

From Reporting to Causality

A new operating model for regulated organisations

The most valuable time to understand a regulatory failure is when the conditions that could cause it are already present – but the failure itself has not happened yet.

EXECUTIVE SUMMARY

Regulated organisations do not lack data. They lack connected understanding.

Regulated organisations operate finance platforms, asset systems, risk registers, operational dashboards, customer-service systems, employee surveys and increasingly sophisticated business-intelligence environments. Yet major failures continue to surprise boards, regulators, government and the public.

The precise incident is rarely predictable with certainty. But the conditions that later explain it frequently existed beforehand: deteriorating performance, unresolved management concerns, resource constraints, delayed investment, weak controls, unclear accountability, employee concerns, customer complaints and risks understood in one part of the organisation but not connected to consequences elsewhere.

Traditional reporting tells leadership what has happened. Forecasting can identify correlations between historical patterns and possible future outcomes. Neither necessarily explains why an outcome is becoming more likely.

This paper argues for a different layer of enterprise architecture: a causal organisational framework that continuously connects regulatory obligations, strategy, decisions, people, operational capability, customer experience and finance. IXGraph is designed to provide that layer without replacing the systems organisations already use.

REPORTING
What happened?

CORRELATION
What tends to happen next?

CAUSALITY
Why is it happening?

INTERVENTION
What should change now?

The proposition

The issue is not that management always knew a specific failure would occur. The stronger proposition is that the conditions, concerns, decisions, dependencies and warning signals that later explain major failures often already existed within the organisation – but were fragmented across people and systems and were not connected into a coherent causal picture.

A regulator often reconstructs the causal graph after failure. The opportunity is to maintain that graph before failure.

01 | THE REGULATORY LANDSCAPE

The warning signs are visible across regulated Britain

Recent regulatory events across aviation, energy, water and local government reveal a common theme: scrutiny increasingly extends beyond the event itself to the quality of decision-making, information, controls, assurance and organisational resilience.

NATS – aviation resilience [1][2]

Following the NATS flight-planning system issue on 8 September 2026, the CAA said NATS would provide a technical report and that Government had asked the regulator to conduct an independent review into what happened and how well NATS is positioned to deliver a resilient service in future. The incident follows the major August 2023 failure and its independent review.

NESO – system operation [3][4]

Ofgem's 2026 review of electricity-system stress during June's extreme heat explicitly asks what decisions were made and why, whether applicable rules were breached, whether control-room records are sufficient, and what lessons should strengthen future resilience. A separate review concerns allegations around record-keeping, system-risk data and decision-making.

Water – compliance and oversight [5][6]

Ofwat's wastewater enforcement work has repeatedly moved beyond individual assets to processes, oversight and governance. Its Welsh Water findings included inadequate processes to identify and address emerging compliance risks, weaknesses in data gathering and analysis, and insufficient information and assurance reaching executives and the Board.

Birmingham – local government [7][8]

Commissioners reported completely inadequate management accounting information, no budget monitoring information during 2023/24, and a failure of internal control and assurance in the run-up to the Section 114 notice. Earlier intervention correspondence also described ignored warning flags in the Oracle programme and longstanding governance failures.

The recurring question is no longer only 'what failed?' It is increasingly 'what information existed, who understood it, what decisions followed, and how did those decisions connect to the organisation's obligations?'

02 | THE STRUCTURAL PROBLEM

The rear-view mirror problem

Most enterprise reporting architectures are exceptionally good at describing things that have already happened. Finance reports expenditure. Asset systems report asset performance. HR reports headcount and absence. Operational systems report incidents. Risk systems record identified risks. Regulatory teams report compliance.

The dashboards can be sophisticated, accurate and close to real time. But the underlying architecture remains primarily retrospective.

Driving an organisation through reporting alone is like driving a vehicle by looking through the rear-view mirror. The view may be detailed and accurate – but it still describes the road already travelled.

