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Strategic sector, generic funding

Analysing ten years of Horizon grants to Europe's biotech firms

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This report is available at cfg.eu/strategic-sector-generic-funding/

Table of Contents

Executive Summary

The EU has decided biotech is strategic and that public money should help build it. Our analysis of ten years of Horizon Europe grants finds that the design of instruments is not aligned with the way biotechnologies actually develop.

Horizon Europe is the EU's €95.5 billion research and innovation programme and its single biggest instrument for turning science into industry. We looked at Horizon because it is the largest and because it reaches across the whole pipeline, from basic research to market. Public funding for biotech also runs through InvestEU, European structural funds, national programmes and soon the European Competitiveness Fund, so this is one part of a wider picture.

To understand the way Horizon grants impact the biotech firms that receive them, we used Horizon grant records linked to firm-level financial, ownership, and patent data from ORBIS, covering 2015 to 2025. We compared biotech against two groups we define for this analysis: digital tech (software and computing) and hard tech (hardware-based fields like chips, materials and clean energy).

The work comes in two briefs. The first asks what a typical biotech firm in receipt of Horizon funding looks like, how it compares to other deep tech sectors and what happens to the firm after a grant. The second looks inside biotech, at how the money splits between health and non-health firms to see how their scale-up and financial profiles differ.

The findings span two layers: the funding instruments, and the technology they are supporting development of. We find that Horizon's instruments are calibrated to the average deep tech firm, which moves fairly directly from research to market, with a grant bridging the gap until private investors take over. This fits software better than biotech, where development challenges come later in the technology's development - for instance, at the scaling-up stage of a bioprocess. Biotech also stays research-intensive for longer than its peers, and its capital needs more closely align with those of hard tech rather than software.

Alongside the instrument analysis, we set out how public money could support biotech better. Funding should build shared foundations the whole field can use, rather than only underwrite one firm's plant or one project's proof. Public funding could have particular leverage in making pilot-scale manufacturing capacity, pooling data on how biological processes behave at scale, and ensuring appropriate availability of a trained workforce.

The European Commission is now examining its levers to strengthen biotechnology, from the Bio-based Europe Alliance gathering offtake commitments to the Bioeconomy Investment Deployment Group on financing. This is the moment to confront the fit between those interventions and the way technologies mature.

What we found

Biotech firms are structurally similar to digital firms but they develop like hard tech. They are young and lean, matching digital firms on age, headcount and revenue, with a median revenue near €1.8 million against €5 million in hard tech. Their development, though, runs on long regulatory approvals, heavy capital and physical scale-up, which is how hard tech behaves. Horizon's instruments are calibrated to a generic deep tech average that fits neither profile well.

Grants lift revenue across deep tech, but in biotech the gain does not last. In biotech the gain turns negative by years four to five, once the firm hits its next milestone and the grant is spent. The tickets are too small to reach the point where private investors could take over.

SMEs make up most of the biotech grantees but capture little of the money. SMEs make up 85% of biotech firms in receipt of grants, but take only 22% of biotech funding, against 52% in digital tech and 35% in hard tech.

Grants raise revenue for independent SMEs, but not for those belonging to a corporate group. Among biotech SMEs, independent firms grow revenue by about 24.7% after a grant, while corporate-group firms show no significant change. Corporate-group SMEs nonetheless receive 66% of SME funding.

Non-health biotech gets less fundamental research funding than health biotech. Non-health biotech - the industrial and agricultural side rather than medicine - gets just 7.6% of its Horizon funding through Pillar I, the science excellence pillar, against 20.7% for health. Only 26.4% of non-health projects sit at early research stages, against 43.1% for health, and universities hold 42.1% of consortium places, against 50%.

Early-stage non-health biotech is funded thinly, and the grants it does get don't show an effect. Early-stage firms take 22.9% of non-health grant money against 37.1% for their health equivalents, and more than four in five never receive above €500,000. Unlike early-stage health firms, they show no measurable revenue gain. Whether that reflects grant size or a thinner surrounding ecosystem, our sample cannot settle.

Introduction

Europe's biotech firms are working on the future in the most literal sense - developing the medicines, materials, tools, and platform technologies that will define the next generation of healthcare, agriculture, and industrial production. Most are small, young, and operating on ambition as much as capital, which is the nature of science-intensive sectors at the frontier. Translating science into commercial reality requires the innovation, capital, manufacturing capacity, and industrial know-how that larger firms bring. A healthy ecosystem needs both the disruptive energy of early-stage firms and the scale of established players.

As the EU Biotech Act takes shape and negotiations over the next Multiannual Financial Framework intensify, the question of how Europe directs public investment into its biotech ecosystem is both alive and consequential. Horizon Europe is the largest single lever available, so whether its instruments are well-matched to the biotech firms it is supporting determines whether that investment arrives where the sector needs it most.

A 2025 report, “Funding ideas not companies. Rethinking EU innovation policy from the bottom up”, gave reason to doubt that it does. Researchers at IEP@Bocconi and EconPol Europe linked roughly two-thirds of all Horizon 2020 and Horizon Europe company grants from 2015 to 2025 to those firms' organisational structure, financial performance and patents[1]. The headline finding was that recipient firms see a revenue increase of around 10%, but the effect fades within about three years, roughly the length of the grant itself[2]. The authors developed this finding in a VoxEU column that has circulated widely in the FP10 debate[3]. The column described Horizon funding as “a flash in the pan”, with the majority of money flowing to large, not particularly dynamic companies, some involved in hundreds of Horizon projects, rather than to the disruptive young firms we assume the programme backs. Independent SMEs receiving single-entity grants show a lasting positive effect, which disappears once a firm belongs to a wider corporate group. Consortium schemes, the instrument Horizon relies on most, showed no measurable effect on long-term growth or innovation. The authors conclude that EU innovation policy should shift towards a bottom-up model: funding ideas rather than large companies, backing small independent firms over large consortia.

While that study pooled every sector inside Horizon's company grants together, here we ask what the picture looks like for biotech specifically (health and non-health biotech), and how biotech compares with other deep tech sectors funded through the same programme. The authors at Bocconi granted us access to the underlying data which lets us investigate what type of biotech firms Horizon funds, where that funding concentrates, and what it produces for the firms that receive it.

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[1] Gros, D., Hofer, S.M., Mengel, P.-L., Molteni, M., Presidente, G., Rujan, C., and Schimmel, F., *IEP-COMPET Dataset*, IEP@BU Working Paper Series (Institute for European Policymaking, Bocconi University, 2025), https://iep.unibocconi.eu/sites/default/files/media/attach/IEP-COMPET%20Dataset%20(2).pdf (accessed 21 July 2026).
[2] Fuest, C., Gros, D., Mengel, P.-L., Presidente, G., and Rujan, C., *Funding Ideas, Not Companies: Rethinking EU Innovation from the Bottom Up*, IEP@BU Report No. 245 (Institute for European Policymaking, Bocconi University, and EconPol Europe/ifo Institute, 2025), https://iep.unibocconi.eu/publications/reports/funding-ideas-not-companies-rethinking-eu-innovation-bottom (accessed 21 July 2026).
[3] Fuest, C., Gros, D., Mengel, P.-L., Presidente, G., and Rujan, C., 'Why EU Innovation Policy Fails to Promote Disruptive Innovation', *VoxEU*, 3 December 2025, https://cepr.org/voxeu/columns/why-eu-innovation-policy-fails-promote-disruptive-innovation (accessed 21 July 2026).

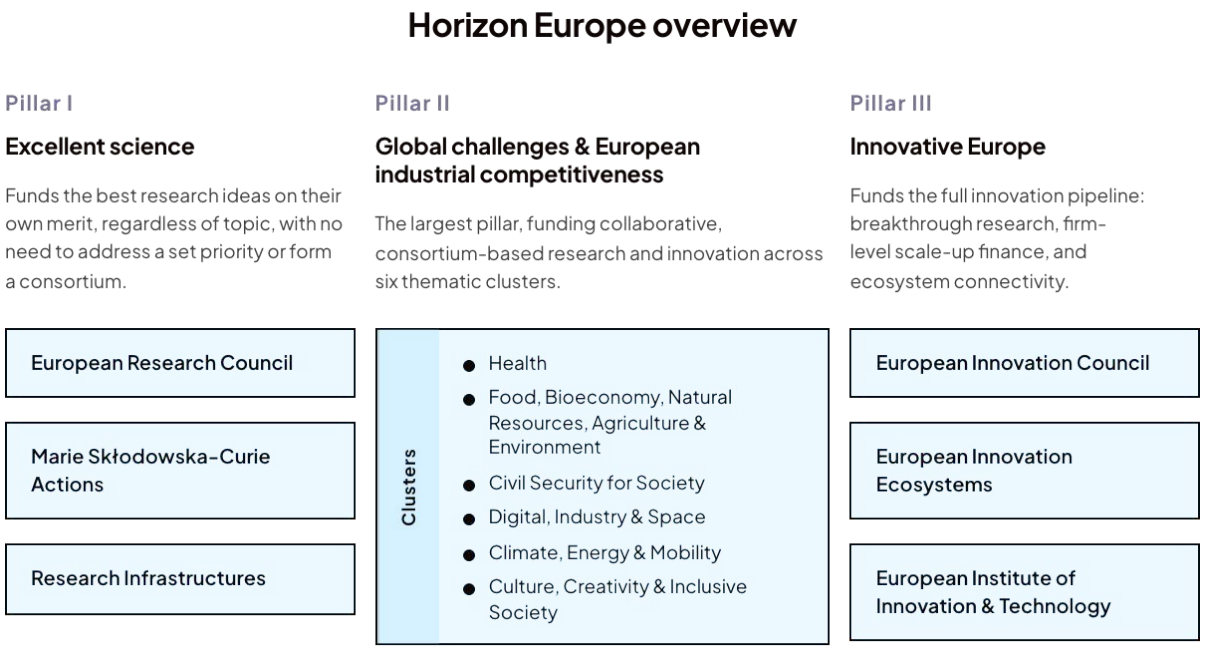
Biotech firms funded through Horizon span health, agriculture, food, and industrial applications. Splitting them into separate sector categories would obscure the biological technology they share, so this report groups firms by that shared technology instead, mirroring how the Commission already structures its own deep tech policy under STEP, the EIC, and the Key Enabling Technologies framework.

Three deep technology groupings follow from this:

- **Biotech**: engineering of biological systems into scalable technologies across health, agriculture, food, and industrial applications.
- **Hard tech**: largely hardware-based, including advanced materials, advanced manufacturing, micro- and nanoelectronics, quantum, space, and clean energy.
- **Digital tech**: software-based, including AI, digital systems, and robotics and autonomy[4].

These frameworks already treat different deep tech domains within Europe's competitiveness and technological sovereignty agenda, funding them through overlapping instruments built on similar assumptions about what firms need.

Horizon Europe, the EU's €95.5 billion research and innovation programme, is the principal public lever spanning the full innovation pipeline from fundamental science to market-ready deep tech. It operates through three structural pillars. Pillar I funds investigator-driven research through the European Research Council and Marie Skłodowska-Curie Actions. Pillar II, the largest, funds collaborative research and innovation across thematic clusters through multi-partner consortia of universities, research organisations, and industry. Pillar III focuses on scaling innovation, centred on the European Innovation Council (EIC), including the EIC Accelerator: the main instrument for firms applying alone rather than through a consortium.



[4] Robotics and autonomy are classified under digital tech. These systems are cyber-physical and rely on hardware such as actuators, sensors, and mechanical platforms, but their differentiation increasingly resides in software such as perception, planning, control, and learning-based autonomy. These software layers are largely platform-agnostic and applied across varied machinery rather than tied to one hardware form, so the competitive edge most often sits with the software dimension.

What is the EU Biotech Act?

The proposal for the EU Biotech Act I was published by the European Commission on 16 December 2025 as COM(2025) 1022[5]. It is the EU's first binding cross-sectoral regulation for biotech, covering health biotech across its full lifecycle, from research through to manufacturing and market access. The aim is to fix the specific obstacles slowing health biotech firms down: slow permitting, fragmented capital markets, a gap in funding for the stage between demonstrating a technology works and manufacturing it at commercial scale, slow regulation generally, and the biosecurity risks that come with faster biotech development. It introduces strategic projects, a recognition status for individual biotech facilities and initiatives that unlocks faster permitting and priority access to EU funding, and it creates a new investment pilot with the European Investment Bank Group to mobilise capital for scale-up. It also shortens clinical trial authorisation timelines, introduces regulatory sandboxes and other regulatory innovation tools to support regulatory learning for novel products, and adds binding biosecurity and biodefence controls, including mandatory screening of synthetic DNA and biological materials of concern. A second legislative initiative is now in preparation, covering industrial biotech, agriculture, aquaculture, and food and feed. Its Call for Evidence closed in June 2026, and it is already weighing tools far removed from public funding: lead market designations and minimum content requirements to force demand for bio-based products, and streamlined permitting to cut the delays that currently slow non-health biotech projects from breaking ground[6].

[5] European Commission, 2025. Proposal for a Regulation on establishing a framework of measures for strengthening the Union's biotechnology and biomanufacturing sectors, particularly in the area of health (European Biotech Act). COM(2025) 1022 final. Brussels, 16 December.
[6] European Commission, 2026. Call for Evidence: Biotech Act II — industrial biotechnology and biomanufacturing. Brussels.

Brief one: Does Horizon funding fit the biotech firms it's seeking to grow?

You may have heard that Europe is having its biotech moment. The proposed Biotech Act (2025) aims to accelerate and facilitate how biotech products move from lab to market, and to unlock investment for biotech companies in Europe, including a €10 billion investment pilot run jointly with the European Investment Bank. It is arriving in two parts: an initial package on health biotech, followed by a second package on non-health biotech. Separately, the EU institutions are negotiating the bloc's next seven-year budget (the 2028–2034 Multiannual Financial Framework), which will determine funding for research through the next Framework Programme, Horizon Europe (informally FP10), and for industrial competitiveness through a new and closely linked European Competitiveness Fund.

All three efforts agree on the same premise: biotech is strategically essential, private capital alone will not build it, and public money has a role to play in bridging the gap from science to commercial production. Biotech is a sector where public funding can be instrumental as risk is high, regulatory timelines are long, capital requirements are heavy, and the pre-commercial phase stretches well beyond what markets will easily fund on their own.

This brief asks whether the public money currently doing most of that bridging reaches the firms the strategy depends on, in the form they actually need. It compares EU funding to biotech firms against funding to their peers in two groups we define for this analysis. Digital tech covers software, AI and computing; hard tech covers hardware-based sectors such as semiconductors, advanced materials, and clean energy. The groupings follow the EU's own technology categories (STEP, the EIC, the Key Enabling Technologies), and firms are sorted using project descriptions, NACE codes and patent data. We looked only at firms that won Horizon funding, the firms the system already selected for. If the instruments fit even these firms poorly, they are unlikely to fit unfunded firms any better. Other instruments, including InvestEU, structural funds, and national programmes, fall outside the scope of this analysis.

Brief I considers three questions. What does the typical Horizon biotech firm actually look like, and how does it compare to its peers in digital and hard tech? What does the financial data say happens to those firms once they receive a grant? And what do the patterns suggest about whether Europe's funding architecture fits the firms it is trying to grow?

The EU deep tech funding landscape

EU-backed deep tech firms span a broad range of technologies. Most firms are around a decade old with small headcounts, and median revenue varies across domains, from €1.8M in biotech to €5M in hard tech.

Sector	Companies	Projects	EU contribution	Median age	Median staff	Median revenue	Median grant
Biotech	3,051	4,352	€2.6B	11	15	€1.8M	€263k
Health Biotech	2,195	3,472	€1.9B	10	13	€1.2M	€270k
Non-Health Biotech	1,075	880	€654M	15	23	€4.4M	€247k
Hard Tech	6,289	6,329	€7.1B	14	25	€5.0M	€261k
Digital Tech	3,166	4,228	€3.1B	10	17	€2.3M	€275k

Deep tech projects with at least one private company receiving public EU Horizon funding (2015–2025). Company information taken at the grant year. All domains and subdomains are mutually exclusive. Classification uses project descriptions, NACE codes and patent data. The biotech classifier is ML-based and takes precedence over the score-based classifiers where domains overlap. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

What does the data show?

The typical biotech and digital tech firm are similar; hard tech stands apart

Comparing the fundamentals of private companies receiving EU Horizon funding (2015–2025) for deep tech projects across biotech, digital tech and hard tech.

	Biotech	Digital tech	Hard tech
Age median, years	12.0 yrs	10.0 yrs	14.0 yrs
Workforce median employees	16 staff	17 staff	24 staff
Revenue median, €M	2.6 €M	2.3 €M	5.0 €M
SME share* % of firms	85%	83%	78%
Loss-making firms % of firms, post-grant	1 in 4	1 in 4	1 in 4

* SME status as inferred by the financial database, not official EU SME status. Information coverage ranges between 43% and 100% across metrics, reflecting differences in firm-level reporting completeness. Domain classification based on ML classifiers. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

Finding 1: Digital tech and biotech - similar firm profiles, differing development needs

On standard measures, biotech firms receiving Horizon funding look statistically like their digital counterparts. Both sectors skew young: 44% of biotech firms and 48% of digital firms are under ten years old, against just 38% in hard tech. Both run lean, with median headcounts of 15 and 17 employees respectively, compared to 25 in hard tech. And both generate modest revenues - €1.8 million median in biotech, €2.3 million in digital - well below the €5.0 million median in hard tech. Hard tech sits clearly apart on every count: older firms, larger workforces, and a much heavier upper tail running into the hundreds of employees, as you would expect from sectors built around physical hardware, specialised infrastructure, and often long development cycles.

