUR 9m to EUR 20m).

Other EU public funding schemes, that are not specifically dedicated to BBI and/or BE, and from which certain BBI and/or BE projects could benefit provided they are compliant with these schemes' requirements or eligibility criteria, include amongst others[91]:

- The SME instrument (under Horizon 2020):
  The SME instrument "supports close-to-market activities, with the aim of giving a strong boost to breakthrough innovation. Highly innovative SMEs with a clear commercial ambition and a potential for high growth and internationalisation are the prime target"[92]. The SME instrument has been provided with about EUR 3bn of funding (all thematic sectors) under Horizon 2020 over 2014-2020. Although the SME instrument is not dedicated to BBI and/or BE, certain of the topics of its work programmes could specifically target parts of these sectors. The SME instrument offers small and medium-sized enterprises phased support, involving business innovation grants for feasibility assessment of a project (up to EUR 50 000 in this optional first phase) and for innovation development and demonstration purposes (up to EUR 2.5m in this second phase of support), as well as access to a wide range of innovation support services and "innovation and business development" coaching.

[88] Horizon 2020 funding devoted to this initiative over 2014-2020 will be used to implement it up until end-2024.
[89] More information available on BBI JU's official website, URL: http://www.bbi-europe.eu/participate/participate
[90] The BBI JU reached the capacity to operate autonomously in October 2015.
[91] This list is not meant to be exhaustive and may not include some new (non-thematic) EU public funding schemes that would have been launched after the conduct of the analysis of PFI presented in this study.
[92] Source: SME instrument official website, URL: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/sme-instrument

- Risk-sharing financial schemes, for instance:
  - EU Finance for Innovators (InnovFin):
    InnovFin is a joint initiative launched in 2014 by the European Commission (under Horizon 2020) and the European Investment Bank Group (EIB and EIF). It consists of a new generation of EU financial instruments (some of them involving financial intermediaries) and advisory services to help innovative firms access finance more easily, supporting research and innovation investments from the smallest to the largest firms[93]. It is making available EUR 24bn of financing (all sectors) over 2014-2020, for instance via loans, loan guarantees and equity investments[94], and is expected to support, when taking into account private financing attracted into projects, up to EUR 48bn of final research and innovation investments. However, with regard to BBI and BE, it is to be noted that InnovFin products currently only accept lower risk levels than those typically found in most BBI and BE projects[95].

  - Financial instruments under the EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME):
    COSME is an initiative targeted at SMEs and launched by the European Commission, running over 2014-2020. Part of this initiative concerns improving access to finance for SMEs, which is done through two financial instruments, the Loan Guarantee Facility (LGF) and the Equity Facility for Growth (EFG) [96], launched in 2014 and managed by the European Investment Fund (EIF). Their goal is to help interested financial intermediaries (e.g. a bank) make more financing available to SMEs. COSME has a total budget of EUR 1.3bn (all sectors) to fund these financial instruments over 2014-2020, which is expected to lead to a total value of lending (via the LGF) to SMEs ranging between EUR 14bn and EUR 21bn, and to an overall amount of equity investments (via the EFG) in SMEs of EUR 2.6bn to EUR 4bn. Besides supporting their access to finance, COSME also help SMEs by: supporting their access to markets, supporting entrepreneurs and aiming to improve their business conditions[97]. However, with regard to BBI and BE, it is to be noted that COSME products currently only accept lower risk levels than those typically found in most BBI and BE projects.

  - The European Fund for Strategic Investments (EFSI):
    EFSI is a joint initiative launched in 2015 by the EIB Group and the European Commission to help overcome the current investment gap in the EU by mobilising private financing for strategic investments[98]. "EFSI is one of the three pillars of the Investment Plan for Europe, which aims to revive investment in strategic projects around Europe to ensure that money reaches the real economy"[99]. The EC and EIB Group contribution to EFSI guarantees has so far been set at EUR 21bn, and is expected to generate EUR 315bn of total investments within three years[100]. However, with regard to BBI and BE, it is to be noted that EFSI currently only accepts lower risk levels than those typically found in most BBI and BE projects.

[93] More information available on InnovFin's websites, URL: http://www.eib.org/products/blending/innovfin/ ; https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance
[94] Projects seeking access to finance under InnovFin can use the dedicated interactive procedure ("6 simple steps to loan funding") to determine which InnovFin product would suit them best:
URL: http://www.eib.org/products/helpingyouinnovate/index.htm?launchtool
[95] BBI projects focusing on bio-fuels (at TRL 7/8) could however fall within the scope of the InnovFin thematic facility "InnovFin Energy Demo Projects", which accepts higher risk levels.
[96] More info available on URL: https://ec.europa.eu/growth/access-to-finance/cosme-financial-instruments_en; http://www.eif.org/what_we_do/guarantees/single_eu_debt_instrument/cosme-loan-facility-growth/index.htm ; http://www.eif.org/what_we_do/equity/single_eu_equity_instrument/cosme_efg/index.htm
[97] More information available on COSME's official website, URL: http://ec.europa.eu/growth/smes/cosme/
[98] More information available on EFSI's websites, URL: http://www.eib.org/efsi/ ; https://ec.europa.eu/priorities/jobs-growth-and-investment/investment-plan_en
[99] Source: http://www.eib.org/efsi/what-is-efsi/index.htm
[100] The European Commission recently proposed increasing EFSI's size and duration. The EFSI guarantee from the EC and EIB Group would reach EUR 33.5bn, with the target that it would mobilise an investment total of EUR 500bn by 2020.

- European Structural and Investment Funds (ESIF):
  The EU Cohesion Policy is "the European Union's strategy to promote and support the overall harmonious development of its Member States and Regions. The policy is implemented by national and regional bodies in partnership with the European Commission"[101]. It is delivered through the European Structural and Investment Funds[102] [103], with a total budget of EUR 454bn over 2014-2020. For instance, the European Maritime and Fisheries Fund (EMFF), one of the ESIF, offers EUR 6.4bn for 2014-2020, of which EUR 71m is dedicated to the Blue Economy programme[104]. 89% of all the EMFF funds are managed by Member States and the remaining 11% by the European Commission. It is also to be noted that EU maritime regions are already using Smart Specialisation Strategies to identify EU funding priorities including Blue Growth. More than 50 regions or countries in the EU have prioritised the Blue Growth sector in their Smart Specialisation Strategies[105]. It is also to be noted that the Horizon 2020 programme, and notably its Societal Challenge of "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy", which is especially relevant to BBI and BE, provides opportunities for national and regional stakeholders to participate in research and innovation projects. The variety of funds dedicating part of their support to research and innovation at EU, national and regional level for 2014-2020 created the need to ensure coherence and coordination between them. To this end, the new EU Regulatory Framework[106] for 2014-2020 calls for synergies and complementarities among various EU policies and funding streams, in particular between ESIF and Horizon 2020.

Project Promoter Feedback on EU funding

As analysed in **Section 3**, while EU funding has proven to be instrumental to the development of the Bioeconomy (according to both PP feedback and the conclusions of the mapping exercise), during interviews project promoters did provide some criticism on accessing EU funding. In particular they mentioned being discouraged by the length and complexity of procedures required to obtain EU funding. Six BE and five BBI project promoters explicitly mentioned that they considered the time and complexity of procedures needed to obtain public funding as burdensome. The project promoters pointed out, however, that a major obstacle for accessing funding was the poor management of EU funds at the national level. They stressed that application procedures for public funding are too lengthy and complicated (*"The funds made available to the aquaculture sector by the EC are poorly managed by our national authority"*, BE11). Furthermore, many of the PFI at the EU level were perceived as being inflexible and not targeting the entire development cycle of projects.

5.2.2 National and/or regional Bioeconomy strategies in EU countries

It is to be noted that besides the four EU countries examined below, some other EU countries are also advanced with regard to Bioeconomy strategies.

Germany

Germany ranks among the world leaders with its dedicated national Bioeconomy policy. To implement its strategy, Germany has put in place a set of targeted PFI to support the BBI and BE sectors. Notably, the existing PFI support start-ups, clusters and demonstration plants, and capacity-building programmes for employees of the Bioeconomy sector. The link between the strategy and the funding mechanism is clearly established in the R&D area, where EUR 2.4bn of research funding has been made available to

[101] Source: http://ec.europa.eu/regional_policy/index.cfm/en/policy/how/stages-step-by-step/
[102] The ESIF include five different funds, more information available on DG Regio's website, URL: http://ec.europa.eu/regional_policy/en/funding/
[103] As an example, an interesting past ESIF project (now closed) for BBI was the "Bio Base NWE" project (size: EUR 6.1m). It received funding from the European Regional Development Fund (ERDF), one of the ESIF, through INTERREG IV B (for North West Europe). The project was notably about providing financial support (in the form of innovation coupons/vouchers reaching up to EUR 30 000 each) to SMEs to perform proof-of-concept studies and/or to demonstrate innovative biobased technologies at the Bio Base Europe Pilot Plant (Ghent, Belgium). More information available on Bio Base 'ew's official website, URL: http://www.biobasenwe.org/en/home/
[104] http://ec.europa.eu/maritimeaffairs/financial_assistance_en
[105] http://s3platform.jrc.ec.europa.eu/home
[106] More information available on: http://ec.europa.eu/regional_policy/en/information/legislation/regulations/

support the Bioeconomy in the period 2010-2018 through a broad range of PFI including grants, subordinated loans and guarantees.

