

DIGITAL TRANSFORMATION · LIFE SCIENCES

The Cost-Governed Enterprise

A digital transformation playbook for implementing advanced computation in Irish life sciences, and for financially governing its cost before it governs you.

REGION

Ireland and EU focus

FORMAT

White paper

EVIDENCE BASE

26 sourced references

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ABSTRACT

Everyone can measure the invoice. Almost no one can measure the return.

Across boardrooms in Dublin, Cork and Limerick the same sentence is being repeated in slightly different accents: we are spending on advanced computation, but we cannot yet prove the return. They are not imagining it. The MIT NANDA initiative, studying 300 public deployments alongside 150 executive interviews and 350 employee surveys, found that **95 per cent of enterprise generative pilots delivered no measurable impact on the profit and loss account**, despite an estimated €27.6bn to €36.8bn of enterprise investment.¹

This paper argues that the shortfall is not, primarily, a failure of the technology. It is a failure of governance. Cost is legible because it is billed. Return is illegible because it is diffuse, delayed and rarely instrumented. The organisations that will win the next five years are

not the ones that spend the most, nor the ones that spend the least. They are the ones that govern the gap between a knowable cost and an unknowable return.

What follows is a complete operating system for doing exactly that. It sets out a taxonomy of where the money actually goes, a set of financial equations that can be entered into a spreadsheet on Monday morning, a governance framework that turns strategy from a slogan into a control structure, and a decision model, the local versus hosted crossover, that determines quantitatively when running your own models beats paying per unit of consumption.

It is written for the Irish life sciences context: HPRA and EMA oversight, the EU AI Act, GxP, GDPR, and an ecosystem in which IDA Ireland and Enterprise Ireland supports sit alongside some of the world's most cost disciplined manufacturing operations.

95%

ENTERPRISE PILOTS
WITH NO MEASURABLE
P&L IMPACT (MIT
NANDA)¹

280×

FALL IN INFERENCE
COST, NOV 2022 TO OCT
2024 (STANFORD HAI)²

98%

ORGANISATIONS NOW
MANAGING THIS SPEND,
UP FROM 31% IN 2024
(FINOPS)³

€99.9bn

IRISH PHARMACEUTICAL
EXPORTS, 2024, ABOUT
45% OF GOODS
EXPORTS⁸



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Twelve parts

A blueprint sized to expand into a full reference volume.

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Currency note: monetary figures are stated in euro. Where a cited source reports in US dollars, the figure is converted at €1 = US\$1.09 and rounded. The reference list quotes each source in the currency it published.

PART I

The ROI Paradox

The defining feature of enterprise adoption in 2026 is an asymmetry of legibility. The cost is precise to four decimal places. The return is a rumour.

Read any of the industry post mortems and a pattern emerges. Pilots proliferate. Invoices arrive on time. And when the chief financial officer asks the one question that matters, what did we get back, the room goes quiet or produces a slide of productivity anecdotes that would not survive an audit. MIT NANDA named this the adoption divide and attributed it not to model quality but to a learning and integration gap: tools that never adapt to the workflow, and organisations that never instrument the outcome.¹

The instinct is to conclude that the technology has not delivered. That conclusion is wrong, and it is expensive, because it triggers exactly the two reactions that destroy value: panicked cost cutting that kills the compounding pilots, or blind escalation of spend in order to catch up.

THE EVIDENCE, READ CORRECTLY

The claim that this technology does not pay is a misreading of the data. McKinsey's 2025 global survey of 1,993 leaders across 105 countries found that 88 per cent of organisations now use it and 74 per cent report first year returns, yet only 39 per cent see enterprise level EBIT impact and just 6 per cent qualify as high performers deriving 5 per cent or more of EBIT from it.²⁰

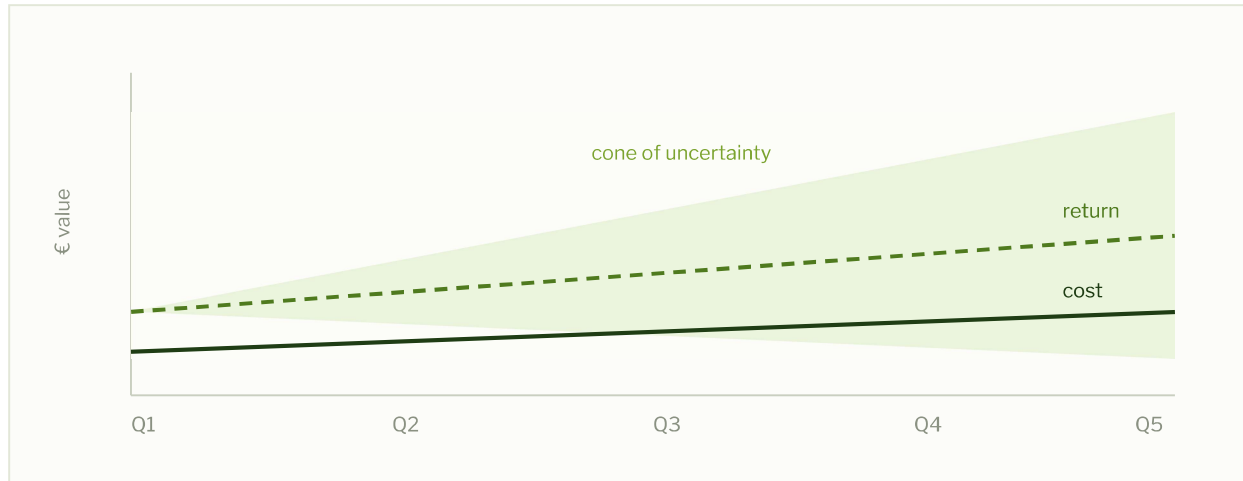
The spread is the story. The average deployment returns about €3.40 for every €1 spent, while high performers return more than €9.48, a roughly threefold gap driven not by better models but by reworking the work itself. High performers are 3.6 times more likely to make transformational change and far more likely to redesign workflows.²⁰

Gartner expected at least 30 per cent of generative projects to be abandoned after proof of concept by the end of 2025, and warns that at least half overrun their budgets through poor architecture and missing operational know how.²¹ Read together this is a governance signal, not a technology verdict, set against a market IDC sizes at €581bn by 2028.²²

The correct diagnosis is subtler. Cost and return are measured on different instruments. Cost is metered by the vendor, denominated in the vendor's units, and lands as a single legible number each month. Return is smeared across time, so this quarter's model rework saves next year's validation hours. It is smeared across functions, so a quality co-pilot reduces a deviation backlog that shows up in the operations numbers rather than in the IT numbers. And it is smeared across counterfactuals you never ran. You are comparing a photograph to a weather system.

