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Applications and Barriers of Technology Insurance Risk Reduction Services in Technological Breakthrough Projects of Specialized and Innovative SMEs in China

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Abstract: *Specialized and innovative small and medium-sized enterprises face technical uncertainty, concentrated operational exposures, and financing constraints during technological breakthrough projects. Technology insurance may support these projects through risk reduction services as well as compensation. This article develops a conceptual framework informed by insurance economics, innovation financing, organizational learning, and selected Chinese policy documents. It examines applications across research, pilot testing, commercialization, and industrial scaling and proposes mechanisms involving hazard identification, learning, financing continuity, and coordination. Implementation faces six barriers: limited insurability, information asymmetry, incentive misalignment, insufficient interdisciplinary expertise, fragmented responsibility, and weak evaluation. A proportionate governance model connects agreed diagnostics, verified implementation, milestone reviews, and sustainable cost sharing. The central argument is that services should reduce avoidable damage while preserving justified experimentation. The analysis generates propositions for future project-level research; it does not estimate causal effects or present illustrative scenarios as* ***observed*** *cases.*

Keywords: *technology insurance; risk reduction services; specialized and innovative SMEs; technological breakthroughs; innovation financing; risk governance*

1. Introduction

Technological breakthroughs require reliable conditions for experimentation as well as scientific knowledge and research expenditure. Innovative firms must maintain laboratories, protect technical information, coordinate suppliers, satisfy customer requirements, and preserve sufficient liquidity after setbacks. Equipment breakdown or preventable testing errors can interrupt a promising project even when its scientific approach remains sound. Conversely, an unsuccessful experiment may produce valuable knowledge without indicating poor management. For China's specialized and innovative small and medium-sized enterprises, concentrated resources can make this distinction particularly consequential. Commonly described as zhuanjingtexin, these enterprises emphasize specialization, refined management, distinctive capabilities, and innovation. Provincial recognition and national little giant recognition are related administrative categories, but neither establishes that every enterprise project constitutes a technological breakthrough. Recent policy has strengthened the connection between insurance and innovation: the 2023 risk reduction guidance encouraged services embedded in enterprise management and production [1]. The February 2026 technology insurance policy emphasized compensation, risk reduction, and financial leverage [2]. Updated SME cultivation measures provide the institutional basis for defining the target population [3].

Technology insurance denotes arrangements addressing risks associated with technological activity and innovative enterprises rather than a single standardized policy. Relevant coverage can concern research assets, equipment, liability, intellectual property, cyber incidents, or specified development risks. Risk reduction services comprise diagnostic, preventive, monitoring, and recovery-preparedness activities addressing identifiable exposures. Compensation transfers financial consequences after an insured event, whereas these services seek to change how losses develop. Understanding this distinction requires attention to the steps between purchasing insurance and improving project continuity. Service availability does not establish delivery; delivery does not establish enterprise uptake

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or effective implementation. The analytical problem is therefore how insurance-related expertise becomes operational action within a technological project, and why that conversion may fail. Proposed applications remain conditional on contract wording and professional competence; ordinary experimental failure is not assumed to be insured.

Three connected theoretical perspectives support this analysis. Insurance economics distinguishes market insurance, self-insurance, and self-protection, indicating that coverage and preventive effort must be examined together [4]. Innovation financing highlights information asymmetry and the difficulty of evaluating research assets [5]. Uncertainty surrounding invention further complicates resource allocation [6]. Coordinating risk management with investment and financing may preserve resources for valuable projects when external funds are costly [7]. Organizational learning explains why specialist advice produces different benefits across enterprises: recognizing, assimilating, and applying external knowledge depends on internal capabilities [8]. Integrating and reconfiguring competencies also matters when project conditions change [9]. Together, these perspectives suggest a conditional sequence in which diagnosis informs implemented controls, controls strengthen resilience, and resilience supports continued experimentation. Contracts, financing conditions, and organizational capacity can interrupt that sequence.

The article asks where risk reduction services can contribute across technological development, through which mechanisms they may support continuity, and what constrains implementation. It adopts conceptual analysis using purposively selected policy documents and theoretical literature directly relevant to insurance services, innovation, and enterprise classification. Policy documents establish institutional context rather than evidence of effectiveness. Theoretical arguments generate conditional propositions rather than causal estimates. Illustrative project scenarios explain the framework and are not field observations or verified enterprise cases. The study is accordingly a bounded interpretive analysis, with subsequent testing requiring actual contracts, service records, implementation evidence, and project outcomes.