Finland

Similarly in Finland, the government has identified the Bioeconomy sector as a major growth area and developed a national Bioeconomy strategy to increase the output of the Bioeconomy. Consistent with its strategy, the government provides significant funding through various PFI, focusing on grants and loans. The Tekes Innovation Agency has developed both grants and loan programmes targeting projects related to or developing bio-materials or BE, with a total budget of EUR 2.1bn of public funding to be made available by 2025. In 2014 Finland also organised an international bio-refinery competition, awarding prizes to a number of promising bio-refinery projects.

Netherlands

In the Netherlands, based on its comprehensive national strategy, the government provides different types of financial assistance through various national and regional programmes focusing on supporting research into biomass production and conversion into fuels, energy, chemicals and bio-materials with a total investment of around some EUR 1.5bn, two thirds of which allocated to bio-energy.

Sweden

Based on its strong national Research and Innovation Strategy for a Bio-based Economy[107], Sweden has developed several strategic PFI of which most important programmes are the Formas grant programme for R&D projects and the Vinnväxt – a programme aimed at promoting sustainable regional growth by developing internationally competitive research and innovation clusters in specific growth fields, which specifically targets the Bioeconomy sector.

Countries with no national Bioeconomy strategy

Italy, the UK and Poland have not yet developed a national Bioeconomy strategy, nor do they have any important PFI instruments in place. However, Poland is now moving towards building its Bioeconomy ecosystems, with many regions mobilised and linked to the Bio-based Industries Joint Technology Initiative (BBI JTI)[108]. The Central and Eastern European Countries (CEEC) are also encouraged to build their national/regional Bioeconomy strategies and increase their participation in Horizon 2020 programme (widening of participation)[109] and Bioeconomy investments, since they have huge under-exploited biomass potential. In spite of not having a dedicated Bioeconomy strategy, France has been proactively developing financial instruments that are also accessible to the Bioeconomy companies. The French PFI programmes include grants, contingent loans, guarantees, equity and venture capital developed by Bpifrance (public investment bank), while Italy is primarily focused on the provision of grants to support the Bioeconomy sector.

Some perspectives at the regional level:

At the regional level, various regions are pioneering on the Bioeconomy (e.g. Flanders, the German regions of Nordrhein-Westfalen and Baden-Württemberg, Lombardia, Picardie and Champagne-Ardenne in France). At macro-regional level, various strategies such as the Danube region strategy are very important for the development of Bioeconomy clusters and initiatives involving the private and public sectors that could bring substantial benefits to the regional economies.

[107] FORMAS, *Swedish Research and Innovation Strategy for a Bio-based Economy*; R3:2012; Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS): Stockholm, Sweden, 2012; p. 36

[108] A Letter of Intent between the BBI JU and eight Polish regions signed at the European Bioeconomy Congress in Lodz, Poland (6 October 2016) aiming at more common actions, "light cooperation" and awareness-raising in the regions (in synergies with Regional Operational Programmes, Smart Specialisation Strategies and related available EU structural funds managed at regional level).

[109] The recently adopted BBI JU Widening Participation Strategy jointly developed by the Bio-based Industries Consortium, the BBI JU and the EC with the planned actions of: a) Raising awareness at European and national and regional level; b) Encouraging wider and inclusive participation; c) Developing knowledge, know-how and partnerships; d) Supporting the market up-take.

5.2.3 National Bioeconomy strategies in non-EU countries

In all of the six non-EU countries analysed, governments have recognised the strategic priority of the Bioeconomy for economic growth and have thus developed a national Bioeconomy strategy. The mapping has shown that this also translates into the development of a broad range of PFI to support the BBI and BE sectors. Public funding programmes in non-EU countries are closely aligned with the overall objectives of the national Bioeconomy strategy and target their financial support at specific subsectors of the BBI and BE sectors. In natural resource-rich countries (Brazil, Canada and US) existing programmes are targeted at the agricultural and forestry sectors and the production of biomass, whereby the programmes of China and Malaysia have a much stronger focus on supporting the bio-technology sector and Bio-Based Industries and manufacturing.

5.3 Finding 2: Grants dominate the PFI landscape, while access to innovative financial instruments is limited

Key section takeaways:

- Grant instruments are available in all countries analysed.
- Innovative financial instruments are under-represented in the EU, while non-EU countries provide a broader mix of PFI.
- Within the EU, the spectrum of available funding types is broader at the national level than at the EU level.

5.3.1 Grant instruments are available in all countries analysed

The study has identified that grants are the most prevalent funding instrument globally, with grant instruments dedicated to BBI and BE projects identified in every country of the mapping scope. This is not surprising and reflects the current state of development of the sectors.

Pan-EU level

In the EU, the main programmes providing grant funding to BBI and BE projects are for instance Horizon 2020 (including the Bio-Based Industries Joint Technology Initiative) and, specifically for BE, the European Maritime and Fisheries Fund (one of the ESIF). Over time, the resources available for innovative projects across a wide range of economic sectors, including in BBI and BE, have been significantly increased. For example, for the period 2014 to 2020, the Horizon 2020 programme has an allocated budget of approximately EUR 80bn (for all Horizon 2020 sectors), compared to around EUR 50bn under the 7th Framework Programme for Research and Technological Development (FP7).

EU countries

At the national level of EU countries, in particular Finland, Germany, Italy, Spain and Sweden frequently use grants to support Bioeconomy programmes. The strong provision of grants is observed even in countries with no identifiable dedicated Bioeconomy strategy. Germany, Italy and Poland award a considerable number of grants, ranging from EUR 20m (development contract, Italy), EUR 36.3m (multiannual support programme, Poland) up to EUR 50m (ERP innovation programme, Germany). In Finland, the largest grant programmes are managed by the *Tekes Innovation Agency* and focus on supporting R&D activities to the tune of EUR 239m in the areas of the Arctic Sea, green growth and green mining programmes.

Non-EU countries

Similarly, in non-EU countries grants are the main funding scheme used by public institutions. In fact, the mapping has shown that they are used in all six non-EU countries analysed. Canada and the US are the countries that most commonly use grants among their financial mechanisms to support the BBI and

BE. Canada awards the largest grants, particularly to support the forestry industry and bio-based materials (around EUR 13-20m per project) through the Investments in Forest Industry Transformation and Forest Innovation programmes. India and Malaysia also use grants that specifically target bio-technology sectors and which range in individual size from EUR 89 000 to EUR 500 000 through the Biotechnology Ignition Grant (BIG), the Biotechnology Industry Partnership Programme (BIPP) and the Biotechnology Commercialisation Grant (BCG). Brazil has developed several programmes that award grants to projects such as those related to the production of bio-fuels and to biomass transformation, amounting to EUR 24m (PAISS Industry).

The importance and availability of grant funding is further mirrored in the capital structures of the project promoters examined. 24% of the project promoters interviewed (out of 46 participants) benefited from grant funding. Again, EU funding played a key role for them. 54% (13 projects) of grant-funded projects in the sample received EU-only grants, 17% (4 projects) a mix of EU and national-level grants, 29% (7 projects) only national-level grants.

5.3.2 Innovative financial instruments are under-represented in the EU, while non-EU countries provide a broader mix of PFI

While at the Pan-EU level grants remain the predominant instrument to support the Bioeconomy, in non-EU countries, governments have developed more flexible financial instruments that provide companies in the BBI and BE sectors with longer-term risk financing, including subsidised loans, guarantees and tax incentives.

Debt capital

While a few contingent, high-risk-taking and subsidised loan mechanisms exist in Europe, on both the EU and national levels, they are relatively limited compared to the resources dedicated to grants. This finding has also been confirmed by interviews with project promoters, who have pointed out that they face significant barriers accessing public debt financing due to the perceived high riskiness of the sector, and the projects' volatile cash flow profiles, which make them risky for lenders.

However, the trend is for increasing resources being dedicated to debt and other financial instruments to sustain BBI, BE and other innovative projects. For example, at the EU level, the InnovFin programme, part of Horizon 2020, has replaced the RSFF (non-thematic scheme) as the innovation finance tool relevant for BBI, BE and other companies investing in innovation. Compared to its predecessor RSFF, the budget for InnovFin has more than doubled, with EUR 24bn in available funds, as mentioned earlier in this document. In addition, the EC has recently established the European Fund for Strategic Investments (EFSI), a financial scheme intended to generate EUR 315bn[110] worth of investments in Europe's strategic infrastructure, including various R&I activities and SMEs. As a result, unprecedented amounts of European-level funds and various financial instruments for the promotion of innovative technologies are currently available.