FIGURE 1

The legibility gap: a knowable cost against an uncertainty cone of return



The cost line is a line: one number per period, billed and auditable. The return is a widening cone. Expected value may exceed cost, but the variance is large and realisation lags. Management's task is not to make the cone disappear. It is to narrow the cone deliberately through instrumentation while keeping the cost line governed.

Why the paradox is a governance problem

If the return were simply absent, the rational move would be to stop. But the evidence from disciplined adopters is that the return is present and merely uninstrumented. The failure is that organisations deploy these capabilities the way they would install a coffee machine, which is to buy it, plug it in and hope, rather than the way they would commission a piece of GMP equipment, which is to define the intended use, qualify it, monitor it and tie it to a measurable output. The discipline that Irish life sciences already applies to physical capital is exactly the discipline missing from its cognitive capital.

You would never install a bioreactor without an IQ, OQ and PQ protocol and a cost of goods model. Why would you install an intelligence pipeline without one?

That single analogy is the spine of this paper. Everything that follows, the cost taxonomy, the financial model, the governance layers and the crossover analysis, is the qualification protocol and cost of goods model for cognitive capital. Make the cost governed and the return instrumented, and the paradox dissolves into a spreadsheet.

THREE SENTENCES TO TAKE TO YOUR BOARD

1. Our cost is fully knowable, so we will govern it to the cent.
2. Our return is currently uninstrumented, so we will invest in measuring it before we invest further in spending.
3. We will not scale any use case past a pilot until its unit economics and its value instrument both exist.

The Anatomy of Cost

The vendor invoice shows one band of a seven band cost structure. The other six are where budgets quietly die.

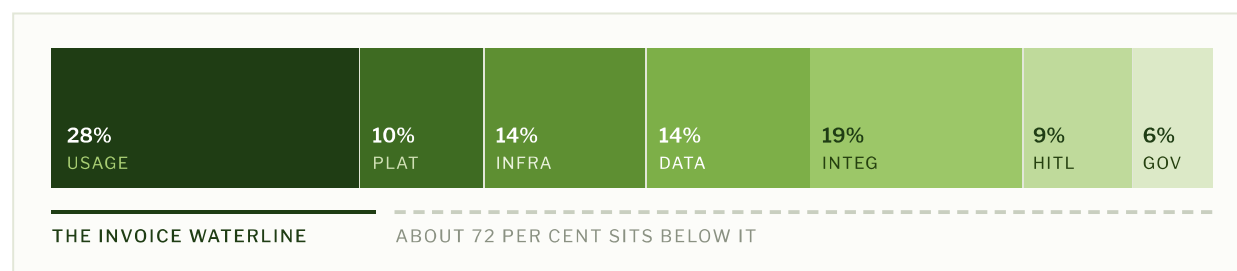
Ask most teams what their programme costs and they read the usage bill. That number is real, but it is typically 15 to 40 per cent of the true, fully loaded cost of a capability in production. To govern cost you must first see all of it. The taxonomy below decomposes spend into seven bands, ordered from most visible to most hidden.

BAND	WHAT IT IS	VISIBILITY	TYPICAL SHARE
1 · Usage	Per unit consumption charges, or the amortised cost of self hosted inference	High, billed	15 to 40%
2 · Platform	Seats, orchestration tools, vector stores, observability, gateways	High	5 to 15%
3 · Infrastructure	Compute, storage, networking, and development, validation and production environments	Medium	10 to 20%
4 · Data	Acquisition, labelling, cleaning, pipelines, retention	Low	10 to 20%
5 · Integration	Building, connecting to systems of record, ongoing maintenance	Low	15 to 30%
6 · Human review	Review, verification, operations labour, change management	Very low	10 to 25%
7 · Governance	Validation, compliance, audit, incident response, drift rework	Hidden	5 to 20%

Table 1. Indicative ranges for a production use case in a regulated environment. They do not sum to 100 per cent because mixes vary. The point is directional: bands four to seven routinely exceed band one.

FIGURE 2

Where the money actually goes: the invoice waterline



An illustrative fully loaded decomposition for a regulated production use case. The governance implication is blunt: a cost control programme that only negotiates the usage bill is optimising a quarter of the problem. The leverage sits in data, integration and human review.

The two bands nobody budgets for

Band six, human in the loop. In a regulated setting most output is not shipped unread; it is reviewed. If a co-pilot drafts a deviation report in four minutes but a specialist spends twenty minutes verifying it, unit cost is dominated by the specialist's time, not by the tokens. The governance question is simple: does the tool reduce net human minutes, or merely relocate them?

Band seven, governance, risk and rework. Validation under GxP, EU AI Act conformity work, audit trails, incident response and the rework caused by model drift are real recurring costs. They are also the costs a mature programme reduces over time by building reusable controls, which is precisely why they belong in the model and not in a footnote.

The Financial Model

Eighteen equations stand between we think this is worth it and we can prove it. Here are the load bearing ones. Put them in a sheet and you have a governance instrument.

3.1 Unit economics: the cost of one useful output

Everything starts with the cost per successful task. Not cost per token, not cost per call, but cost per output that actually cleared review and was used. Tokens are the vendor's unit. Cost per successful task is yours.

EQUATION 1 · COST PER SUCCESSFUL TASK

$$C_{task} = (C_{infer} + C_{review} + C_{infra}) \div p_{success}$$

C_{infer} is model cost per attempt · C_{review} is human verification cost per attempt · C_{infra} is allocated platform and infrastructure per attempt · $p_{success}$ is the share of attempts that pass review and are used, from 0 to 1.

The success denominator is the term teams forget. A model that is 30 per cent cheaper per call but succeeds 60 per cent of the time instead of 90 per cent is more expensive per useful output. Quality is a cost lever, not a separate axis.

EQUATION 2 · INFERENCE COST PER ATTEMPT

$$C_{infer} = (t_{in} \times \pi_{in}) + (t_{out} \times \pi_{out})$$

t_{in} and t_{out} are input and output tokens per attempt · π_{in} and π_{out} are price per token. Output tokens are usually the dominant term. Control verbosity and you control the bill.

3.2 Total cost of ownership

Governance runs on annualised total cost of ownership, summing the seven bands across the lifecycle and discounting nothing yet.