Despite the similarity between biotech and digital tech firms participating in Horizon, the underlying development process for biotech is categorically different to digital tech: It runs on long regulatory timelines, heavy capital expenditure, physical hardware, and laboratory to scale-up infrastructure, with a slow path from scientific proof-of-concept to commercial product[7]. On those terms, biotech's development logic sits much closer to hard tech. Biotech firms are combining the development demands of hard tech with the firm scale and balance sheets of digital tech[8]. This is a structural tension at the heart of biotech's commercialisation challenges.

Finding 2: Biotech firms skew towards earlier stages of technology readiness development

Firms participating in Horizon biotech projects show a distinct orientation towards earlier-stage, research-intensive activity than in comparable deep tech sectors. These are private, for-profit companies whose R&D is by definition commercially oriented, yet even this commercially relevant research remains tied closely to academic institutions. Unlike in digital tech, where a firm draws on research to build a product and then largely departs from it, biotech development tends to stay scientifically intensive well into commercialisation. Scaling a biological system, optimising a fermentation process, qualifying an engineered cell strain for consistent production at volume - these involve genuine scientific and technical uncertainty when moving from lab to facility. Scale-up is increasingly recognised as a primary technical bottleneck: processes that perform reliably at bench scale can behave unpredictably at industrial volume, requiring original problem-solving at each transition point[9]. The broader literature makes the point that biological

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[7] OECD, 'Boosting Biotechnology Innovation through Agile Regulation and Finance Instruments', OECD Policy Briefs, No. 41 (OECD Publishing, 2025);
Starr, J., Erdoes, K., Colvin, B., Ghosh, S., and de Kok, S., 'Bridging the Valley of Death: Building a Bio-Industrial Pilot Plant Network', Chemical Engineering Progress, November 2025;
World Bio Market Insights, 'Surviving the Valley of Death: A Guide for Bio-Startups', World Bio Market Insights, 17 September 2025, https://worldbiomarketinsights.com/surviving-the-valley-of-death-a-guide-for-bio-startups/ (accessed 21 July 2026).

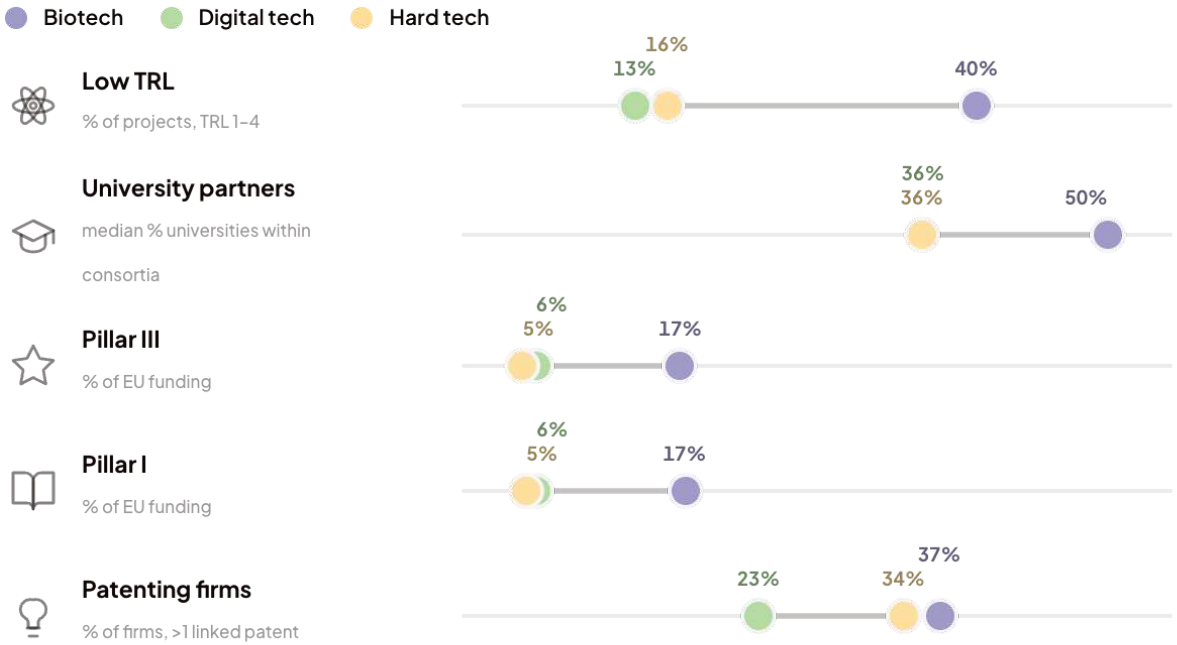
[8] Lazonick, W., and Tulum, Ö., 'US Biopharmaceutical Finance and the Sustainability of the Biotech Business Model', Research Policy, 40/9 (2011), 1170–1187, https://doi.org/10.1016/j.respol.2011.05.021;
EY, How Can Biopharma Keep Its Balance? EY Biotech Beyond Borders Report 2026 (EY Insights, 2026).

[9] Rugbjerg, P., Myling-Petersen, N., Porse, A., Sarup-Lytzen, K., and Sommer, M.O.A., 'Diverse Genetic Error Modes Constrain Large-Scale Bio-Based Production', Nature Communications, 9 (2018), 787, https://doi.org/10.1038/s41467-018-03232-w;

innovation isn't cleanly sequential as research to engineering to market do not hand off in tidy stages[10],[11]. It's more of a continuum where scientific and technical challenges are interwoven throughout the development cycle. As a result, policies and instruments that delineate development stages and scientific challenges strictly tend to impede technology commercialisation.

Biotech firms lean earlier-stage and more research-intensive than both hard and digital tech

How biotech, digital tech and hard tech projects draw on EU Horizon funding (2015–2025) and partner with academia.



Pillar I (Excellent Science) funds the best research ideas on their own merit, with no set priority or consortium required. Pillar III (Innovative Europe) funds the full innovation pipeline: breakthrough research, firm-level scale-up finance and ecosystem connectivity.

Information coverage ranges between 80% and 100% across metrics, reflecting differences in reporting completeness. Domain classification based on ML classifiers. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

The data reflects this: forty percent of Horizon biotech projects are classified as being at low technology readiness levels (TRL) (1–4), more than double the rate of digital (13%) and hard tech (16%). The median biotech project has a university partner share of 50%, well above both digital and hard tech at 36% each, and biotech firms receive 17% of their EU funding through Horizon's basic science pillar, compared to around 5% for both digital and hard tech.

Kim, J.Y., Yu, H.E., Kim, M.H., and Lee, S.Y., 'Beyond Petrochemicals: Challenges and Opportunities in Industrial-Scale Biomanufacturing', Nature Communications, 17 (2026), 4819, https://doi.org/10.1038/s41467-026-73835-1.

[10] National Research Council, *Industrialization of Biology: A Roadmap to Accelerate the Advanced Manufacturing of Chemicals* (The National Academies Press, 2015).

[11] Ellwood, P., Williams, C., and Egan, J., 'Crossing the Valley of Death: Five Underlying Innovation Processes', Technovation, 109 (2020), 102162, https://doi.org/10.1016/j.technovation.2020.102162;
Espinel-Ríos, S., 'Biotechnology Systems Engineering: Preparing the Next Generation of Bioengineers', Frontiers in Systems Biology, 5 (2025), 1583534, https://doi.org/10.3389/fsysb.2025.1583534.

Universities contribute well beyond early-stage discovery into scaling lab results to industrial production, optimising bacterial strains, and the analytical testing that confirms purity and quality[12]. For smaller biotech firms, having academic partners allows for access to containment facilities, bioreactor systems, and analytical equipment that is prohibitively expensive to own independently. This relationship is in many ways symbiotic, a natural extension of the technology translation and knowledge-transfer roles that universities have come to embrace, and one that reinforces regional innovation ecosystems and academic missions around impact. However, this could also be symptomatic of a deeper structural gap: the absence of accessible, commercially-oriented shared infrastructure at the scale the sector requires[13]. Academic institutions are configured for research and training, not commercial translation. Routing firms through them by default, rather than by design, can leave firms working with timelines and incentives that don't match what getting a technology to market actually requires.

Finding 3: Biotech firms carry a higher-risk profile than deep tech peers

Biotech firms in the Horizon cohort show a somewhat different risk and innovation profile to their deep tech peers. They pattern with hard tech on IP intensity: 37% hold patents, against 34% in hard tech and just 23% in digital. Yet they draw 17% of their funding through Pillar III, the EIC's higher-risk, breakthrough-oriented instruments, compared to around 5% for both digital and hard tech. This is consistent with a sector operating at earlier stages of the innovation cycle and with higher uncertainty than comparable cohorts.

Two years after a project starts, roughly one in four firms across all three sectors is loss-making, with rates of 24% in biotech, digital, and hard tech alike. That consistency suggests loss-making at this point is a feature of the Horizon deep tech cohort broadly, not a biotech-specific concern. The two-year snapshot cannot show how that loss-making picture diverges over time.

Biotech's patent intensity and its higher share of funding through EIC high-risk instruments point to a sector operating at an early, high-risk stage, the profile Horizon's SME-oriented instruments are designed to support. Yet SMEs capture a smaller share of overall biotech funding than their headcount share or risk profile would suggest, and a smaller share than SMEs capture in either digital or hard tech. This raises a structural question about whether current Biotech programme design inadvertently favours larger, more established participants.

Finding 4: Biotech SMEs capture less funding compared to SMEs in digital and hard tech

SMEs make up 85% of biotech firms in the Horizon cohort, slightly higher than digital (83%) and hard tech (78%). But biotech SMEs capture only 22% of biotech funding, compared to 52% in digital and 35% in hard tech. Put the other way around, the small minority of non-SME biotech firms in the Horizon cohort capture nearly four euros in five. Some of this gap can be explained

[12] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033;
IBISBA, 'About', IBISBA, https://ibisba.eu/about/ (accessed 21 July 2026).
[13] European Commission, Proposal for a Regulation of the European Parliament and of the Council on the European Biotech Act, COM(2025) 1022 final (Brussels, 16 December 2025).

structurally: biotech Horizon funding tends to flow toward larger consortia and capital-intensive scale-up projects.

Finding 5: Horizon grants translate into revenue growth on average, but the picture diverges by domain

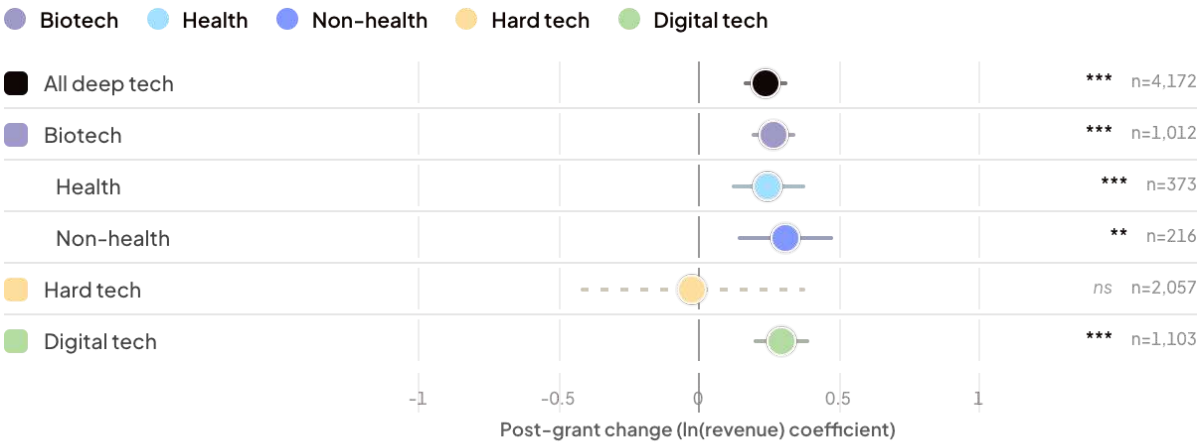
The descriptive profiles of the three deep tech domains differ, in firm characteristics, grant distributions, and position in the technology readiness cycle. But once a firm receives a grant, do these differences translate into differing financial outcomes for the firms?

We use a dataset built by researchers at Bocconi University[14], linking Horizon Europe grant records to firms' Orbis financial accounts. We restrict to firms with exactly one grant, so any revenue change can be traced to it, and compare revenue before and after, controlling for firm fixed effects and year fixed effects. What remains is our estimate of the grant's effect.

Across the full sample, post-grant revenue is significantly higher than pre-grant revenue for firms active in deep tech Horizon projects. At the aggregate level, the grant does what the policy was designed to do. The sector breakdown diverges considerably across the three domains.

Boosted revenues after EU funding for biotech and digital tech, not hard tech

Association between EU Horizon grant receipt and firm revenue, by deep tech sector and subdomain (2015–2025). Coefficients are positive and significant for biotech and digital tech but not distinguishable from zero for hard tech.



*** p<0.01 ** p<0.05 * p<0.1 **ns** not significant

Two-way fixed-effects regressions on the matched CORDIS×Orbis panel; points are coefficients with 95% confidence intervals. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

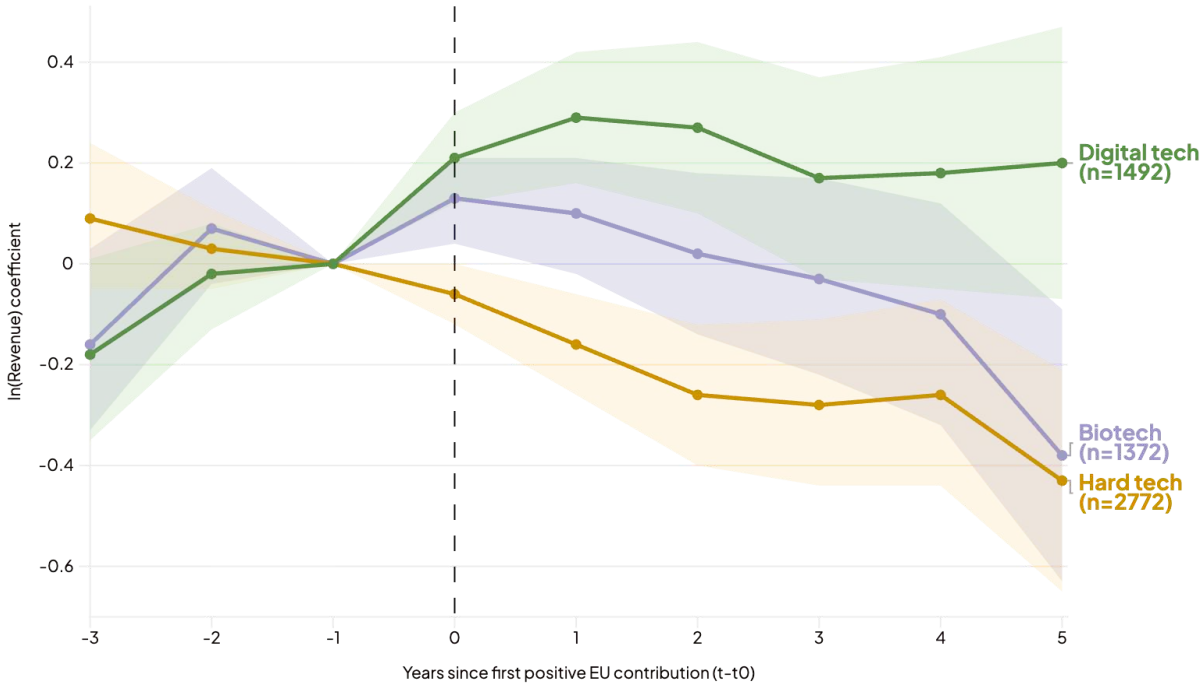
[14] Gros, D., Hofer, S.M., Mengel, P.-L., Molteni, M., Presidente, G., Rujan, C., and Schimmel, F., *IEP-COMPET Dataset*, IEP@BU Working Paper Series (Institute for European Policymaking, Bocconi University, 2025), https://iep.unibocconi.eu/sites/default/files/media/attach/IEP-COMPET%20Dataset%20(2).pdf (accessed 21 July 2026).

The post-grant effect for digital tech is significantly positive and persists across the full post-treatment window. This fits a sector with short paths to market, software-scale cost structures, and revenue cycles that sit comfortably within the grant horizon. The grant bridges a short financing gap to commercial viability, as the policy intends.

Hard tech is more selective. In aggregate the coefficient is negative and not statistically different from zero, but pulling subdomains apart we can see that advanced manufacturing, space & aerospace and MedTech & devices show significant positive effects, while the remaining hard tech sub-domains show no measurable revenue response. One plausible explanation is proximity to a downstream customer base. Where that customer base is identifiable and proximate, such as defence ministries, aerospace primes, healthcare providers, and established industrial supply chains, the grant translates into measurable revenue growth in the years that follow.Where the customer base is more diffuse, or dependent on long public-procurement timelines that operate on horizons much longer than the grant itself, the funding lands but it is not followed by revenue growth for the firm.

Horizon grants lift biotech revenue in the short term, but the boost fades within four years

Digital tech firms sustain their gains after receiving a grant, while hard tech firms have a persistent declining trend.