Forecasting helps, but correlation is not causality

CORRELATION

When A occurred previously, B tended to follow. Useful for prediction, pattern recognition and anomaly detection – but often silent on the organisational mechanism that connects them.

CAUSALITY

Decision A changed capability B, which affected execution C, customer outcome D and regulatory obligation E. The relationship itself becomes explicit and examinable.

A forecast might predict rising complaints. A causal model seeks the organisational pathway: investment constraint → deferred maintenance → declining resilience → increased intervention → employee workload → slower response → customer interruption → complaints → regulatory exposure.

03 | THE MISSING LAYER

The missing data is often human

Some of the most valuable evidence of an emerging failure never reaches the data warehouse. It exists in the experience, judgement and concerns of the people operating the organisation.

EXECUTIVE sees constraint	MANAGER sees workaround	FRONT LINE sees fragility	CUSTOMER TEAM sees symptoms	REGULATORY TEAM sees exposure
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An operations director may know a process is becoming fragile. Finance may know expenditure is constrained. Engineering may know maintenance has been deferred. Front-line employees may know that workarounds have become normal. Customer teams may see a shift in complaints. Regulatory specialists may know an obligation is approaching a critical threshold.

Every fact can exist somewhere while the organisation itself still fails to know what those facts mean when connected together.

Silos are therefore not merely a data-location problem

Data warehouses, lakes, APIs, ERP platforms and BI tools bring information together physically. But physical integration is not the same as connecting meaning. A maintenance-budget reduction can appear as a finance variance, deferred work, staffing pressure, declining reliability, customer disruption and regulatory exposure in different systems – without any system recording that these are parts of the same organisational story.

The critical enterprise question is not simply ‘where is the data?’ It is ‘what does this information affect?’

04 | THE REQUIRED CHANGE

A causal framework for the regulated enterprise

A regulated organisation has an advantage when building a causal model: many of the outcomes it must protect are already externally defined through licences, statutory duties, performance commitments, safety standards, environmental obligations, financial-resilience requirements and governance controls.

INTENT	STRATEGY	CAPABILITY	EXECUTION	EXPERIENCE	FINANCE
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IXGraph structures the enterprise around six connected constants: Intent → Strategy → Capability → Execution → Experience → Finance. Regulatory obligations are then connected into this model rather than treated as a separate reporting exercise.

What the framework must record

Layer	Examples	Causal role
People	Executive and employee assessments; responsibility; decision rights	Captures organisational knowledge and accountability
Decisions	Investment, resourcing, priorities, controls, exceptions	Records interventions that change conditions
Systems	Finance, ERP, CRM, asset, operational and risk data	Provides objective evidence and outcomes
Regulation	Obligations, standards, commitments, controls	Defines the external outcomes to protect
Relationships	Affects, depends on, owns, evidences, conflicts with	Turns disconnected facts into a traversable model