The article makes two contributions. First, it distinguishes justified technological experimentation from avoidable operational damage, identifying a boundary that preventive intervention should respect. Second, it explains how service provision may become risk governance through enterprise uptake, verified implementation, and coordinated recovery. This shifts the analytical focus toward the conditions connecting insurance services with project resilience and provides a basis for examining both their potential contribution and their implementation barriers.

2. Applications and Mechanisms of Risk Reduction Services

Technological development includes uncertainty that cannot be removed through better inspection. The performance of an unfamiliar material, the scalability of a novel process, or the compatibility of components in a new architecture may remain unknown until experiments occur. This uncertainty is part of knowledge creation. By contrast, inadequate equipment maintenance, undocumented parameter changes, or missing recovery procedures create avoidable exposure around the experiment. An effective service approach should preserve the first while reducing the second.

Interdependence can transform an operational incident into a wider project crisis. A pilot-line interruption delays validation, delayed validation postpones customer acceptance, and postponed acceptance delays cash receipts. The resulting liquidity pressure may then reduce maintenance, testing, or staff retention, increasing future vulnerability. Services should identify these transmission paths rather than assess isolated assets alone. However, mapping a path does not establish that all consequences are insurable. Contracts may cover only particular events and specified categories of loss.

2.1 Applications across the project lifecycle

2.1.1 Research and experimental preparation

Early services should establish a proportionate picture of the project and its essential operating conditions. A joint diagnostic discussion can identify the technical objective, current evidence, critical assets, information dependencies, and foreseeable interruption pathways. The purpose is not to judge whether researchers have selected the only correct scientific approach. It is to identify weaknesses that could prevent the approach from being tested reliably. This distinction keeps the service within an intelligible boundary and reduces the risk of insurance specialists making unsupported technical judgments.

ISSN 2616-5902 Vol. 8, Issue 10: 73-81, DOI: 10.25236/AJBM.2026.081010

Practical interventions may include reviewing maintenance arrangements for critical instruments, checking access controls for research data, examining backup procedures, and assessing emergency responses. Training can focus on identifiable failure pathways rather than generic awareness. For example, if a project depends on long-duration tests, staff can agree on procedures for power interruption, data recovery, and the preservation of partially completed samples. The value of such measures depends on the project's actual requirements, not on their visibility in a service report.

2.1.2 Pilot testing and process validation

Pilot testing is a particularly important application because changes in scale can create unfamiliar interactions. A service team may review process interfaces, equipment compatibility, operator readiness, and the implications of changing inputs or operating parameters. A structured change review asks what has changed, which previous assumptions no longer hold, and which controls require revision. This is more useful than repeating a property inspection that does not consider the project's transition from laboratory work to integrated operation.

Monitoring can be designed around a limited number of decision-relevant signals. Sensor coverage alone does not establish risk reduction. The parties must decide who receives an alert, how quickly it should be checked, who can stop a process, and how restarting is authorized. Thresholds should reflect technical evidence and operational context. Where reliable thresholds do not yet exist, a supervised learning period may be more appropriate than automated intervention. Monitoring arrangements should disclose uncertainty and remain open to expert review.

Consider an illustrative precision-component project moving from individual prototypes to a pilot production batch. A specialist identifies inconsistent machine calibration and unclear responsibility for approving process adjustments. The enterprise introduces a calibration schedule and change log before the next trial. These measures may improve the reliability of validation evidence and reduce avoidable batch losses. They do not guarantee that the new component will meet customer requirements. Any insurance response to a failed batch would still depend on the insured event and the contract's exclusions.

2.1.3 Commercialization and customer acceptance

Commercialization introduces a different set of dependencies. Technical performance must be communicated through specifications, testing protocols, acceptance criteria, and contractual responsibilities. Insurance-related services can help identify mismatches between operating assumptions and the conditions under which customers intend to use a product. They can also assist firms in organizing traceable evidence and planning responses to defects or interruptions. Such work should be undertaken by qualified specialists within an agreed remit; it is not a substitute for independent legal advice or mandatory certification.

Intellectual property services may include identifying areas requiring specialist review, improving records of ownership and licensing, and clarifying procedures for responding to allegations. A patent registration should not be interpreted as proof of freedom to operate. Similarly, a preliminary screening cannot guarantee that no dispute will arise. Service quality depends partly on communicating these boundaries to managers who may otherwise mistake an insurance-related assessment for comprehensive legal clearance or a guarantee of commercial exclusivity.

