



Lifecycle Readiness Misalignment in Brownfield EPIC Projects: A Practitioner-Informed Governance Framework for Interface Assurance and Value Delivery

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ABSTRACT

Brownfield engineering, procurement, installation, and commissioning (EPIC) projects are delivered within operating assets where production continuity, constrained access, legacy infrastructure, and multiple organisational interfaces create tightly coupled dependencies. Conventional controls can report high completion within individual functions while the overall system remains unready for commissioning or operations. This study offers a distinct reconceptualisation of project readiness through a preliminary construct termed lifecycle readiness misalignment (LRM). A practitioner-informed conceptual theory-building design was applied to four anonymised critical-incident accounts retrospectively reconstructed from the author's own professional memories and non-confidential self-observations in oil and gas project environments. The accounts are conceptual propositions rather than independently verified historical cases and require multi-informant validation. They concerned transformer availability, electrical-submersible-pump cable and casing compatibility, vendor-specialist mobilisation, and delayed permanent grid connection. The accounts were standardised through a common reflective extraction protocol and examined using reflexive thematic analysis and cross-account comparison. Three accounts illustrated constrained downstream progression. A fourth illustrated how a local alternative, rapid decision authority, and a pre-mobilisation plan can absorb a readiness gap without critical schedule impact. The analysis suggests that local functional readiness can coexist with system unreadiness when dependencies are not formally accepted at lifecycle interfaces, while buffering and corrective capacity may moderate downstream consequences. No production, netback, financial-cost, or proprietary operational data were collected or estimated; value exposure is therefore discussed qualitatively. The article proposes LRM as a preliminary construct and develops the Integrated Lifecycle Readiness and Risk Governance Model (ILRGM), comprising evidence-based readiness gates, provider–acceptor accountability, leading indicators, lifecycle coordination reviews, and learning loops. Direct causal effects and validated performance improvements are not established. The study offers conceptual and analytical propositions for independent, multi-informant, comparative, longitudinal, and quantitative validation.

Keywords: brownfield projects; EPIC; project governance; operational readiness; interface management; systems thinking; value delivery; practitioner-informed theory building

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<https://doi.org/10.5281/zenodo.22755762>

Received 1 July 2026; Received in revised form 8 August 2026; Accepted 10 September 2026

Available online 14 September 2026

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1. Introduction

In these brownfield settings, new or modified assets must be engineered and delivered within an existing operational system. Work is constrained by legacy equipment, live production, limited shutdown opportunities, restricted access, incomplete records, and dependencies on operations, suppliers, contractors, and enabling infrastructure. These conditions make performance sensitive to the quality of coordination and acceptance across lifecycle interfaces. Research on project governance increasingly treats governance as more than formal control. Governance shapes decision rights, accountability, stakeholder interaction, strategic alignment, and the conditions under which value can be realised (Brunet, 2021; Song et al., 2022; Turner, 2020; ul Musawir et al., 2020). This broader view is important because project success is now understood as multidimensional, extending beyond cost, time, and scope to include outcomes, stakeholder perceptions, benefit realisation, and longer-term value (Ika & Pinto, 2022; Zwikael, 2024; Zwikael & Huemann, 2023). The Project Management Institute's seventh edition of the PMBOK Guide formalised a shift towards principles, performance domains, systems thinking, tailoring, and value delivery (Project Management Institute [PMI], 2021). The eighth edition, published in November 2025, retained that foundation while organising guidance around six core principles and seven performance domains and expanding attention to accountability, procurement, adaptability, artificial intelligence, and actionable process guidance (PMI, 2025). These standards support a systemic view of projects, but they do not by themselves explain how readiness deficiencies arise, cross organisational interfaces, and constrain operational value in brownfield EPIC delivery. The practical problem examined in this article is recurrent: engineering may report approved design, procurement may report equipment delivered, installation may report mechanical completion, and operations may report staffing preparation, yet commissioning or production cannot proceed. The missing condition is often not an isolated deliverable but synchronised readiness across dependencies. A technically compliant component may be incompatible with the receiving system; installed equipment may remain unusable because power infrastructure is incomplete; or a fully installed package may not be commissioned because specialist vendor support is unavailable.

Risk management standards provide processes for identifying, analysing, treating, monitoring, and communicating uncertainty (International Organization for Standardization [ISO], 2018). These processes remain essential. However, even robust risk identification may not reveal the aggregated readiness of interdependent functions. A risk register can contain individual risks without showing whether the collective system has reached an acceptable transition state. Conventional controls may therefore identify threats yet still fail to assemble the evidence required for a lifecycle go/no-go decision. The distinction matters because an operational consequence can emerge when several locally manageable conditions combine at an interface.

The research gap is the absence of an integrated construct and explicit governance process for situations in which local functional readiness coexists with system unreadiness across the delivery lifecycle. Relevant knowledge is distributed across project governance, systems thinking, interface management, operational readiness, commissioning and startup integration, and benefits management. Governance research explains decision structures and accountability; systems research emphasises interdependence; interface studies examine coordination across technical and organisational boundaries; commissioning and operational-readiness guidance addresses transition to use; and benefits research shifts attention from outputs to value. These streams remain insufficiently connected around readiness transfer and formal acceptance at upstream and downstream interfaces. Interface research shows that problems at design–construction and stakeholder boundaries generate rework, delay, and performance loss (Al Qasem & El-Sayegh, 2025; Zhang et al., 2022). Boundary-spanning

research similarly demonstrates the importance of roles that connect organisations and support collaboration (Satheesh et al., 2024; van Meerkerk et al., 2024). These studies clarify why boundaries matter, but readiness is usually treated as an outcome of coordination rather than as an explicit, governable state transferred and accepted across interfaces.