EU Horizon-funded deep tech firms, 2015–2025. Single-project firms only. Shows fractional change in revenue before and after grant receipt. Shaded area shows the 95% confidence interval. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

The biotech coefficient looks similar to digital, positive and significant. Stacking every firm's trajectory on top of each other shows a more detailed picture: the post-grant effect is positive initially for biotech, broadly in line with digital, but it declines faster and turns negative by years four to five after grant receipt. This is consistent with what we know about biotech development timelines. Biotech firms operate on horizons long enough that, for a material share of grant recipients, the next technical, clinical, or regulatory milestone falls outside the

window in which the grant is still visible in the firm's accounts. When that milestone is missed, the follow-on private capital that would sustain revenue growth does not materialise, and the early effect of the grant erodes.

Finding 6: Independent SMEs gain more from grants than SMEs in corporate groups

We split firms into two groups using company ownership data from our financial database (Orbis): independent firms, which answer to no parent company, and corporate-group firms, which are subsidiaries or parent companies within a wider group. To see if there is a difference, we zoom into SMEs across both groups, so that firm size does not distort the comparison. A large company for whom a grant is a small fraction of its turnover would not be expected to show much of an effect.

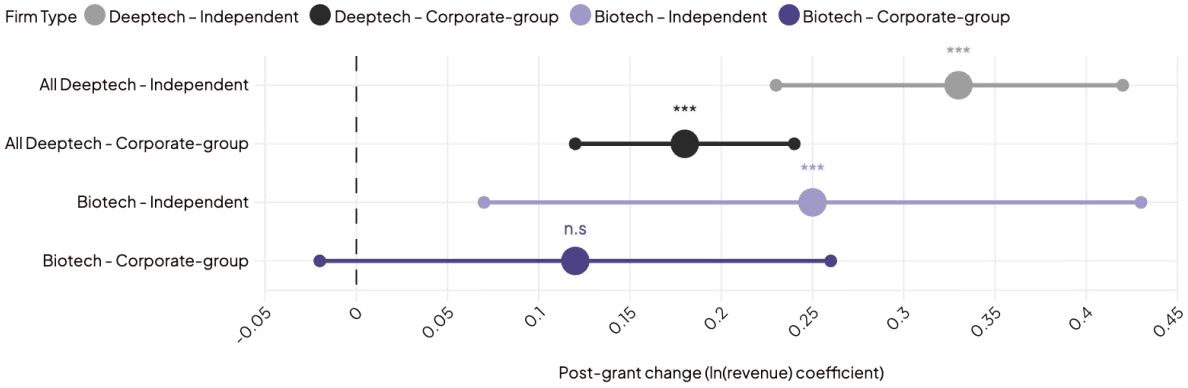
Across deep tech, independent SMEs see their revenue rise by approximately 32.7% after receiving a grant. SMEs owned by a corporate group also see a rise, but a smaller one, at 18.4%.

Among biotech SMEs, independent firms see a 24.7% increase. Biotech SMEs owned by a corporate group show no significant change in revenue after receiving a grant.

These findings mirror those of the Institute for European Policymaking at Bocconi University (IEP@BU), whose analysis of all Horizon grants found the same pattern: EU grants boost revenue more for independent SMEs than for SMEs owned by corporate groups[15]. IEP@BU proposes an explanation based on financial need: subsidiaries are unlikely to be financially constrained, since a parent company can plug gaps that a grant would otherwise fill. For a standalone startup, the same grant can determine whether the firm and its ideas survive at all.

Independent vs corporate-group SMEs – does revenue increase after receiving a grant?

EU grants boost revenue more for independent SMEs than for corporate-group SMEs. In biotech only independent SMEs show significant revenue gains post-grant.



EU Horizon-funded firms, 2015–2025. Single-project firms only. Two-way fixed effects regression (firm and year). Standard errors clustered at firm level. Significance: *** p<0.01, ** p<0.05. n.s = not significant. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

[15] Fuest, C., Gros, D., Mengel, P.-L., Presidente, G., and Rujan, C., *Funding Ideas, Not Companies: Rethinking EU Innovation from the Bottom Up*, IEP@BU Report No. 245 (Institute for European Policymaking, Bocconi University, and EconPol Europe/ifo Institute, 2025), https://iep.unibocconi.eu/publications/reports/funding-ideas-not-companies-rethinking-eu-innovation-bottom (accessed 21 July 2026).

Corporate-group biotech SMEs still take home the larger share of biotech SME funding, 66% against 34% for independent biotech SMEs, despite the evidence that those grants don't measurably translate into revenue growth. This skew towards corporate-group recipients holds across deep tech more broadly: corporate-group SMEs receive 64% of SME funding in digital tech and 73% in hard tech. A shift of even a modest share towards independent SMEs could plausibly generate more output for the same level of public spending.

What this means for policymakers

Instrument calibration is key for biotech

To illustrate our point, the EIC accelerator has a €10 million equity ceiling and a €2.5 million grant ceiling, which together cap the public capital any single firm can receive. This may be adequate for a digital firm at median revenue with a short path to market, but the same ceiling often falls short for a biotech firm at the same revenue level, facing multi-year regulatory approval, significant pre-commercial capital expenditure, and no near-term return. The instrument is calibrated to a generic deep tech average, and applying that average uniformly, rather than to each sector's development logic causes a miscalibration.

Recent additions partially acknowledge the gap. The Strategic Technologies for Europe Platform (STEP) Scale-Up, launched in 2025, channels equity-only investments of €10–30 million through the EIC Fund into scale-ups across digital, clean tech, and biotech, aiming to catalyse total funding rounds of €50–150 million. Advanced Innovation Challenges, an ARPA-style pilot launched in the EIC's 2026 work programme, tests a different design: challenge-driven, demand-led funding staged across two phases, targeted at fields where Europe is strong in research but slow to commercialise. Both instruments offer larger or differently structured funding than the EIC Accelerator's fixed grant-and-equity ceilings, consistent with an emerging view that grant-based support alone may not carry firms across the commercialisation valley. Whether their calibration reflects biotech's specific cost structure and development timelines, or still leans on a broader deep tech average that systematically underestimates what the sector requires, is something only time and further data will show.

Programme design features compound this misalignment, such as the EIC one-grant rule, which limits firms to a single Accelerator award over the programme period and is consistent with a model in which firms progress linearly from late-stage development to commercialisation. This assumption is more likely to hold in digital than in biotech where firms at TRL 6–8 may still be several years and millions away from regulatory approval or revenue generation; a single intervention may not bridge the financing gap. The structural risk is that firms exit public support before private capital is willing to enter, and in biotech that private capital is scarce to begin with: US biotech venture capital investment has run consistently ahead of the EU's over the past decade, reaching up to ten times the European level at its 2021 peak[16].

[16] OECD, 'Boosting Biotechnology Innovation through Agile Regulation and Finance Instruments', OECD Policy Briefs, No. 41 (OECD Publishing, 2025).

These observations do not suggest that Horizon instruments are mis-specified in general, but rather that their effects are not uniform across sectors.

The same instrument interacts differently with firms depending on development model, capital intensity, and time to market. In biotech, where early-stage research, high-risk innovation, and capital-intensive scaling are tightly interwoven, these differences become particularly pronounced.

Policy is beginning to reflect this. The proposed €10 billion investment pilot under the EU Biotech Act, implemented with the EIB Group, explicitly aims to tailor financing to biotech-specific risk profiles rather than the generic deep tech average. It is likely to be particularly relevant for industrial and non-health biotech, where firms face the same capital-intensive development requirements as health biotech but without the regulatory certainty or specialist investor base.

The broader implication is that funding effectiveness depends as much on the volume of support as on alignment with sector-specific development dynamics. Where these dynamics diverge, as they do in biotech, a more differentiated approach to instrument design is required.

Funding should follow a strategic and compounding architecture

Biotech does not move through neat stages from research to engineering to market, rather scientific challenges run through the entire development cycle. Scaling a biological system, optimising fermentation, or qualifying an engineered organism each requires solving real scientific problems, not just engineering up what worked in the lab[17]. Funding architectures that assume otherwise are likely to impede technology translation[18].

So, if biotech does not develop linearly, neither should funding. A European perspective has to support the whole **bio-stack** in parallel. For industrial biotech that looks like: the strategic question of which feedstocks European biological systems can viably grow on, the engineered organisms themselves, the predictive digital systems that anticipate how those organisms will behave at industrial scale, the fermentation and processing steps that scale them up, and the analytical methods that verify what they produce. Funding one layer while starving another does not move the stack forward, it just shifts where the bottleneck sits (read more in our Call For Evidence for Biotech Act II).

Coordinating this kind of parallel progress requires a standing body with the mandate and continuity to track and update all five layers together, rather than ad hoc oversight of each in isolation. The US biotech roadmap points to Sematech, the long-running US semiconductor industry consortium, and the UK Synthetic Biology Leadership Council, established in 2012 to refresh the UK roadmap on a rolling basis, as two working precedents for this kind of body[19]. This

[17] National Research Council, Industrialization of Biology: A Roadmap to Accelerate the Advanced Manufacturing of Chemicals (The National Academies Press, 2015)
[18] Ellwood, P., Williams, C., and Egan, J., 'Crossing the Valley of Death: Five Underlying Innovation Processes', Technovation, 109 (2020), 102162, https://doi.org/10.1016/j.technovation.2020.102162. *Same source as footnote 4.*
[19] National Research Council, Industrialization of Biology: A Roadmap to Accelerate the Advanced Manufacturing of Chemicals (The National Academies Press, 2015).

is the kind of deliberate and continuous alignment of EU policy, investment, and innovation we called for in *Towards a European BioPower*.

For European policymakers, the case for bio-stack thinking maps onto two priorities already in motion: Strategic autonomy in biotech depends on coordinated capabilities across the stack, not isolated strengths in individual layers. A country that funds organism design without fermentation infrastructure, or fermentation without analytical methods, must still depend on and import the missing pieces. And planning public funding across the bio-stack prevents waste: investment in any single layer pays back only if the surrounding layers can absorb it. This coordination is not an argument for trimming Pillar I or compromising European Research Council independence. Investigator-driven frontier research is the foundation the whole stack depends on. Differentiated instruments elsewhere in the stack exist to capture and support that value, to help realise it, not to draw funding away from Pillar I.

The EIC suite operates on a different logic. The Commission reviews priorities and themes annually through Challenge calls and work programmes - but to what extent does this include strategic full bio-stack thinking? Horizon funding architecture has continued to evolve: STEP Scale-Up arrived in 2025, Advanced Innovation Challenges piloted in 2026. But the underlying parameters of the EIC instruments and STEP Scale-Up (TRL bands, ceilings, eligibility rules, the one-grant constraint) sit in the multi-annual programme, with no standing body reviewing whether they keep pace with the development logic of the quickly advancing technologies they are meant to support. A standing mechanism to ensure this learning loop is implemented would increase the effectiveness of EU public funding.

The Biotech Act creates an opening to change this. Its first, health-focused proposal (COM(2025) 1022, December 2025) introduces "health biotechnology strategic projects" and "high impact health biotechnology strategic projects": designations that recognise priority projects and unlock fast-track permitting, coordinated support, and easier access to EU funding. The high-impact tier is reserved for projects that demonstrate, "by virtue of [their] scale, scope or cross-border relevance, a strong systemic and catalytic potential within the Union's biotech ecosystem to accelerate innovation and enhance the translation of research into market applications"[20]. This systemic, ecosystem-level framing is the logic the bio-stack requires. Four features will determine whether it delivers on that logic:

1. The designations cannot remain confined to health. As currently drafted they reach only health biotech. The forthcoming non-health package (Biotech Act II) expected at the end of 2026 should equally integrate systems-level and bio-stack logic.
2. The designations need continuous updating, so the system tracks a fast-moving technology base rather than locking in yesterday's priorities.
3. They need to span the full technical stack, not name isolated projects. For example, for non-health biotech, that would mean feedstock science, fermentation, processing, organism design, and analytical infrastructure advancing in parallel.

[20] European Commission, Proposal for a Regulation of the European Parliament and of the Council establishing a framework of measures for strengthening the Union's biotechnology and biomanufacturing sectors, COM(2025) 1022 final (Brussels, 16 December 2025), Article 4.

4. There needs to be a robust feedback mechanism into instrument design itself, so the EIC and new instruments match the development logic of the technologies they support, rather than the deep tech average that this analysis has shown does not fit biotech.

Biotech Act II should borrow ambition and learnings from the Chips Acts

In 2020 and 2021, the global chip shortage turned a long-standing strategic weakness into a visible crisis. The US made 37% of the world's chips in 1990; by 2020 its share had fallen to 12%[21], and the EU's share of global manufacturing capacity stood at around 9%[22]. Car plants sat idle, and in Germany the hit to car production alone is estimated to have cut GDP by around 1.5% in the first nine months of 2021[23]. Both jurisdictions reached the same conclusion: a foundational industry had moved offshore, and reversing that required public money on a bold, industrial scale.

The CHIPS and Science Act passed in the US in August 2022, carrying $52.7 billion. The EU Chips Act followed in September 2023, mobilising up to €43 billion[24]. Both take the same shared architecture approach: a significant portion of the money targets capability the whole sector can draw on, rather than individual companies. This includes pilot lines that bridge laboratory process development and industrial-scale fabrication, the data that accumulates across them, and the workforce trained to operate them. The EU launched four pilot lines, each with an explicit mandate to serve start-ups and SMEs. The research was being done in Europe, the manufacturing had gone elsewhere, and bridging the two was too expensive and too risky for any one firm to attempt alone.

Is there evidence this works? The Chips Act's record separates cleanly into two halves. The European Court of Auditors found progress clearest under the pillar housing the pilot lines and shared research infrastructure, while the firm-level manufacturing-subsidy pillar saw slow uptake. The same audit concluded the Act is very unlikely to reach its 20% market-share target by 2030, a target the subsidy machinery was meant to deliver. When the Commission proposed Chips Act 2.0 in June 2026, it kept and expanded the pilot lines and overhauled the target-and-subsidy design. The half that worked is the half biotech should borrow[25].

This same logic applies to biotech - we propose a three pillars structure where the EU should concentrate public investment to build this shared-capability layer: physical infrastructure, intelligent digital infrastructure, and knowledge infrastructure.

[21] Semiconductor Industry Association, 2021 State of the U.S. Semiconductor Industry (Washington, DC: SIA, 2021)
[22] European Court of Auditors, The EU's Strategy for Microchips, Special Report 12/2025 (Luxembourg: European Court of Auditors, 2025)
[23] OECD, Vulnerabilities in the Semiconductor Supply Chain, OECD Science, Technology and Industry Working Papers, No. 2023/05 (Paris: OECD Publishing, 2023).
[24] Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 Establishing a Framework of Measures for Strengthening Europe's Semiconductor Ecosystem (Chips Act) [2023] OJ L229/1.
[25] European Commission, Proposal for a Regulation of the European Parliament and of the Council on a framework of measures for strengthening the Union's semiconductor ecosystem, repealing Regulation (EU) 2023/1781 (Chips Act 2.0) COM(2026) 504 final (Brussels, 3 June 2026).

1. Physical infrastructure – the foundational backbone for scale-up support

A shared European scale-up infrastructure would let any SME with a promising fermentation process or a novel production host work through the engineering and scientific challenges that emerge at each scale transition, generate the data needed to attract follow-on capital, and leave with a validated route to market. This is what shared, affordable biomanufacturing infrastructure would offer: access to facilities a small firm could never build on its own.

It would also de-risk the sector for private investors. A process proven at pilot scale, with the performance data to show it, is a far more fundable proposition than a promising result in a lab flask, which is often where the capital hesitates. This breaks a funding deadlock: the proof investors want is expensive to produce, and a shared facility does not make it free, but by spreading the cost across many users it brings that first proof within reach of firms that cannot yet raise against it. A shared site offers more than equipment - firms tap into the operators, process engineers, and hard-won troubleshooting know-how already there.

This is most urgent and impactful for the newest biology, where nobody knows how a novel process will behave outside the lab. Take AI-designed biologics: proteins and other molecules generated by algorithms rather than found in nature.[26] However well the design performs on screen, no one knows how the process will behave in a fermentation tank. Or engineered chassis cells, microbes whose DNA has been rewritten to turn them into tiny factories, which tend to lose those modifications over a long production run: the cells that abandon the costly engineered traits grow faster and take over.[27] This is called selection pressure, evolution at work in real time! Or new manufacturing paradigms, such as continuous bioprocessing, which keeps a bioreactor running for weeks instead of restarting after each batch, but few processes have made the transition from laboratory demonstration to commercial scale.[28] Other approaches move away from the standard microbial workhorses like bacteria and yeast fed with sugar. Cell-free systems skip living cells entirely, using only the molecular machinery extracted from them[29]; and gas-fermenting microbes are being engineered to grow on industrial CO_2 or waste gases rather than sugar, turning emissions into chemicals and fuels[30]. Both are too new at industrial scale for anyone to have worked out how to run them reliably. In every case above, the science and engineering sit at the frontier and the manufacturing knowledge needed to run these processes at scale is still in development. This makes shared learning particularly high-impact as compared to more established processes.