In the non-EU countries analysed, a broader spectrum of innovative debt funding is available. This includes contingent loans (China), zero interest loans (Canada, India), hybrid schemes (Canada, Malaysia). In China, for instance, *Innofund* is the largest public programme supporting early stage technology companies in the Bioeconomy sector, focusing on providing financing through a range of funding schemes, in particular contingency loans. In Canada, the *Innovation Demonstration Fund (IDF)* of Ontario is the most significant hybrid programme, with EU 161m of public funding. In Malaysia, the government's principal programme (Biotechnology Commercialisation Fund) also makes extensive use of hybrid schemes.

Equity and venture capital

In the EU, some equity and venture capital products complement grant schemes and debt in order to improve the access-to-finance conditions of innovative projects. The existing equity and venture capital

[110] The European Commission recently proposed increasing EFSI's size and duration. The EFSI guarantee from the EC and EIB Group would reach EUR 33.5bn, with the target that it would mobilise an investment total of EUR 500bn by 2020.

financial instruments at the pan-EU level, including EFSI, InnovFin, COSME (Equity Facility for Growth) and KIC Innovation Highway, are generic financial instruments and do not specifically target Bio-Based Industries or the Blue Economy, nor would most BBI/BE projects be compliant with these schemes. They remain however a valid financing option for less risky projects in BBI/BE.

At the EU-country level, in particular France has provided its financial support for the Bioeconomy sector in the form of equity and venture capital. The government has developed five different equity and venture capital instruments, including the *Capital Innovation Large Venture (CILV)* venture capital fund, which provides financing to innovative biotech firms and has a total global budget of EUR 600m, and the *Société des projets industriels (SPI)* programme, which provides the Bioeconomy industry with significant equity financing through a total budget of EUR 425m. Furthermore, the UK, the Netherlands and Spain provide equity and venture capital funding to BBI and BE companies. In the UK, the Green Investment Bank (GIB) provides up to GBP 3bn in equity and loans to accelerate investment in the UK's transition to a green economy. In the Netherlands, the Dutch Government and the Province of Brabant have created the *BOM Venture Capital* fund, which finances innovative and financially healthy companies and start-ups by providing equity capital and subordinated loans of up to EUR 2.5m.

Equity support for BBI and BE companies by governments is less common in the non-EU countries. Only China and Canada have established significant equity funds to support projects dedicated to biotechnologies. In China, the government has developed equity funds specifically dedicated to the Bioeconomy, including the Innofund, managed by the Torch Programme and the BioMass Equity Fund.

Other types of incentive

The analysis has found that non-EU countries have a broader mix of incentives in place to support the Bioeconomy, including tax incentives and guarantees. For instance, the Chinese Government has developed different tax incentives to support the R&D activities of innovative companies, including such mechanisms as reduced corporate income tax and tax concessions on technology transfers. In Malaysia, the Biotechnology Commercialisation Fund (BCF) provides nine different types of tax incentive, which include exemption from tax on statuary income, concessionary tax rates, tax exemption on dividends, exemption of import duty and sales tax or deduction on expenditure incurred for R&D. In Canada, the Scientific Research and Experimental Development programme provides extensive tax incentives to the sector.

5.3.3 Within the EU, the spectrum of available funding types is broader at the national level than at the EU level

At the national level, several countries provide a much broader range of financial instruments than at the EU level. There are however important differences between individual countries. While Finland and Germany, for instance, focus on grants and loans to support BBI and BE projects, France, Spain and the UK use a much wider set of public financial instruments, including equity and venture capital. For instance, in France several instruments have been developed to provide equity and venture capital financing to innovative companies, including the *Société des projets industriels (SPI)* investment programme (in the amount of EUR 425m) and the *CapAgro* Innovation programme. In Spain, the *Innvierte* programme coordinated by the Centro de Desarrollo Tecnológico Industrial is providing equity and venture capital funding, particularly for companies with a low TRL level (1-6). The UK has also developed a broader mix of investment programmes to support the sector and has emphasised the need to go beyond grant financing to ensure the further development of the sector.

The wider mix at the national level also reflects the varying maturity of local BBI/BE projects, local availability of raw resources and differences in national public policies and development strategies. Finland for instance is the only country in the EU sample that identified the Bioeconomy as one of its major growth areas, and is at the same time one of the countries with the broadest available range of PFI.

Financial instruments and grants[111]

As mentioned earlier, for the purposes of this study and throughout the document the term "PFI" encompasses financial support mechanisms such as equity or quasi-equity investments, loans, guarantees and other risk-sharing instruments, including grants. In the context of the study's recommendations, the scope of PFI emphasises implicitly risk-sharing financial instruments (i.e. excluding grants).

Grants are direct financial contributions by way of donation that finance actions intended to help achieve certain objectives.

Risk-sharing financial instruments allow for the sharing of a defined risk between two or more entities (e.g. between the public and private sectors). They may take the form of equity or quasi-equity investments, loans or guarantees, or other risk-sharing instruments, and may be combined with grants.

Risk-sharing financial instruments are complementary to grants, and as such have a number of specific characteristics:

Size and leverage effect

Funds contributed to financial instruments are by design aimed to mobilise external investments that complement the original contribution, thus increasing the overall size of the financing and the impact of the original contribution. As such, they have a potential catalytic (crowd-in) effect, potentially mobilising additional capital beyond what is provided by the instrument itself.

Financial discipline and upside potential

Given the embedded return and repayment expectations, contrary to grants, financial instruments introduce a level of financial discipline to project beneficiaries, improving the quality of projects and likelihood of them achieving commercialisation and profitability.

Efficiency and effectiveness gains

Funds contributed to financial instruments have a revolving nature (i.e. certain portion can be recovered and reinvested) and can thus be put into future use and made available to other projects, thus introducing an economical approach to the use of scarce budgetary resources.

5.4 Finding 3: EU initiatives focus primarily on supporting the R&D phase and less support is available for commercialisation

Key section takeaways:

- The majority of EU funding for the Bioeconomy is primarily R&D-driven and focused on early stage innovations, both on the pan-EU and on the individual MS levels.
- A comprehensive and continuous approach beyond the R&D and pre-commercial stages is missing and more support is needed for companies to commercialise new products.

[111] See Regulation No 966/2012 of the European Parliament and of the Council of 25 October 2012: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R0966&from=EN
and European Commission Financial instruments in ESIF programmes 2014-2020 Reference Guide: http://ec.europa.eu/regional_policy/sources/thefunds/fin_inst/pdf/fi_esif_2014_2020.pdf

5.4.1 Pan-EU level

The majority of EU funding for the Bioeconomy, for example under Horizon 2020, is primarily R&D-driven and focused on earlier stage innovations. Horizon 2020 provides financial support for public-private partnerships in the Bioeconomy, with low to medium/high TRL (up to TRL 8). Based on the findings from the mapping performed by EY, it seems that at the EU level a comprehensive and continuous funding approach beyond the R&D and pre-commercial stages is missing and more support is needed for companies to commercialise new products in the Bioeconomy sector. In particular, the funding needs of the commercialisation stages (TRL 8-9) remain not fully addressed.

5.4.2 EU countries

At the national EU country level, available PFI are perceived as targeting mostly lower TRL levels, with an identified lack of a continuous funding approach beyond the R&D stage. For instance in Sweden the Vinnväxt programme primarily provides funding to research and innovation programmes with low TRL. Similarly in Finland, the Tekes Innovation Agency supports a broad range of projects and companies with a strong emphasis on R&D and the early innovation stages. In Germany several programmes provide financing to the early stages of innovations, including the *Neue Produkte für die Bioökonomie* – a programme that provides financial support to innovative companies with relatively low TRL levels.

5.4.3 Non-EU countries

On the other hand, non-EU countries provide more long-term financing and support strategic "bio-refinery" projects which move beyond the R&D and innovation phase to the production and commercialisation of bio-based products and materials. Non-EU countries have more programmes that move beyond the early R&D stages and instead focus their support on pilot and production phases to help companies bring their new products to market. For instance, in Brazil the PAIS Industry Programme, in the US the Bio-refinery Assistance Programme, in Canada the *AgriInnovation* Programme, and in Malaysia the *BiotechCrop* programme are providing longer-term financing to support the R&D phase as well as financing for the entire process of development, production and commercialisation of innovative bio-based products, technologies and services. Thus, non-EU PFI seem to target a wider TRL range, whilst public debt made available in the EU seems to mostly address the R&D stage.

5.5 Finding 4: Existing funding in the EU flows mostly to the bio-energy (including bio-fuels) and agricultural sectors, with less support for value-added product development

Key section takeaways:

- Few European programmes exist to support the development of integrated value chains, where they would have a larger impact on economic growth and the generation of employment.
- The existing PFI at EU level largely support the production of biomass and bio-energy (including bio-fuels) and to a lesser extent industrial bio-technology and high valued-added bio-based products.
- At the individual MS level and in the non-EU countries analysed, differences between national strategies are observed. It appears that resource-rich countries tend to fund programmes promoting the primary production sector, while countries with fewer raw resources focus on related secondary sectors such as biotech or bio-based chemicals.