The aim is to conceptualise how readiness deficiencies can emerge and propagate across lifecycle interfaces in brownfield EPIC projects and to develop a practitioner-informed governance framework for managing those dependencies. The study addresses three questions:

1. RQ1. How can readiness misalignment be conceptualised across lifecycle interfaces in brownfield EPIC project environments?
2. RQ2. What governance and coordination patterns are illustrated by the anonymised practitioner accounts?
3. RQ3. How can these practitioner-informed patterns inform a lifecycle readiness governance framework oriented towards value delivery?

The article makes three bounded but distinctive contributions. First, it formalises LRM as a preliminary construct that makes the paradox of local completion alongside system unreadiness analytically visible and governable. Second, it identifies a recurrent propagation pattern linking unresolved dependencies, failed or incomplete interface acceptance, downstream constraint, and value exposure, while recognising buffering capacity as a possible moderator. Third, it develops ILRGM as an operationally specific assurance layer that complements established risk, interface, project-governance, commissioning, and operational-readiness processes by defining who provides readiness evidence, who accepts it, which authority decides, and how exceptions are escalated and closed. The framework's performance benefits remain propositions awaiting empirical validation.

2. Literature review and conceptual framing

2.1 Project governance, decision making, and value

Project governance defines the structures and practices through which projects are directed, decisions are made, responsibilities are assigned, and organisational objectives are protected. Systematic reviews indicate that governance is closely associated with strategic implementation and benefits realisation, but definitions and mechanisms remain fragmented (ul Musawir et al., 2020). Governance research has consequently moved from a narrow focus on control towards contextual and practice-based explanations of how actors interpret rules, negotiate priorities, and make decisions in temporary organisations (Brunet, 2021; Song et al., 2022). Turner (2020) argues that governance influences project decisions through the architecture in which decision makers operate. This is relevant to readiness because unresolved dependencies often persist not from lack of technical knowledge but from unclear authority, fragmented incentives, or delayed escalation. Organisational architecture also determines whether the owner, contractor, supplier, commissioning team, and operator can coordinate effectively across temporary and permanent structures (Denicol et al., 2021). Value-oriented project research challenges the assumption that successful delivery is equivalent to producing outputs on time and within budget. Ika and Pinto (2022) emphasise the multidimensional and time-dependent character of project success. Zwikaël and Huemann (2023) similarly distinguish outputs, outcomes, benefits, impact, and value. For brownfield projects, an installed asset that cannot start safely or deliver production has achieved output completion without realising the intended benefit. This distinction underpins the present argument that readiness alignment is an intermediate governance capability connecting delivery activity to operational value.

2.2 Systems thinking and project interdependence

Systems thinking directs attention to interactions, feedback, emergence, and the consequences of optimising parts of a system independently. Complex project outcomes cannot always be reduced to a single failed activity because technical components, organisations, contracts, information, and operating conditions influence one another. Recent construction research demonstrates that project complexity, stakeholder engagement, and social dynamics interact in shaping outcomes (Omotayo et al., 2024). Brownfield EPIC delivery is especially suited to a systems lens. Existing assets impose design constraints; procurement choices affect installation methods; installation quality affects commissioning; and operational acceptance depends on documentation, training, utilities, and maintainability. A local decision may be rational within one function but create an adverse system effect downstream. Systems thinking therefore shifts the unit of attention from the completed task to the dependency network in which that task must function. The systems perspective also exposes a limitation in linear stage models. Engineering, procurement, installation, commissioning, and operations are commonly depicted in sequence, yet actual delivery contains feedback loops. Installation can reveal design incompatibility, commissioning can return systems for rework, and operations can require changes to maintainability or control philosophy. A readiness framework must therefore allow iterative acceptance and re-entry rather than assume irreversible progression.

2.3 Interface management and boundary spanning

Interfaces occur where information, responsibility, equipment, decisions, or acceptance criteria cross organisational or technical boundaries. Design–construction interface problems remain a recognised source of uncertainty and rework (Al Qasem & El-Sayegh, 2025). Research on prefabricated construction also links stakeholder engagement and interface-management performance, showing that effective coordination depends on relationships as well as formal processes (Zhang et al., 2022). Boundary-spanning studies provide a complementary organisational explanation. Boundary spanners connect parties, translate information, and support collaboration across institutional and contractual divisions. Their effectiveness depends on project conditions, including complexity and contract form (Satheesh et al., 2024). In public infrastructure projects, boundary-spanning activity has been associated with fairness, innovation, and performance (van Meerkerk et al., 2024). Building on the literature on interface coordination and boundary spanning, the present study does not treat an interface merely as a communication point. Instead, it conceptualises an interface as a readiness-transfer point. At this point, the receiving function requires evidence that an upstream output is usable under downstream conditions. Engineering readiness, for example, is incomplete if procurement cannot source the specified item or installation cannot deploy it within site constraints. This provider-acceptor interpretation gives interface management an explicit assurance function.

2.4 Distinguishing lifecycle readiness misalignment

Lifecycle readiness misalignment is defined here as a condition in which one or more project functions satisfy their local completion criteria while the collective system lacks the accepted dependencies needed for safe and effective progression across a lifecycle interface. The construct does not replace risk, interface, or operational-readiness concepts. It integrates them around a specific analytical question: can the receiving system use what the upstream function declares ready? LRM has five proposed dimensions: (1) local readiness status, referring to completion claimed within a function; (2) dependency completeness, referring to technical, resource, information, vendor, and infrastructure prerequisites; (3) interface

acceptance, referring to evidence-based confirmation by the receiving function; (4) system readiness, referring to the combined ability to progress; and (5) value exposure, referring to the operational or benefit consequence of remaining unready. The theoretical advance is not integration alone. LRM treats readiness as an emergent system condition rather than a property held independently by a component or department. It also treats interface acceptance as an assurance function rather than a communication event. Traditional punch lists, issue logs, and incident reports may reveal discrepancies after they become visible; ILRGM introduces a pre-emptive governance mechanism that requires evidence-based acceptance before a critical transition. Some advanced systems-integration approaches include organisational concerns, but they do not typically formalise provider–acceptor evidence, lifecycle acceptance, decision authority, and exception closure as one readiness architecture. The proposed theoretical mechanisms are:

- A readiness paradox: a project function can be locally complete while the receiving system remains unable to progress.
- A propagation mechanism: an unresolved dependency can cross an interface and become a downstream constraint, rework requirement, or temporary workaround.
- An assurance mechanism: readiness becomes governable when the receiving function formally accepts evidence of usability under downstream conditions.
- A contingent consequence: buffering and corrective capacity may absorb a misalignment, so disruption is not treated as deterministic.