Shared not-for-profit (NFP) infrastructure is the most direct route. Bio Base Europe Pilot Plant in Ghent has run as an open-access, NFP facility for SMEs since 2008. It has completed more than

[26] Watson, J.L., Juergens, D., Bennett, N.R., Trippe, B.L., Yim, J., Eisenach, H.E., et al., 'De Novo Design of Protein Structure and Function with RFdiffusion', Nature, 620 (2023), 1089–1100, https://doi.org/10.1038/s41586-023-06415-8.
[27] Rugbjerg, P., Myling-Petersen, N., Porse, A., Sarup-Lytzen, K., and Sommer, M.O.A., 'Diverse Genetic Error Modes Constrain Large-Scale Bio-Based Production', Nature Communications, 9 (2018), 787, https://doi.org/10.1038/s41467-018-03232-w.
[28] Drobnjakovic, M., Hart, R., Kulvatunyou, B.S., Ivezic, N., and Srinivasan, V., 'Current Challenges and Recent Advances on the Path towards Continuous Biomanufacturing', Biotechnology Progress, 39/6 (2023), e3378, https://doi.org/10.1002/btpr.3378.
[29] Silverman, A.D., Karim, A.S., and Jewett, M.C., 'Cell-Free Gene Expression: An Expanded Repertoire of Applications', Nature Reviews Genetics, 21 (2020), 151–170, https://doi.org/10.1038/s41576-019-0186-3.
[30] Zhang, C., Fei, Q., Fu, R., Lackner, M., Zhou, Y.J., and Tan, T., 'Economic and Sustainable Revolution to Facilitate One-Carbon Biomanufacturing', Nature Communications, 16 (2025), 4896, https://doi.org/10.1038/s41467-025-60247-w.

900 confidential bilateral projects with over 300 companies and research institutions worldwide, and has experience with over 90 consortium-based projects, including more than 30 BBI JU and CBE JU projects. That track record makes shared facilities a proven mechanism for catalysing EU funding and de-risking innovation at demonstration scale, not a marginal add-on. Its infrastructure is modular: individual process steps, such as pretreatment, fermentation, and purification, can be run at different scales and recombined, rather than the whole line being fixed to one size. This attracts international firms to Europe for scale-up. Cemvita, a US firm, ran its fermentation process through 2–litre, 30–litre, 1,500–litre, and 15,000–litre stages before reaching a 75,000–litre demonstration run, climbing the entire scale-up ladder at Bio Base Europe without switching sites or partners.[31] Europe already has an asset that works, is competitive, and attracts international players. The problem is that it is one of a handful of legacy facilities, loosely networked through initiatives like Pilots4U, rather than a funded, expanding public system.

These kinds of public SME-facing infrastructures are fragile. The UK's Vaccine Manufacturing and Innovation Centre was funded with £250 million by 2021, then sold off before completion in 2022 when fiscal priorities changed, a decade of strategic intent undone by a single change of government.[32] They are fragile operationally too: equipment ages faster than budgets can replace, skilled operators leave for better-paid industry jobs, and pressure to recover costs pushes access toward the established firms that can afford it, rather than the early-stage firms the facilities were built to serve.

On the private side, only a handful of Europe's 20 to 30 industrial biotech Contract and Manufacturing Organizations (CMOs) are equipped for large-scale fermentation, and those that are tend to prioritise established, long-term clients, leaving the most innovative early-stage players stranded.[33] Access also depends on process fit: a startup's downstream process must be compatible with the CMO's existing infrastructure, no CMO will build a new downstream processing line to accommodate a startup, however promising its future business looks. This is the gap pilot plants like Bio Base Europe are designed to close. As open-access, mission-driven facilities, they support unproven and non-standard processes that a commercially-driven CMO cannot. But no single facility can offer every process fit. Europe needs complementary specialisations across facilities, covering different feedstocks, fermentation types, and downstream processes, so a start-up can find a technical match somewhere in the system. Biotech Act II should build this with three lessons in mind: long-term political and financial commitment so facilities are not sold off when budgets tighten, governance that keeps access open to early-stage firms rather than prioritising larger repeat customers, and capacity that keeps pace with the frontier.

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[31] Cemvita, 'Cemvita Successfully Demonstrates 75,000–Litre Industrial Scale-Up of FermOil Platform Using Crude Glycerin, a Byproduct of Biodiesel Production', Cemvita, 3 June 2026, https://www.cemvita.com/cemvita-successfully-demonstrates-75000-liter-industrial-scale-up-of-fermoil-platform-using-crude-glycerin-a-byproduct-of-biodiesel-production/ (accessed 21 July 2026).

[32] Glover, R.E., Roberts, A.P., Singer, A.C., and Kirchhelle, C., 'Sale of UK's Vaccine Manufacturing and Innovation Centre', BMJ, 376 (2022), o508, https://doi.org/10.1136/bmj-2022-069999;
Daly, P., 'Sale of UK Vaccine Manufacturing Plant Branded "Ridiculously Short-Sighted"', The Independent, 6 April 2022, https://www.independent.co.uk/news/uk/uk-government-boris-johnson-mike-riley-daisy-cooper-government-b2052270.html (accessed 21 July 2026).

[33] BioConsulting GmbH, 'Valleys of Death in Biotechnology — And How to Survive Them', BioConsulting, 13 July 2025, https://bio.consulting/valleys-of-death-in-biotechnology-and-how-to-survive-them/ (accessed 21 July 2026).

2. Intelligent digital infrastructure – data as the new shared competency

A pilot plant's output is not only a validated process, every scale-up campaign also produces something else: operational data that no single SME can produce alone, and that no individual firm has incentive to share. Run across a network of facilities, that data becomes a valuable shared record of what works, what fails, and under what conditions, accumulating across users. This is federated bioprocess intelligence, and it improves as more campaigns run through the network. Today the opposite happens: each firm keeps its results in its own format, and the same costly failures are rediscovered across the sector, one company at a time.

In *Towards a European BioPower,* we make the case for shared research infrastructure across member states, from cloud labs to biofoundries, as the way to "transform Europe's fragmented biotech landscape into a cohesive ecosystem". That argument is about accelerating the Design-Build-Test-Learn cycle at lab scale, biotech's core engineering loop: design an organism or process, build it, test how it performs, and learn from the result before the next iteration.[34] This logic can be carried downstream, to the pilot-scale manufacturing infrastructure where the loop runs again, this time proving the process at industrial volume rather than at the bench. Because scale-up processes are run on common infrastructure under common protocols, the learnings are transferable through shared data standards rather than trapped in incompatible in-house datasets, and a single European record accumulates in place of thousands that are not interoperable.

This matters most for the frontier processes described above, which do not have decades of industrial experience to fall back on. For these, the shared data learnings are the manufacturing roadmap. Building the capacity to capture and pool it is work no single firm will undertake, because no single firm captures the return: precisely what public investment exists to provide.

This thinking is already being implemented in the semiconductor sector: In the US, the National Semiconductor Technology Center pairs a shared design and data layer with common prototyping and production lines, so knowledge on research through to scaleup processes accumulates centrally rather than dissipating.[35] Biotech Act II could set the political commitment to build the equivalent for biomanufacturing.

[34] Carbonell, P., Le Feuvre, R., Takano, E., and Scrutton, N.S., 'In Silico Design and Automated Learning to Boost Next-Generation Smart Biomanufacturing', Synthetic Biology, 5/1 (2020), ysaa020, https://doi.org/10.1093/synbio/ysaa020;
Gurdo, N., Volke, D.C., McCloskey, D., and Nikel, P.I., 'Automating the Design-Build-Test-Learn Cycle Towards Next-Generation Bacterial Cell Factories', New Biotechnology, 74 (2023), 1–15, https://doi.org/10.1016/j.nbt.2023.01.002.

[35] NIST, 'Biden-Harris Administration Announces First CHIPS for America R&D Facilities and Selection Processes', National Institute of Standards and Technology, 12 July 2024.

Good data: accelerated development

If we look at the biotech field more broadly, AI and ML models built on biological data are a manifestation of this data collection challenge. The availability of standardised and comparable data in a field determines how fast its models improve[36]. Where standardised, comparable data is abundant the models have evolved quickly, and where it is fragmented they have lagged. Proteins are the clearest case, with plentiful, consistent and curated sequence and structural data serving as the backbone of fast-advancing models.[37] Single-cell biology, metabolomics, and clinical data are patchier and harder to compare across datasets, and progress in model development there has been slower.[38] Data federation could play a dual role in countering this. It would pool data that already exists but sits trapped in incompatible formats across firms and labs.[39] In domains where little structured data exists yet, it generates that data through common protocols and shared facilities.[40] At the macro level, this is likely to mean that data-rich fields will pull in talent and investment while the data-poor fields fall behind. Policy tools should be used to more evenly develop the quality and quantity of biological and process data which could unlock the development of AI models across academia and industry.[41]

3. Knowledge infrastructure – talent at home and for export

Shared pilot plants and the data they generate are part of successful biotech scale-up. The other part is the knowledge infrastructure that runs them: the trained operators, engineers, and scientists who resolve the scientific and technical problems that arise when laboratory processes meet industrial scale.

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[36]Subramanyam, Anirudh, Yuxin Chen, and Robert L. Grossman, 'Scaling Laws Revisited: Modeling the Role of Data Quality in Language Model Pretraining', arXiv preprint (2025), arXiv:2510.03313, https://doi.org/10.48550/arXiv.2510.03313 (accepted, ICLR 2026).
DenAdel, A., et al., 'Evaluating the Role of Pretraining Dataset Size and Diversity on Single-Cell Foundation Model Performance', Nature Methods (2026), https://doi.org/10.1038/s41592-026-03120-y.

[37]Varadi, Mihály, et al., 'AlphaFold Protein Structure Database: Massively Expanding the Structural Coverage of Protein-Sequence Space with High-Accuracy Models', Nucleic Acids Research, 50/D1 (2022), D439–D444, https://doi.org/10.1093/nar/gkab1061.

[38]Kedzierska, K.Z., et al., 'Zero-Shot Evaluation Reveals Limitations of Single-Cell Foundation Models', Genome Biology, 26/1 (2025), 101, https://doi.org/10.1186/s13059-025-03574-x;
Deng, Y., et al., 'An End-to-End Deep Learning Method for Mass Spectrometry Data Analysis to Reveal Disease-Specific Metabolic Profiles', Nature Communications, 15/1 (2024), 7136, https://doi.org/10.1038/s41467-024-51433-3.

[39] Sheller, M.J., et al., 'Federated Learning in Medicine: Facilitating Multi-Institutional Collaborations without Sharing Patient Data', Scientific Reports, 10/1 (2020), 12598, https://doi.org/10.1038/s41598-020-69250-1;
Fleming, J., et al., 'AlphaFold Protein Structure Database and 3D-Beacons: New Data and Capabilities', Journal of Molecular Biology, 437/15 (2025), 168967, https://doi.org/10.1016/j.jmb.2025.168967.

[40] National Institutes of Health, 'NIH Launches Bridge2AI Program to Expand the Use of Artificial Intelligence in Biomedical and Behavioral Research', news release, 13 September 2022, https://www.nih.gov/news-events/news-releases/nih-launches-bridge2ai-program-expand-use-artificial-intelligence-biomedical-behavioral-research.

[41] Wilkinson, Mark D., et al., 'The FAIR Guiding Principles for Scientific Data Management and Stewardship', Scientific Data, 3 (2016), 160018, https://doi.org/10.1038/sdata.2016.18;
National Institutes of Health, 'NIH Launches Bridge2AI Program to Expand the Use of Artificial Intelligence in Biomedical and Behavioral Research', news release, 13 September 2022, https://www.nih.gov/news-events/news-releases/nih-launches-bridge2ai-program-expand-use-artificial-intelligence-biomedical-behavioral-research.

Ireland's National Institute for Bioprocessing Research and Training, established in 2011 with €57m of IDA Ireland funding, is the clearest working example. NIBRT is a biopharma institute running as a four-university consortium (UCD, Trinity, DCU, IT Sligo). The structure plays to biotech's already-deep university dependency (50% median consortium share in our data, the highest of any deep tech sector) and orients it toward industrial translation. Its facility is a working bioprocessing plant replica: single-use bioreactors, automation stacks, QA workflows identical to industry. Critically, NIBRT is not only a training centre, it also functions as an applied R&D test bed, so cohorts do not only learn to operate established processes but learn to develop new ones. It trains over 4,000 operators and engineers per year.

Ireland is the world's third-largest pharmaceutical exporter, with €116bn in annual export revenue and 85,000 sector jobs. NIBRT is consistently named as the reason multinationals chose Ireland over comparable jurisdictions: the structural answer to where a manufacturing operation will source its workforce.

NIBRT's curriculum, facility design, and certification regime have been licensed to the Jefferson Institute for Bioprocessing in Philadelphia ($10m partnership) and to K-NIBRT in Songdo (2,000 Korean trainees per year). Each deal generates revenue, extends a global professional network anchored in Ireland, and embeds NIBRT-pioneered processes as the operating standard in the receiving jurisdiction.

Currently, no equivalent exists for European industrial biomanufacturing. Training in these domains happens ad hoc, inside individual firms, on equipment configurations that do not transfer. Whichever jurisdiction builds this institutional model first will set the standards the rest of the sector operates within.

Europe is structurally well-positioned to be that jurisdiction. The bloc hosts the densest concentration of research-intensive universities in the world, and biotech already runs through them more deeply than any comparable deep tech sector. The four-institution consortium model that delivered NIBRT is replicable at European scale several times over, with regional specialisation across Member States. The talent base is in place, what is missing is the institutional design that converts academic capacity into industrial capability.

The infrastructure pillars compound to bring returns for public spending

The three pillars deliver more together than separately. A trained workforce, physical scale-up infrastructure, and accumulated process intelligence in one place are what a firm needs to generate the data that convinces private investors a project is de-risked, and what the current European ecosystem fails to deliver under any existing instrument.

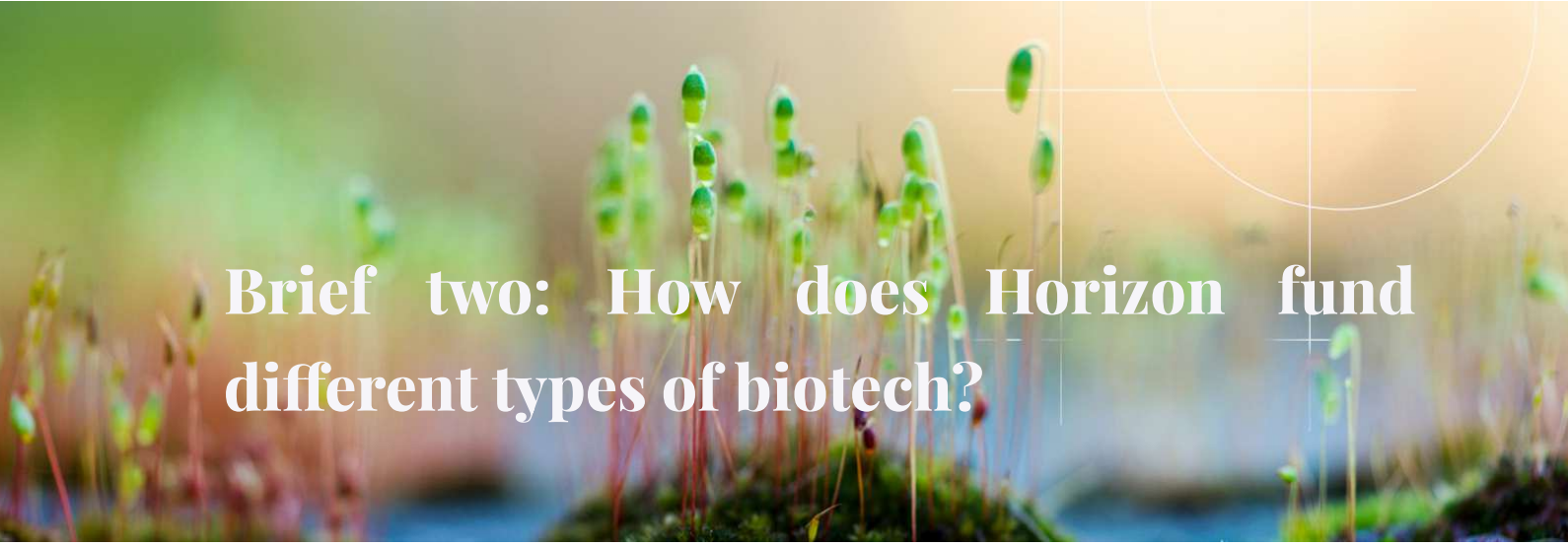
The leverage on Horizon spend follows from this. Each grant today funds one project at a time, with the learning contained inside its firm or consortium. A federated pilot plant infrastructure changes that. Every campaign that runs through it, whether Horizon-funded, privately backed, or nationally supported, deposits knowledge, protocols, and more experienced operators back into the platform for the next user. For a sector struggling at the science-to-commercial transition, this determines whether public investment compounds or dissipates.

Brief one conclusions

Findings: Horizon biotech firms resemble digital tech firms in size and revenue, but their development process runs on hard tech's timelines and capital needs. Biotech firms skew to earlier-stage, more research-intensive work than either peer sector, with heavier university dependence, fundamental science funding and higher-risk EIC funding. Grants raise revenue on average, but the effect fades within four to five years, faster than digital tech, tracking biotech's longer path to the next milestone. Independent biotech SMEs see revenue rise 24.7% after a grant; SMEs owned by corporate groups show no significant change. Corporate-group SMEs receive 66% of biotech SME funding against 34% for independent SMEs, and non-SME firms take close to four euros in five of all biotech funding. Funding concentrates in the segments showing the weakest measurable return.