5.5.1 Few European programmes exist to support the development of integrated value chains

PFI in the Bioeconomy sector add the highest value when they support the development of integrated value chains, from the agriculture/agro-food, forest-based and waste sectors to Bio-Based Industries, and thus have a larger impact on economic growth and the generation of employment at the pan-EU level. Due to the high value added during the production process, the industrial bio-technology and manufacturing industries generate much higher employment than the bio-energy sector and thus have a more positive impact on the overall economy. Specifically, bio-based materials can directly support 5 to 10 times more employment and 4 to 9 times the value added compared with energy use.[112]

5.5.2 Pan-EU level

The existing PFI at the EU-level largely support the production of biomass and bio-energy and to a lesser extent industrial bio-technology and bio-refineries. At the EU level the development of bio-energy has been given high priority through the allocation of public financing and the introduction of critical regulations. On the other hand, the support for the high value added industrial bio-technology and bio-chemical sector is more limited. In fact, the Bio-Based Industries (BBI) Joint Undertaking, the principal private-public partnership at the pan-EU level, which provides financial support to (i) investments in the bio-based industry, (ii) the development of pilot, demonstration and flagship plants and (iii) the commercialisation of BBI and BE products in Europe, foresees a significantly smaller budget, totalling, as mentioned earlier in this document, EUR 3.7bn, of which only around EUR 1bn comes from the EU (EUR 2.7bn from the private sector).

5.5.3 EU countries

Differences in the funding approach can be noted between the countries analysed at the national level. For example Germany, France and the UK, given their scarcity of natural resources coupled with strong industrial bases, are more focused on supporting bio-technology and bio-based chemical industries, including the construction of bio-refineries, which can act as a catalyst to support the further development of bio-based products and materials. In contrast, resource-rich countries such as Finland have focused an important part of their public funding on supporting the agricultural and forestry sectors and the production of biomass and bio-energy.

5.5.4 Non-EU countries

When comparing pan-EU programmes to non-EU countries, similar trends in terms of stronger support for the agriculture/forestry and bio-energy (including bio-fuels) sectors in comparison to the higher value added bio-technology and bio-chemical industry can be observed. Similarly to Europe, resource-rich countries such as Canada and the US were found to fund programmes promoting the primary production sector, while countries with fewer raw resources (e.g. Malaysia) focus on the development of related sectors (e.g. biotech). For instance in the US, the Biomass Programme (with USD 26.7m) and the USDA Agricultural and Food Research Initiative (with USD 136m) have committed resources to support R&D in advanced bio-energy and high-value bio-based products. In Canada, the forestry sector is a strategic sector and several funding mechanisms, including the Investments in Forest Industry Transformation programme have committed significant resources (EUR 125m) to supporting transformative solutions and the development of bio-based forest products.

[112] Carus, M. et al (nova-Institute) 2010: The development of instruments to support the material use of renewable raw material in Germany – Market volumes, structures and trends.

6 KEY FINDINGS AND RECOMMENDATIONS

6.1 Key Findings

(1) BBI and BE projects face issues accessing private capital

The majority of BBI[113] and BE[114] projects surveyed (77% or 33 out of 43 projects in total, 20 out of 27 in BBI and 13 out of 16 in BE) face access-to-finance issues. Moreover, 79% of all respondents reporting access-to-finance issues indicate that the lack of interest from private financial market participants is related to the specificities and associated lack of understanding of the BBI and BE industries. Across the sample, data collected from project promoters indicates that no significant correlation can be concluded between the variables (i) project investment size (average interviewed project size for BBI is EUR 124m and for BE EUR 16m), Technology Readiness Levels (TRL, sample covered TRL between 6-9), and (ii) the existence or not of access-to-finance issues, suggesting that there are systemic barriers to financing as explained below.

(2) Regulation and market and demand framework conditions are perceived as the most important drivers and incentives but also present the biggest risks and challenges for both BBI and BE project promoters as well as financial market participants to invest in the Bioeconomy

According to project promoters, primarily active in BBI, regulation and market and demand framework conditions can act as the most important drivers and incentives for more sponsor and private sector investments. Specifically, they mention (i) regulation, primarily at the EU level and the national level, (ii) growing markets and demand and (iii) EU financial incentives, such as grant funding for BBI and BE projects, being the top three drivers for investing in the Bioeconomy.

However, project promoters also cite regulation and market and demand framework conditions as the biggest risks and challenges for investments in the Bioeconomy. In particular:

1. **Market and demand risks rank as the highest business risk factor for investments in BBI and BE for groups of project promoters.** These risks relate to the lack of developed markets and insufficient demand for BBI and BE outputs and products, largely affected by regulation.

2. **Regulatory risks rank as the second highest business risk factor for investments in BBI and BE** and as the top **challenge for conducting business activities for both BBI and BE project promoters**. These risks and challenges are primarily related to the lack of an effective, stable and supportive EU regulatory framework.

3. **Financial market participants recognise the role of a stable and supportive regulatory** framework but are cautious about its potential market distortion effects.

4. **Operational and technological risks primarily for BBI projects**, mainly related to risks during the demonstration phase of BBI projects and when scaling them up to flagship/FOAK operations (TRL 8-9) and the innovative nature of technologies in BBI and BE. **Legal regime risks mainly for BE** promoters, primarily related to complex and lengthy licensing procedures and overall BE legislation in the countries in which they operate.

[113] In BBI, the majority of projects produce outputs such as bio-materials, bio-chemicals and bio-products, some of which co-generated with bio-fuel. The remaining three projects are bio-energy-producing bio-fuels as sole output.
[114] In BE, all electricity-generating projects were excluded from the scope with the exception of multi-use offshore platforms (combining energy with other activities).

5. **Financial risks** are mentioned by both BBI and BE promoters and relate primarily to the risks that both BBI and BE projects demonstrate low or volatile profitability and cash flow generation, driven by volatilities in volumes and prices of both inputs/feedstock and outputs/products. These risks occur especially at the earlier stages of projects, leading to potential liquidity issues. The large size of capital expenditures required, especially relevant to BBI projects and to a lesser extent to BE projects, ranks as the second highest financial risk.

6. **Other risks and challenges** mentioned primarily relate to societal issues that affect access-to-finance such as public perception of the Bioeconomy and the issue of the green premium that can be attached to Bioeconomy products and outputs.

7. **Issues with public funding**, which, according to BBI and BE project promoters, relate to the fact that public funding targets mainly the R&D phase of projects and less the demonstration and commercialisation phases. Also, project promoters report complicated and lengthy application procedures for public funding. Finally, project promoters who manage to obtain public funding mention its small size relative to their needs and the unfavourable terms attached. As a result, the existing PFI do not seem to have a sufficient catalytic effect in mobilising private capital for the later phases of projects (demonstration, flagship and industrial-scale).

(3) The main funding gaps exist in (i) Bio-based Industries and Blue Economy projects scaling up from pilot to demonstration projects and (ii) particularly in Bio-based Industries, moving from demonstration to flagship/first-of-a-kind (FOAK) and industrial-scale projects

Data from the capital structure of BBI and BE projects suggests that push mechanisms such as grants are not sufficient in size or catalytic impact and need to be complemented by different public and private sector interventions to fill the BBI and BE funding gaps. Data on the capital structure of surveyed BBI and BE projects reflects the limited availability of private debt capital from financial market participants. As BBI and BE projects increase in size and technological maturity, project promoters appear to resort to own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects. Grants, primarily from EU programmes (e.g. under the BBI Joint Technology Initiative) are also available for more technologically mature projects (up to TRL 7-8). However, as BBI and BE projects increase in size and technological maturity, the relative presence of grants in the capital structure diminishes due to the large size of projects, especially in BBI. Instead, public debt capital appears to play a larger role in the capital structures of both BBI and BE projects. Yet the presence of both forms of public capital does not manage to attract (crowd-in) sufficient private debt capital, which represents a small percentage of the capital structures of both BBI and BE projects. The reasons behind such an insufficient crowd-in effect are the perceived high industry-specific risks, which in the view of investors are not sufficiently absorbed by the current form, design and risk absorption capacity of public sector financing mechanisms.

Despite a degree of possible selection bias inherent in the sample (which was selected as a result of discussions between the consultant, EIB and the EC), the data suggests that the main funding gaps for both BBI and BE projects exist when:

(i) **Projects move from the pilot to the demonstration plant phase (TRL 6-7)** either for technology licensing or commercial production purposes. According to BBI and BE project promoters, this phase of the project cycle is marked by high technological risks, which non-specialist private investors (sector-agnostic) are not well equipped to assess. As a result, funding from private investors in general is overly expensive for promoters and the attached funding conditions cannot be met by many projects. From the public side, grant funding is available but this is often restricted to the R&D phase and conditional on lengthy and complicated application procedures, which deter promoters from applying. The existence of public funding both in the form of grants and debt

instruments does not manage to cover this funding gap, which according to the capital structure analysis is filled with own funds and equity from strategic/industrial partners and a few specialist investors to finance their projects.