Table 1. Conceptual positioning of lifecycle readiness misalignment

Related concept	Primary focus	Typical limitation for this study	Proposed contribution of LRM
Project risk management	Uncertain events and effects on objectives	Risks may be listed individually without representing the combined readiness state	Treats readiness as a system condition produced by multiple dependencies
Interface management	Coordination across organisational and technical boundaries	Often focuses on communication, responsibility, or issue tracking	Frames interfaces as evidence-based readiness transfer and acceptance points
Operational readiness	Preparation for handover, startup, operation, and maintenance	Progressive approaches address earlier lifecycle conditions, but formal downstream acceptance of every critical upstream dependency may remain implicit or uneven.	Requires active evidence acceptance at engineering, procurement, supplier, installation, infrastructure, commissioning, and operations interfaces.

Related concept	Primary focus	Typical limitation for this study	Proposed contribution of LRM
Systems integration	Technical compatibility and performance of connected components	Often emphasises technical compatibility; advanced approaches may include organisational integration but do not usually formalise provider-acceptor evidence, transition authority, and exception closure as one lifecycle assurance mechanism.	Combines technical and organisational readiness and elevates evidence-based interface acceptance to a formal governance function for emergent system conditions.
Benefits management	Realisation of outcomes and value	May not specify the operational conditions that enable benefits	Positions readiness alignment as a capability between outputs and value
Brownfield execution practice	Front-end definition, stakeholder alignment, interface reduction, and systematic programme management	Provides practical disciplines but does not explicitly represent local readiness coexisting with system unreadiness	Adds a cross-lifecycle governance construct and evidence-acceptance mechanism for dependency closure

3. Methodology

3.1 Research philosophy and design

The study adopts an interpretivist perspective because it examines how readiness criteria, responsibility, dependency closure, and transition acceptance are understood within complex organisational settings. Readiness is not treated solely as an objective technical state. It is also shaped by professional judgement, decision rights, expectations, and acceptance practices across functions. A practitioner-informed conceptual theory-building design was used, supported by retrospective, structured introspection and reconstruction of four anonymised critical-incident accounts from the author's memory and non-confidential self-observations. Unlike a conventional case study, the approach did not use external archival records, formal interviews, or independently auditable case protocols. The outputs are therefore conceptual propositions rather than verified historical accounts. The purpose was to develop an explanatory construct and governance framework, not to test hypotheses or claim a representative empirical sample. An incident was operationally defined as a bounded practitioner account in which an expected transition condition, an unresolved dependency, an affected interface, and an observable downstream response or mitigation could be described without proprietary or identifiable information (Flanagan, 1954). Incident boundaries began at the earliest recalled readiness claim or assumption and ended when progression was restored, deferred, constrained, or absorbed through a controlled response. The comparison baseline was reconstructed by combining widely applicable engineering, commissioning, and operational-readiness practices with the author's professional schema. It is an interpretive benchmark for

theoretical pattern matching, not an objectively derived or independently validated standard. Future studies should validate transition baselines through Delphi panels, multi-informant interviews, and systematic comparison with authorised procedures and industry guidance. Pattern matching was used within the interpretivist design to compare meanings and structures across the accounts, not to confirm a pre-defined causal model, verify company records, or count frequencies. The unit of analysis is the readiness incident as reconstructed in the anonymised account and its apparent interface-level propagation or absorption. The approach draws selectively on case-study logic by preserving relevant context and comparing structured incident accounts (Yin, 2018), while reflexive thematic analysis identifies patterns of meaning across those accounts (Braun & Clarke, 2021a, 2021b; Byrne, 2022). The researcher's professional interpretation was treated as a visible and bounded analytical resource. Reflexivity was operationalised through the following controls:

- A structured reflective extraction matrix applied consistently to every practitioner account.
- A dated analytical decision log recording changes to codes, themes, and framework elements.
- Theme-specific reflexive memos separating the recalled or observed sequence from professional interpretation and recording potential bias.
- Alternative explanations and a devil's-advocate test asking what other conditions could explain the observed sequence or weaken the readiness interpretation.
- A recommendation for peer debriefing by an independent qualitative researcher before future instrument development or multi-informant validation.

Together, these practices created an audit trail for the evolution of codes, themes, and framework elements (Berger, 2015; Carcary, 2020).

3.2 Researcher positionality and setting

The researcher is the sole practitioner-informant and has 26 years of professional experience in the oil and gas industry across brownfield infrastructure modifications, pipeline construction, production-expansion programmes, electrical-submersible-pump (ESP) deployment, commissioning, startup, and operational-readiness activities. During the professional period represented by the accounts, the researcher served as the ESP focal point and directly observed or supervised the general types of well tie-in, installation, and commissioning situations discussed. These are the author's own retrospective reflections and self-observations, not observations collected from other practitioners. The role involved equipment specification, procurement follow-up, supplier coordination, storage, electrical integration, commissioning support, startup, and coordination with engineering and production functions. The manuscript does not reproduce or analyse employer records arising from those responsibilities. This embedded position supported contextual understanding of interactions among reservoir engineering, procurement, vendors, drilling, construction, commissioning, and operations. It also created risks of recall bias, selective attention, and over-identification with practitioner explanations. These risks were addressed by applying the same reflective fields to each account, comparing account structures rather than relying on a single narrative, using conservative causal language, considering alternative explanations, and separating observed or remembered sequence from theoretical interpretation. The researcher's positional knowledge helped identify potentially important dependencies; personal authority was not treated as independent proof of a claim.