EQUATION 3 · ANNUAL FULLY LOADED TCO

$$TCO_{yr} = \sum_{b=1..7} C_b$$

Each C_b is a band from Table 1, annualised. Amortise one off build costs, integration and initial validation, over the expected useful life L of the capability.

3.3 Return, benefit and ROI

The instrument for return is benefit realised: the sum of labour hours redeployed, cycle time value, error and rework avoided, and revenue enabled, each with an explicit and defensible attribution factor stating what share of the benefit is genuinely due to the capability rather than to the process change around it.

EQUATION 4 · ATTRIBUTED BENEFIT

$$B_{yr} = \sum_j \alpha_j \cdot v_j \cdot q_j$$

v is the unit value of a benefit stream, q the quantity, α the attribution factor set conservatively and reviewed.

EQUATION 5 · RETURN ON INVESTMENT

$$ROI = (B_{yr} - TCO_{yr}) \div TCO_{yr}$$

Report ROI with its α assumptions attached. An ROI without a stated attribution factor is marketing, not measurement.

3.4 Payback, net present value and the hurdle

EQUATION 6 · SIMPLE PAYBACK

$$T_{payback} = I_0 \div (B_{mo} - C_{mo})$$

If the denominator is zero or below, the use case is not yet economic. Fix unit economics before scaling.

EQUATION 7 · NET PRESENT VALUE

$$NPV = -I_0 + \sum (B_t - C_t) \div (1 + r)^t$$

r is the discount or hurdle rate, N the horizon. A use case clears governance only if NPV is positive at the corporate hurdle rate.

THE GOVERNANCE TEST, IN ONE LINE

A use case may scale past pilot if and only if cost per successful task is stable and falling, ROI is positive at a conservative attribution factor, NPV is positive at the hurdle rate, and the value instrument exists. Miss any one and it stays a pilot.

The Governance Operating System

Governance is not a policy PDF. It is a control structure with seven layers, each owning specific decisions, metrics and gates.

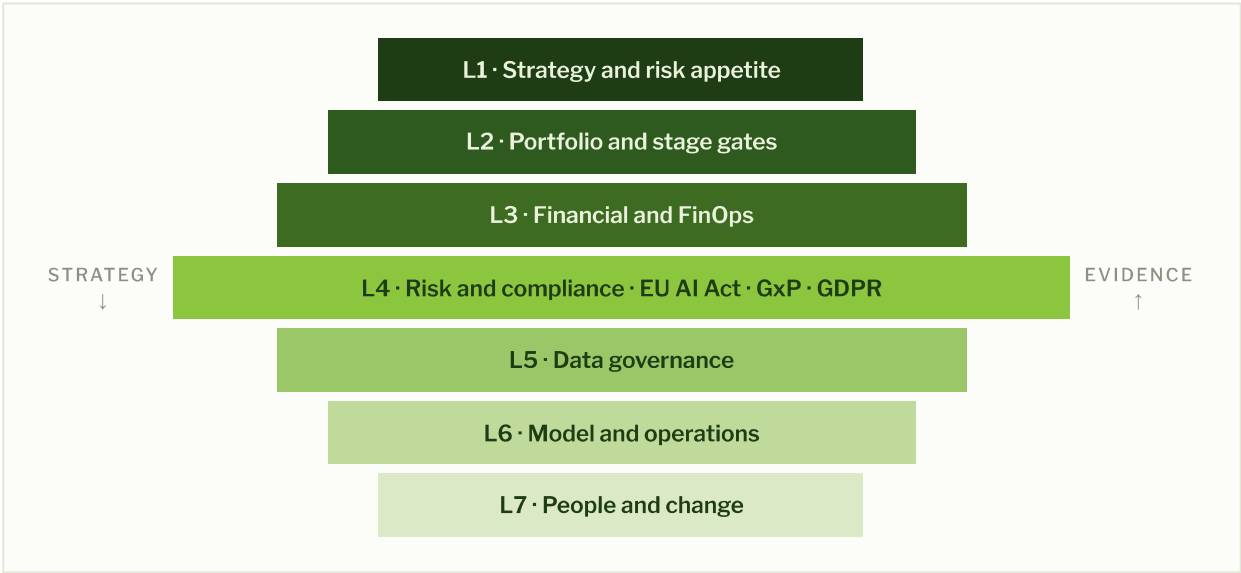
Most governance failures are structural rather than moral. Nobody owned the decision, so the decision was made by whoever held a corporate card. The operating system below assigns every recurring decision to a layer, an owner and a cadence. Adopt it and shadow spending has nowhere to hide.

LAYER	OWNS	KEY ARTEFACT	CADENCE
L1 · Strategy	Why we invest, risk appetite, the return against cost thesis	Charter and investment thesis	Annual
L2 · Portfolio	Which use cases live or die, stage gates, prioritisation	Use case portfolio and scorecards	Quarterly
L3 · Financial	Budgets, unit economics, allocation, showback	Cost model and FinOps dashboard	Monthly
L4 · Risk	EU AI Act class, GxP validation, GDPR, audit	Risk register and conformity file	Continuous
L5 · Data	Provenance, quality, retention, access, residency	Data contracts and lineage	Continuous
L6 · Model and Ops	Model selection, hosting, evaluations, drift, versioning	Model registry and evaluation suite	Continuous
L7 · People	Skills, roles, review design, adoption, ethics	Capability plan and RACI	Ongoing

Table 2. The seven governance layers.

FIGURE 3

The governance stack: strategy flows down, evidence flows up



Decisions and risk appetite cascade down from strategy; cost, evidence and risk signals flow up from operations. Layer four is drawn widest because in a regulated Irish context it constrains every other layer. It is not a gate at the end, it is a rail on the whole track.

The single most important control: the stage gate

At layer two, every use case passes through the same four gates. No gate, no budget. This is how an unbounded field of pilots becomes a governed portfolio.

GATE 0 Framing Intended use defined, value hypothesis stated, EU AI Act risk class assigned. KILL IF NO OWNER	GATE 1 Pilot Thin slice built, cost per successful task measured, success rate measured. KILL IF UNIT ECONOMICS FAIL	GATE 2 Validate GxP and regulatory evidence assembled, controls in place, NPV positive. KILL IF NOT DEFENSIBLE	GATE 3 Scale Cost allocation live, drift monitoring on, benefit instrument reporting. REVIEW QUARTERLY
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PART V · THE CORE COST LEVER

The Local versus Hosted Crossover

The largest structural cost decision is make versus rent: pay per unit of consumption to a commercial service, or amortise your own hardware running open weight models. There is a volume at which ownership wins, and it is knowable.