(ii) **Particularly for BBI projects, moving from demonstration to flagship/FOAK and industrial-scale phases (i.e. moving from demonstration to TRL 8-9)** presents additional challenges in attracting private capital. This phase refers to the up-scaling or ramp-up stage as projects move from demonstration to the commercialisation phases (TRL 8-9) with the expectation of selling to customers and, in the case of TRL 9, making a profit. While scale-up requires large investments, projects in this phase face unfavourable market and demand and regulatory framework conditions, which hamper investments. As a result, even projects that enter the TRL 9 phase continue to face revenue uncertainty, low or volatile profitability, and cash-flow and liquidity issues. As a consequence, private market participants are reluctant to invest. From the public side no dedicated support for industrial-scale (TRL 9) projects is available, which prevents a large number of them from reaching this stage.

(4) Financial market participants are attracted by the growth potential of the Bioeconomy, but due to its high perceived risks and information asymmetries, identify two unaddressed funding gaps

To gather feedback from financial market participants (FMP) regarding their interest in investing in BBI and BE projects and to test their appetite for existing, new or modified PFI, a balanced sample of 16 European debt and/or equity providers, including banks, asset managers and private equity players, was interviewed. 13 of the interviewees had already invested in the Bioeconomy in the past.

1. **The key drivers of FMPs' interest and investment in the Bioeconomy are its sustainable features and large future growth potential.** When asked about their incentives for investing in BBI and BE projects, the interviewed FMP most frequently mentioned market and demand drivers, in particular those related to the sustainable and innovative dynamic of the Bioeconomy. As a result of the perceived high growth potential of the industry, FMP are equally motivated by the related profit prospects and the potential for early mover advantages (when investing early in an industry that is expected to grow significantly).

2. **FMP perceive investments into the Bioeconomy as very risky.** Despite the significant interest in the sector by the interviewed FMP, a number of risks were identified that play an important role in investor considerations.

(i) **Information asymmetry and technology risk limit FMPs' propensity to invest in BBI and BE, steering private capital towards more mature projects.** Irrespective of their profile, most of the interviewed FMP indicated a preference for more mature and technologically advanced projects. At the same time the strongly perceived operational and technological risks, coupled with information asymmetry and insufficient understanding of the sector and related risk assessment, were found to be the biggest investment hurdles within the interviewed sample.

(ii) **The perceived instability of the market and fluctuating demand for BBI and BE products hinder FMP from investing in the sector.** Off-take agreements play a crucial role in mitigating the perceived market and demand risks, ensuring stable revenues for the company's continuity and cash flow for the debt and equity holders.

(iii) **Regulation and market and demand framework conditions can be important drivers but can also present the biggest risks and challenges for financial market participants to invest in the Bioeconomy.** Efficient regulation can play a "market-shaping" role by incentivising demand and supply of BBI and BE products and thus limiting the perceived market instability. On the other hand,

heavy market intervention can also deter private investors who are discouraged by external factors they have no control over.

(iv) **BBI and BE projects require a significant investment volume whilst generating unstable revenues and cash flows, increasing the financial risk for investors.** These financial risks were also identified by project promoters, who confirmed that cash flow, liquidity levels and returns are volatile prior to having successfully commercialised the product.

3. **FMP identify two funding gaps faced by BBI and BE project promoters.** The analysis of FMPs' key hurdles that deter them from investing in BBI and BE projects as well as their assessment of business and financial risks largely coincides with that of project promoters. FMP identify the same two funding gaps as the interviewed project promoters: (i) scaling-up from pilot to demonstration projects and (ii) moving from demonstration to flagship/first-of-a-kind (FOAK) and industrial-scale projects.

(5) Existing public financial instruments are utilised but their catalytic impact could be further enhanced

1. **Bioeconomy strategies are a key trigger for providing PFI, which are widely used both within and outside the EU**

At EU country level the most advanced and targeted programmes supporting the BBI and BE sectors are those that have also developed a national and/or regional Bioeconomy strategy and the establishment of national/regional coordinating agencies. Beyond the institutional framework and financing available at EU level, in particular Germany, Finland, the Netherlands and Sweden are the most advanced countries in Europe in terms of the development of national and/or regional Bioeconomy strategies as well as providing a broad set of PFI to support the sector.

Especially in Europe, numerous funding programmes and PFI are available both at EU and national levels providing large amounts of funding. Some of the EU's key programmes for supporting the Bioeconomy include Horizon 2020 and notably its Societal Challenge of "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy" (with a EUR 3.8bn budget for the whole Bioeconomy, including BBI and BE, over 2014-2020). As an illustration, Horizon 2020 launched in 2014 its flagship initiative for BBI: the Bio-based Industries Joint Technology Initiative (BBI JTI, referred to in the related EU regulation as the BBI Initiative), a EUR 3.7bn Public-Private Partnership (PPP) between the EU and the Bio-based Industries Consortium (BIC), in which the mobilised Horizon 2020 contribution reaches nearly EUR 1bn[115] over 2014-2020[116], leveraging an expected EUR 2.7bn of private financing. The Bio-based Industries Joint Technology Initiative, which will be implemented by the Bio-based Industries Joint Undertaking (BBI JU, established in 2014) until 2024, aims to support the development of the EU's bio-based industries by awarding grants to research and innovation projects (ranging from lab projects to first-of-a-kind flagship commercial plant projects) and to coordination and support projects in this field.[117]

Next to grants and other initiatives (e.g. InnovFin) under Horizon 2020 (H2020), other EU-level programmes, such as the European Fund for Strategic Investments (EFSI) and the European Structural and Investment Funds (ESIF), can contribute to the Bioeconomy. EU-wide programmes are further complemented by national level funding and through various instruments offered by national, regional and/or local development agencies (e.g. Tekes in Finland, Invitalia in Italy, the Netherlands Enterprise Agency, Innovate UK, and so on).

[115] The Horizon 2020 contribution of EUR 975m to the Bio-based Industries Joint Technology Initiative comes from the Horizon 2020 Societal Challenge "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy" for ~EUR 825m (which is included in the aforementioned budget of EUR 3.8bn for this Societal Challenge) and from the "Leadership in Enabling and Industrial Technologies" part of Horizon 2020 for ~EUR 150m.
[116] Horizon 2020 funding devoted to this initiative over 2014-2020 will be used to implement it up until end 2024.
[117] More information available on BBI JU's official website, URL: http://www.bbi-europe.eu/participate/participate

2. **Grants dominate the PFI landscape, while access to innovative financial instruments is limited**

   Grant instruments are available in all countries analysed. Grants are used widely in the EU, especially at the R&D stages, where data suggests that they have the most impact in terms of their role in the capital structure as funding sources for projects (i.e. with a significant portion of the total funding at early development stages coming from grants). Nevertheless, BBI and BE project promoters cite lengthy and complex application procedures leading to difficulties in decision-making and financial planning, hence creating financing bottlenecks and project implementation delays.

   Innovative financial instruments are under-represented in the EU, while non-EU countries provide a broader mix of PFI. Innovative debt finance instruments with appropriate risk tolerance and tailored to the specificities of BBI and BE projects are essential to fill funding gaps**.** Despite some risk-sharing PFI available in the EU for pilot and demonstration stage projects, the data suggests that such financing may not be sufficiently available as a pull factor for continuous and consistent funding beyond pre-commercial stages. EU funding instruments, primarily grants, focus primarily on supporting the R&D phase and less support is available for commercialisation while existing risk-sharing financial instruments under programmes such as InnovFin, EFSI or COSME may only meet limited demand of BBI and BE projects given their risk absorption profile.

   Within the EU, the spectrum of available funding types is broader at the national level than at the EU level. There are also important differences between individual countries. While Finland and Germany, for instance, focus on grants and loans to support BBI and BE projects, France, Spain and the UK use a much wider set of public financial instruments, including equity and venture capital. The wider mix at the national level also reflects the varying maturity of the local BBI/BE projects, local availability of raw resources and differences in national public policies and development strategies.

   Grants are direct financial contributions by way of donation. Risk-sharing financial instruments allow for the sharing of a defined risk between two or more entities (e.g. between the public and private sectors). They are complementary to grants and can have increased size, leverage and thus catalytic (crowd-in) effect. They can also introduce financial discipline and upside potential improving the quality of projects and likelihood of them achieving commercialisation and profitability. Finally, funds contributed to financial instruments have a revolving nature (i.e. certain portion can be recovered and reinvested) and can thus be put into future use and made available to other projects.

3. **EU initiatives focus primarily on supporting the R&D phase and less support is available for commercialisation**

   The majority of EU funding for the Bioeconomy is R&D-driven and primarily focused on early stage innovations. Programmes such as Horizon 2020 provide funding to innovative companies with low to medium/high TRL levels (up to TRL 8). Similarly, at the level of individual MS, based on the mapping of available PFI prepared by the consultant, the majority of identified funding programmes support mostly the R&D and early innovation stages of the Bioeconomy. A comprehensive and continuous funding approach beyond the R&D and pre-commercial stages is missing, and more support is needed for companies to commercialise new products. Europe-wide, in particular the funding needs of the commercialisation stage (TRL 9) remain not fully addressed.