3.3 Practitioner-account basis and selection

The conceptual analysis uses four anonymised practitioner accounts: (C1) unavailability of step-down transformers required for ESP startup at several new wells; (C2) cable-casing and installation-compatibility difficulties affecting no more than two wells; (C3) a vendor-specialist mobilisation delay of several hours at commissioning; and (C4) delayed permanent grid connection for a well located a substantial distance from the existing electrical supply. Purposeful maximum-variation selection was used to represent four different dependency domains: critical equipment availability, technical and installation compatibility, specialist-resource mobilisation, and enabling infrastructure. The set also included one mitigated account (C3) to challenge a deterministic disruption explanation. Four accounts were retained because these were the bounded, meaningfully recalled, non-proprietary examples that met all inclusion criteria and provided variation suitable for initial conceptual comparison. This number does not imply thematic saturation, representativeness, or empirical sufficiency. The accounts were reconstructed from the author's professional experience and non-confidential self-observations during an approximately one-year operational period in which he served as ESP focal point. They are not derived from company-owned daily reports, site logs, technical reports, document-control extracts, corporate databases, correspondence, or proprietary files. No information restricted by employment or confidentiality obligations, and no detail available solely through privileged employee access, was used. The accounts are presented as generalised practitioner illustrations rather than independently auditable organisational cases. A practitioner account was included when it met four conditions: it involved at least two lifecycle functions; a function appeared locally ready; an unresolved dependency prevented, constrained, or credibly threatened downstream progression; and a corrective, temporary, or mitigating response could be described. Accounts were included only when they could be generalised without naming an organisation, location, contract, person, production figure, commercial value, equipment rating, proprietary specification, or restricted operating detail. Experiences that required company-owned records or proprietary detail to retain their meaning were not used. The four accounts are therefore purposively selected conceptual illustrations and should not be interpreted as a complete or representative incident sample.

Each practitioner account was transformed through six transparent reflective steps:

1. Define the account boundary and the general project context.
2. State the generally expected transition condition and the apparent local-readiness position.
3. Describe the missing dependency, detection point, consequence, and response in non-proprietary terms.
4. Structure the account into common fields: expected transition, local readiness, missing dependency, provider, acceptor, detection point, consequence, response, and possible alternative explanation.
5. Separate the practitioner account from the subsequent theoretical interpretation.
6. Record uncertainty and omit any detail that is proprietary, employee-restricted, unverified, or unnecessary for the conceptual argument.

Incident-level production, netback, financial cost, and attributable delay were neither collected nor estimated for this study. The value-exposure dimension is therefore descriptive and qualitative; quantitative assessment is reserved for future authorised research using auditable data and the protocol in Table 5.

Table 2. Anonymised practitioner accounts

Practitioner account	Context	Local readiness reported or observed	Unresolved dependency	Downstream consequence	Response
C1	ESP production-expansion activity involving several new wells	Well, ESP equipment, installation, and production objective substantially ready	Step-down transformer required for ESP electrical supply unavailable	Startup constrained for several hours to approximately one day in some situations	Refurbishment or redeployment of available transformers pending permanent supply
C2	ESP installation campaign affecting no more than two wells	Cable engineered, specified, approved, and procured	Combined cable-casing, installation-method, and well-condition compatibility not fully verified	Friction clearance difficulty and technical reassessment; exact attributable delay unavailable	Review of specification, installation approach, and completion conditions; practical corrective solution implemented
C3	ESP commissioning activity	Equipment delivered, installation complete, and electrical integration substantially complete	Vendor specialist arrival delayed by several hours; specialist support was expected for commissioning	No critical schedule delay established because the gap was absorbed	Local alternative, rapid decision authority, experienced team, and pre-mobilisation plan
C4	Production-expansion initiative involving a remote well	Well, ESP, installation, and project team ready	Permanent electrical distribution extension incomplete because of distance from existing supply	Permanent-power transition constrained; exact duration and production effect were not collected or estimated	Temporary power generation while permanent connection was developed

3.4 Data analysis

Analysis followed the recursive logic of reflexive thematic analysis rather than a reliability-coding model. The four structured practitioner accounts were managed manually in a reflective spreadsheet to maintain close engagement with each account. The spreadsheet fields were: account ID; general context; observation confidence; expected transition; local readiness; missing dependency; provider; acceptor; decision authority; detection point; apparent downstream effect; corrective response; alternative explanation; initial code; theme; reflexive memo; and limitation. A pre-defined reflective guide supported consistent reconstruction, and a cross-account matrix supported comparison of common, contrasting, and account-specific patterns. No company document, document-control extract, or qualitative-data-analysis software was used. The analytical sequence was: (1) reconstruct each account

using the same fields; (2) code local completion, missing dependency, interface, consequence, mitigation, and uncertainty; (3) compare codes across all accounts using a constant-comparison matrix; (4) develop and revise candidate themes; (5) challenge each theme with alternative explanations and the mitigated C3 account; and (6) connect the retained themes abductively to governance, systems, interface, readiness, and value literature. Future larger, team-based studies should use authorised empirical data and NVivo, ATLAS.ti, Dedoose, or an equivalent QDAS platform to improve retrieval, version control, and team auditability. The audit trail recorded code changes, rejected interpretations, theme revisions, and the link between every interpretive claim and its relevant practitioner account. A reflexive memo was completed for each theme. Each memo documented assumptions introduced by the researcher's professional background, a devil's-advocate alternative, and the reason that the retained interpretation was considered the most coherent but still provisional explanation. The mitigated C3 account was deliberately used to test and weaken deterministic claims. LRM and ILRGM were then developed as abductive conceptual propositions linking the practitioner-informed patterns to existing theory.