Commercial services are the right answer at low and spiky volume: near zero fixed cost, frontier quality, no operations burden. But their marginal cost is constant, since every unit costs the same as the last. Self hosting inverts the shape: high fixed cost in hardware and operations labour, near zero marginal cost. Somewhere the two lines cross. Below the crossover, rent. Above it, own.

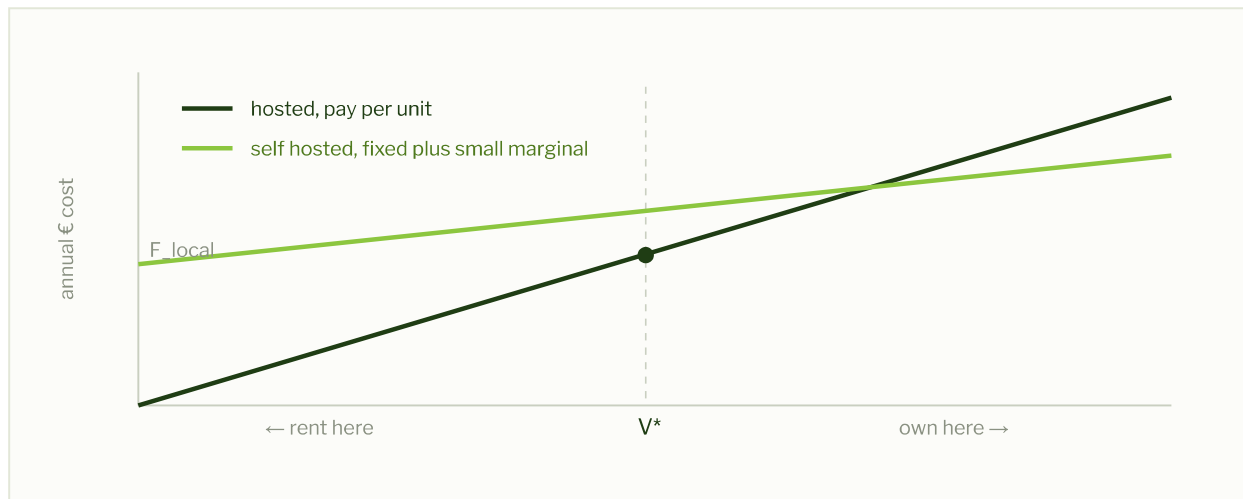
EQUATION 8 · THE CROSSOVER VOLUME

$$V^* = F_{local} \div (c_{hosted} - c_{local})$$

F_{local} is the annual fixed cost of self hosting, being amortised hardware plus operations labour plus platform · c_{hosted} is marginal cost per unit on the commercial service · c_{local} is marginal cost per unit self hosted, mostly energy. Above V^* , self hosting is cheaper.

FIGURE 4

The crossover: rent below V^* , own above it



Below V^* the near zero fixed cost of a hosted service wins. Above it the self hosted line's near flat marginal cost wins, and the gap widens with every additional unit. For high volume, privacy sensitive, repetitive workloads such as document extraction, classification and drafting at scale, regulated manufacturers frequently sit well above V^* .

THE NUMBERS, AS THEY STAND IN 2026

Renting has never been cheaper, or falling faster. Stanford HAI's 2025 index found the cost of inference for a mid tier model fell from €18.40 per million tokens in November 2022 to €0.06 by October 2024, a reduction of roughly 280 times in about eighteen months, with task dependent price declines of 9 to 900 times per year and hardware costs falling about 30 per cent annually.² Current published list prices per million input and output tokens sit around €1.61 and €12.90 for flagship tiers, €4.60 and €23 at the top of the range, and €1.84 and €11 for mid tier alternatives, per 2026 pricing trackers.¹⁰

Owning has never been more viable. Open weight families have largely closed the real world quality gap at roughly five to ten times lower per unit cost. Self hosting a 70 billion parameter class model on your own accelerators is estimated at five to twenty times cheaper than frontier list prices at high volume, with break even around 5 to 10 million tokens per day.¹¹

The three axes that move the crossover

Volume and steadiness

High, predictable volume favours ownership, because the hardware stays busy. Spiky, low volume favours renting.

Privacy and residency

In pharma, sending intellectual property or patient adjacent data to a third party can be a compliance cost or an outright bar. On premise processing keeps data inside the boundary, which shifts V* effectively to zero for some workloads.

Quality headroom

If a mid size open weight model clears your success bar, ownership is viable. If only a frontier model passes, rent the frontier for those tasks and own the rest. The answer is usually a portfolio, not a monogamy.

HYBRID IS THE MATURE DEFAULT

Route cheap, high volume, private tasks to owned open weight models. Reserve the metered frontier service for low volume, high difficulty tasks where quality headroom justifies the premium. Governed routing between the two is the cost control programme.

The Implementation Roadmap

A phased, gated path from first pilot to governed scale, designed so that cost is controlled and value is instrumented at every step rather than retrofitted at the end.

0

Foundations

Stand up layers one, three and four. Write the charter and risk appetite, build the empty cost model from Part III, and assign use cases to EU AI Act risk classes. Establish the local sandbox so experimentation cost is near zero from day one.

GATE

Charter signed

Weeks 0 to 6

1

Thin slice pilots

Pick two or three high volume, low regulatory risk use cases. Build the thinnest slice that produces a real output. Instrument cost per successful task and success rate from the first day. Kill anything whose unit economics do not converge.

GATE

Unit economics measured

Weeks 6 to 16

2

Validate and harden

For survivors, assemble GxP and regulatory evidence, wire in human review controls, and confirm NPV at the hurdle rate. Decide make versus rent per use case using the crossover from Part V.

GATE

Defensible, NPV positive

Weeks 16 to 28

3

Govern at scale

Turn on cost allocation and showback, drift monitoring, and the benefit instrument. Move from project to portfolio: the quarterly layer two review now runs the whole estate on evidence.

GATE

FinOps and drift live

Weeks 28 onward

The Cost Maturity Model

Five levels. Most Irish organisations sit at level one or two and believe they are at level three.

