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RESEARCH ARTICLE

ENGINEERING MANAGEMENT STRATEGIES FOR ENHANCING INDUSTRIAL COMPETITIVENESS, OPERATIONAL RESILIENCE, AND SUSTAINABLE BUSINESS PERFORMANCE IN AUSTRALIA

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Abstract

Australian industrial firms compete from a high-cost, geographically distant base and have recently absorbed severe disruption to supply, labour and demand. Engineering management, the discipline that plans, organises and controls technical operations, is central to how they respond,yet evidence on which of its strategies improve competitivenes s, resilience and sustainable business performance together remains fragmented. This review synthesises 30 journal articles, all peer review ed and dated 2020 to 2025, selected through a systematic integrative de sign and anchored by a scientometric review of construction engineerin g and management research produced by Australia-based academics and a multiple case study of competitive manufacturing in high-cost environments. Twelve of the articles draw on Australian data, including surveys of 598, 447, 204 and 117 firms or managers. The synthesis yields three findings. First, competitiveness in high-cost settings rests on a broad operations capability base spanning quality, cost, time, flexibility and innovation, supported by formal planning and access to finance. Second, operational resilience is built through manager-level capabilities that create visibility, responsiveness and flexibility, through digital technologies that work mainly by enabling incremental innovati on, and through the capacity to exploit and explore at once. Third, resilience and competitiveness translate into sustainable business performance only when firms develop learning and reconfiguration capabilities and embed environmental practice in operations. The paper offers a four - phase resilience cycle of engineering management strategies and an ambidexterity portfolio, together with priorities for Australian research and practice.

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Introduction:-

For Australian industry, the period since 2020 has combined familiar structural pressures with acute shocks. Firms that make, build and move physical goods operate far from most of their customers and suppliers and, like manufacturers in other high-cost economies, cannot rely on cost-related capabilities alone (Sansone et al., 2020). The COVID-19 pandemic then disrupted supply chains, logistics, operations, market demand and labour supply at once (Nakandala et al., 2023), and considerable government support was provided to sustain business activity and

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employment (Watson & Buckingham, 2023). The experience exposed how much industrial performance depends on the way technical operations are planned, coordinated and adapted.

Engineering management sits at that junction. It covers the strategic and operational decisions through which engineering capability is converted into products, projects and services: operations strategy, planning and control, quality and risk management, supply chain coordination, technology deployment and continuous improvement. Australia has a substantial research base in the field. A scientometric review of 4,318 publications by 158 Australia-based academics in construction engineering and management placed the country fourth worldwide by research volume and found a distinctive emphasis on safety and stakeholder management alongside risk, sustainability, cost and design (Ahmad et al., 2024). Yet most of this research addresses individual projects or functions, and less is known about which management strategies strengthen firms' competitive position, their resilience to disruption and their longer-term sustainability at the same time.

These three outcomes are often treated as competing goals. Competitiveness is associated with efficiency and lean operations, resilience with buffers and redundancy, and sustainability with investment whose returns are slow or uncertain. Recent research suggests the relationships are more complex. Smart manufacturing, for example, has been found to improve cost, quality and delivery simultaneously while failing to raise financial margins (Arcidiacono & Schupp, 2024), and resilience capabilities built during a crisis can be repurposed for exploration once it passes (Herold et al., 2024). Understanding these interactions matters for firms in high-cost economies, where the margin for strategic error is narrow.

This review synthesises evidence published between 2020 and 2025 to identify the engineering management strategies associated with industrial competitiveness, operational resilience and sustainable business performance, and to interpret that evidence for Australia. It contributes an integrated account of how the three outcomes connect, an analysis of Australian evidence that is scattered across operations, supply chain, construction and economics journals, and two frameworks intended to support strategic choice: a resilience cycle that maps strategies to phases of disruption, and a portfolio that balances exploitation and exploration.