Intercoder reliability is not claimed because reflexive thematic analysis emphasises situated interpretation rather than coder consensus (Braun & Clarke, 2021b). Confirmability was strengthened through iterative self-reflection, a dated decision trail, theme-specific bias memos, active search for alternative explanations, and deliberate use of C3 as a contrasting mitigated account. Traceability is provided by the structured accounts in Table 2, the analytical trail in Table 3, and the detailed account boundaries in Appendix B; together they allow reviewers to follow the reasoning from account pattern to conceptual claim, although they cannot independently verify the remembered events. Future validation should include peer debriefing, secondary analysis by an independent qualitative researcher, and multiple informants. The qualitative dimensions and codes reported here can inform later instrument development without treating the present accounts as frequency data. The four accounts are insufficient to estimate prevalence, identify boundary conditions reliably, establish discriminant validity, or infer causal effect. Prospective negative-case and matched-counterfactual sampling remain priorities.

Table 3. Analytical trail from practitioner accounts to themes

Practitioner-account pattern	Illustrative initial codes	Analytical theme	Interpretive claim
A function completed its defined task, but the system could not progress	Local completion; system unready; least-ready dependency	Local readiness can coexist with system unreadiness	Completion must be assessed relative to the receiving system
A missing item or resource sat outside the immediate work package	Hidden dependency; supplier reliance; infrastructure reliance	External dependencies determine lifecycle readiness	Scope boundaries do not eliminate system dependencies
The unresolved condition appeared during a later phase	Downstream transfer; late discovery; rework or delay	Readiness gaps propagate across interfaces	Interface assurance should occur before transition commitments
Temporary equipment, local alternatives, or rapid mobilisation restored progression	Workaround; buffering capacity; contingency; deferred permanent solution	Response capacity moderates the effect of readiness gaps	Temporary or local recovery requires explicit governance and closure

Practitioner-account pattern	Illustrative initial codes	Analytical theme	Interpretive claim
No function consistently owned end-to-end readiness	Fragmented accountability; local optimisation; escalation gap	Cross-functional coordination is a governance capability	Readiness needs provider, acceptor, and decision authority

4. Findings

4.1 Cross-incident pattern

Across the four practitioner accounts, readiness problems did not begin with total failure of a project function. In each account, substantial work appeared complete and one or more functions could reasonably be described as locally ready. In C1, C2, and C4, an unresolved dependency constrained downstream progression. In C3, a similar interface vulnerability was absorbed through a local alternative, rapid decision authority, and a pre-mobilisation plan. The cross-account pattern is therefore conditional: local completion may contribute to downstream disruption when interface acceptance is incomplete and buffering or corrective capacity is insufficient. The sequence reported below is an analytically derived conceptual proposition, not a statistically validated causal model. It represents the most coherent interpretation across the three constraining practitioner accounts, while the mitigated C3 account indicates a possible boundary condition. The model is presented with that epistemological limit. The practitioner accounts were technically different. One concerned equipment availability, one combined component compatibility with installation method and well conditions, one concerned specialist mobilisation and successful mitigation, and one concerned enabling infrastructure. Their commonality lies at the governance level rather than in a shared technical cause: each account illustrated a gap, or threatened gap, between the criteria used by the originating function and the conditions required by the receiving function.

Table 4. Cross-account comparison and qualitative value exposure

Practitioner account	Provider–acceptor interface	Readiness gap	Observed or mitigated effect
Qualitative value exposure	Step-down transformer unavailable when the startup sequence required it	Startup constrained for several hours to approximately one day in some situations	Descriptive only: possible startup waiting and temporary-solution burden. No quantitative value data were collected or estimated.
C2 Cable-casing installation	Approved component and installation approach not fully aligned with actual well conditions	Difficulty in no more than two wells, followed by reassessment and corrective action	Descriptive only: possible deployment, standby, and rework exposure. No duration or cost estimate is claimed.
C3 Vendor specialist	Expected specialist arrival delayed by several hours	No critical delay established because a local alternative and pre-mobilisation plan absorbed the gap	No critical schedule or material value effect was established in the practitioner account; this is a limited mitigated illustration.

Practitioner account	Provider–acceptor interface	Readiness gap	Observed or mitigated effect
C4 Grid connection	Permanent power extension incomplete because of substantial distance from existing supply	Temporary generation supported progression while permanent supply was developed	Descriptive only: possible temporary-power, maintenance, risk, and production-constraint exposure. No quantitative data were used.

4.2 Value-exposure reporting boundary

This conceptual study did not collect or estimate incident-level production, netback, supplier rates, labour rates, temporary-power costs, or audited delay attribution. Table 4 therefore discusses value exposure qualitatively. This avoids presenting potential production, gross revenue, or unverified duration as an audited economic loss. Table 5 specifies the evidence and attribution rules that future authorised empirical research would require for finance-auditable quantification.

Table 5. Proposed protocol for future quantification of LRM value exposure and ILRGM benefits

Exposure category	Illustrative calculation	Minimum evidence required	Reporting rule
Deferred production service or	Daily deferred quantity $\times$ contribution margin or approved netback $\times$ verified delay duration	Timestamped readiness and startup dates; approved production/service forecast; finance-approved value basis	Report a range and sensitivity analysis; do not use gross revenue as avoided loss without justification
Schedule contractor extension and	Time-dependent project and contractor cost per day $\times$ attributable delay days	Baseline and actual milestone dates; approved daily rates; attribution record	Separate total delay from the portion reasonably attributable to the readiness dependency
Rework replacement and	Verified rework hours $\times$ loaded labour rate + materials + specialist and equipment cost	Work orders, timesheets, purchase records, technical change records	Distinguish corrective work from planned scope and unrelated changes
Temporary workaround	Rental or depreciation + fuel/energy + maintenance + mobilisation + risk-control cost	Temporary-equipment register; invoices; fuel or energy records; management-of-change documentation	Report duration, operating limits, expiry, and permanent-closure cost
ILRGM implementation benefit	Avoided attributable delay, rework, and workaround cost – implementation and administration cost	Comparable baseline; implementation effort; pre-registered outcome definitions; matched or longitudinal data	Treat pilot targets as hypotheses; report null and adverse effects as well as improvements