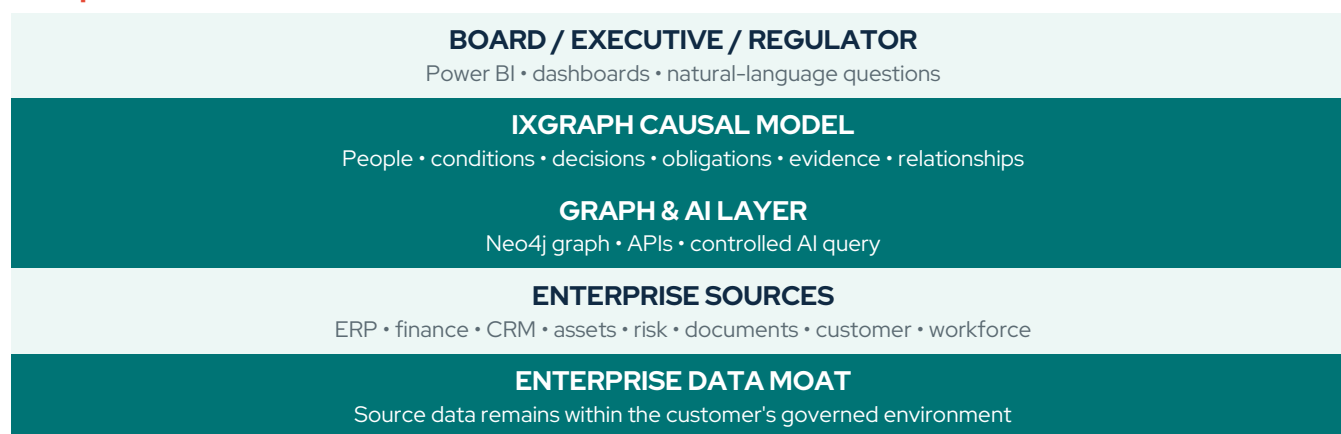
05 | IXGRAPH

IXGraph: a connected organisational and regulatory layer

IXGraph is a graph-native enterprise model designed to connect organisational conditions, people, decisions, operational information, financial information, customer experience and regulatory obligations.

It does not require the enterprise to abandon its existing technology. Oracle remains Oracle. SAP remains SAP. Salesforce remains Salesforce. Asset platforms, document repositories, data warehouses and BI environments continue to operate. IXGraph sits across and between them as a connected knowledge and causal layer.

Conceptual architecture

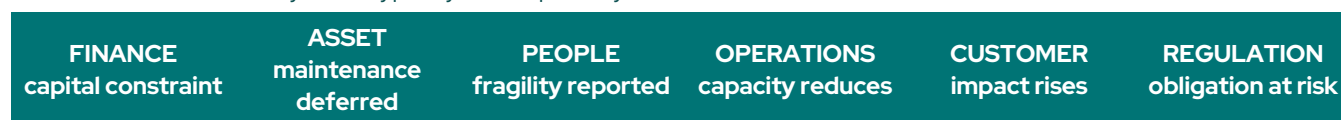


The result is not simply a model of the organisation's data. It is a model of the organisation: what it is trying to achieve, what conditions exist, who is accountable, which decisions have been made, what evidence supports them, and which regulatory outcomes may be affected.

06 | WORKED EXAMPLE

From a water-company signal to regulatory exposure

The following is an illustrative causal chain, not a reconstruction of any named company's failure. It shows how IXGraph can connect evidence that conventional systems typically hold separately.



What changes when the relationships are explicit?

1. Finance becomes operational context

A budget decision is no longer just a variance. It is connected to the assets, teams, capabilities and obligations that may be affected.

2. Employee knowledge becomes structured evidence

Repeated concerns from people closest to the process can be compared with objective operational measures rather than remaining in meetings or email.

3. Regulatory obligations become traversable

Management can move backwards from an obligation to the conditions supporting it, or forwards from a decision to the obligations it may influence.

4. Contradictions become signals

If reported KPIs remain green while operational teams consistently report deteriorating conditions, the disagreement itself becomes visible.

5. Intervention becomes earlier

Leadership can act while the causal conditions are forming, rather than waiting for the regulatory outcome to become measurable.

07 | AI AND THE GRAPH

AI becomes more useful when the relationships are explicit

Generative AI can retrieve documents, summarise reports and interrogate databases. But an LLM connected to disconnected enterprise information still has to infer many of the relationships that matter.

A graph makes those relationships explicit. AI can interrogate connected organisational context rather than merely searching disconnected documents and records.

The value of AI is not only finding more information. It is asking better questions of an organisational model whose relationships can be evidenced.

Questions a causal enterprise model should support

- Which current organisational conditions create the greatest risk to our regulatory obligations?
- What evidence supports management's assertion that this obligation is under control?
- Which decisions have improved financial performance while increasing operational or regulatory risk?
- Where do employee assessments conflict materially with reported KPIs?
- Which obligations depend on a small number of people, systems or operational capabilities?
- What intervention would address the greatest number of connected causal conditions?