The research questions follow in Section 2, and Section 3 explains how the evidence was located and analysed. Section 4 examines competitiveness in high-cost settings, Section 5 the building of operational resilience, and Section 6 the conditions under which both lead to sustainable business performance, together with the proposed frameworks. Section 7 discusses implications, research priorities and limitations, before Section 8 draws the argument together.

Aim, Objectives and Research Questions:-

The review seeks to determine which engineering management strategies enable industrial firms to become more competitive, more resilient and more sustainable at once, and how Australian firms can apply them. Its objectives are: (1) to identify the operations, planning and productivity strategies associated with competitiveness in high-cost economies; (2) to explain how operational and supply chain resilience are built and how they affect performance; (3) to establish when competitiveness and resilience strategies also yield economic, environmental and social gains; and (4) to integrate these findings into frameworks suited to Australian conditions.

The synthesis is organised around three research questions. RQ1: Which engineering management strategies does the recent evidence associate with industrial competitiveness, particularly in high-cost economies such as Australia? RQ2: Through which capabilities do firms build operational and supply chain resilience, and how does resilience translate into performance? RQ3: Under what conditions do competitiveness and resilience strategies also produce sustainable business performance, and how can they be combined in practice? Sections 4, 5 and 6 respectively address these questions.

Review Methodology:-

An integrative review design with systematic search and selection procedures was used. Integrative reviews are suited to questions that cross disciplinary boundaries and draw on heterogeneous methods; here the relevant evidence spans operations management, supply chain management, construction engineering, quality management and industrial economics.The search, conducted in November 2026 in a comprehensive scholarly metadata index, combined outcome terms ("competitiveness", "competitive manufacturing", "operational resilience", "supply chain resilience", "business continuity", "sustainable business performance") with strategy terms ("operations capabilities", "strategic planning", "risk management", "ambidexterity", "agile manufacturing", "Industry 4.0", "lean

practices", "predictive maintenance", "last planner"). Parallel searches added "Australia" or "Australian" and retained records whose titles or abstracts referred to Australian firms, managers or data.

Articles qualified when they were peer-reviewed journal publications dated 2020 to 2025 in their version of record, written in English, set in industrial firms, supply chains or engineering projects, and reported empirical results, a meta-analysis or a systematic review bearing on at least one research question. Conference papers, commentaries, corrections, items published outside the window, and records whose abstracts and metadata could not be verified against the registered digital object identifier were excluded.

Two seed studies framed the selection: the scientometric review of Australia-based construction engineering and management research (Ahmad et al., 2024) and a multiple case study of the challenges facing competitive manufacturing in high-cost environments (Edh Mirzaei et al., 2021). The other 28 studies were chosen for relevance, rigour and complementary coverage. The corpus comprises 21 quantitative studies, three mixed-method studies, three qualitative studies, and three reviews or meta-analyses, with 12 drawing on Australian samples or data.

Studies were coded for context, sample, design, strategies examined, outcomes, mediating and moderating variables, and stated limitations. Thematic synthesis then grouped findings by research question, distinguishing replicated results from isolated ones and noting contradictory evidence. All statements attributed to sources were checked against their abstracts and, where accessible, full texts; no data were collected or estimated by the author.

Competitiveness in a High-Cost Economy:-

The literature on high-cost manufacturing offers the most direct guidance for Australian firms. A multiple case study of five Swedish manufacturers identified seven categories of challenge to sustaining competitive manufacturing, ranging from product characteristics and employee involvement at the micro level to supply chain collaboration and industry systems at the macro level, and translated them into a prescriptive checklist (Edh Mirzaei et al., 2021). A related focus group with 14 representatives of five Swedish firms found that all operations capabilities identified in the literature were considered critical, but that firms in high-cost settings emphasised a broad set covering quality, cost, time, flexibility and innovation instead of cost alone (Sansone et al., 2020). The implication is that competitiveness in such economies depends on combining capabilities, not on excelling at one.