Financing continuity becomes relevant where acceptance milestones trigger payment. The service team can map the sequence from testing to acceptance, invoicing, and receipt of cash. It may identify the need for contingency funding if requalification is required after a covered operational incident. Such mapping helps management see how a technical interruption could become a liquidity problem. It does not transform ordinary customer nonpayment into an insured event or mean that a bank must extend credit because insurance services are present.

2.1.4 Industrial scaling and ongoing operation

During scaling, the emphasis shifts toward repeatability and the management of cumulative exposure. Potential services include reviewing quality-control interfaces, assessing dependencies on critical suppliers, and updating interruption and recovery plans. A project that previously involved a few supervised units may now generate obligations across many customers. Services should therefore examine whether traceability, maintenance, and incident-response capacity have kept pace with output. The appropriate intensity depends on exposure and complexity rather than a uniform requirement imposed on every enterprise.

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Supply-chain reviews should focus on dependencies that management can realistically influence. Identifying a sole-source input is only the first step. The enterprise must assess alternative qualification times, inventory constraints, and the consequences of substitution. An insurance specialist may contribute loss scenarios and recovery planning while technical staff judge compatibility. Where no feasible substitute exists, transparent recognition of the dependency is more useful than a recommendation to diversify that ignores technical or commercial limitations.

Table 1 summarizes proposed applications and their limits. These are analytical service possibilities, not a catalogue of products confirmed to be available throughout the market.

Table 1 Proposed applications and their limits

Project stage	**Priority exposure**	**Possible service**	**Observable implementation evidence**	**Important limit**
Research	Invalid experiments and loss of essential records	Instrument review and data recovery planning	Calibration records and tested recovery procedures	Does not establish scientific feasibility
Pilot testing	Scale effects and process instability	Change review and monitored trial procedures	Approved changes and documented alert responses	Does not guarantee a successful pilot batch
Commercialization	Qualification disputes and interface failures	Acceptance review and incident evidence protocols	Agreed test conditions and responsibility records	Does not guarantee customer demand or legal clearance
Industrial scaling	Repeated defects and concentrated dependencies	Traceability review and continuity planning	Tested recovery arrangements and supplier scenarios	Does not eliminate common shocks or all liability

2.2 Mechanisms and testable propositions

The theoretical perspectives identify a conditional chain: service provision may improve information and controls; implemented controls may strengthen resilience; resilience may support continued experimentation. Information quality, enterprise uptake, contractual alignment, and financing conditions influence each link. The chain can break at any point. This is the article's organizing framework, developed through conceptual synthesis rather than presented as a tested model. It supports the propositions below.

The expected outcome is a reduction in avoidable incidents or their consequences, conditional on meaningful uptake. This yields Proposition 1: project-specific risk reduction services are more likely to improve operational resilience when recommendations are implemented before exposure increases, and their effect is mediated by implementation quality. The proposition rejects a simple equivalence between visits and outcomes. It also allows a null result where diagnosis is accurate but management cannot finance the necessary changes or lacks authority over the relevant dependency.

Proposition 2 states that the contribution of services to learning is stronger when the enterprise has sufficient internal expertise and assigns responsibility for translating external advice into project routines. Firms with very limited capacity may require implementation support before they can benefit from sophisticated diagnostics. At the same time, excessive dependence on external providers may weaken ownership. The expected relationship is therefore conditional: more specialist input is not necessarily better when it exceeds the firm's ability to evaluate and use it.

Proposition 3 states that implemented services may support project continuity by reducing disruptive operational losses and improving the credibility of recovery arrangements, with stronger effects where financing constraints are binding. Any effect on bank terms is further conditional on lender recognition of the information. A risk assessment is neither a credit rating nor a promise that the technology will succeed. Lenders must retain independent responsibility for evaluating repayment capacity, collateral, coverage, and the borrower's broader financial position.

Proposition 4 states that services are more likely to improve recovery coordination when participants agree in advance on information access, decision authority, and escalation procedures. Additional data sharing without these agreements may increase exposure and conflict. Proposition 5 adds an innovation boundary condition: when assessment requirements reward predictability so

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strongly that firms avoid technically promising but uncertain experiments, services may reduce exploratory activity even while measured losses decline. The framework therefore treats innovation preservation as part of service quality.

3. Barriers to Effective Application

Implementation barriers interact. Limited evidence increases information demands, confidentiality concerns restrict disclosure, and weak expertise reduces implementation. Uncertain benefits discourage investment, while fragmented responsibility obscures accountability. Effective responses must therefore address connected constraints rather than rely on additional inspections or subsidies alone.