LEVEL	STATE	COST SIGNAL	WHAT IS MISSING
L0 · Shadow	Spending on personal cards, ungoverned	Invisible	Everything
L1 · Aware	Central bill exists, no unit economics	One total number	Attribution and unit cost
L2 · Measured	Cost tracked per use case	C_task per use case	Return instrument
L3 · Governed	Stage gates, FinOps and ROI in place	ROI and NPV per use case	Portfolio optimisation
L4 · Optimised	Portfolio managed, make versus rent routed	Marginal cost of value	Continuous frontier review

Table 3. Maturity levels.

Maturity is not about how much you run. It is about how well you can answer questions about it. The test for each level is a single question a finance director could ask.

L0 TO L1

What did we spend last month?

If the honest answer is that it sits on various cards, you are at level zero. The move up is one control: route all spend through a central account or gateway so that a single number exists.

L1 TO L2

What does one useful output cost?

A single monthly total is level one. Decomposing it to cost per successful task per use case, including review time and success rate, is level two. This is the step most organisations skip.

L2 TO L3

Which use cases actually pay, and how do you know?

Measurement without a return instrument and a stage gate is level two. Adding ROI with a stated attribution factor, an NPV test at the hurdle rate, and a kill gate is level three.

L3 TO L4

What is your marginal cost of value?

Level four runs the estate as a portfolio: routing each task to the cheapest adequate model, retiring laggards, and re-underwriting the frontier continuously.

THE LEVEL THREE SELF DECEPTION

The most expensive place to sit is level two while believing you are at level three: dashboards full of usage metrics that look like governance but carry no return instrument and no kill gate. Usage is not value. If no use case has ever been killed at a gate for failing its economics, you are not yet governed. You are merely measured.

The FinOps Metrics System

The dashboard that changes behaviour. If a number does not have an owner and a target, delete it. Vanity metrics measure activity, not stewardship.

FinOps discipline has moved decisively into this territory. The FinOps Foundation reports that 98 per cent of organisations now manage the spend, up from 31 per cent in 2024, with getting to unit economics among the fastest rising priorities.³ Four metric families carry a governed estate. Each metric below is specified as definition, owner, target, and the perverse incentive to avoid.

FAMILY	METRIC	OWNER	TARGET OR SIGNAL
UNIT	Cost per successful task by use case, month on month trend	Use case owner and FinOps	Flat or falling
UNIT	Cost per 1,000 successful outputs	FinOps	Below the value per 1,000
UNIT	Review pass rate	Quality and use case owner	Meets the use case service level
EFFICIENCY	Share of spend below the invoice waterline, bands four to seven	FinOps	Understood, not hidden
EFFICIENCY	Idle hardware share for owned capacity, and cache reuse rate	Platform and operations	Idle below 20%, reuse rising
VALUE	Attributed annual benefit and ROI, with the attribution factor stated	Finance and use case owner	Positive at a conservative factor
VALUE	Payback period trend	Finance	Shortening
GOVERNANCE	Showback coverage, share of spend allocated	FinOps	Toward 100%
GOVERNANCE	Shadow spending incidents, and use cases past each gate	Layer two portfolio owner	Incidents toward zero

Table 4. The metric set for a governed estate.

The perverse incentives to design out. A cost per call target invites teams to game verbosity down at the expense of quality, so watch the success rate alongside it. A raw ROI target invites optimistic inflation of the attribution factor, so require the assumption to be stated and reviewed. An idle hardware target invites make work to keep the cluster busy, so pair it with unit cost. Every single metric needs its counterweight on the same screen.

SHOWBACK BEFORE CHARGEBACK

Start by showing each function its own cost. Behaviour changes the moment a team sees its number next to its peers. Only move to internal chargeback, where the cost actually lands on the function's budget, once the allocation model is trusted. A premature chargeback fight over imperfect allocation will stall the whole programme and drive spend back into the shadows.

The Irish and EU Context

In Ireland, governance is not a maturity aspiration. It is increasingly a legal requirement layered on an already heavily regulated industry.

The EU AI Act, live dates. In force since August 2024, with prohibited practice bans applying from 2 February 2025 and general purpose obligations from 2 August 2025. 2 August 2026 switches on penalty enforcement, Article 50 transparency duties and national market surveillance sanctions.⁴ Under the 2026 Digital Omnibus, the heaviest Annex III obligations were deferred to 2 December 2027, and capabilities embedded in regulated products under Annex I to 2 August 2028. That is breathing room, not a reprieve.⁵

Penalties are turnover scaled. Up to €35m or 7 per cent of global turnover for prohibited practices, €15m or 3 per cent for high risk non compliance, and €7.5m or 1 per cent for supplying incorrect information.⁴ These are band seven numbers that dwarf any usage bill.

Code of practice. If you build on general purpose models, note the voluntary EU code of practice published on 10 July 2025, with signatories listed from 1 August 2025, covering transparency, copyright, and safety and security. It is the emerging baseline your vendors are expected to meet, and a due diligence checklist for your own procurement.²³

EMA, HPRA and GxP. The EMA's final reflection paper on use in the medicinal product lifecycle, adopted on 9 September 2024 by CHMP and CVMP, sets a risk

based, human centred bar from discovery through pharmacovigilance, with explicit weight on data quality and bias.⁷ Layered on GAMP 5 and EudraLex Annex 11 validation, the statement that the model changed and we did not revalidate is an audit finding waiting to happen. Where the software is itself the device, the HPRA acts as national competent authority under EU MDR 2017/745 and IVDR 2017/746, and the IMDRF good machine learning practice principles set the lifecycle bar.²⁴

GDPR and data residency. The EDPB's Opinion 28/2024, adopted on 17 December 2024 at the request of the Irish Data Protection Commission, makes clear that model anonymity is assessed case by case and that unlawful training data can taint downstream use.⁶ For personal or IP sensitive workloads this is a decisive argument for on premise processing, since data stays inside the boundary, simplifying lawful basis and transfers.

Funding offsets the build. Ireland's research and development tax credit rose to 30 per cent for periods from 1 January 2024 and is legislated to 35 per cent for 2026, with the first year payable threshold lifted to €75,000, a combined benefit near 42.5 per cent with the trading deduction.⁹ Together with IDA Ireland and Enterprise Ireland supports, factor this offset into the upfront investment term in the payback equation.