Operational excellence methods remain part of that combination. A meta-analysis of 40 studies published between 1993 and 2020 found a significant positive correlation of 0.37 between aggregate lean practices and organisational performance, with positive relationships for operational, financial, market and environmental outcomes, and highlighted the role of moderating variables (Antony et al., 2022). Smart manufacturing adds capability but not automatically profit. Among 234 automotive component suppliers, adoption improved cost, quality and delivery performance, yet among the 81 firms for which financial data were available, these operational gains did not produce superior financial performance. The authors concluded that smart manufacturing may help firms defend their competitive position without necessarily raising margins (Arcidiacono & Schupp, 2024).

Australian evidence adds a dynamic perspective on productivity. An analysis of Australian manufacturing entrants found that new firms were relatively unproductive at entry, but that survivors made a large productivity gain within a year and converged with mature firms. Entrants that grew substantially by their third year, termed transformative, held a major productivity advantage, as did those located within clusters of firms and patents (Bakhtiari, 2020). For engineering managers, the finding underlines that early operational learning and access to knowledge networks shape whether young firms become competitive.

Planning and finance matter as much as technique. Using a national dataset of Australian SMEs collected by the statistical agency, a study found that firms using strategic planning together with robust budget planning and monitoring expressed greater optimism about future sales growth, and that firms combining these practices with market development showed both higher growth and greater optimism (Rice et al., 2024). Access to finance shapes the ability to improve processes: analysis of Australian firm-level data from 2006 to 2018 showed that financial constraints reduced the probability of process innovation by around 10% for firms without prior process innovation and around 12% for firms with it (Roche et al., 2022). Constrained firms, in other words, are less able to sustain the process improvements on which competitiveness in high-cost settings depends.

Digital readiness is uneven. A survey of Australian supply chain practitioners found several Industry 4.0 technologies still at an early stage of adoption, larger firms more digitally ready than smaller ones, and significant

gaps between the impact practitioners expected from certain technologies and the investment planned for them (Hopkins, 2021). In construction, a state-of-the-art review of Australian timber supply chains found that inconsistencies in upstream sawmilling constrained the benefits of prefabrication and proposed a priority-based roadmap of technical, operational and policy actions (Dissanayake et al., 2025). Both studies show that competitiveness depends on coordination across firms as well as within them.

In answer to RQ1, the evidence associates competitiveness in high-cost economies with four engineering management strategies: building a broad operations capability base rather than pursuing cost leadership; deploying operational excellence and smart manufacturing to defend position while recognising their limited effect on margins; combining formal strategic and budgetary planning with market development; and securing the finance and inter-firm coordination that sustain process innovation. Table 1 summarises the Australian evidence on which this conclusion partly rests.

Table 1. Australian evidence on competitiveness, resilience and performance

Study	Sample and method	Principal finding	Implication
Ahmad et al. (2024)	Scientometric review; 4,318 publications by 158 academics	Fourth globally by volume; strong emphasis on safety and stakeholder management	Social performance is a national research strength
Bakhtiari (2020)	Firm-level productivity analysis of manufacturing entrants	Survivors converge quickly; fast growers and clustered firms gain advantage	Early learning and knowledge networks matter
Rice et al. (2024)	National SME dataset; regression	Strategic and budget planning linked to growth optimism and growth	Formal planning supports competitiveness
Roche et al. (2022)	Firm microdata, 2006–2018	Financial constraints cut process innovation probability by about 10–12%	Improvement depends on access to finance
Hopkins (2021)	Survey of supply chain practitioners	Early adoption; larger firms more ready; impact–investment gaps	Target digital support at smaller firms
Nikookar and Yanadori (2022)	Survey of 598 manufacturers	Managers' social and human capital and cognition build visibility, responsiveness and flexibility	Develop managers as a resilience asset
Nakandala et al. (2023)	Survey of 117 manufacturers	Digital capability builds operations resilience through incremental innovation	Link technology to innovation routines
Herold et al. (2024)	Survey of 447 supply chain managers	Most supply chains pursue exploitation and exploration together after the crisis	Repurpose crisis capabilities
Mamun (2025)	Survey of 204 SMEs	Digital technologies and ambidexterity mediate supply chain management effects	Combine supply chain practice with ambidexterity
Gao et al. (2025)	Two rail projects; 43 surveys, 19 interviews	Digital last planner improved schedules, cost, safety and quality	Digital planning tools aid project control
Watson and Buckingham (2023)	Evaluation of pandemic business supports	Higher profitability and jobs; mixed effects on dynamism	Support preserves capability but not renewal