3.1 Risk and information constraints

The first barrier is the difficulty of defining and pricing unfamiliar technological exposures. Breakthrough activity may have few comparable historical observations, changing experimental conditions, and uncertain causal pathways. Insurers cannot infer a reliable loss distribution simply because an enterprise has received a policy designation. Even apparently similar projects may differ in the conditions that determine failure. A service assessment can reduce some informational uncertainty, but it cannot create stable probabilities for every novel scientific or commercial outcome.

Ambiguity becomes particularly serious when ordinary experimental failure is confused with accidental damage. The parties may agree that equipment breakdown is covered but disagree about whether a failed trial was caused by equipment malfunction, process design, operator error, or an unworkable technical principle. The more intertwined these causes become, the harder it is to separate underwriting, technical diagnosis, and claims investigation. If enterprises anticipate broad disputes, they may regard the policy and its associated services as offering little dependable protection.

Information constraints compound the difficulty of identifying and assessing unfamiliar risks because useful diagnosis often requires information that enterprises are reluctant to disclose. Technical parameters, process designs, supplier identities, and customer requirements may reveal the basis of competitive advantage. A small enterprise may have limited capacity to assess how an insurer or subcontractor will store and use those records. The request for detailed data can therefore create a trade-off between better assessment and a higher perceived risk of disclosure. Refusal to share information should not automatically be interpreted as poor governance.

The asymmetry operates in both directions. Enterprises may know more about technical weaknesses than insurers, while insurers may understand exclusions and assessment limitations better than the enterprise. Third-party specialists add further information boundaries. A report can appear authoritative even when it reflects a narrow review or incomplete evidence. Insurance research emphasizes the importance of identifying selection and information problems rather than inferring mechanisms from simple correlations [10]. Here, transparency about scope is a practical counterpart to that analytical caution.

3.2 Incentive and capability constraints

The third barrier concerns who pays for prevention and who benefits. An insurer usually captures only the reduction in losses falling within its coverage and contract period. The enterprise may capture benefits through fewer uninsured disruptions, stronger routines, and more reliable customer relationships. Staff training may continue to benefit the firm after it changes insurers. This creates a cost-recovery problem for a provider that finances substantial services upfront but cannot retain enough of the resulting value.

Enterprise incentives may also be weak. Recommendations can require immediate expenditure while benefits remain uncertain and difficult to observe. Managers under pressure to complete a milestone may defer maintenance or documentation because the cost is visible and the avoided loss is hypothetical. Some firms may value a premium subsidy more than preventive assistance. These possibilities require evidence rather than assumptions about managerial indifference. Resource constraints and poorly matched recommendations may explain nonimplementation as readily as a lack of commitment.

Performance-linked pricing may partly align interests, but it can create new problems. Discounts based on low reported incident numbers can discourage disclosure. Rewards for completed inspections

ISSN 2616-5902 Vol. 8, Issue 10: 73-81, DOI: 10.25236/AJBM.2026.081010

can encourage superficial activity. Long contracts may help recover service costs but reduce the enterprise's ability to switch providers. Public subsidies can improve access but may also finance services that would have been purchased anyway. A credible arrangement must consider these responses and explain why a particular payment mechanism matches the benefit being supported.

Professional capability determines whether incentives can translate into useful services, since technology-related assessments require combinations of expertise that are difficult to assemble. Insurance professionals may understand coverage and loss adjustment but lack detailed knowledge of a novel manufacturing process. Engineers may understand failure pathways without understanding how advice affects coverage or claims. Intellectual property and cybersecurity questions may require separate specialists. No single generalist can credibly address all of these domains. The challenge is to coordinate qualified expertise while keeping the service affordable and understandable for a smaller enterprise.

Outsourcing expands access but creates accountability problems. A provider may rely on subcontractors whose qualifications, conflicts of interest, and quality controls are unclear to the insured firm. Standard report templates can conceal substantial differences in expertise. A highly technical report may also be unusable if it fails to connect findings with feasible operating decisions. Service capability should therefore be assessed through relevant experience, scope discipline, and implementation support rather than the prestige of a provider's name alone.

3.3 Responsibility and evaluation constraints

Responsibility becomes unclear when the insurer sells coverage, a broker organizes services, a subcontractor performs the review, and enterprise managers decide whether to act. If a recommended control fails, the parties may disagree about whether the advice was deficient, implementation was incomplete, or the event lay outside the review's scope. This uncertainty can discourage candid recommendations or encourage defensive paperwork. Enterprises may also incorrectly assume that following advice guarantees a claim will be paid.