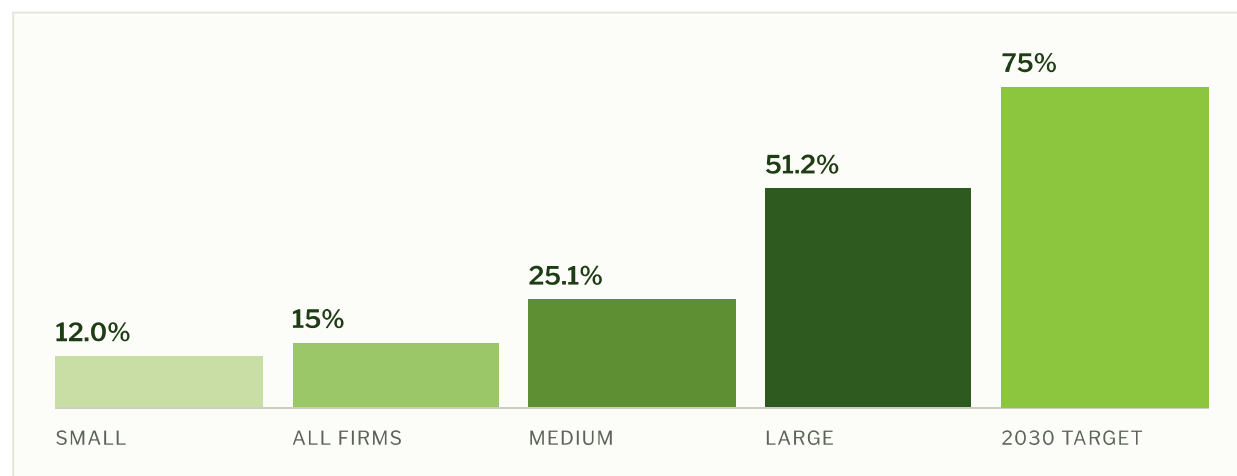
Ireland is the second largest exporter of pharmaceuticals in the European Union and the third largest in the world, with about €99.9bn of pharmaceutical and medical exports in 2024, up roughly 29 per cent year on year and equal to about 45 per cent of all goods exports, across more than 90 companies employing some 50,000 people directly.⁸ The stakes of getting governance right here are national, not merely corporate.

The Irish adoption picture, by the numbers

The national data tells a story of rapid but deeply uneven adoption. Per the CSO's Information Society Statistics for enterprises in 2024, more than 15 per cent of all Irish enterprises adopted these tools in 2024, nearly double the 8 per cent of 2023. The average hides a chasm by firm size: 51.2 per cent of large enterprises, 25.1 per cent of medium and just 12.0 per cent of small.¹² Among large firms, 30 per cent already automate workflows or assist decisions this way. Independent survey work agrees on direction. Deloitte, with UCD Smurfit, found 62 per cent of leading Irish companies adopting, rising to 94 per cent in technology, media and telecommunications, that one in four Irish firms now has a chief officer for the domain, and ranked Ireland first in EMEA for strategy integration.¹³ Against this sits the national ambition of the refreshed strategy: 75 per cent of enterprises using these technologies, cloud and big data by 2030.¹⁴

FIGURE 5

Adoption by Irish enterprises, 2024, against the 2030 national target



Source: CSO Information Society Statistics, enterprises, 2024;¹² national target from the refreshed national strategy.¹⁴ The gap between a 12 per cent adopting small business base and a 75 per cent national target is a cost governance opportunity. The winners will be those who adopt and instrument, not those who merely adopt.

The talent constraint is the binding one

In Ireland the scarcest input is not compute, it is people. The Expert Group on Future Skills Needs, with NIBRT, projects 14,000 to 26,000 additional biopharma jobs over five years on a base of 50,000, while warning that graduate inflow could fall short by about 3,000 roles every year, with acute shortfalls in digital and data scientists and in chemical and digital process engineers.¹⁸ Deloitte likewise found talent to be the single biggest barrier to adoption in Ireland.¹³ This has a direct consequence for the cost model: it inflates band six, human review, and band five, integration and engineering, wage rates. That is precisely why a governance programme which reduces net human minutes per output, rather than merely cutting the usage bill, is the higher leverage play in this market.

The Irish funding stack

Few jurisdictions match Ireland's density of state supports for exactly the band three and band five build costs this paper models. Fold these into the upfront investment and the annual fixed cost of self hosting before concluding that a use case fails its payback test.

SUPPORT	BODY	WHAT IT OFFSETS
Research and development tax credit, 30% rising to 35% for 2026	Revenue	Qualifying build work, with a combined benefit near 42.5 per cent
Discovery voucher and digital discovery grant	Enterprise Ireland	Structured feasibility and assessment at gate zero
Grow Digital voucher	Local Enterprise Office	Small business digital tool adoption
European Digital Innovation Hubs, phase two, 2026 to 2029, €23m	CeADAR, FactoryXChange, Data2Sustain, ENTIRE	Test before invest, skills and technical expertise
Industry 4.0 and readiness assessment	Irish Manufacturing Research	Manufacturing readiness and deployment, with more than €6m in live projects

Table 5. Selected Irish and EU supports relevant to the cost of build.

IDA Ireland reported €13.2bn of client capital investment and a record €1.9bn in research, development and innovation in 2024, with foreign direct investment supporting 544,619 jobs. The biopharmachem sector alone reports about €116bn in exports and 80,000 direct and indirect jobs.^{16 19} Since 1 August 2024 national research funding runs through Taighde Éireann, Research Ireland, backing centres including Insight, ADAPT and CeADAR, the national centre for applied intelligence, which alone secured €5.675m under the second phase of the European Digital Innovation Hubs.²⁵ For a life sciences firm these are not academic curiosities. They are subsidised routes to de risk the band four and band five build before it reaches your own profit and loss account. Ireland's 2025 Digital Decade country report notes an adjusted roadmap adopted in November 2024 with 81 measures and a €9.2bn budget, yet small business digitalisation and advanced adoption still sit only around the EU average.²⁶



PART X

Risk Register and Controls

Ungoverned spend fails in predictable ways. A governed register, scored, owned and reviewed on a cadence, turns vague anxiety into specific controls.

Score each risk on likelihood by impact, assign an owner and a review cadence, and attach the specific control. The point is not the register's existence but its liveness. A risk with no owner and no last reviewed date is decoration.