4.3 Theme 1: Component completion did not establish interface readiness

The cable–casing practitioner account provides the clearest illustration. The cable had passed through engineering, approval, and procurement, yet deployment in up to two wells exposed friction and clearance limitations. The account indicates that compatibility, installation method, and well conditions may all have contributed to the difficulty. The local engineering process had produced an approved component, but the receiving installation system required assurance of deployability in the actual completion condition. The interpretation is not that engineering alone was deficient; it is that component-level approval did not establish interface readiness. A similar pattern appeared in the transformer account. Several new wells required step-down transformers to convert an available higher-voltage supply to the lower voltage required by the ESP system. The well, ESP package, and installation appeared substantially ready, but transformer availability constrained startup for periods recalled as ranging from several hours to approximately one day in some situations. No equipment-rating, cost, production, or source-document data were used. Readiness was therefore interpreted as being constrained by the least usable critical dependency rather than by average activity completion.

4.4 Theme 2: Supplier and infrastructure dependencies were hidden, but mitigation capacity mattered

Vendor-specialist availability and permanent grid connection sat partly outside the immediate installation work package, yet both were relevant to the transition. In C3, specialist support was expected for commissioning, but a delay of several hours was absorbed through a local alternative and a pre-mobilisation plan, so no critical delay was established. In C4, the well was located a substantial distance from an existing electrical supply, making the permanent connection a long-duration enabling activity. Temporary power supported progression while the permanent link was developed. No exact duration, generator specification, fuel-use, cost, or production data were collected or reported. These dependencies can be described as hidden only relative to departmental reporting. They were not conceptually unknowable. The governance problem was that they were not consistently represented as evidence-based acceptance criteria for the lifecycle transition. The C3 episode also shows that the existence of a readiness gap does not inevitably produce delay: experienced personnel, a local substitute, rapid decision rights, and a contingency plan can absorb the threat.

4.5 Theme 3: Unresolved constraints moved downstream

The three constraining practitioner accounts illustrate temporal displacement. A compatibility and installation-condition problem appeared during deployment; an equipment-availability gap appeared at startup; and infrastructure distance constrained the permanent-power transition. The C3 account illustrates the contrasting possibility that a dependency can be detected and absorbed before it becomes a critical downstream delay. This displacement can distort accountability. The phase experiencing the delay may be treated as the problem owner, while the causal dependency sits upstream or outside the formal scope. LRM therefore involves both technical propagation and organisational transfer of unresolved responsibility.

4.6 Theme 4: Temporary workarounds protected value but deferred permanent closure

Two practitioner accounts involved explicit temporary solutions: refurbished or redeployed transformers and temporary power generation. These responses illustrate adaptive

capability and the preservation of progress. They also show that readiness is not necessarily binary. A system can become conditionally ready through a controlled temporary configuration.

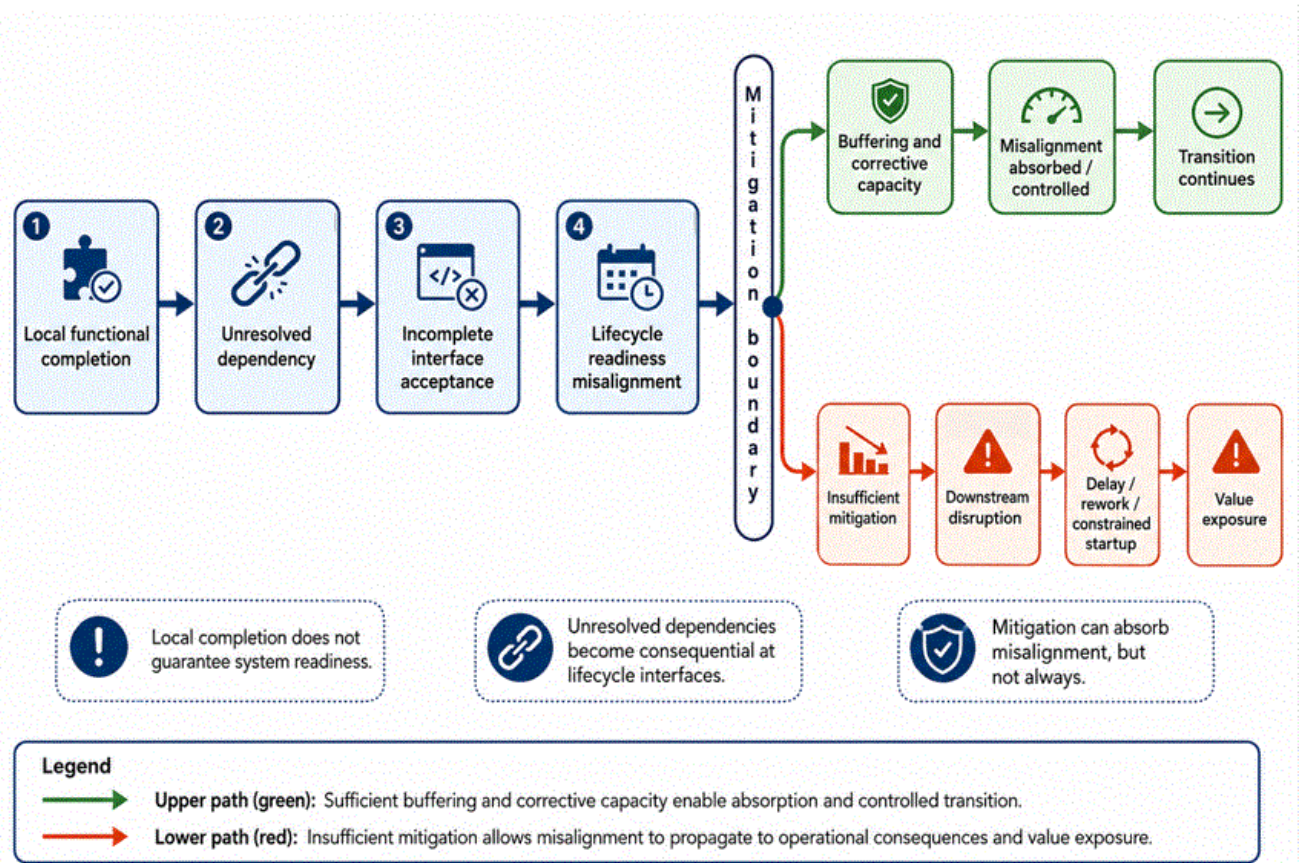
Temporary readiness requires separate governance. A workaround should be governed by:

- A documented technical basis and risk assessment.
- Defined operating limits and monitoring requirements.
- A named owner and decision authority.
- An expiry or revalidation condition.
- A path, budget, and responsibility for permanent closure.