Several boundaries therefore require explicit treatment. The service agreement should distinguish advice from mandatory policy conditions, identify the authority for approving technical changes, and explain how service findings affect underwriting. It should clarify the provider's obligations and applicable responsibility for negligent work. The precise legal treatment depends on the relevant jurisdiction and contract and is not resolved here. The organizational point is that ambiguity should be addressed before an incident rather than left entirely to a later claims dispute.

Institutional fragmentation adds another layer. Agencies supporting innovation, insurance development, enterprise cultivation, and intellectual property may operate separate programs with different reporting requirements. Firms can then spend substantial time proving eligibility rather than implementing improvements. Coordination is useful where it reduces duplicated assessments and aligns support with actual project needs. It becomes counterproductive when it produces additional approvals or implies that participation in one program guarantees protection or financing under another.

Evaluation problems make responsibility gaps harder to resolve because a loss that did not occur is not directly observable. A firm may report no incident because services were effective, because its exposure declined, because it was fortunate, or because reporting was incomplete. High service activity can coexist with weak outcomes, while improved reporting may initially increase recorded incidents. Evaluation based only on premium volume, inspection counts, or raw claim frequency can therefore create misleading conclusions about the quality of risk reduction.

Attribution is particularly difficult when enterprises self-select into services. Better-managed firms may be more willing to participate, making the service appear effective even without a causal contribution. Alternatively, insurers may target the riskiest projects, making useful services appear associated with worse outcomes. Changes in technology maturity, funding, and customer demand further complicate comparison. A credible assessment requires exposure-adjusted outcomes, evidence about implementation, and an explicit account of how participants were selected.

Innovation adds a further measurement problem. Fewer failed experiments do not necessarily indicate better governance. The firm may simply conduct fewer ambitious trials. Similarly, a project terminated after credible negative evidence should not automatically be classified as a risk-management failure. Careful innovation measurement requires distinctions between innovation activities and outcomes [11]. Evaluation of risk reduction services should additionally distinguish

ISSN 2616-5902 Vol. 8, Issue 10: 73-81, DOI: 10.25236/AJBM.2026.081010

delivery, implementation, learning, and final outcomes. This distinction informs the governance model developed in Section 4.

4. Pathways for Improving Risk Reduction Services

4.1 Service processes and responsibility arrangements

A practical model should begin with a jointly agreed diagnostic scope. The enterprise and insurer identify the project, its current stage, the exposures under review, and the limits of available expertise. They then select a small number of interventions according to criticality, feasibility, and timing. The enterprise retains authority over research decisions, while specialists provide advice within their competence. A written service plan connects each intervention with an owner, evidence of completion, and a review point.

Implementation should be followed by verification rather than assumed from expenditure or attendance. A purchased backup system should be tested; an emergency procedure should be rehearsed; a revised testing protocol should be used in practice. Verification can remain proportionate to the exposure. It need not require a costly external audit for every routine action. The objective is to establish whether the intended control operates and whether the enterprise understands its limitations.

Reviews should be triggered by material project changes, including a new pilot configuration, customer application, critical supplier, or production scale. Where exposure remains stable, routine follow-up may suffice. This approach directs specialist resources toward decisions where they can add value. It also reduces repetitive inspections that consume staff time without changing practice. Review findings should feed back into both the enterprise's operating routines and the insurer's understanding of the exposure, subject to agreed information boundaries.

Data governance must extend beyond obtaining general consent. The agreement should identify data categories, permitted purposes, access roles, retention periods, and subcontractor responsibilities. Where possible, assessments can use verified summaries or on-site review instead of transferring complete research datasets. These measures will not eliminate concerns, and some projects may remain unsuitable for external review. They can, however, reduce unnecessary disclosure and make the relationship between information demands and actual service decisions more intelligible.

4.2 Professional capabilities and cost sharing

Collective support is most defensible where it addresses an identifiable barrier that individual contracts cannot resolve efficiently. Examples include shared training, anonymized incident classifications, and access to specialist expertise for smaller projects. Public agencies could support these functions through transparent eligibility and evaluation rules. Such proposals are normative recommendations of this article. They should be tested through bounded pilots rather than interpreted as evidence that a particular subsidy structure will necessarily improve innovation performance.