RISK	FAILURE MODE	L×I	CONTROL	OWNER
Shadow spending	Ungoverned spend and data leakage	H×H	Central gateway, showback, gate zero for every use case	L2 portfolio
Runaway usage	Verbose outputs, loops, no cap	M×H	Spend caps per use case, output length limits, alerts	FinOps
Quality collapse	A low success rate inflates cost per task	M×H	Evaluation suite, success rate service level, model routing	Quality
Model drift	Silent degradation leading to rework	M×M	Drift monitoring, versioned registry, scheduled re evaluation	Operations
Vendor lock in	Price rises with no exit	M×M	Abstraction layer, and an owned open weight fallback	Architecture
Compliance gap	Unvalidated model in a GxP or high risk path	L×H	Layer four rail, conformity file, revalidation on change	Regulatory
Data leakage	IP or personal data sent to a third party service	M×H	Loss prevention at the gateway, local models for sensitive data, residency rules	DPO
Over automation	Human oversight removed where it mattered	L×H	Review by design on consequential decisions, statutory oversight duties	Function lead
Concentration	One model or vendor underpins many use cases	M×M	Diversified routing, documented fallbacks, exit test	Architecture

Table 6. Cost governance risk register.

Cadence. Runtime risks, meaning runaway consumption, drift and quality, are monitored continuously and reviewed monthly at layer three. Structural risks, meaning lock in, concentration and compliance, are reviewed quarterly at layer two. The full register is re scored at the annual layer one strategy review. The three that most often kill programmes quietly are shadow spending, quality collapse and the compliance gap. Govern those three first.

Case Vignettes

Three composite Irish scenarios, each worked end to end through the equations of Part III and the crossover of Part V. All figures are illustrative: plausible, internally consistent, and clearly not any real firm's private data.

A · The Cork contract manufacturer: document extraction at volume

A contract manufacturer extracts structured data from batch records and certificates of analysis: 40,000 documents a year, each roughly 8,000 input and 1,500 output tokens. The incumbent design uses a frontier hosted service plus heavy specialist review. The question is whether a fine tuned open weight model on premise beats it.

COMPONENT, PER DOCUMENT	BEFORE, HOSTED AND HEAVY REVIEW	AFTER, ON PREMISE AND LIGHT REVIEW
Inference cost	€0.05	€0.01
Human review	12 min × €60/h = €12.00	5 min × €60/h = €5.00
Allocated infrastructure	€0.20	€0.55
Success rate	0.90	0.94
Cost per successful task	€13.61	€5.91

Table 7. Cork contract manufacturer, cost per successful task before and after.

Net cost per successful task falls by about 57 per cent, and note where the saving lives. Almost all of it is band six, review minutes, not the usage bill. On pure inference the crossover barely matters at this volume, since roughly 570 million tokens a year sits below a cost only threshold. What tips the decision to own is GDPR and intellectual property residency, plus the review time gain from a model tuned to the document format. The hosted frontier service is retained only for the 2 per cent of genuinely ambiguous documents, which is the hybrid routing of Part V.

B · The hospital group: clinical administrative drafting

ATTRIBUTED BENEFIT €616k 200 clinicians × 30 minutes a day × 220 days = 22,000 hours a year, at €70 an hour loaded, with a deliberately conservative attribution factor of 0.4.	ANNUAL TCO €180k Fully loaded on premise cost: hardware amortisation, operations, validation and support. Data sensitivity makes local processing mandatory under GDPR.	RETURN AND PAYBACK 242% · 4 months With upfront build of about €150k and net monthly benefit near €36k, NPV is comfortably positive at any sane hurdle rate.
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The lesson: even on a conservative attribution and a local only constraint, the case clears on labour redeployment alone, provided the benefit is instrumented through time and motion measurement rather than assumed.

C · The mid cap biologics manufacturer: a quality co-pilot

A quality co-pilot drafts deviation and corrective action documentation. Volume is medium and regulatory load is high, so band seven dominates. The instructive finding is that the cheaper model is the wrong lever.

LEVER	ACTION	ANNUAL EFFECT ON COST PER TASK
Cut the model price	Swap the frontier hosted service for a cheaper model	–€0.04, negligible
Redesign the review	Structured templates and confidence flags cut review from 20 to 12 minutes	–€8.00, dominant

Table 8. Biologics quality co-pilot, two paths to the same budget.

In a regulated setting, cost control lives in bands six and seven, not band one. The winning move is not procurement but process: a review workflow the tool is designed to accelerate, and a validation approach that makes drift cheap to catch. Chase the usage bill here and you optimise a rounding error while the real cost, specialist minutes and rework, runs untouched.

Templates and Appendices

Adopt tomorrow artefacts, written out in full. Copy them into your own stack and you have the skeleton of a governed programme.

A · The one page monthly board memo

PROGRAMME BOARD MEMO · [MONTH / YEAR]

1. **Thesis.** Cost is knowable and governed to the cent; return is being instrumented before further spend.
2. **Portfolio.** Use cases live, split across gate one, gate two and gate three; number killed this quarter and the reason.
3. **Unit economics.** Blended cost per successful task this month against last; best and worst use case; success rate trend.
4. **Value.** Attributed benefit year to date with the attribution factor stated; portfolio ROI; use cases below the NPV threshold.
5. **Make versus rent.** Decisions taken this month and the crossover volume that drove them.
6. **Risk.** Top three register movements and any regulatory items.
7. **Asks.** Decisions and budget needed from the board.

B · Cost model spreadsheet specification

Eight tabs. Inputs, holding prices, wage rates, hurdle rate and grant offset. Bands, the seven band build up from Table 1. Unit, equations one and two. TCO, equation three. Value, equations four and five with the attribution factor as an explicit reviewable input. Capital, equations six and seven. Crossover, equation eight. Dashboard, the Part VIII metric set. Every headline number on the dashboard traces to a formula, and every formula traces to an input. No hard coded results.