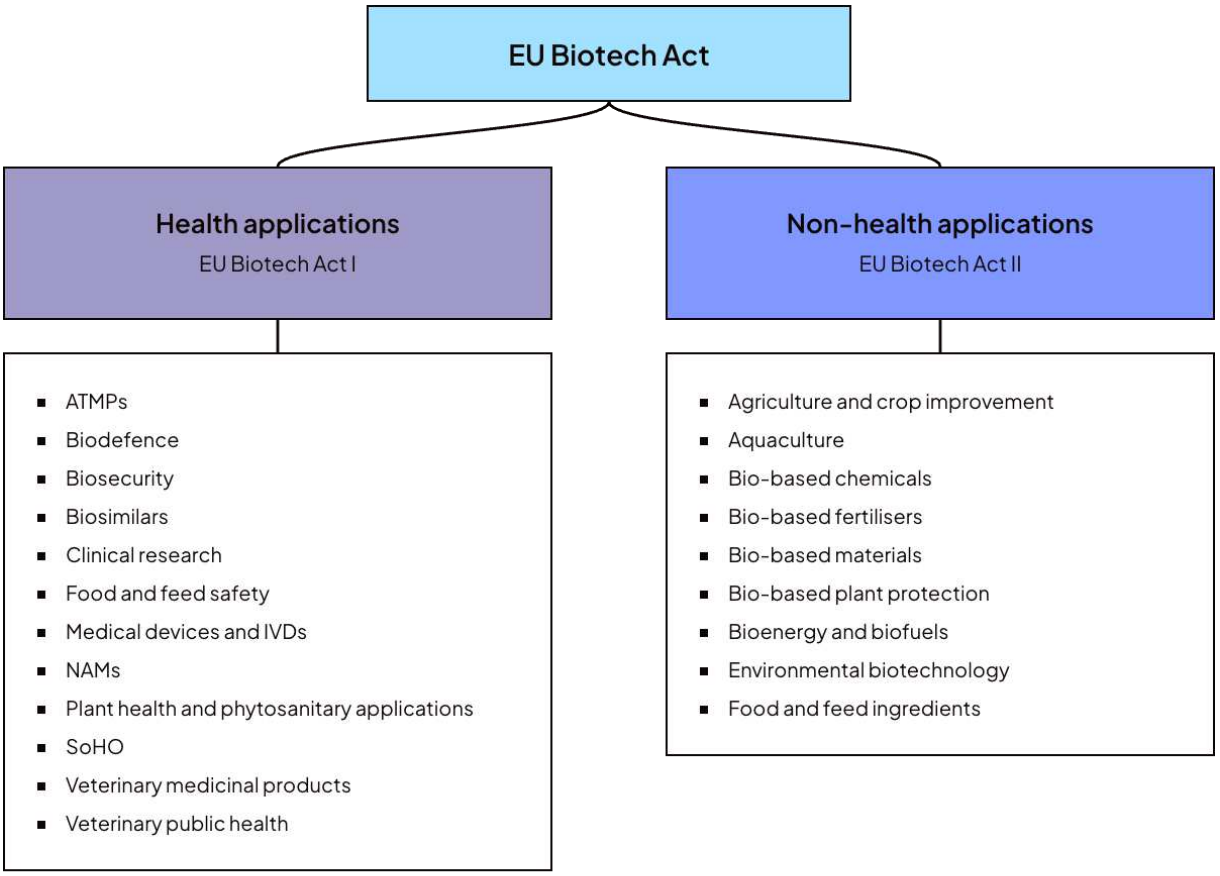
Conclusion: Horizon's instruments seem to be calibrated to a generic deep tech average. Our data points towards a mismatch between that average and biotech's cost structure and timelines.

Suggestions: Calibrate instruments to biotech's actual development logic rather than the deep tech average, with a mechanism to update that calibration as the field evolves and accelerates. Build bio-stack logic deep into EU funding logic, so instrument design funds R&D across the whole bio-stack, working toward solving (particularly for industrial biotech) scale-up challenges and increasing cost competitiveness. Bio-stack logic recognises that science-to-market challenges run throughout biotech development and that its layers are interdependent, a concept we put forward in our Biotech Act II Call for Evidence Submission. Build shared, EU-funded infrastructure across three pillars: physical scale-up facilities, a federated data layer, and training institutions modelled on NIBRT. This lets public investment compound across users instead of dissipating project by project. Direct a larger share of investment toward independent SMEs, the segment where grants demonstrably convert into revenue growth.



Brief two: How does Horizon fund different types of biotech?

Horizon Europe grants to private firms offer a useful window into where EU public R&D money is actually landing, and within biotech, health and non-health firms follow markedly different patterns. This Brief focuses on that split. We leaned on the most authoritative definition available: the European Commission's proposed Biotech Act, which distinguishes explicitly between health and non-health biotech applications. A machine learning classifier trained on expert-labelled project descriptions and the Act's own definitions does the sorting. The result is two firm profiles that look quite different from each other.



ATMPs: Advanced Therapy Medicinal Products. IVDs: In Vitro Diagnostics. NAMs: New Approach Methodologies. SoHO: Substances of Human Origin.

Industrial biotechnology accounts for the largest share of firm non-health biotech projects in the Horizon dataset (approximately 2/3rds of funding). In practice, this means engineered microorganisms used to produce chemicals, materials, fuels, food ingredients, and agricultural inputs from feedstocks (e.g. sugars, agricultural residues, industrial CO_2, and waste streams). How this works is scientists modify the DNA of a microorganism, usually a bacterium or yeast, so that it produces a specific molecule of interest in a predictable and optimised way. The modified cells are grown and then transferred into fermenters (large steel tanks) where they are fed a feedstock and held at the right conditions to produce the target molecule: a plastic precursor, a flavouring, a fuel, a fertiliser ingredient. Industrial biotech sits at the heart of Europe's bioeconomy strategy and its ambitions for strategic autonomy. And it is unlike any manufacturing technology that came before it: conventional industrial processes use chemistry and predictable physics, while biomanufacturing uses living cells that respond, adapt, and evolve. In essence, the cell is the 'factory'. Fermentation itself is ancient, but engineering cells to have improved characteristics (eg. higher yield, quality, robustness) and/or to make non-native molecules, and harnessing them efficiently and reliably at industrial scale, is something we are still learning how to do.

The premise behind funding industrial biomanufacturing is that bio-based production can substitute for current petrochemical processes producing most of our everyday materials, chemicals, and fuels. With bio-based processes facing a structural cost disadvantage against 150 years of petrochemical infrastructure, supply chains, and input prices that have never incorporated their environmental costs - strategic public investment to facilitate industrial biotech's cost competitiveness is critical.

This brief asks if Horizon funding is reaching the firms that would build that robust future, or reinforcing what Europe already does well, incrementally? Commercialisation is constrained by many things at once, with no single one explaining why so few processes reach the market: feedstock costs, scarce scale-up infrastructure, weak market pull against amortised petrochemical incumbents, and thin late and/or early-stage capital and talent. This brief follows the public money, asking which firms and stages the grants reach, and what happens once the firms are funded.

What does the data show?

Finding 1: The typical non-health biotech grant recipient is older, larger, and less risky than its health counterpart

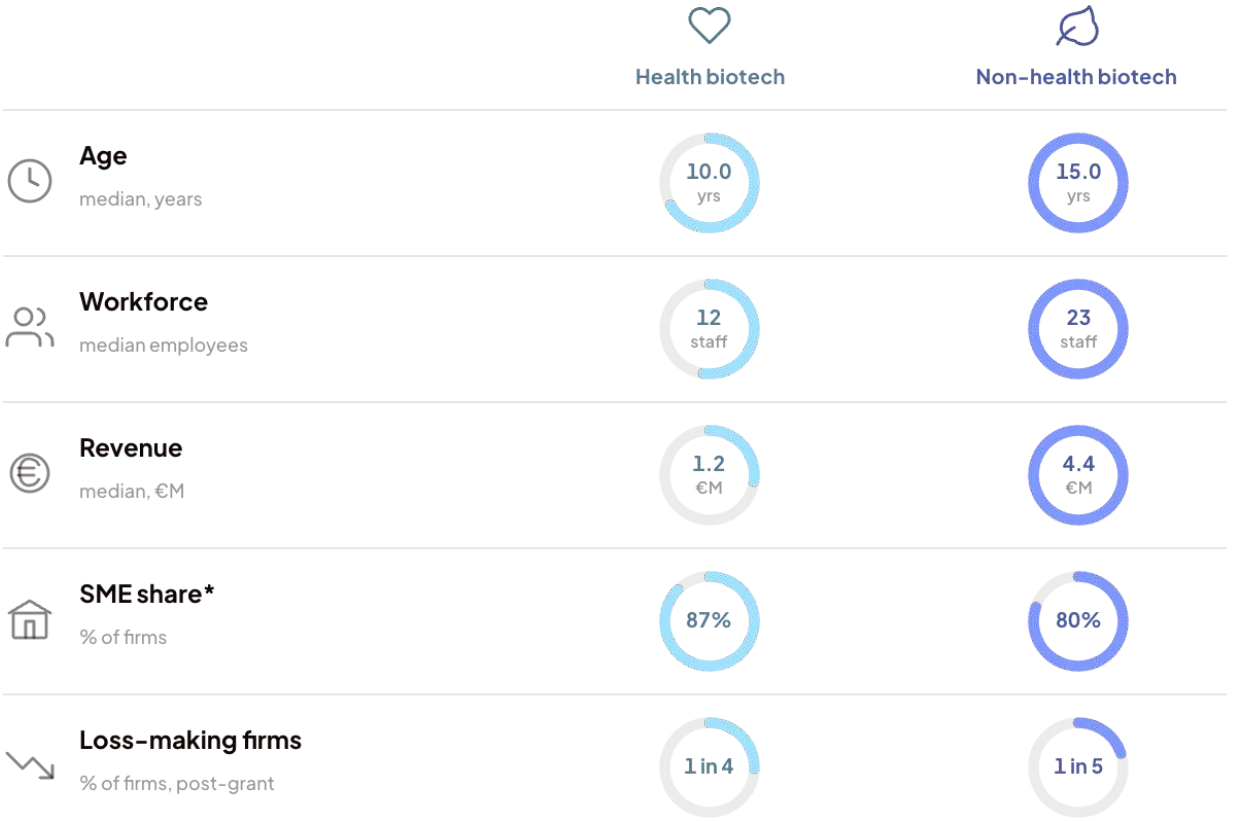
The median health biotech firm receiving Horizon funding is 10 years old, employs 12 people, and turns over around €1.1M a year. One in four is still loss-making three years after the grant comes in - in other words, very small, early-stage companies, operating in a market that hasn't paid off yet.

Non-health biotech firms look quite different. The median recipient is older (15 years), larger (23 employees), and generates four times the revenue compared to its health counterparts - around €4.3M a year. Fewer than one in five is loss-making after the grant. These are small but

established businesses, with a lower-risk profile and a foothold in relatively niche markets.

Non-health biotech firms are older and better resourced

Non-health biotech companies receiving EU Horizon funding (2015–2025) are older, employ more people and earn more revenue. Health biotech skews younger, smaller and riskier.



* SME status as inferred by the financial database, not official EU SME status. Information coverage ranges between 52% and 89% across metrics, reflecting differences in firm-level reporting completeness.

Domain classification based on ML classifiers. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

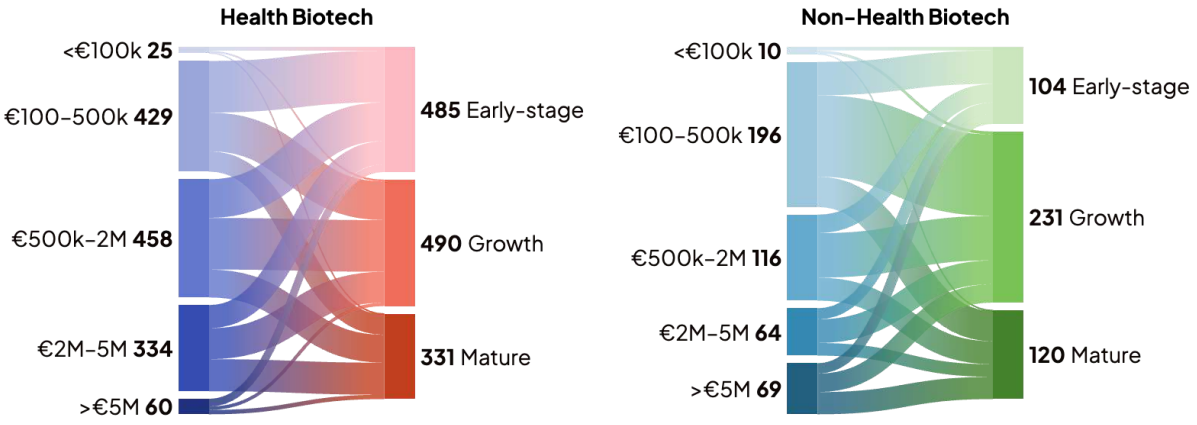
Finding 2: Funding concentrates in growth-stage firms in non-health biotech and relatively underfunds early-stage firms

We sort firms into early-stage, growth, and mature tiers using an equal-weighted score across headcount, age, and revenue, with cut-offs aligned to the EU's SME definition. We classified 70.7% of biotech firms into a stage.

In non-health biotech, growth-stage firms take the largest share of grant money: 50.9%, or €231M. Early-stage firms make up a third of recipients (32.6%) but receive less than a quarter of the money (22.9%, or €104M). Mature firms take the rest (26.2%, or €119M).

Health biotech distributes differently. Early-stage firms make up 44.8% of recipients and receive 37.1% of the grant money (€485M). As the Sankey flow charts show, early-stage health firms draw roughly €139M in the €2M-5M bracket and €24M above €5M, compared with only about €19M and €0M, respectively, for early-stage non-health firms in those same brackets. These large grants to early-stage health companies include EIC Accelerator awards of around €2.5M, routinely going to high-growth young firms.

Horizon II Funding flows to companies by maturity



This gap may partly reflect fewer early-stage non-health firms existing and/or applying to Horizon, rather than allocation alone. In any case, this thin early-stage pipeline is a signal of an undersupported layer of the ecosystem, one which the funding system should seek to strengthen given the EU's large ambitions for the sector.

In non-health biotech, the grant distribution is highly concentrated in growth firms - is Horizon funding what Europe *already* does well, or what Europe needs to build?

Finding 3: Horizon funds what Europe already does well rather than category-creating firms

Non-health biotech, fermentation, agricultural applications, and bio-based chemicals, have been part of Europe's industrial fabric for decades. The EU bioeconomy generated €863 billion in value added in 2023, employing 17.1 million people; biomanufacturing has grown at 4.7% annually since 2008, outpacing ICT, transport, and financial services[42-43]. Scaling bio-based processes is genuinely capital-intensive. The instruments directing the largest tickets, BBI-JTI under Horizon 2020 and its successor CBE JU under Horizon Europe, are public-private partnerships designed specifically for this: funding the scaling and demonstration of bio-based processes, moving

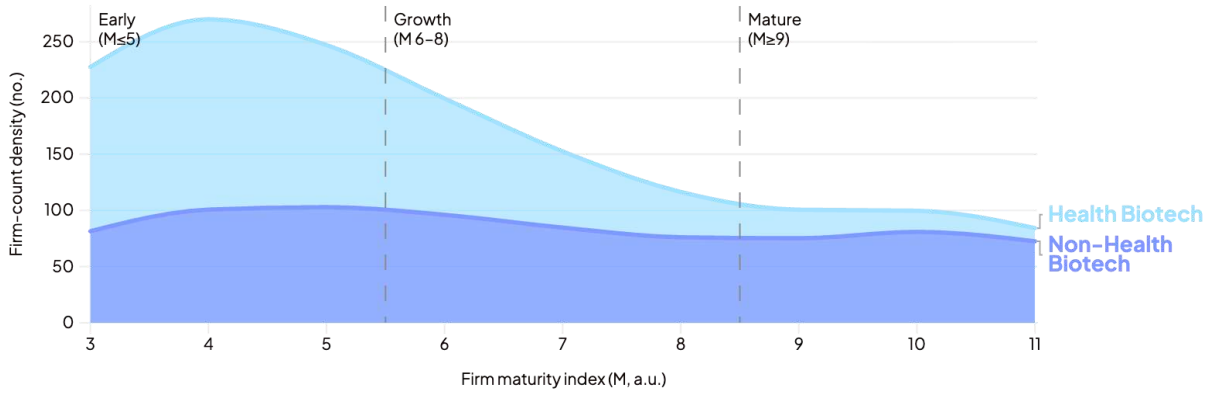
[42] EuropaBio, 'Measuring the Economic Footprint of the Biotechnology Industry in the European Union', *EuropaBio*, https://www.europabio.org/measuring-the-economic-footprint-of-the-biotechnology-industry-in-the-european-union/.
[43] European Commission / Joint Research Centre, The EU Bioeconomy at a Glance: Focus on Economic Value Added, Employment and Innovation (Publications Office of the European Union, 2024).

them from pilot stage into full commercial production. They were built for growth-stage firms, and the grant distribution reflects that.