08 | WHY EXISTING ARCHITECTURE IS NOT ENOUGH

Why a data warehouse + BI + an LLM still does not create causality

The strongest alternative to IXGraph is not another graph product. It is the argument that an organisation already has a data warehouse, Power BI or Tableau, and can now place a large language model over the top. That combination is powerful – but it solves a different problem.

A warehouse can consolidate data. BI can visualise it. An LLM can retrieve, summarise and reason across accessible information. None of those components, by themselves, creates a governed and persistent model of the organisational relationships that explain why outcomes emerge.

DATA WAREHOUSE stores facts	BI shows measures	LLM interprets context	IXGRAPH records relationships
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The distinction is the relationship layer

Capability	Warehouse + BI	LLM over enterprise data	IXGraph causal layer
Integrates structured data	Strong	Can query accessible sources	Connects source evidence to organisational meaning
Shows performance and trends	Strong	Can explain and summarise	Links measures to conditions, decisions and obligations
Captures employee judgement	Usually separate	Can read text if accessible	Structures human assessments as governed graph evidence
Records decision → consequence	Rarely explicit	May infer from documents	Persistent, explicit and traversable
Maps evidence to regulation	Usually reporting-led	Can retrieve rules	Obligations are nodes connected to responsible conditions and evidence
Explains provenance	Data lineage	Citation/retrieval dependent	Relationship provenance can be inspected and challenged
Persists causal hypotheses	No	Generally generated at query time	Yes – as an evolving organisational model

Inference is not the same as an organisational record

An LLM may infer that a maintenance decision contributed to an operational problem because it finds both ideas in documents. That can be useful, but the relationship is generated at query time and may change with context, model or evidence retrieved. For a regulated organisation, important relationships need to be explicit, governed, attributable and capable of being challenged.

IXGraph does not compete with the data warehouse, BI or the LLM. It makes each of them more valuable by giving them a governed model of organisational meaning.

The architecture is complementary

SYSTEMS OF RECORD	DATA / BI	IXGRAPH CAUSAL MODEL	AI / CDA	BOARD & REGULATOR
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Existing systems remain authoritative for transactions and measurements. BI remains the presentation environment. AI remains a powerful interface. IXGraph supplies the missing connective tissue: who, what, why, dependency, evidence, decision, obligation and consequence.

09 | THE CORE PROPOSITION

Regulators reconstruct the causal graph after the event

A striking feature of regulatory investigation is how closely the process resembles construction of a knowledge graph. Investigators collect records, identify people, establish timelines, inspect decisions, compare what different functions knew, trace dependencies, map responsibilities and test those facts against regulatory obligations.

The output is usually a narrative report. Underneath that narrative, however, sits a network of entities and relationships: who knew what; which condition existed; which decision was made; what evidence supported it; what was affected; which control failed; and which obligation was breached.

EVENT	EVIDENCE	PEOPLE	DECISIONS	DEPENDENCIES	OBLIGATIONS	CAUSE
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The conventional model

Today, much of this causal reconstruction occurs after the outcome. The organisation first experiences the incident or regulatory breach; evidence is then assembled retrospectively; causal relationships are reconstructed; lessons are identified; and controls are changed.

The IXGraph model

IXGraph reverses the timing. It creates and maintains the relationships while the organisation is operating. Conditions, assessments, evidence, decisions and obligations can be connected before a failure becomes the event around which the evidence is finally assembled.

The proposition is not that IXGraph predicts the incident. It is that the organisation should not have to wait for an incident before it can see the relationships that make failure more likely.

From post-event causality to pre-event causality

POST-EVENT REGULATORY INVESTIGATION	IXGRAPH CAUSAL OPERATING MODEL
Collect evidence after failure	Continuously connect evidence before failure
Interview people to discover what was known	Capture structured organisational conditions and perceptions
Reconstruct decisions and responsibilities	Record decisions, ownership and affected relationships
Map the event against regulatory obligations	Connect current conditions directly to obligations
Explain why controls failed	Expose conflicting evidence, weak dependencies and causal pathways
Recommend remediation	Support intervention while choices remain available

Why this matters to a Board

This changes the governance question from whether the organisation can explain a failure after the event to whether it can demonstrate, before the event, that it understands the conditions capable of producing one.