C · Equation reference card

THE LOAD BEARING SET, ALL IN ONE PLACE

$$1 \cdot C_{\text{task}} = (C_{\text{infer}} + C_{\text{review}} + C_{\text{infra}}) \div p_{\text{success}}$$

$$2 \cdot C_{\text{infer}} = (t_{\text{in}} \times \pi_{\text{in}}) + (t_{\text{out}} \times \pi_{\text{out}})$$

$$3 \cdot \text{TCO}_{\text{yr}} = \sum C_{\text{b}} \text{ for } b = 1 \text{ to } 7$$

$$4 \cdot B_{\text{yr}} = \sum \alpha_j \cdot v_j \cdot q_j$$

$$5 \cdot \text{ROI} = (B_{\text{yr}} - \text{TCO}_{\text{yr}}) \div \text{TCO}_{\text{yr}}$$

$$6 \cdot T_{\text{payback}} = I_0 \div (B_{\text{mo}} - C_{\text{mo}})$$

$$7 \cdot \text{NPV} = -I_0 + \sum (B_t - C_t) \div (1 + r)^t$$

$$8 \cdot V^* = F_{\text{local}} \div (c_{\text{hosted}} - c_{\text{local}})$$

D · Gate zero use case intake form

A use case may not consume budget until this one pager is complete: a named accountable owner; the intended use and value hypothesis, meaning what output and what it is worth; the value instrument, meaning how the benefit will be measured; the EU AI Act risk class; the data class and residency, meaning whether personal or IP data is involved and whether local processing is required; the make versus rent hypothesis; and the success and kill criteria for the pilot. No owner, no intended use and no instrument means no gate zero.

E · Governance charter and RACI

LAYER	ACCOUNTABLE	RESPONSIBLE	CONSULTED
L1 Strategy	Board and chief executive	Chief digital officer	Finance, quality
L2 Portfolio	Chief digital officer	Portfolio lead	Function leads
L3 FinOps	Chief financial officer	FinOps lead	IT, function leads
L4 Risk and compliance	Chief quality and regulatory officer	Regulatory affairs, data protection officer	Legal, IT security
L5 Data	Chief data officer	Data engineering	Data protection officer, quality
L6 Model and operations	Head of machine learning	Operations	Security, quality
L7 People and change	Chief human resources officer	Learning and development, change leads	Function leads, unions

Table 9. RACI across the seven layers.

A CLOSING WORD

The organisations that will thrive in Irish life sciences are not those that spend the most, nor those that wait for certainty. They are the ones that treat cognitive capital with the same discipline they already bring to physical capital, governing a knowable cost while patiently instrumenting an uncertain return. That is not a technology programme. It is a management one.

REFERENCES AND SOURCES

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Every headline figure in this paper is sourced. Primary and official sources are used where available. A small number of figures, notably current list prices and self hosting economics, draw on 2026 industry pricing trackers and are marked as such.

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95 per cent of enterprise pilots show no measurable P&L impact; about US\$30bn to US\$40bn enterprise investment; 150 interviews, 350 surveys, 300 deployments.

Reported August 2025

forbes.com ↗

2 Stanford HAI, 2025 AI Index Report, chapter 1

Inference cost for a mid tier model fell about 280 times, from US\$20.00 per million tokens in November 2022 to US\$0.07 in October 2024; hardware costs down about 30 per cent a year.

Stanford University, 2025

hai.stanford.edu ↗

3 FinOps Foundation, State of FinOps 2025 and 2026

Organisations managing this spend rose from 31 per cent in 2024 to 63 per cent in 2025 and 98 per cent in 2026; survey covers more than US\$69bn of cloud spend.

FinOps Foundation, 2026

data.finops.org ↗

4 EU Artificial Intelligence Act, implementation timeline and penalties

In force August 2024; prohibited practices 2 February 2025; general purpose obligations 2 August 2025; enforcement and transparency 2 August 2026. Fines to €35m or 7 per cent.

European Commission, 2026

artificialintelligenceact.eu ↗

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Annex III high risk deferred to 2 December 2027; Annex I embedded products to 2 August 2028.

Legal analyses, 2026

digital-strategy.ec.europa.eu ↗

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Adopted 17 December 2024 at the request of the Irish Data Protection Commission; anonymity assessed case by case; consequences of unlawful training data.

EDPB, December 2024

edpb.europa.eu ↗

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Final, adopted 9 September 2024 by CHMP and CVMP; risk based and human centred; data quality and bias.

EMA, September 2024

ema.europa.eu ↗

8 IDA Ireland, IPHA and BioPharmaChem Ireland, Irish pharmaceutical sector

About €99.9bn of medical and pharmaceutical exports in 2024, roughly 45 per cent of goods exports and 29 per cent year on year growth; 90+ companies; about 50,000 employed directly.

IDA Ireland and IPHA, 2025

idaireland.com ↗

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Rate 25 to 30 per cent for periods from 1 January 2024, legislated to 35 per cent for 2026; first year payable threshold €75,000; about 42.5 per cent combined benefit.

Revenue and KPMG, 2026

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Indicative per million token list prices for flagship and mid tier models, as compiled by industry pricing comparisons.

Industry pricing trackers, 2026

artificialanalysis.ai ↗

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Open families near frontier parity at about five to ten times lower per unit cost; self hosting a 70 billion parameter class model five to twenty times cheaper at high volume; break even about 5 to 10 million tokens a day.

Industry analysis, 2026

spheron.network ↗

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More than 15 per cent of Irish enterprises adopting in 2024 against 8 per cent in 2023; large 51.2 per cent, medium 25.1 per cent, small 12.0 per cent.

CSO, released February 2025

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62 per cent of leading Irish firms adopting, 94 per cent in technology, media and telecommunications; one in four has a dedicated chief officer; Ireland first in EMEA for strategy integration; talent the top barrier.
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Target of 75 per cent of enterprises using these technologies, cloud and big data by 2030; regulatory sandbox; human centric governance principles.
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Discovery voucher, digital discovery grant, Grow Digital voucher, digital transition fund; €23m for four hubs, 2026 to 2029, targeting 3,000 or more engagements.
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234 investments, 69 first time; more than 13,000 future jobs; 59 per cent regional; €13.2bn client capital expenditure; record €1.9bn research and innovation; 544,619 supported jobs at year end.
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More than €6m of active projects across manufacturers; readiness index assessments; €23.5m five year funding, an increase of 57 per cent.
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14,000 to 26,000 additional biopharma jobs projected over five years; graduate inflow may fall short by about 3,000 a year; shortages in digital and data scientists and process engineers.
EGFSN and NIBRT, April 2024
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At least 30 per cent of projects expected to be abandoned after proof of concept by end 2025; at least half overrun budgets through poor architecture and missing operational know how.
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Published 10 July 2025, signatories listed from 1 August 2025; chapters on transparency, copyright, and safety and security.
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researchireland.ie ↗
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Govern the cost, and the return becomes legible.

This white paper is published as part of a continuing programme of independent research into digital transformation and financial governance across the Irish and European life sciences sector.

€3.40

Average return per €1 of spend, against €9.48 for high performers

39%

Of organisations see enterprise level EBIT impact

€99.9bn

Irish medical and pharmaceutical exports, 2024



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