4. **Existing funding in the EU flows mostly to the bio-energy (including bio-fuels) and agricultural sectors, with less support for value-added product development**

   Few European programmes exist to support the development of integrated value chains, e.g. from the agriculture/agro-food, forest-based and waste sectors to BBI, where they would have a larger impact on economic growth and the generation of employment. To exemplify, bio-based materials

can directly support 5 to 10 times more employment and 4 to 9 times the value added compared with energy use.[118]

The existing PFI at the EU level largely support the production of biomass and bio-energy and to a lesser extent the industrial bio-technology and bio-refineries. At the EU level the development of bio-energy (including bio-fuels) has been given high priority through the allocation of public financing and the introduction of critical regulations. On the other hand, the support for the high value added industrial bio-technology and bio-chemical sector is more limited (e.g. the EU Horizon 2020 contribution to the BBI JU amounts to around EUR 1bn, expected to mobilise around EUR 2.7bn of private funding).

At the individual MS level, as well as in the non-EU countries analysed, differences between national strategies are observed. It appears that resource-rich countries (e.g. USA, Canada) fund programmes promoting the primary production sector, while countries with fewer natural resources (e.g. Germany, France or Malaysia) focus on the development of related sectors such as biotech or bio-based chemicals. In those countries that have fewer natural resources, the construction of bio-refineries can act as a catalyst to support the further development of bio-based products and materials.

(6) Policy actions and/or new or modified public financial instruments could de-risk Bio-based Industry and Blue Economy investments and catalyse (crowd-in) private capital

1. **The evaluation of the existing financial toolbox of EU public programmes and instruments in support of BBI and BE projects highlights the importance of risk-sharing instruments as pull mechanisms to incentivise and attract private capital capable of filling funding gaps.** The study also shows that existing tools are primarily technology-push mechanisms incentivising industrial research and innovation and the deployment of new technologies. Their availability and impact however reduces as BBI and BE projects increase in size and technological maturity near commercialisation, leading to the creation of funding gaps. The study also indicates that project promoters and financial market participants alike would benefit from increased information dissemination and cooperation outlets which could strengthen their understanding of both the industry as well as the various stakeholders' needs.

2. **Demand side: In terms of funding, project promoters ask for adapted or new PFI, primarily loans and guarantees that can absorb the financial and business risks of BBI and BE and carry favourable conditions.** During the interviews, BBI and BE promoters asked for PFI that allow effective risk-sharing between the public and private sectors, which they expect to have a catalytic impact encouraging more private investors to participate in BBI and BE projects. Loans and guarantees are seen as the number one instrument to fill funding gaps, followed by hybrid mechanisms, in part for their non-dilutive impact, and equity investments. They also indicate the need for more favourable conditions for PFI such as longer grace periods and tenors, lower interest rates and simpler procedures.

3. **Supply side: In terms of funding, financial market participants ask for different and targeted PFI for each funding gap**

   Contingent loans, supported by 69% of interviewed FMP, could help fill both identified funding gaps by mitigating technology and operational as well as market and demand risks. Through the introduction of equity-like features (i.e. junior positioning in the capital structure), such loans have

[118] Carus, M. et al (nova-Institute) 2010: The development of instruments to support the material use of renewable raw material in Germany – Market volumes, structures and trends.

the potential of attracting additional private capital by effectively de-risking the investment profile of private investors.

Investment platforms were also supported by 69% of FMP. By pooling several investors' resources together (and partially backing them up with a public contribution) to invest into various projects, an investment platform could diversify investor risk and therefore attract private capital to riskier projects (e.g. at multiple TRL levels), which may otherwise be deemed too risky for FMP acting independently. A platform thus has the potential to mitigate technology and operational risk (Funding gap 1), market and demand risk (Funding gap 2), as well as regulatory risks through the potential positive signalling effect of a public backing, while also crowding in additional private capital.

Hybrid instruments (e.g. combining both debt and equity features), backed by 50% of interviewed FMP, have the potential of particularly addressing market and demand risks through their risk-absorbing and equity-like features and thus responding to the needs of the second funding gap (i.e. moving from demonstration to flagship and industrial-scale projects). Finally, 81% of interviewed investors were also in favour of the development of an information exchange platform which could help address the challenge of information asymmetry.

6.2 Key Recommendations

(1) Establish an effective, stable and supportive regulatory framework for BBI and BE at the EU level, which is essential

The reduction of regulatory uncertainty can help mitigate market and demand risks typically faced by BBI and BE projects. Policy actions should demonstrate long-term regulatory commitment to support green alternatives to fossil-based products targeting the entire value chain while allowing free market forces to operate sufficiently. These policy actions should primarily aim to introduce price and volume stability and availability of biomass inputs/feedstock, as well as to trigger stable demand for BBI and BE outputs/offtake. Examples of regulatory actions can include the promotion of reliable access to feedstock for material uses (helping create a level playing field for material compared to energy use of biomass) through coherent biomass certification frameworks, structured supply chains (both upstream and downstream) that promote the ability to withstand market shocks, the harmonisation of labelling and certification standards for reliable BBI and BE technologies, processes and products and the overall promotion of the Bioeconomy to increase public awareness, perception and support. Other actions can include defined policy targets for the use of biomass in the material and chemical sectors, procurement programmes, mandatory use or prohibition of products based on their environmental footprint and perhaps even direct financial incentives such as tax schemes, targeted output subsidies, feed-in tariffs, preferential credits and others, in line with EU regulation. It is recommended that relevant and affected stakeholder groups be consulted and involved at all stages of the development of such a regulatory framework.

(2) Further reinforce awareness about InnovFin and the European Fund for Strategic Investments (EFSI), which can match the funding needs of certain BBI and BE projects

Existing programmes at the EU level, such as the BBI JTI (part of H2020), make available grant funding for BBI and BE projects up to flagship/FOAK level. EU programmes also make grant funding available for BE projects. Additionally, other EU funding tools exist for projects entering the demonstration and commercialisation phases, such as the EIB's existing mainstream instruments (e.g. InnovFin, EFSI), although not being Bioeconomy-specific. However, the interviews with project promoters and investors suggest that besides grant funding, there appears to be a certain lack of awareness on the part of project promoters about available risk-sharing funding tools at EU level. Specifically, the study indicates

that many Bioeconomy promoters are not yet sufficiently familiar with various risk-sharing EIB-EC financing schemes, including InnovFin and EFSI, hence suggesting the existence of certain information gaps and the need for a more targeted outreach to those promoters (this also applies to project promoters and investors in the Circular Economy, as shown in the earlier mentioned study).

The present study has already raised some awareness about EC-EIB risk-sharing instruments, while at the moment of its finalisation, the EIB Group (EIB and EIF) is already involved in a number of operations (loans and guarantees under EFSI and other schemes) supporting BBI and BE projects of various sizes (SMEs, mid and large-caps) that meet the risk absorption capacity, eligibility, bankability and other criteria of these schemes. While at this stage it is too early to assess whether instruments such as EFSI can sufficiently address BBI and BE funding gaps, the experiences gained from evaluating and financing BBI and BE projects can help address certain information gaps and create more awareness about currently available funding tools for projects that can be eligible under existing schemes (e.g. InnovFin, EDP thematic finance, EFSI).

This study therefore recommends the EC to consider addressing a number of information gaps through the implementation of an EU-wide contact, information exchange and knowledge sharing platform that improves awareness of existing public financing tools – as well as of advisory services available to project promoters under EFSI and InnovFin (e.g. the "6 simple steps to find your funding" online interface for InnovFin) – and facilitates relationships between BBI and BE project promoters, industry experts, public authorities and financial market participants active or seeking to become active in the Bioeconomy. The publication of this report will hopefully provide further impetus to continue raising awareness about the existing funding programmes and should be complemented with targeted awareness events and workshops that attract BBI and BE stakeholders. Here, the EIB's Advisory Services through its Innovation Finance Advisory will work closely with the relevant EIB and EC services in improving information flow and exchange. Efforts could include the increased presence of providers of risk-sharing funding tools, such as the EIB and the EC, in targeted sector (awareness-raising) events and stronger communication of messages about their contribution to the Bioeconomy (e.g. project financings, case studies) towards Bioeconomy stakeholders.

(3) Develop a new EU risk-sharing financial instrument dedicated to BBI and BE, potentially taking the form of a thematic investment platform that can meet the funding needs of BBI and BE projects and mobilise private capital

In the key findings section of this study, the feedback from BBI and BE project promoters and financial market participants indicates that there appears to be a need for public sector intervention beyond a supportive regulatory framework at the EU level. This intervention can take the form of a risk-sharing financial instrument, capable of addressing the multiple types of identified project risks (e.g. regulatory, technological, operational, market and demand, and others) of variable intensity (staged approach), across different stages of projects' technological maturity (throughout TRL 6-9 where funding gaps are identified), and be flexible in terms of size to cover both small and larger project capital needs. Eventually, it should lead to effective risk-sharing between the public and private sectors, in a way that renders BBI and BE projects bankable and financeable, thus mobilising (crowding in) private capital.