For the regulator, that potentially creates a stronger form of assurance: not simply periodic performance reporting, but traceability from obligation to condition, evidence, decision, owner and intervention.

A regulated organisation should be able to demonstrate not only that it knows its current performance, but that it understands why that performance exists and what is capable of changing it.

10 | The cost of standing still

More dashboards will not solve a relationship problem

Without a causal layer, regulated organisations are likely to accumulate more data, more dashboards, more regulatory reports and more AI – while still discovering some of their most important problems only after consequences become measurable.

STATUS QUO

Incident → measurement → escalation → investigation →
causal reconstruction → remediation

CAUSAL OPERATING MODEL

Condition → relationship → emerging exposure → executive
understanding → intervention → evidence

The consequences of late understanding

The cost is not confined to fines. It includes emergency capital expenditure, service disruption, customer compensation, political intervention, management distraction, reputational damage, financing pressure, executive turnover and loss of public trust.

Regulators already reconstruct causality

After a major failure, investigators assemble documents, interview staff, examine decisions, reconstruct timelines, identify dependencies and determine why controls did not work. In effect, they build a causal graph after the event. The strategic opportunity is to maintain that connected evidence before the event.

Retrospective investigation asks why the organisation failed. Causal management asks the same question early enough to change the answer.

11 | Governance and assurance

A different relationship between board, executive and regulator

A causal model can shift regulatory assurance from periodic assertion toward continuous traceability. Instead of presenting only outcomes, an organisation can demonstrate the conditions affecting them, management assessments, decisions taken, evidence supporting those decisions, accountable individuals, operational dependencies and links to obligations.

From compliance reporting to line of sight

OBLIGATION

CONDITION

EVIDENCE

DECISION

OWNER

OUTCOME

A board member should be able to select a regulatory obligation and traverse backwards through the graph to the processes, capabilities, assets, people and evidence supporting it. Equally, a decision should be traversable forwards to identify the regulatory outcomes it may affect.

The governance benefit

This creates an auditable line of sight from decision to obligation. It does not eliminate judgement or uncertainty. It makes the basis of that judgement visible, connected and challengeable.

The question for the Board changes from 'Are we compliant?' to 'Which current conditions are increasing the probability that we will cease to be compliant?'

12 | Conclusion

The next step is not better reporting. It is earlier understanding.

The recurring lesson from regulatory failure is not that organisations lack information. It is that information without relationships provides an incomplete picture of organisational reality.

NATS can possess extensive technical data. NESO can possess extraordinary visibility of the electricity system. Water companies can monitor millions of operational data points. A council can operate sophisticated finance and ERP platforms. None of those capabilities, by itself, guarantees that leadership can see the chain of cause and consequence developing across the organisation.

The next generation of regulated enterprise architecture needs to connect three worlds that have historically been separated: what the organisation's systems know; what its people know; and what its regulatory obligations require.

IXGraph is designed to provide the architecture through which those relationships can be represented, governed, interrogated and continuously understood. Its differentiation is not that it stores more data or produces another dashboard: it makes organisational relationships persistent and explicit, so that BI can display them, AI can interrogate them and management can act on them.

IXGraph is not another reporting system. It is a living model of why an organisation behaves as it does – designed to expose the causes of tomorrow's regulatory outcomes in today's organisational conditions.

The board question

See more. Lead more.

SOURCES AND REGULATORY EVIDENCE

Primary sources

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About this paper

This paper uses public regulatory evidence to illustrate a structural management problem. It does not assert that IXGraph would have predicted any specific historical incident, nor does it infer facts beyond the cited regulatory record. The worked causal chains are illustrative of the architecture and method.

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