What is harder to explain is that mature incumbents absorb 26.2% of grant value (€119M), and early-stage firms are underrepresented at 32.6% of recipients that receive only 22.9% of grant value, compared to 44.8% and 37.1% in health biotech. More than four in five early-stage non-health firms (211 of 255, 82.7%) never receive a grant above €500k. A grant of that size is unlikely to fund meaningful technology development in biotech. A 2023 McKinsey study found that Europe already leads the US on incremental innovation patents in food technology, macromolecular chemistry, and environmental applications[44]. However, at the frontier (the authors singled out cell printing and engineered bacteria specifically[45]) US players hold nine of ten top patent positions and investment runs four times higher. The authors identified the absence of bio-first platform companies, firms that treat rewiring biology itself as their core technology, as Europe's most notable structural gap. Most of these innovative firms are, especially in Europe, early-stage[46] - they are creating new categories rather than scaling established ones. Horizon funding in non-health biotech is thinnest in exactly this segment. This maps onto Bocconi's broader analysis of Horizon using our same database: Europe tends to fund middle technologies and what industry already does well rather than disruptive innovation.[47]

EU support reaches far more early-stage health biotech firms than non-health

Firm-count density by maturity stage (early, growth, mature), health vs. non-health biotech recipient firms



EU Horizon-funded biotech firms, 2015–2025. Firm maturity index M = size score + age score + revenue score. Tiers: Early-stage M≤5, Growth M=6–8, Mature M≥9. Health Biotech n=1,712; Non-Health Biotech n=885. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

[44] Evers, M., Stein-Asmussen, A., Szlezak, N., and Zemp, A., Europe's Bio Revolution: Biological Innovations for Complex Problems (McKinsey & Company, 2023).
[45] Evers, M., Stein-Asmussen, A., Szlezak, N., and Zemp, A., Europe's Bio Revolution: Biological Innovations for Complex Problems (McKinsey & Company, 2023).
[46] Evers, M., Stein-Asmussen, A., Szlezak, N., and Zemp, A., Europe's Bio Revolution: Biological Innovations for Complex Problems (McKinsey & Company, 2023).
[47] Fuest, C., Gros, D., Mengel, P.-L., Presidente, G., and Tirole, J., EU Innovation Policy: How to Escape the Middle Technology Trap, Report No. 75 (CESifo EconPol Europe, Institute for European Policymaking @ Bocconi University, and Toulouse School of Economics, 2024).

Detect, protect, restore, adapt: non-health biotech's next frontier that is relatively underfunded

This brief's argumentation centres on industrial biotech, and reflects the Commission's own strategic thinking: the EU Bioeconomy Strategy, the Biotech Act's non-health provisions, the CBE JU and its predecessor the BBI-JTI are all built primarily around bio-based industrial production, as is Europe's wider push to build a competitive bio-industrial base.

But non-health biotech covers much more than this. Our Horizon database shows private firms, not just research universities, developing: microbiome-based systems to clean contaminated soils and groundwater (SYMBIOREM[48]; MIBIREM[49]). Others build portable biological sensors that detect pathogens and chemical pollutants in air, soil, and water in real time[50], and enzyme systems that break down nerve agents on surfaces[51]. In agriculture, firms are applying new genomic techniques, including CRISPR gene editing, to develop virus-resistant crop varieties with better industrial properties[52]; and engineering the relationship between crop roots and soil microbiomes to breed climate-resilient varieties that need fewer chemical inputs[53].

In clean energy, EIC Pathfinder projects are building synthetic protocells inspired by plankton that perform artificial photosynthesis to reoxygenate the atmosphere and produce a precursor to clean hydrogen fuel (PLANKT-ON)[54]. Where biology meets computing, others are programming living fungal materials using genetically encoded sensors and closed-loop feedback circuits - essentially software running on biological hardware (LoopOfFun[55]), and engineering living microbial inks through computational modelling that are applied to buildings as a probiotic architectural coating, creating a responsive microbiome on urban surfaces (REMEDY[56]). Firms are also exploring DNA data storage, which encodes digital information directly into DNA molecules at densities no conventional hard drive can approach.[57]

These projects address critical European challenges - contaminated land and waterways, food security and agricultural resilience, the clean energy transition, urban environments, defence, and critical data infrastructure - and carry potential benefits with high-added value for European society. Yet they receive disproportionately less early-stage support than health biotech. Across Horizon, 21% of health biotech funding flows through Pillar I (the excellent science pillar supporting the most research-intensive work) compared with 8% for non-health. EIC Pathfinder and Accelerator support, designed specifically for deep tech companies in their earliest stages follows the same pattern: the Pathfinder programme funds 39 health biotech projects for every 29 in non-health; the Accelerator 30 for every 21. This is biotech moving from making products to building tools: systems that sense, compute, adapt, and self-repair, programmable

[48] https://cordis.europa.eu/project/id/101060361
[49] https://cordis.europa.eu/project/id/101059260
[50] https://cordis.europa.eu/project/id/101135402
[51] https://cordis.europa.eu/project/id/684759
[52] https://cordis.europa.eu/project/id/101061015
[53] https://cordis.europa.eu/project/id/101060057
[54] https://cordis.europa.eu/project/id/101099192
[55] https://cordis.europa.eu/project/id/101070817
[56] https://cordis.europa.eu/project/id/101185862
[57] https://cordis.europa.eu/project/id/101115292

infrastructure woven into our societies. That frontier carries some of the most transformative potential in the field, and this early-stage is where non-health funding is scarcest.

Finding 4: the technology base is shifting toward bio-digital approaches, but funding hasn't fully followed

The technological underpinnings of non-health biotech are shifting. Roughly 70% of non-health Horizon funding flows into food, agriculture, bioenergy, and bio-based chemical applications - established domains with strong European industrial roots. Digital and AI approaches are present and growing in non-health biotech, from around 12% of projects in H2020 (2014–2020) to 23% in Horizon Europe (2020–2027), though projects remain largely product-specific: optimising one enzyme, modelling one pathway, improving one fermentation process.

What comes next in biomanufacturing, bio-digital manufacturing, sits at the convergence of two fields. On the biological side, engineered organisms and redesigned metabolic pathways are expanding what living systems can produce. On the digital side, AI models learn from each run, predicting how a process will behave, flagging when it drifts, and adjusting it in real time, so that output becomes more reliable and cheaper with every cycle.

Its building blocks are synthetic biology, AI and machine learning for designing and optimising bioprocesses, and digital platforms for running them. These are general-purpose capabilities. Together they change how biological production is designed, tested, and scaled across food, materials, chemicals, agriculture, and energy alike.

Competitive advantage in the next wave of non-health biotech will belong to those who fund these capabilities as shared infrastructure that many sectors can build on, rather than as one-off applications tied to a single product.

Whether established players are building these capabilities, or positioned to, is an open question. A healthy bioeconomy innovation ecosystem needs grants reaching both the established firms scaling proven processes and the frontier players experimenting outside the box,[58] building the synthetic biology, AI-driven bioprocess design, and biomanufacturing platforms the next generation of European bio-based industry will depend on.

Finding 5: The Horizon science-firm innovation relationship is weaker in non-health biotech

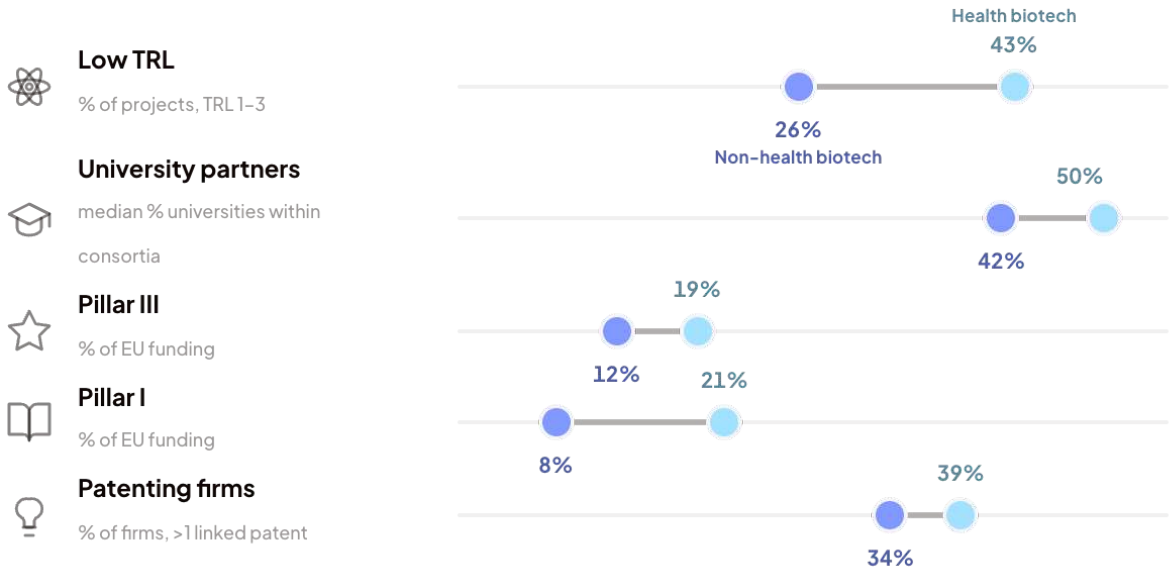
Across three separate measures, non-health biotech sits much further from fundamental science than health biotech does. Just 7.6% of non-health biotech Horizon funding flows through Pillar I, the science excellence pillar where frontier and early-stage research happens, against 20.7% for

[58] Philp, J. and Winickoff, D., 'Innovation Ecosystems in the Bioeconomy', OECD Science, Technology and Industry Policy Papers, No. 76 (OECD Publishing, 2019).

health biotech. Only 26.4% of non-health biotech projects are at low TRL (1–3), against 43.1% for health, and universities hold 42.1% of consortia places, against 50%.

Health biotech leans earlier-stage with closer academic ties

Health biotech projects sit at lower technology-readiness levels, collaborate more with universities, and draw a larger share of Pillar I (Excellent Science) and Pillar III (Innovative Europe) EU Horizon funding (2015–2025) than non-health biotech.



Pillar I (Excellent Science) funds the best research ideas on their own merit, with no set priority or consortium required. Pillar III (Innovative Europe) funds the full innovation pipeline: breakthrough research, firm-level scale-up finance and ecosystem connectivity.

Information coverage ranges between 77% and 100% across metrics, reflecting differences in reporting completeness. Domain classification based on ML classifiers.

Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

Non-health biotech competes on the market on different terms than health biotech does. A new drug can succeed on almost efficacy alone compared to existing treatments, relatively independently of production scale. In non-health domains, a bio-based industrial process producing, for example, a chemical or material competes on margin against a petrochemical process that has often had decades to pay off its capital investment and optimise its economics.

This competition happens at an industrial scale, so reaching that scale is a precondition for competing with incumbents. Scale is necessary, but not always sufficient: margin depends on factors beyond plant size including feedstock availability and price, the chemistry of the target product, the capital cost of a plant, the operational cost of a plant, secondary processing steps of the product, and the ability to produce consistently at volume.

For some products the gap is structural, when the feedstock costs nearly as much as the finished product, even a highly efficient process cannot reach parity, and scale or efficiency gains do not change that. However, where the economics are close enough to compete, how efficiently the biology converts feedstock into product often decides whether a process succeeds, and that efficiency is a question of fundamental science.

We find that non-health biotech features less in Pillar I funding and low-TRL work. This points to less capacity to do exactly the kind of fundamental synthetic biology research which could lead to increased robustness and performance of key processes. This is further expanded in the section below "*Competing at scale: constraints are systemic*".

Finding 6: The grant effect on revenue differs between health and non-health and by stage in biotech

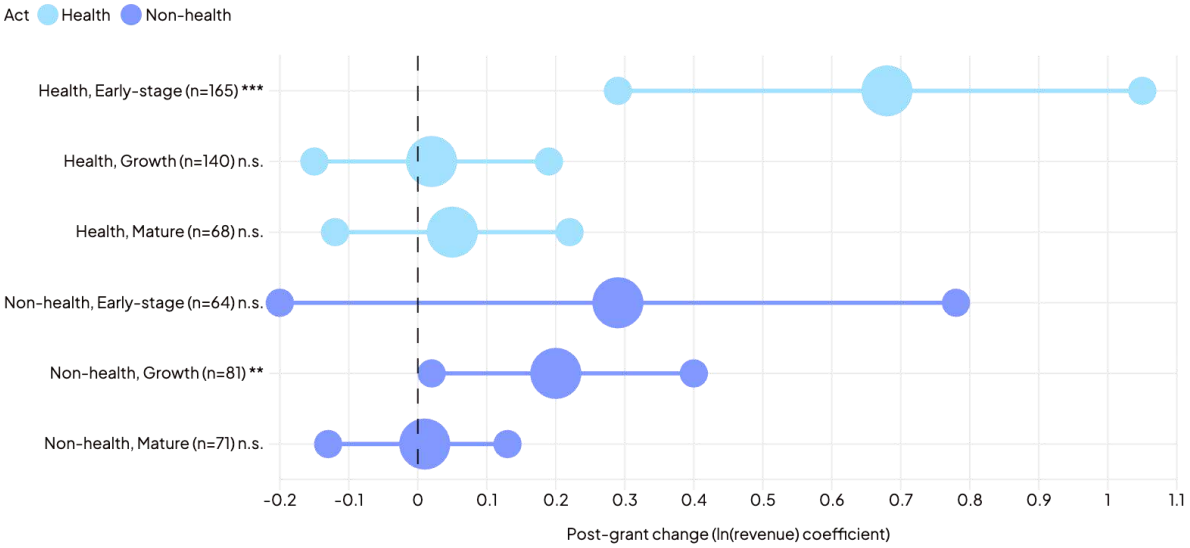
The descriptive picture above shows that health and non-health biotech receive Horizon funding through quite different distribution patterns, with different firm profiles, different ticket sizes, and different stages of firm development absorbing the money. The next question is whether Horizon funding to firms actually translates into revenue growth, and for whom.

We draw on the IEP-COMPET dataset[59], linking CORDIS project records to Orbis financial accounts. We restrict to firms with a single Horizon grant, controlling for firm and year fixed effects, to isolate the grant's effect on revenue. The biotech sub-sample is small once cut by sub-sector and stage, so these findings are directional rather than definitive.

Early-stage health biotech shows a significant positive effect of the grant on firm revenue outcome. European health biotech sits on dense pre-existing research clusters, a specialist investor base familiar with its development pathway, and an EIC instrument suite that routinely directs grants of around €2.5 million to high-growth early-stage firms. Horizon appears to be reinforcing an ecosystem that already absorbs public investment productively.

Post-grant biotech revenue patterns vary by sub-domain and stage

EU grants are followed by a significant boost in revenue for early-stage health biotech firms and growth-stage non-health biotech firms, but not for the rest of the sector.



EU Horizon-funded biotech firms, 2015–2025. Single-project firms only. Two-way fixed effects regression (firm and year). Standard errors clustered at firm level. n = number of firms. Significance: *** p<0.01, ** p<0.05, * p<0.1; n.s. = not significant. Source: authors' analysis of CORDIS; Orbis, Bureau van Dijk.

[59] Gros, D., Hofer, S.M., Mengel, P.-L., Molteni, M., Presidente, G., Rujan, C., and Schimmel, F., IEP-COMPET Dataset, IEP@BU Working Paper Series (Institute for European Policymaking, Bocconi University, 2025), https://iep.unibocconi.eu/sites/default/files/media/attach/IEP-COMPET%20Dataset%20(2).pdf (accessed 21 July 2026).

Early-stage non-health biotech, by contrast, shows no significant revenue effect. To note, the revenue coefficient is larger than for growth-stage non-health biotech firms, so the lack of significance could be attributed to high variability in a small sample size.

The descriptive picture in Finding 2 already shows that this layer of the ecosystem is underfunded relative to its health counterpart, with early-stage non-health firms receiving 22.9% of grant value against 37.1% for their health equivalents. What the regression adds is that even when these firms do receive grants, the grants do not translate into measurable revenue growth. More than four in five early-stage non-health firms receive grants below €500k, and the regression suggests that those small tickets do not effectively allow early-stage firms to develop. What may be missing is not only large enough grants, but the wider ecosystem that translates capital into growth. This could be infrastructure and scale-up gaps or the absence of the kind of mature, specialist investor base that early-stage health biotech can draw on, but that is lacking for non-health biotech.

The growth-stage results reverse the pattern. Non-health biotech at the growth-stage responds positively to grant receipt ($p<0.05$), which is consistent with the design logic of CBE JU and BBI-JTI: once a firm has cleared early process validation, the remaining constraints (yield, downstream processing, capacity) respond to incremental capital. Health biotech at the growth-stage shows no significant effect, most likely because a large share of these firms are running clinical trials whose binary outcomes decide success or failure regardless of grant funding.

For non-health biotech, two findings stand out.

1. The growth-stage positive result validates the existing scaling architecture. Funding to growth-stage non-health firms has a positive effect on revenue, so continued scale-up support has empirical backing rather than resting on assumption alone.

2. Early-stage firms are where disruptive innovation tends to happen, and where a grant is smallest relative to firm size, so the revenue effect should be largest here if anywhere. Instead it's absent. That points to an ecosystem not yet configured to support disruptive non-health biotechnologies, which is a troubling finding given Europe's ambitions in the sector.

Growth-stage funding is working on its own terms. The question is what it will have to work with in ten years, given that it is fed by an early-stage layer being underfunded today.

What is the catalytic effect of small grants for large, mature firms?

In both health and non-health biotech, mature firms receive a significant share of the smallest grants: €58M in the €100–500k bracket in non-health biotech, €109M in health. These almost certainly reflect consortium participation allocations, where established firms contribute specific expertise to a larger collaborative project. That function has genuine value for ecosystem integration, as it brings large firms into shared R&D agendas, and gives smaller consortium members access to capabilities they could not afford alone. But established firms

getting this money means early-stage firms don't. A €200k grant is unlikely to materially shape what a firm already generating tens of millions in revenue chooses to develop. Redirecting some of that money toward an early-stage non-health pipeline would help balance the ecosystem's funding stage distribution.

What this means for policymakers

An incremental bioeconomy - by design?

This data is consistent with a Horizon portfolio weighted more toward incremental work in the niches where bio-based manufacturing has already commercialised than toward the pioneering platform development that would robustly expand the sector. Part of this tilt is structural to how the relevant instruments are programmed: The Joint Undertaking model that channels the largest non-health biotech tickets (CBE JU and its predecessor BBI-JTI) gives industry partners deep influence over the research agenda (according to some commentators, this includes over project evaluation), a design that critical analyses argue reinforces incumbent priorities rather than opening space for frontier and disruptive entrants.[60] In non-health biotech, grants concentrate in growth-stage, more established firms, while early-stage firms receive a smaller share and show no measurable revenue effect from the grants they do get.