In terms of the form of such instrument, patient capital, ideally in the form of debt, appears most suitable. Specifically, project promoters express interest in debt features including long tenors, long grace periods, flexible terms and advantageous interest rates. Both project promoters and financial market participants simultaneously favour some equity-type characteristics, specifically high risk absorption acting as a first-loss piece or risk cushion for more senior forms of capital. However, at the same time, such instrument should be less dilutive than equity, as expressed by both project promoters and financial market participants.

In view of the above, the findings of the study make a compelling case for the development of a new pan-EU thematic investment platform dedicated to BBI and BE projects, which could combine all the desirable criteria outlined above. By way of definition, investment platforms are dedicated financing structures, and co-financing/risk-sharing arrangements that pool together several sources of financing from various investors in order to channel financing and investments in portfolios of projects. Investment platforms can provide various forms of capital (equity, quasi-equity, loans, guarantees etc) either directly to projects or to funds and other intermediaries, backed by a risk-absorption mechanism from the EU.[119]

The main advantages of investment platforms are their flexible investment criteria and the possibility of combining several sources of funding. Investment platforms can also introduce stage-based mechanisms whereby the level of risk-absorption is tailored to the stage and technological maturity of projects, thus filling both funding gaps identified in the study. Other features could include contingencies, such as coverage against unexpected increases in feedstock prices due to exogenous factors (e.g. adverse regulatory changes, weather conditions and others). Accordingly, other contingent features could provide coverage against unexpected revenue shortfalls by securing a minimum income stream for projects that face revenue risks, especially during the ramp-up period of operations. Finally, due to the pooling/aggregation effect, investment platforms can reduce transaction and information costs thus providing more efficient risk allocation between various investors.

The actual development, implementation and management of such dedicated instrument need to be evaluated and agreed upon by the appropriate stakeholders and agents of EU institutions.

(4) Explore the creation of an EU-wide contact, information exchange and knowledge sharing platform or other channels to facilitate relationships between BBI and BE project promoters, industry experts, public authorities and financial market participants active or seeking to become active in the Bioeconomy.

Such an EU platform could play an important role in facilitating the transition to a Bioeconomy by raising awareness amongst potential project promoters and investors, improving the bankability of projects, maximising the use of existing EIB instruments and analysing whether new financing mechanisms need to be established. The lead by the EC and its ongoing support by the EIB, NPBs and potential MS ministries would send strong signals, besides concrete policy actions, about the commitment of authorities to supporting green alternatives to fossil-based products.

Depending on the further articulation of the market needs such a platform to be assessed by the relevant EC services could ultimately, when up to speed, fulfil the following key functions:

1. **Coordination and communication**

   The platform could share and leverage the knowledge and experience of the BBI and BE community, bringing together all relevant stakeholders (i.e. project promoters/companies, financial investors, as well as regulators, feedstock producers and traders, and commercialisation and market representatives). Such a meeting point could help promoters and investors find partners, match various needs, and create business partnerships. It could also collect and make available BBI and BE-relevant data and analyse trends as well as monitor existing initiatives (e.g. on the socio-economic and financial impact). In this perspective, it would be important to make available, especially for investors, reliable market intelligence data and market forecasts, so as to raise their interest and knowledge of the BBI and BE sectors and of their market prospects in the years ahead. All of this would allow BBI and BE promoters and investors to receive reliable sector-related information

[119] Public capital from the EU would serve as first-loss piece or risk cushion, up to a certain percentage of the investment size of the portfolio of projects, thereby lowering the investment risk for investors.

(market, technical and financial), as well as tracking the progress of the Bioeconomy and coordinating, from a high-level perspective.

Proactive communication and knowledge sharing at EU-wide level can furthermore be a powerful means of raising awareness among multiple audiences (promoters, policy makers, investors, public, scientific community, citizens) about the merits of BBI and BE, as well as increasing awareness about the industry and its framework conditions.

2. Advisory support

An advisory function could provide tailored support to project promoters and financial market participants in assessing the technological, market and other risks of innovative technologies or innovative business models of BBI and BE projects, as well support in accessing suitable sources of financing (including EU funds). Such support would be particularly welcomed by financial market participants as a number of them, especially generalist/sector-agnostic investors, either struggle to assess specific BBI and BE risks (e.g. market, technological) or consider that the transaction costs for tailored-risk assessments are too high. These types of financial market participants, such as commercial banks (some of which may already be active as financial intermediaries in existing EU/national non-thematic financial products), could value the analytical input of public institutions on BBI and BE project risk assessment.

In addition, BBI and BE projects could be supported with respect to access-to-finance and technical project preparation, helping them to prepare a bankable business case. The mapping exercise showed that such advisory services are limited at EU level and that a few are only available in EU countries (i.e. Germany, Sweden and Finland). Depending on the type of support needed (which will vary by stage of the project development cycle) it has to be further considered which service providers should be involved. Existing advisory services of the EIB could form a part of the offering with respect to project preparation and access-to-finance support complemented by institutional support by other bodies. Such advisory services would be welcomed by BBI and BE project promoters, the large majority of which indicated a favourable stance towards such support, as was repeatedly highlighted during the interviews. Follow-up analysis and feasibility checks are necessary to determine the exact nature of the advisory support needed.

To avoid duplication it will be important to build on existing platforms in the same sector, such as the BIO-TIC industrial biotech partnering platform or the KIC InnoEnergy platform of the European Institute of Innovation & Technology (EIT), while looking for “smart” synergies with similar initiatives in other sectors, like the pillar II (Advisory) of the Circular Economy Finance Support Platform.

7 BIBLIOGRAPHY

- ***Bioökonomierat (German Bioeconomy Council)***

"**Bioeconomy Policy (Part II) Synopsis of National Strategies around the World**", Report, *C. Fund, P. Dieckhoff, B. El-Cichakli and C. Patermann, Bioökonomierat (German Bioeconomy Council)*, January 2015, Berlin (DE), published by the Office of the Bioeconomy Council, published on the Bioökonomierat official website on 26/11/2015, http://www.biooekonomierat.de/fileadmin/Publikationen/berichte/Bioeconomy-Policy_Part-II.pdf

- ***European Commission (EC)***

"**An integrated Maritime Policy for the European Union**" COM(2007) 575 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, European Commission (EC), 10/10/2007, Brussels (BE), EC official website, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52007DC0575

"**Article 87 of the EC Treaty (ex Article 92)**", European Commission (EC), Brussels (BE), official website, (http://ec.europa.eu/competition/legislation/treaties/ec/art87_en.html)

"Bio-based economy in Europe: state of play and future potential – Part 2", Summary of the position papers received in response to the European Commission's public on-line consultation, *DG Research and Innovation, DE Biotechnologies, Agriculture and Food*, European Commission, 2011, Brussels (BE), EC official website,

https://ec.europa.eu/research/consultations/bioeconomy/bio-based-economy-for-europe-part2.pdf

"**Blue Growth – opportunities for marine and maritime sustainable growth**" COM(2012) 494 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Maritime Affairs, European Commission (EC), 2012, Brussels (BE), EC official website, http://ec.europa.eu/maritimeaffairs/documentation/publications/documents/blue-growth_en.pdf

"**Blue Growth – Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts**", Third Interim Report, ECORYS, Deltares & Oceanic for the European Commission (EC) DG MARE 13/03/2012, Brussels (BE), EC official website, http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/blue_growth_third_interim_report_en.pdf

"**Closing the loop - An EU action plan for the Circular Economy**" Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 2.12.2015 COM(2015) http://ec.europa.eu/environment/circular-economy/index_en.htm

"**Commission proposes strategy for sustainable Bioeconomy in Europe**", European Commission (EC) press release, 13/02/2012, Brussels (BE), EC official website, http://europa.eu/rapid/press-release_IP-12-124_en.htm

"**European Bioeconomy: policies, research and innovation, investments, markets and regulations**", *W. Kütt, European Commission (EC), DG Research and Innovation, Bioeconomy – Bio-based Products and Processing*, 03-04/09/2015, Vilnius Innovation Forum (VIF), Vilnius (LT), VIF official website, http://innovationdrift.com/wordpress/wp-content/uploads/2015/09/European-Bioeconomy-policies_Waldemar-Kutt.pdf

"Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth" Commission Communication of 22 November 2006 to the Council, the European Parliament and the European Economic and Social Committee

"Innovating for Sustainable Growth: A Bioeconomy for Europe" European Commission (2012); COM (2012) 60 final; European Commission: Brussels, Belgium
https://ec.europa.eu/research/Bioeconomy/index.cfm?pg=policy&lib=strategy

"**Factsheet: Horizon 2020 budget**", European Commission (EC), 25/11/2013, Brussels (BE), EC official website, http://ec.europa.eu/research/horizon2020/pdf/press/fact_sheet_on_horizon2020_budget.pdf