Extended temporary operation can increase fuel or energy use, maintenance burden, safety exposure, emissions, operating cost, and the risk that a temporary configuration becomes normalised. These effects strengthen the sustainability and asset-integrity rationale for formal closure governance.

4.7 Theme 5: End-to-end readiness ownership was fragmented

All four incidents involved more than one function, and none could be understood through the originating function alone. Engineering needed installation and well-condition knowledge; procurement and electrical integration needed alignment on transformer availability; supplier planning needed project, access, and contingency coordination; and infrastructure delivery needed alignment with operational startup. The recurrent governance issue was fragmented end-to-end visibility of the dependency. In C3, that weakness was offset by local response capacity rather than by complete initial alignment. This supports the interpretation of cross-functional coordination as a governance capability. Communication is necessary but insufficient. Effective coordination requires accepted criteria, decision rights, escalation routes, and authority to stop or condition a transition when evidence is incomplete.

Figure 1. Proposed LRM mechanism with mitigation boundary

5. Discussion

The findings do not invalidate conventional risk management. Transformer availability, vendor mobilisation, cable compatibility, installation conditions, weather exposure, and grid connection can all be represented as risks. The added insight is that their managerial significance depends on whether they prevent an accepted lifecycle transition and whether the organisation has sufficient buffering and corrective capacity. LRM therefore shifts the analytical question from 'what risks exist?' to 'what evidence demonstrates that the receiving system can proceed, and what response exists if a dependency remains open?' ISO 31000 emphasises integration, structured assessment, monitoring, communication, and continual improvement (ISO, 2018). ILRGM is consistent with those principles but uses readiness as an organising state. Individual risks remain documented and treated in the risk register; ILRGM gates aggregate evidence from risks, issues, procurement, documents, permits, technical verification, and operations into a holistic transition decision. This bridges the gap between risk identification and an operational go/no-go or conditional-acceptance point.

The incidents support a systems interpretation because no single component determined readiness independently. System readiness emerged from the relation among equipment, installation conditions, infrastructure, specialist resources, documentation, and operations. This is consistent with research emphasising project complexity and interacting organisational conditions (Denicol et al., 2021; Omotayo et al., 2024). The implication is that local optimisation can reduce system performance. A procurement team may meet an order-placement metric while the commissioning date remains exposed. Engineering may complete a design review without validating deployability. Construction may report mechanical completion while operations cannot accept the asset. Governance must therefore connect

functional metrics to system-level acceptance. Interface-management literature stresses coordination, information exchange, and stakeholder relationships (Al Qasem & El-Sayegh, 2025; Zhang et al., 2022). The present findings add an assurance perspective. At a lifecycle boundary, the upstream function should provide evidence and the receiving function should confirm that the output is usable under downstream conditions. This interpretation is compatible with boundary-spanning research. Boundary spanners can translate requirements and resolve cross-organisational issues, but their contribution is stronger when embedded in an explicit governance process (Satheesh et al., 2024; van Meerkerk et al., 2024). Personal coordination should not be the sole control for safety-critical or value-critical dependencies. The three constraining incidents and one mitigated episode separate output completion from operational value. Installed equipment, a completed well, or an approved design has limited value until the broader system can use it. This supports contemporary project-success and benefits research, which distinguishes delivery outputs from outcomes and value (Ika & Pinto, 2022; Zwikael, 2024; Zwikael & Huemann, 2023).

Readiness alignment can therefore be conceptualised as an intermediate capability. Governance affects decision quality and accountability; those decisions affect dependency closure and interface acceptance; readiness alignment enables startup and stable operations; and operations enable benefit realisation. Earlier dependency closure may reduce rework, time-dependent cost, and reliance on temporary solutions, but the present evidence cannot estimate the magnitude of those effects. Table 5 therefore serves as a future measurement protocol rather than an empirical benefit calculation. A non-empirical illustration clarifies the potential business relevance. If a verified readiness gap extends a transition by d days and the authorised time-dependent project or service cost is c per day, the attributable exposure would begin with $d \times c$, to which verified rework and temporary-workaround costs could be added. This is a measurement logic, not a finding from the present study; no incident-level financial magnitude is claimed. The mitigated C3 episode suggests a boundary condition: LRM may create exposure without producing material disruption when experienced personnel, a local substitute, rapid decision rights, and a contingency plan are available. Buffering capacity should therefore be treated as a potential moderator in future empirical tests, not as proof that readiness misalignment is harmless.