This does not mean frontier work is absent from European non-health biotech. The convergence of synthetic biology and novel metabolic engineering with machine learning and predictive digital twins represents a qualitative shift in what bio-based production can do and how the Valley of Death between lab demonstration and commercial viability can be crossed. This frontier work *is* happening in European science, for example at DTU Biosustain, Wageningen, and Chalmers, but the early-stage companies that should be translating this science into commercial development are underrepresented in Horizon's non-health biotech portfolio. The lower university share in non-health biotech consortia (42.11% against 50% in health) hints at exactly the structural disconnect identified in research on the valley of death: academic discovery and industrial application operating at different speeds, with weaker bridging mechanisms to enable disruptive innovators than comparable sectors.[61-62]

We should continue funding scaling and demonstration - that work needs to expand and to be coherently designed to have a create the full bio-stack across CBE JU, BBI-JTI, InvestEU, IPCEI, and the emerging tools of the Biotech Act. But Europe also needs to nurture the innovation

[60] Lühmann, M., 'Whose European Bioeconomy? Relations of Forces in the Shaping of an Updated EU Bioeconomy Strategy', Environmental Development, 35 (2020), 100547, https://doi.org/10.1016/j.envdev.2020.100547; Global Health Advocates and Corporate Europe Observatory, Research & Destroy: The Factories of the Industrial Bioeconomy Threaten the Climate and Biodiversity (Brussels: Corporate Europe Observatory, 2020), https://corporateeurope.org/sites/default/files/2020-05/BBI-report-final_0.pdf (accessed 21 July 2026).
[61] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033.
[62] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'From Innovation to Application: Bridging the Valley of Death in Industrial Biotechnology', *Trends in Biotechnology*, 39/12 (2021), 1237–1239, https://doi.org/10.1016/j.tibtech.2021.04.010.

pipeline scaling depends on. Early-stage firms pursuing disruptive innovation sit at a stage where private investment is typically harder to secure given the technical and regulatory risk. In non-health biotech, this early-stage layer receives a fraction of what health biotech does. This is the pipeline that eventually produces the technologies that scale; without it, demonstration funding has, quite literally, less to demonstrate. The Biotech Act has an opportunity to develop this, particularly the enabling layer of cross-cutting tools, platform logic and digital tools for enhanced scale-up behaviour prediction, alongside its scale-up provisions.

Competing at scale: constraints are systemic

Our results show that non-health biotech features less in Pillar I funding and low-TRL work. This points to less capacity to do the kind of fundamental synthetic biology research which could lead to increased robustness and performance of the organisms doing the work. The following section looks at why underfunding early-stage research-adjacent projects matters. We explore titre, rate, and yield (TRY) as an example of a cost constraint rooted in fundamental science, then turn to scale-up and pilot plants where lab research is tested against industrial reality. Lastly, we speak to federated data as the missing link between lab and plant

Three intertwined processing metrics - TRY, can constrain the cost competitiveness of a new bio-based process.[63] Techno-economic analyses across precision fermentation, bio-based chemicals, and one-carbon biomanufacturing consistently identify low TRY as the binding constraint on cost competitiveness, because poor yields force larger fermenters, higher capital expenditure, and inefficient downstream processing, which produce order-of-magnitude cost differences between a lab-scale demonstration and commercially viable production at industrial scale.[64] Research on the 'valley of death' has identified this TRY gap as fundamental, finding that biotech commercialisation remains structurally blocked at the science-to-industry interface.[65]

Improving TRY depends on fundamental synthetic biology research at every level of the cell.[66] At the smallest scale, that means engineering individual enzymes and the chemical pathways they drive. At the largest, it means mapping and redesigning a cell's entire metabolism so the whole organism works as a dependable production factory. A 2020 study shows what this looks like in practice: A genome-scale metabolic model was used to work out, at the genetic level, which reactions to remove so that the cell would make the target product chemical as it grew. In a single

[63] Santos-Navarro, F.N., Picó, J., et al., 'Gene Expression Space Shapes the Bioprocess Trade-Offs Among Titer, Yield and Productivity', Applied Sciences, 11/13 (2021), 5859, https://doi.org/10.3390/app11135859;Banerjee, D., Eng, T., Lau, A.K., et al., 'Genome-Scale Metabolic Rewiring Improves Titers Rates and Yields of the Non-Native Product Indigoidine at Scale', Nature Communications, 11 (2020), 5385, https://doi.org/10.1038/s41467-020-19171-4.

[64] Barbosa, A.V.L., Paredes, M.L.L., Alijó, P.H.R., Sardou, A.C.O., Maia, J.G.S.S., and Bastos, J.B.V., 'Continuous Design and Technoeconomic Assessment of Commercial-Scale Biorefinery Processes for the Production of Succinic Acid', Biofuels, Bioproducts and Biorefining, 18 (2024), 1289–1305, https://doi.org/10.1002/bbb.2624;
Cunniffe, J., Berrio, V.R., Hunter, C., et al., 'Techno-Economic Analysis of Industrial-Scale Fermentation for Formate Dehydrogenase (FDH) Production', Bioresources and Bioprocessing, 12 (2025), 145, https://doi.org/10.1186/s40643-025-00985-3;
Zhang, C., Fei, Q., Fu, R., Lackner, M., Zhou, Y.J., and Tan, T., 'Economic and Sustainable Revolution to Facilitate One-Carbon Biomanufacturing', Nature Communications, 16 (2025), 4896, https://doi.org/10.1038/s41467-025-60247-w.

[65] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033.

[66] Chai, T., Tao, Y., Zhao, C., and Chen, X., 'Hierarchical Metabolic Engineering for Rewiring Cellular Metabolism', FEMS Microbiology Reviews, 49 (2025), fuaf047, https://doi.org/10.1093/femsre/fuaf047.

Design-Build-Test-Learn (DBTL) cycle the redesigned strain reached 50% of its theoretical maximum yield, and it held that performance all the way from small shake flasks to industrial-scale bioreactors.[67] The researchers estimated that the same model could reach 90% of maximum yield over further DBTL cycles. The gap between what has been demonstrated and what is possible is fundamental science still to be done, and doing can be decisive on whether a process is cost-competitive and robust at industrial scale. Bio-digital approaches are increasingly how that work happens, combining AI-driven strain design, machine learning for predictive metabolic modelling, digital twins for fermentation, and adaptive laboratory evolution, all embedded in the fully integrated DBTL cycles that apply the scientific method through prediction and iterative learning.[68]

Industry has every interest in better TRY. However, the fundamental science that produces step-change improvements is rarely the kind of research and development that private firms fund, because the returns are diffuse, the timelines are long, and the science sits too far upstream. Work of this kind depends on public investment, and supporting it is what Pillar I exists to do.

The science capable of fundamentally shifting what TRY can achieve, rather than incrementally improving it, is the kind Pillar I is designed to fund: work with diffuse returns and long timelines that private firms are least likely to fund on their own. However, non-health draws barely a third of health's Pillar I share of funding, and only 26.39% of its projects sit at low TRL against health's 43.07%. Yet this is the work that can determine whether a bio-based process can undercut a petrochemical one, and whether it survives the jump from a few litres in a flask to tens of thousands in a reactor. If bio-based production is going to close the cost gap with petrochemical incumbents, the science that can help get it there, and keeps it robust at scale, needs a Pillar I allocation proportional to the science it requires, not a fraction of it.

Scale-up and pilot plants: where the science-commercialisation relationship becomes real

Much of the conversation about bio-based scale-up centres on physical capacity and its cost: large-scale fermentation tanks, downstream processing facilities, and the engineers who run them, all of it capital-heavy and slow to build. This is where the well-documented valley of death sits,[69] in assets that are expensive, intermittently used, and unglamorous, generating none of the intellectual property a novel organism does.

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[67] Banerjee, D., Eng, T., Lau, A.K., et al., 'Genome-Scale Metabolic Rewiring Improves Titers Rates and Yields of the Non-Native Product Indigoidine at Scale', Nature Communications, 11 (2020), 5385, https://doi.org/10.1038/s41467-020-19171-4.

[68] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033;
Zhang, C., Fei, Q., Fu, R., Lackner, M., Zhou, Y.J., and Tan, T., 'Economic and Sustainable Revolution to Facilitate One-Carbon Biomanufacturing', Nature Communications, 16 (2025), 4896, https://doi.org/10.1038/s41467-025-60247-w.

[69] First Bight Ventures, The Industrial Biomanufacturing Graveyard: A Study of Previous Failures and Its Illumination (First Bight Ventures, 2025);
GFI Europe, 'Bio Base Europe — Visiting the Bridge Over the Innovation Valley of Death', GFI Europe, https://gfieurope.org/blog/bio-base-europe-bridge-over-innovation-valley-of-death/ (accessed 21 July 2026).

A pilot plant is a physical site, but it does something more specific than housing equipment: it is where lab-stage biology and industrial engineering problem-solve together, testing whether upstream science actually holds up once commercial conditions apply. This convening space, where research, scale-up science, and commercial realities meet, can start to close the science-firm gap the Horizon data points towards.

Currently, a big constraint is that this infrastructure has to be built rather than rented. This goes against the classical biotech investor logic as they were largely trained in pharma, where a mature contract manufacturing network can be plugged in late. That model does not transfer to food ingredients or bio-based chemicals, where margins are thinner, volumes are orders of magnitude higher, and platforms are usually bespoke to a single process. No one firm can justify owning capacity it uses only intermittently, which makes the lack of shared pilot infrastructure a market failure that public investment exists to solve.[70] The US has committed over $200M to shared facilities at 5,000–25,000 litre scale on exactly this logic. Europe's main instruments, the BBI JU and its €2 billion successor the CBE JU, instead de-risk deployment plant by plant, so the asset stays private and does not compound.

Brief I sets out what the alternative looks like: a coordinated European pilot plant network built on three compounding layers, shared physical infrastructure for scale-up, a federated data layer that turns every campaign into transferable process intelligence, and the training infrastructure that supplies the operators and engineers to run it. These are the spaces where foundational research and commercialisation actually meet, where a result from the lab is tested against industrial reality and either holds or breaks. In essence, researchers are engineering tiny living factories, so what fails at scale feeds back into the basic science, telling researchers which organisms, pathways, and processes need rethinking. A pilot plant network is therefore not only a bridge from science to market but the mechanism that keeps the science itself improving to meet real world conditions and commercial considerations.

Visible only at scale: science, infrastructure, and the cost gap

Adequate infrastructure and trained operators is the prerequisite for scale-up; the science is what then has to succeed on it, and the hardest scientific challenges surface only once a process reaches industrial scale. Post-mortems of the industrial biotech commercial failures find the same recurring causes: organisms that perform well in a two-litre flask behave differently in a 100,000–litre fermenter; microbes that lose their engineered properties over a production run as natural selection works against the modifications; processing costs that fail to fall with volume the way financial models assumed.[71] KiOR (failed biofuel company) projected 67 gallons of fuel per ton of biomass in its investor filings; actual production yielded far less.[72] Amyris (which

[70] Starr, J., Erdoes, K., Colvin, B., Ghosh, S., and de Kok, S., 'Bridging the Valley of Death: Building a Bio-Industrial Pilot Plant Network', Chemical Engineering Progress, November 2025.
[71] Stumpf, M.P.H., Synthetic Biology's $12 Billion Graveyard: The Scientific Failures Behind Industrial Biomanufacturing's Lost Decade — and the Computational Tools That Could Prevent the Next One (University of Melbourne / Cell Bauhaus PTY LTD, 2026);
Rugbjerg, P., Myling-Petersen, N., Porse, A., Sarup-Lytzen, K., and Sommer, M.O.A., 'Diverse Genetic Error Modes Constrain Large-Scale Bio-Based Production', Nature Communications, 9 (2018), 787, https://doi.org/10.1038/s41467-018-03232-w.
[72] Stumpf, M.P.H., Synthetic Biology's $12 Billion Graveyard: The Scientific Failures Behind Industrial Biomanufacturing's Lost Decade — and the Computational Tools That Could Prevent the Next One (University of Melbourne / Cell Bauhaus PTY LTD, 2026).

converted cane sugar into a chemical precursor using engineered yeast), hit 15% yield at lab scale and couldn't replicate it in production with the company eventually filing for bankruptcy.[73]

For products competing head-on with petrochemicals, feedstock economics can be decisive, since even a perfect fermentation cannot close the cost gap when the raw material costs nearly as much as the finished product. This does not weaken the case for better science, instead it pushes foundational research further upstream, toward alternative feedstocks, waste-derived substrates, and CO_2-based conversion routes where fermentation gains can then be realised.

> *The point for policymakers is that more industrial plants without funding the underlying science in parallel scales the same failure modes at greater cost without accelerated learnings.*

No single bottleneck explains the pattern of commercial failures in industrial-scale biomanufacturing, because the causes are systemic. Feedstock costs can make a process uneconomic *regardless* of how well the biology performs, particularly for low-added products. Downstream processing can consume more capital than the fermentation itself. And building a first-of-a-kind production plant is itself a structural disadvantage: the financing costs alone make it nearly impossible to compete on price with petrochemical facilities that were built decades ago and have long since paid off their debts. TRY, the efficiency with which an engineered organism converts inputs into outputs under real production conditions,[74] is not always the first constraint to bind, but it cuts across all the others: poor fermentation performance forces larger reactors, drives up downstream costs, and amplifies feedstock waste. It is also the constraint that most often reveals itself only at industrial scale, when living systems meet conditions that cannot be replicated in the lab. All of this decides one thing: whether a bio-based process can undercut the petrochemical one it aims to replace.

Closing the loop: federated data as the missing link between lab and plant

Closing that gap increasingly depends on something the industry, as a collective, does not yet have enough of - data. Predicting how a strain behaves over a full industrial production campaign requires federated bioprocessing intelligence, meaning shared cross-process data that makes real prediction possible.[75]

Building that predictive capability is cross-cutting, platform-level work that a single firm will not fund, because a single firm cannot capture the returns. This is one part of the infrastructure

[73] Stumpf, M.P.H., Synthetic Biology's $12 Billion Graveyard: The Scientific Failures Behind Industrial Biomanufacturing's Lost Decade — and the Computational Tools That Could Prevent the Next One (University of Melbourne / Cell Bauhaus PTY LTD, 2026).
[74] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033;
Santos-Navarro, F.N., Picó, J., et al., 'Gene Expression Space Shapes the Bioprocess Trade-Offs Among Titer, Yield and Productivity', Applied Sciences, 11/13 (2021), 5859, https://doi.org/10.3390/app11135859.
[75] Kampers, L.F.C., Asín-García, E., Schaap, P.J., Wagemakers, A., and Martins dos Santos, V.A.P., 'Navigating the Valley of Death: Perceptions of Industry and Academia on Production Platforms and Opportunities in Biotechnology', EFB Bioeconomy Journal, 2 (2022), 100033, https://doi.org/10.1016/j.bioeco.2022.100033;
Zhang, C., Fei, Q., Fu, R., Lackner, M., Zhou, Y.J., and Tan, T., 'Economic and Sustainable Revolution to Facilitate One-Carbon Biomanufacturing', Nature Communications, 16 (2025), 4896, https://doi.org/10.1038/s41467-025-60247-w.

coordination our piece Towards a European BioPower called for - a network of cloud labs and European biofoundries, built as shared infrastructure to democratise advanced tools and let SMEs prototype at scale. This kind of shared infrastructure extends past research to scaleup: pilot plants that generate bioprocessing data that can feed back into the fundamental synthetic biology research to produce industrially-robust strains and back into process runs. The data layer comes from a concerted effort to identify which forms of data to collect and share at the European level, and how to integrate process improvement learnings. Recent research points to what this investment should look like in practice:[76]

- Federated data-sharing systems that allow companies to pool operational knowledge from industrial campaigns without surrendering commercial secrets;
- AI models trained not just on laboratory data but on the full complexity of industrial fermentation, including mixing dynamics, stress responses, and genetic drift;
- Digital twin platforms that can simulate a scale-up campaign.
- Data standards to support the building of foundational models (read more in our Call For Evidence for Biotech Act II)

Advanced biomanufacturing is the science of living factories, systems of great biological complexity, designed by evolution over billions of years, now being re-engineered to work for us. Understanding them well enough to make them reliable at industrial scale, with the help of data and learning systems, is one of the defining scientific challenges of the next decade. It is exactly the kind of early-stage, infrastructure-enabling science that public investment exists to support, and that the Biotech Act II has an opportunity to make deliberate space for, alongside its scale-up provisions.