"**Guidance for Member States on definition and use of repayable assistance in comparison to financial instruments and grants**", European Commission (EC), 15/04/2015, Brussels (BE), official website, http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/guidance_repayable_assistance_en.pdf

"Horizon 2020 – Work Programme 2016 – 2017: Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the Bioeconomy" European Commission Decision C(2016)1349 of 9 March 2016, http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-ga_en.pdf

"Horizon 2020 – Work programme 2014-2020" (C2015)8621, 19. General Annexes, Revised, European Commission (EC), 04/12/2015, Brussels (BE), EC official website, http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-ga_en.pdf

"**Innovation for Sustainable Growth – A Bioeconomy for Europe**" (COM(2012) 60 final), *European Commission (EC), Directorate General for Research and Innovation, Directorate E – Biotechnologies, Agriculture, Food, Unit E.1 – Horizontal aspects*, 13/02/2012, Brussels (BE), EC official website, http://ec.europa.eu/research/bioeconomy/pdf/201202_innovating_sustainable_growth_en.pdf

"**Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth**" COM(2014) 0254 final/2, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, European Commission (EC), 13/05/2014, Brussels (BE), EC official website, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0254R(01)&from=EN

"**Joint Technology Initiative in the field of Bio-based industries**", Roadmap, European Commission (EC), DG RTD, November 2012, Brussels (BE), EC official website, http://ec.europa.eu/smart-regulation/impact/planned_ia/docs/2013_rtd_007_biobased_industries_en.pdf

"**Strategic Innovation and Research Agenda (SIRA), Bio-based and Renewable Industries for Development and Growth in Europe – March 2013**" http://ec.europa.eu/research/participants/data/ref/h2020/other/legal/jtis/bbi-sira_en.pdf

"**Towards a more effective use of tax incentives in favour of R&D**", Commission Communication of 22 November 2006 to the Council, the European Parliament and the European Economic and Social Committee, European Commission (EC), Brussels (BE), official website, http://ec.europa.eu/taxation_customs/resources/documents/workdoc_tax_incentives_en.pdf

- ***European Investment Bank (EIB)***

"**Assessment of access-to-finance conditions for projects supporting Circular Economy**", Final report, *S. Acsinte, A. Verbeek,* J. Byström, L. Goovaerts and M. Francini, *InnovFin Advisory and European Investment Bank (EIB) Advisory Services* 2015, Luxembourg (LU), EIB official website, http://www.eib.org/attachments/press/innovfin-advisory-report-on-circular-economy-full-report-public.pdf

- ***European Parliament***

"**Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013**" 20/12/2013, Brussels (BE), official website,http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0320:0469:en:PDF

"**Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012**", 26/10/2012, official website,http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:298:0001:0096:en:PDF

- ***Global Bioeconomy Summit***

"**Bio-economy as part of the transition to a new economic model**", *Janez Potočnik, Co-Chair UNEP International Resource Panel (IRP)*, Global Bioeconomy Summit (GBS) 2015, Berlin (DE), 25/11/2015, GBS official website, http://gbs2015.com/fileadmin/gbs2015/Downloads/Strategic_Debate_1.pdf

- ***International Energy Agency (IEA)***

"**Tracking Clean Energy Progress 2013**", Report, IEA Input to the Clean Energy Ministerial, International Energy Agency (IEA), 2013, Paris (FR), IEA official website, http://www.iea.org/publications/tcep_web.pdf

- ***Organisation for Economic Cooperation and Development (OECD)***

"**Effective Carbon Prices**", OECD, 04/11/2013, Paris (FR), OECD official website, http://dx.doi.org/10.1787/9789264196964-en

"**Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels**", OECD, 28/01/2013, Paris (FR), OECD official website, http://www.oecdilibrary.org/docserver/download/2212051e.pdf?expires=1455878637&id=id&accname=oid012043&checksum=DC87A54C3CA29973D74FE1BEAE08177D

- ***Other authors***

"**How to shape the next level of the European bio-based economy?"** by Michael Carus, Achim Raschka, Kerstin Iffland, Lara Dammer, Roland Essel, Stephan Piotrowski (2016) http://bio-based.eu/?did=40097&vp_edd_act=show_download

"The Blue Economy, 10 Years, 100 Innovations, 100 Millions of Jobs" Pauli G., (2010), Report to the Club of Rome, Paradigm Publications, Taos

"European Bioeconomy in Figures", Bio-Based Industries Consortium, prepared by nova-Institute for Ecology and Innovation, Brussels, Belgium, 2016

"Sustainable growth from Bioeconomy", The Finish Bioeconomic Strategy (2014), Government of Finland

"Swedish Research and Innovation Strategy for a Bio-based Economy"; FORMAS, R3:2012; Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS): Stockholm, Sweden, 2012; p. 36

"**The development of instruments to support the material use of renewable raw material in Germany – Market volumes, structures and trends"** Carus, M. et al (nova-Institute) 2010

"The role of biomass and bioenergy in a future Bioeconomy: Policies and facts" by Scarlat, Nicolae, Jean-François Dallemand, Fabio Monforti-Ferrario, and Viorel Nita Environmental Development 15 (2015): 3-34

- ***United Nations Environment Programme (UNEP)***

"**Decoupling Natural Resource Use and Environmental Impacts from Economic Growth**", *Fischer-Kowalski, M., Swilling, M., von Weizsäcker, E.U., Ren, Y., Moriguchi, Y., Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Hennicke, P., Romero Lankao, P., Siriban Manalang, A., Sewerin, S., Report of Working Group on Decoupling to the International Resource Panel, United Nations Environment Programme (UNEP)*, 2011, New York (USA), UNEP official website, http://www.unep.org/resourcepanel/decoupling/files/pdf/Decoupling_Report_English.pdf

"**Decoupling 2 Technologies, Opportunities and Policy Options**", *Working Group on Decoupling, United Nations Environment Programme (UNEP)*, 2014, New York (USA), UNEP official website, http://www.unep.org/resourcepanel/Portals/24102/PDFs/IRP_DECOUPLING_2_REPORT.pdf

- ***Websites***

Bio-based industries (BBI) Joint Undertaking (JU), Website, *Bio-based Consortium (BIC) and the European Commission (EC)*, 2014, official website http://www.bbi-europe.eu/

Bio Base NWE, official website, http://www.biobasenwe.org/en/skills-expertise/services/

Conference of Parties (COP) 21, Sustainable Innovation Forum 2015, Website, *United Nations Environment Programme (UNEP), 2015, official website,* http://www.cop21paris.org/

COSME, EC, official website, http://ec.europa.eu/growth/access-to-finance/cosme-financial-instruments/index_en.htm

EFSI, EIB, official website, http://www.eib.org/efsi/efsi_dashboard_en.jpg

EIT, EIB, official website, Sept-15, http://eit.europa.eu/newsroom/eit-bridging-innovation-gap

European Commission (EC), "Societal challenges", official Website, https://ec.europa.eu/programmes/horizon2020/en/h2020section/societal-challenges

European Commission (EC), "Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy", official Website, https://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water

European Commission (EC), "Paris Agreement", official Website, http://ec.europa.eu/clima/policies/international/negotiations/future/index_en.htm

European Commission (EC), Research & Innovation, "Bioeconomy", official website, https://ec.europa.eu/research/bioeconomy/index.cfm

European Commission (EC), Environment, "Circular Economy Strategy", official website, http://ec.europa.eu/environment/circular-economy/index_en.htm

European Commission (EC), Press release database, official website, http://europa.eu/rapid/press-release_SPEECH-14-546_en.htm

European Commission (EC), "Innovation deals for a Circular Economy", official website, https://ec.europa.eu/research/innovation-deals/index.cfm

European Commission (EC), "Innovating for Sustainable Growth: A Bio-economy for Europe", official website, http://ec.europa.eu/research/bioeconomy/pdf/201202_innovating_sustainable_growth_en.pdf

European Commission (EC), "Rules under Horizon 2020", official website, http://ec.europa.eu/research/horizon2020/pdf/press/fact_sheet_on_rules_under_horizon_2020.pdf

European Commission (EC), "European Institute of Innovation and Technology", official website, https://ec.europa.eu/programmes/horizon2020/en/h2020-section/european-institute-innovation-and-technology-eit

InnovFin, EIB, official website, http://www.eib.org/attachments/general/events/20150205_innovfin_finland_bartels_en.pdf.pdf

Food and Agriculture Organisation of the United Nations (FAO), "The state of World Fisheries and Aquaculture", official website, http://www.fao.org/fishery/sofia/en

Global Footprint Network (GFN), "Footprint Basics", Website, 2015, official website, http://www.footprintnetwork.org/pt/index.php/GFN/page/footprint_basics_overview/

PBI, EIB, official website, http://www.eib.org/products/blending/project-bonds/index.htm

European Investment Bank

The EU bank

Information Desk
+352 4379-22000
+352 4379-62000
info@eib.org

European Investment Bank
98-100, boulevard Konrad Adenauer
L-2950 Luxembourg
+352 4379-1
+352 437704
www.eib.org