Payments should follow the function being supported. Insurers can finance activities primarily reducing covered losses, enterprises can contribute to improvements with substantial private benefits, and collective programs can support shared capabilities with wider spillovers. In practice, benefits are difficult to divide precisely, so negotiated contributions may be necessary. Transparent service budgets and deliverables are preferable to treating every activity as a free addition to the policy. Explicit costs help participants judge value and discourage nominal services.

Data infrastructure should begin with common definitions and access rules rather than an ambition to collect all enterprise information centrally. Incident records can distinguish exposure, event, consequence, response, and confidence in causal attribution. Aggregated learning may then become possible without circulating detailed technical secrets. Participation should remain consistent with applicable obligations and agreed purposes. A shared database is useful only if its records are sufficiently comparable, protected, and connected to practical decisions.

4.3 Evaluation and policy coordination

Evaluation should use three complementary dimensions. Delivery measures establish whether the agreed service occurred. Implementation measures establish whether recommendations changed practice. Outcome measures examine disruption, recovery, and project continuity, interpreted against

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exposure and project stage. Each dimension answers a different question. A high implementation rate does not establish causality, but it provides evidence about the mechanism that an outcome comparison alone would miss.

Suitable indicators might include the time required to close priority findings, the proportion of critical controls tested successfully, interruption duration, and the time needed to restore essential project activity. Learning can be assessed through documented changes in assumptions and investigative practice. Final outcomes may include milestone achievement and commercialization, but these depend on many factors outside insurance. Innovation preservation should also be monitored through changes in experimental scope and decisions to pursue uncertain but technically justified pathways.

Coordination should also connect the service cycle with the firm's existing project governance. A technical manager can define the experimental boundary, an operations manager can own preventive actions, and a finance manager can assess implementation costs and recovery liquidity. Smaller firms may combine these roles, but the decisions still require explicit ownership. Providers should record unresolved disagreements rather than imply consensus through a completed checklist. Where a recommendation would materially narrow experimental scope, the enterprise should document the expected safety or continuity benefit alongside the potential loss of learning. This record makes the trade-off reviewable without transferring scientific authority to the insurer.

At the policy level, coordination should focus on compatible evidence requirements. Enterprise-support agencies and insurers can agree which existing records demonstrate project stage, service delivery, or implementation, reducing repeated requests for the same information. A common record should not imply common eligibility or automatic approval: funding, insurance coverage, and lending decisions retain distinct purposes. Pilot programs can publish aggregated implementation findings and reasons for nonparticipation, allowing evaluation of whether services reach firms with limited capabilities. Such feedback can support adjustment of service scope and cost sharing before wider expansion, while protecting confidential project information.

Future research should assemble project-level longitudinal data linking actual service content, implementation dates, contract characteristics, and subsequent outcomes. Administrative recognition, enterprise size, project maturity, financing conditions, and prior risk-management capability are relevant controls. Researchers should distinguish an offer of service from participation and verified implementation. They should also retain records of terminated projects where possible; examining only surviving firms would omit precisely the continuity problems that the framework seeks to explain.

A randomized phased offer could identify the effect of access where operationally feasible. It would primarily estimate the effect of being offered services, unless participation and implementation were also addressed. Where randomization is unavailable, a staggered rollout may support a difference-in-differences design if timing and comparison groups are credible. Matching alone cannot remove unobserved differences in managerial quality or project risk. Researchers should explain selection, examine prior trends, and avoid presenting an administrative policy date as automatic causal identification.

5. Conclusion

Technology insurance risk reduction services can be understood as potential organizational support for the conditions under which technological experimentation occurs. Their most credible contribution lies in identifying avoidable hazards, improving operational learning, protecting continuity, and clarifying responsibilities across project partners. These contributions remain conditional on expertise, enterprise uptake, contractual alignment, and feasible interventions. Coverage expansion and service activity alone cannot establish that technological breakthrough performance has improved.

The central design principle is to reduce avoidable damage while preserving justified experimentation. A failed technical hypothesis is different from an experiment invalidated by preventable operational weakness. Services should help enterprises recognize that difference and act on it. Excessive demands for predictable outcomes can undermine the exploratory behavior that innovation requires. Accordingly, lower incident counts should be evaluated alongside evidence about learning, exposure, and the ambition of the project portfolio.

The analysis is limited by its conceptual method and purposive source selection. It offers no estimate of service effectiveness, prevalence, or sectoral differences, and its illustrative scenarios are

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not observed cases. Future project-level evidence is needed to test the propositions and compare alternative delivery models. Nevertheless, the framework provides a practical basis for designing services whose responsibilities are clear, whose costs are visible, and whose contribution can be examined beyond the existence of an insurance policy.

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