6. Managerial implications

First, sponsors and project directors should distinguish functional completion from system readiness. A dashboard that aggregates percentage complete can conceal a single critical dependency. Reviews should therefore display the readiness of interfaces and critical chains of prerequisites. Second, startup readiness should be governed from early design. The incidents demonstrate that startup problems can originate in specification, equipment strategy, vendor contracting, logistics, and enabling infrastructure. Operations and commissioning representatives should participate in decisions that create downstream acceptance conditions. Third, interface ownership should include both evidence provision and acceptance. A responsibility matrix should identify who produces the item, who confirms usability, who resolves disagreement, and who authorises a conditional transition. This is more precise than assigning a single task owner without identifying the receiving function. Fourth, temporary solutions require formal lifecycle control. Temporary transformers or power generation can protect short-term continuity, but they introduce additional risk, maintenance, energy use, emissions, cost, and closure obligations. Temporary readiness should be approved with operating limits, monitoring, an accountable owner, an expiry or revalidation date, and a funded permanent solution. Reducing avoidable rework and prolonged temporary operation may support safety, resource efficiency, lower carbon exposure, and more reliable service delivery,

although these broader impacts require measurement. Fifth, lessons learned should be converted into controls. Recording that a vendor arrived late or a cable was incompatible is insufficient. The lesson should prompt specific changes to: (1) contract clauses and mobilisation lead times; (2) interface checklists and design-verification procedures; or (3) readiness criteria, digital fields, and escalation thresholds. Sixth, implementation should be integrated with existing tools. Gate dates can be represented as schedule milestones; evidence can be governed through document-control and portfolio systems; interface dependencies can be linked to risk, issue, procurement, permit, and commissioning registers; and digital models can support technical validation. Adoption metrics should include the percentage of critical interfaces governed through ILRGM, completion of provider-acceptor training, evidence completeness, user-reported ease of use, administrative hours, data-quality exceptions, and timeliness of gate decisions. The governing principle is traceability from dependency to evidence, owner, acceptor, decision, consequence, and closure not the purchase of a particular software product. Seventh, transferability requires contextual substitution rather than literal copying. In a brownfield hospital expansion, the provider-acceptor chain could connect design, infection control, medical-equipment procurement, facilities engineering, clinical operations, and regulatory approval. In an offshore wind project, it could connect turbine manufacture, port logistics, installation vessels, offshore commissioning, grid connection, and control-room acceptance. In a large-scale IT deployment, it could connect software development, infrastructure, cybersecurity, data migration, operations, and user acceptance. ILRGM is likely to be most useful in settings with complex supply chains, live operations, stringent regulation, or high safety and value exposure. It may add little value in small, non-critical, loosely coupled projects with simple and already visible dependencies.

7. Limitations and future research

The study has substantial limitations that define the status of its claims. The practitioner-account base is small, single-author, purposively selected, and concentrated in an approximately one-year period of oil and gas brownfield activity. Three accounts illustrated a constraining pathway and one vendor-support account illustrated absorption without critical delay. This mitigated account is useful but insufficient to establish robust boundary conditions, prevalence, causal effect size, predictive performance, or the comparative necessity of ILRGM. The selection process may over-represent memorable governance problems and under-represent routine recoveries, drilling, operations, logistics, weather-related interruption, and alternative causal pathways. No audited economic effect is reported because production, cost, and attributable-delay data were not collected or estimated for this conceptual study. The four practitioner accounts are anonymised, generalised, and not independently auditable. No organisational dataset or company-owned record was used to support them. This avoids disclosure or misuse of proprietary material, but it also means that other researchers cannot independently verify the underlying experiences, inspect original records, test alternative coding on source documents, or confirm every transition baseline. The analysis is dominated by one practitioner perspective and may be affected by recall, selection, and interpretation bias. It cannot establish prevalence, causal effect, statistical generalisability, or the economic magnitude of LRM. Independent studies using authorised, multi-informant, prospective, and auditable data are required. The study also does not empirically examine contractual incentives, commercial claims, subcontracting structures, institutional power, or conflicting acceptance rights in multi-contractor environments. These factors may shape whether dependencies are disclosed, accepted, deferred, or transferred and could alter the feasibility of provider-acceptor governance. Future research should therefore combine technical interface data with contract form, incentive structure, decision-rights mapping, and stakeholder perspectives.

LRM and ILRGM remain preliminary. Future research should prioritise authorised longitudinal and comparative multi-case designs that track readiness transitions in real time from engineering through operations. A standard prospective interface log should record every critical transition, local readiness claim, required evidence, missing dependency, mitigation, acceptance decision, and outcome, including successful absorption and non-events. Multiple informants should be sampled from engineering, procurement, construction, commissioning, operations, and suppliers to capture conflicting provider-acceptor interpretations. Negative cases should be actively sought through readiness-meeting minutes, risk-closure records, structured interviews, and prospective logging. This design is necessary to estimate how often misalignment is absorbed, identify boundary conditions, and reduce single-practitioner bias. Before advanced quantitative testing, research should develop and psychometrically validate an LRM instrument. Item generation should draw from the qualitative dimensions and multi-informant interviews; expert review should assess content validity; cognitive interviews and pilot testing should assess clarity; exploratory factor analysis should examine structure; confirmatory factor analysis should test measurement fit; and reliability, convergent validity, discriminant validity, and measurement invariance should be evaluated. Data sources may combine structured surveys with archival schedule milestones, interface sign-offs, document-control evidence, procurement status, commissioning event logs, and temporary-workaround records. Dependency completeness may be quantified as verified critical prerequisites divided by required prerequisites, with criticality weights. Interface acceptance may be measured through formal sign-off rate, evidence verification rate by the receiving function, unresolved acceptance disputes, exception quality, and late discovery after transition.

Declarations: Ethics determination: The conceptual development phase involved no recruitment of human participants, no collection of identifiable personal data, and no use of company-owned or confidential organisational records. Separate organisational data-use permission is not claimed as necessary on the current source basis because no organisational records were used.

Conflict of interest: The author declares no known competing interests relevant to this manuscript.

Data availability: No organisational dataset or company-owned record underlies this article. The anonymised practitioner accounts, analytical themes, and reflective extraction structure used for the conceptual analysis are reported in the manuscript and appendices. No daily report, site log, technical report, document-control extract, corporate database entry, correspondence, drawing, or proprietary file was accessed, retained, or analysed for this study. Consequently, there is no restricted organisational dataset to share.

Use of generative artificial intelligence: Generative AI tools were used for language editing, structural review, and document formatting. The author reviewed and verified the arguments, incident descriptions, references, tables, and final wording and retains full responsibility for accuracy, originality, confidentiality, and compliance with the target journal's policy.

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