The bioeconomy cannot be granted into existence

Horizon grants can take non-health biotech from lab bench to pilot facility and to commercialisation demonstration, but even a well-calibrated programme cannot resolve the deeper market failure at the heart of bio-based commercialisation. Demonstration and scale-up instruments do two things at once: they prove that bio-based alternatives actually work, and they stimulate the bio-based industrial substitution that is critical for Europe's strategic autonomy and resilience. But they fund one application at a time, and one application at a time cannot build a full bioeconomy. Bio-based processes face a structural cost disadvantage against 150 years of petrochemical infrastructure, supply chains, and input prices that have never incorporated their environmental costs - and this was not simply the result of market forces, it was actively constructed. The Commission acknowledges as much: "the current oil-based economy was built through a century of economies of scale" and that "similar efforts are required to build this capacity for bio-based products".[77] The US federal government introduced tax breaks for oil and gas as early as 1916; over the subsequent decades, federal subsidies to the industry averaged $1.8 billion *per year* in inflation-adjusted terms. European governments pursued comparable

[76] Kim, J.Y., Yu, H.E., Kim, M.H., and Lee, S.Y., 'Beyond Petrochemicals: Challenges and Opportunities in Industrial-Scale Biomanufacturing', Nature Communications, 17 (2026), 4819, https://doi.org/10.1038/s41467-026-73835-1.
[77] European Commission, Directorate-General for Environment, 'The Facts About the Bioeconomy', European Commission, https://environment.ec.europa.eu/strategy/bioeconomy-strategy/facts-about-bioeconomy_en;
Pfund, N. and Healey, B., What Would Jefferson Do? The Historical Role of Federal Subsidies in Shaping America's Energy Future (DBL Investors, 2011).

industrial strategies through preferential tax treatment, state ownership of national oil companies, and infrastructure investment. The bio-based sector has received nothing remotely comparable. Public grants and equity investment can de-risk a bio-based process enough to attract follow-on private investment, but neither changes the cost structure the resulting product meets on entering a market shaped by a century of subsidy to the petrochemical incumbent it aims to replace.

The main lever to tackle this sits outside Horizon's remit: market-shaping policy that prices in environmental costs and creates durable demand for bio-based products. The EU has the tools to do this. Without using them at a meaningful scale, even successful demonstrations will remain perpetually subsidy-dependent.

Non-health biotech needs four interventions working together:

1. Continued scale-up support.
2. Market conditions that pull bio-based products into a competitive position.
3. An innovation pipeline reaching early-stage firms and frontier science to produce what the market can then pull.
4. Cross-cutting bio-digital capabilities that support and accelerate learnings from science to successful commercialisation

Brief two conclusions

Findings: Non-health biotech firms are older, larger, and less risky than health biotech firms, and Horizon funding to them concentrates in growth-stage, more established players. Early-stage non-health firms receive a smaller funding share than their health counterparts and, unlike early-stage health firms, show no measurable revenue effect from the grants they do get. The lack of post-grant revenue growth for early-stage non-health biotech firms points towards a wider ecosystem gap (weaker infrastructure, thinner specialist investment), but the sample is too small to confirm it. Non-health biotech also sits further from fundamental science on every measure: lower fundamental science funding, lower low-TRL share, lower university involvement in projects. Growth-stage non-health firms do respond positively to funding, validating the existing scale-up architecture.

Conclusion: Non-health biotech funding rewards what Europe already does well rather than building the cutting-edge frontier (bio-first platform companies, bio-digital manufacturing) where Europe is weakest against the US.

Suggestions: Rebalance funding toward early-stage, science-adjacent non-health biotech. Pair continued scale-up support with market-shaping policy that prices in bio-based products' environmental advantage, since grants alone cannot offset a century of fossil-fuel infrastructure subsidy and scale.

Methodology

This analysis uses the IEP-COMPET dataset from Bocconi University, which links Horizon 2020 and Horizon Europe grant records (CORDIS) to firm-level financial and ownership data (Orbis) and patent records (Orbis Intellectual Property). The sample covers Horizon projects with at least one private company, 2015 to 2025, with company information taken at the grant year.

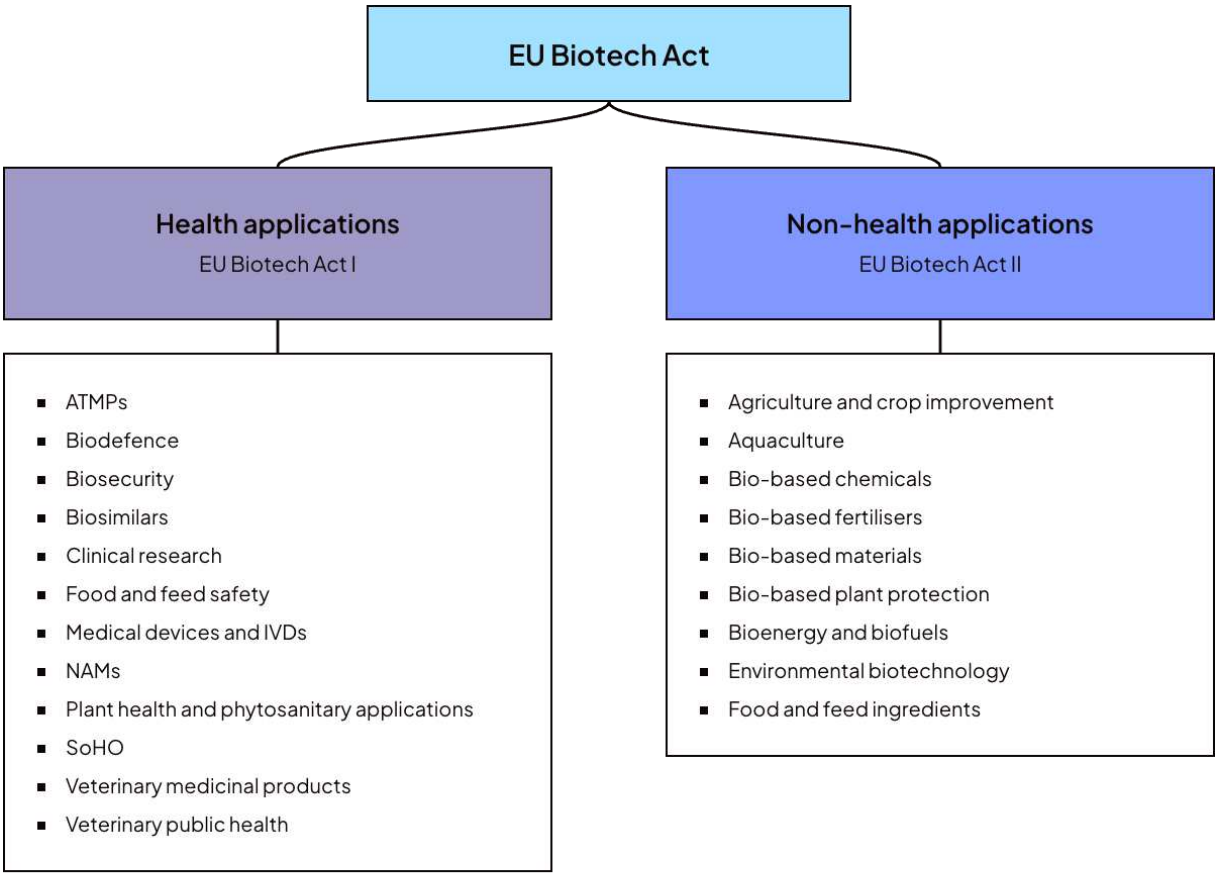
Deep tech taxonomy

Firms are sorted into three mutually exclusive deep tech groups, Hard Tech, Digital Tech, and Biotech, using a technology-based classification rather than sector R&D-intensity measures, which fail to capture cross-cutting technologies such as biotechnology whose applications span several industries. The taxonomy is anchored in the Strategic Technologies for Europe Platform (STEP), operationalised through the EIC deep tech domain structure, and cross-mapped to the legacy Key Enabling Technologies framework for backward compatibility. Twelve domains are defined, covering advanced materials, advanced manufacturing, micro- and nanoelectronics, nanotechnology, photonics, quantum technologies, space and aerospace, clean energy and climate, medical devices and diagnostics, AI and digital, robotics and autonomous systems, and biotechnology.

For Hard Tech and Digital Tech, each project-participant row is scored independently against all domains using four evidence signals: high-specificity keywords in the CORDIS objective text; the programme name, call identifier, or topic label; the firm's four-digit NACE industry code from Orbis; and, where available, the International Patent Classification codes on the firm's linked EPO patents. Confirmation requires the keyword signal plus at least one of the other three. Each row is assigned to its highest-scoring domain, with ties broken by a fixed priority order (patents, text, programme, NACE). Because assignment is exclusive, subsector counts sum to group totals without double-counting.

Biotech classifier

Biotech is classified following the definition in the EU Biotech Act (COM(2025) 1022): under Article 2(1)(1), the application of science and technology to living organisms, or parts, products, or models thereof, to produce knowledge, goods, or services. To do this we use a machine-learning classifier trained on the language of the Act together with expert-labelled Horizon project descriptions (84 for Stage A, 53 for Stage B). The classifier works in two stages: it identifies biotechnology projects (Stage A), then splits them into Health and Non-Health biotech (Stage B). Article 2(1)(2) defines health biotechnology as that directed at the promotion, protection, or restoration of human health, including veterinary public health and food safety where these serve human health protection. Non-health biotechnology is the statutory residual: all confirmed biotechnology not directed at human health, covering agriculture, environmental remediation, industrial bioprocessing, bio-based materials, and clean energy.



ATMPs: Advanced Therapy Medicinal Products. IVDs: In Vitro Diagnostics. NAMs: New Approach Methodologies. SoHO: Substances of Human Origin.

Both stages share the same architecture. Each project description is converted into a 768-dimensional dense vector using the all-mpnet-base-v2 sentence embedding model, which captures semantic meaning rather than surface vocabulary. A logistic regression classifier then assigns a probability score between zero and one.

The decision rule uses symmetric probability thresholds. At Stage A, projects scoring between 0.35 and 0.65 are flagged as borderline; 0.65 or above confirms biotechnology, and 0.35 or below confirms non-biotechnology. The same threshold governs the health versus non-health distinction at Stage B, with additional rule-based flags triggered by edge cases the Act explicitly acknowledges: food safety, veterinary applications, bioremediation, probiotics and microbiome research, and One Health framing. In total, 112 projects (0.4 percent of all Horizon projects in the dataset) were flagged at Stage A, and 244 confirmed biotech projects (5.3 percent of the Biotech projects) at Stage B. All 356 were submitted for structured secondary review using Claude (claude-sonnet-4-6), with the prompt framed against the statutory language of the Act and the edge-case decision rules in its Explanatory Memorandum. Borderline cases cluster around genuinely ambiguous categories: bioremediation may serve ecological restoration, drinking-water safety, or both; probiotic research spans food manufacturing and clinical microbiome therapy; veterinary research is health biotechnology when it addresses zoonotic disease risk but non-health when it concerns livestock productivity. Cases that remained

indeterminate after review are excluded from the confirmed-sector analyses. Health biotechnology, as defined by this procedure, comprises 2,131 unique private firms; non-health biotechnology comprises 1,026.

Firm stage

Firms are placed in early-stage, growth, and mature tiers from three equally weighted signals, headcount, age, and revenue, with cut-offs aligned to the EU SME definition and the biotech sample distribution. Stage assignment covers 2,309 of the 3,270 biotech firms (70.7 percent); the remaining 961 could not be matched to Orbis or had no recorded firm-level EU contribution in CORDIS.

Revenue effect

The revenue analysis estimates the effect of grant receipt on firm revenue. Because firms received their first grant in different years, we line them up by the moment of receipt rather than by calendar year: each firm's own grant year becomes year zero, and we compare revenue before and after that point across firms treated at different times. The effect is estimated in two forms: a before-and-after comparison, and a year-by-year path around receipt.

Before and after grant receipt. The binary specification is a two-way fixed effects panel regression, $\ln(\text{Revenue})_{i} = \beta \cdot 1\{t \geq to_i\} + \alpha_i + \delta + \varepsilon_i$, where to is the firm's first year of positive EU contribution and the indicator switches from zero to one in that year and stays on. Firm fixed effects absorb time-invariant company characteristics (size, country, founding year) and year fixed effects absorb common shocks (recessions, the pandemic, interest-rate moves), so β captures the within-firm revenue change pooled across all post-grant years. The outcome is the natural logarithm of annual revenue, so β is the effect on log revenue; for small values this approximates a proportional change, and the exact proportional change is exp(β) – 1, the form used when effect sizes are reported in the text. Standard errors are clustered at the firm level. This specification is also what the subgroup forest plots use: the same regression run separately on different groups of firms, for example independent SMEs or early-stage biotech, with each group's estimated effect and confidence interval on one row so the groups can be compared side by side. The event study is not used for the subgroups because the per-year coefficients become too imprecise once the sample is split into small cells.

Over time. A single before-and-after figure conceals whether the effect builds, holds, or fades. The event-study specification replaces the one post-grant indicator with a separate indicator for each year relative to receipt, $\ln(\text{Revenue})_{i} = \Sigma\_\{k \neq -1\} \beta\_k \cdot 1\{k = t - to_i\} + \alpha_i + \delta + \varepsilon_i$, binned to three years before receipt and to five years after. The year immediately before receipt (k=–1) is the baseline year each other year is measured against, so each β_k gives log revenue in that event-year relative to it. This traces the full path of the effect across the post-grant years, which the single before-and-after coefficient cannot show.

Sample and controls. Both specifications use the same sample. It is restricted to firms holding a single Horizon grant, so the estimated change ties to one identifiable grant rather than an accumulating portfolio. The outcome enters as a strict natural logarithm of revenue, which is

undefined for firm-years with zero or missing revenue; these observations are dropped rather than transformed or imputed. Of 92,721 firm-years in the single-project panel, 63,672 enter the regression. Almost all of the loss is missing revenue (28,037 firm-years), reflecting the delay with which small firms file accounts in Orbis; a smaller share (1,012 firm-years) is dropped because revenue is recorded as zero and its logarithm is undefined. These zero-revenue years fall disproportionately on early-stage firms yet to record sales. Ownership comparisons restrict both groups to Orbis-classified SMEs so that independent and corporate-group firms are compared at a similar scale. Ownership type follows the Orbis classification: independent firms (entity types IndepCo and SingleLoc) are standalone companies with no identified parent, while corporate-group firms (entity types GUO, ContrSubs, and Branch) belong to a wider group as ultimate owners, controlled subsidiaries, or branches.

Parallel trends. The event-study coefficients for the pre-receipt years test the assumption behind both specifications. Treated firms show significantly higher revenue two years before receipt (k=–2) than in the reference year immediately before treatment ($\beta_{-2} = +0.069$, $p < 0.001$), while three years before is indistinguishable from the reference year ($\beta_{-3} = +0.017$, $p = 0.297$). A joint Wald test rejects the hypothesis that the pre-receipt coefficients are together zero ($\chi^2(2) = 23.4$, $p < 0.001$), so the pre-trends fail jointly and not only at a single year. The pattern is consistent with an Ashenfelter's dip (Ashenfelter 1978; Heckman and Smith 1999): firms tend to apply for public funding when performance has recently softened, so the year just before receipt looks unusually weak compared with earlier years. Because every event-time coefficient is measured against this reference year, the magnitudes should be read as conditional on that baseline rather than as clean deviations from an undisturbed trend. As a robustness check, we re-estimated the event study using alternative baselines: the earliest pre-grant bin (k=–3), the average of all pre-grant years, and a version dropping the suspect year. The post-grant effects survive all three, so the direction and persistence of the finding are not an artefact of the depressed baseline, even if the precise size of each coefficient is more sensitive to the choice of reference year.

Estimator caveat. Both specifications are conventional two-way fixed effects estimators, and both are exposed to a known problem under staggered treatment timing with effects that change over time. In the before-and-after specification, the estimator identifies the effect partly by comparing later-treated firms against firms treated earlier, and those earlier firms are still undergoing their own evolving grant effect, so they act as imperfect controls and can bias the pooled coefficient. The event-study specification is subject to a related contamination when cohort-specific effects differ. The estimators designed to address this underlying bias (Sun and Abraham, 2021; Callaway and Sant'Anna, 2021) work by estimating each treatment cohort separately, drawing controls from firms not yet treated, and then reading off either the corrected per-year coefficients or a corrected average effect. Applying them reliably requires each treatment cohort to be well populated across the event window, and that condition is not met here. Once the sample is narrowed to biotech and split further by ownership, stage, and health status, the individual cells contain too few firms to support cohort-by-cohort estimation. For this reason the effects are reported as plain two-way fixed effects estimates, carrying the staggered-adoption limitation described above rather than as heterogeneity-robust ones.

Disclaimers and limitations

- This analysis does not claim to be an exhaustive review of Horizon-funded deep tech firms, though it covers a substantial share of private companies across biotech, hard tech, and digital tech, 2015 to 2025.
- Because the biotech classifier is more compute-intensive than the scoring approach used for the other two groups, biotech's share may be slightly overstated relative to hard tech and digital tech. Firms often span multiple domains, so classification is inherently subjective; groups were assigned for clarity and comparability rather than granularity.
- Revenue data thins sharply in the most recent years. Orbis compiles revenue from filed company accounts, which arrive with a delay, so revenue is available for more than 36,000 firm-years in a typical year (2015 to 2024) but only 2,412 in 2025, while EU grant data is populated through 2025.
- The biotech sub-sample becomes small once split by sub-sector and stage, so the revenue findings should be read as directional rather than definitive. The two-way fixed effects estimate is a within-firm before-and-after comparison identified in the standard way; the thin never-treated pool rules out heterogeneity-robust estimators such as Sun-Abraham (2021) and Callaway-Sant'Anna (2021), which require sufficient never- or not-yet-treated firms within each cohort.
- We restrict ourselves to firms with exactly one grant for the regression analysis to more accurately estimate the effect of a grant, but single-grant firms differ systematically from repeat recipients - smaller, less networked, less experienced with EU processes. So the revenue estimates describe single-grant firms, not Horizon recipients generally.
- Financial and ownership metrics are drawn from Orbis and may not reflect standardised accounting across all firms. SME status and ownership type follow Orbis classifications, not official EU SME designation.

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The Centre for Future Generations is an independent think-and-do tank with a mission to help policymakers anticipate and govern rapid technological change.

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