Study	Sample and method	Principal finding	Implication
Dissanayake et al. (2025)	State-of-the-art review of timber supply chains	Upstream sawmilling inconsistencies limit prefabrication benefits	Coordinate across supply chain stages

Building Operational Resilience:-

Resilience, understood here as the capacity to anticipate, absorb, recover from and adapt to disruption, gained prominence when the pandemic underlined how exposed supply chains were (Nikookar & Yanadori, 2022). Australian evidence on the topic is comparatively strong. A survey of 598 Australian manufacturing firms found that the social capital, human capital and cognition of supply chain managers contributed to three organisational antecedents of resilience, namely visibility, responsiveness and flexibility, which in turn strengthened supply chain resilience (Nikookar & Yanadori, 2022). The finding locates the origins of resilience partly in the capabilities of individual managers, which can be developed through selection, training and networks.

Digital technologies contribute through innovation rather than directly. In 117 Australian manufacturing firms, Industry 4.0 capabilities improved supply chain resilience directly, but their effect on operations resilience passed through incremental innovation. Incremental innovation and operations resilience acted as serial mediators between technology and supply chain resilience (Nakandala et al., 2023). Because the study treated operations resilience and supply chain resilience as distinct constructs and found that technology affected them differently, it cautions against assuming that investment aimed at one will automatically strengthen the other. Studies elsewhere reach compatible conclusions. Among Jordanian manufacturers, supply chain agility, flexibility and collaboration were positively related to operational performance, and well-judged use of digital technologies strengthened that relationship (Alkhatib & Momani, 2023). Big data analytics capabilities improved firm performance by raising supply chain resilience through innovative capability and information quality, with risk management culture moderating the link between resilience and performance (Bahrami & Shokouhyar, 2022).

Ambidexterity, the capacity to exploit existing competencies while exploring new ones, recurs as a resilience mechanism. In a dataset of 2,765 manufacturing SMEs, ambidexterity and strategic consistency together explained resilience, reconciling earlier arguments for experimentation and for reliability (Iborra et al., 2020). Among 351 Malaysian manufacturing SMEs, ambidextrous capabilities mediated the positive effect of proactive resilience strategies on organisational performance (Pertheban et al., 2023). In Australia, a survey of 204 SMEs found that implementing supply chain management, adopting Industry 4.0 technologies and practising organisational ambidexterity all improved performance, with technology and ambidexterity mediating the effect of supply chain management (Mamun, 2025). Jordanian evidence likewise shows supply chain exploration and exploitation mediating the effect of Industry 4.0 capabilities on operational performance (AL-Khatib, 2025).

What happens after a crisis is equally important. Using a survey of 447 Australian supply chain managers, a study applied the concept of exaptation to ask how resilience capabilities built during the pandemic could be repurposed. It found that most supply chains were able to pursue exploitative and exploratory capabilities simultaneously, suggesting that crisis-era investments need not be written off once conditions normalise (Herold et al., 2024). Resilience, on this view, is not only defensive; it can become a source of renewal.

Formal continuity arrangements help, but not mechanically. Among 555 German conformity assessment bodies, contingency plans did not directly reduce order declines during the pandemic; they did so indirectly by enabling faster responses, and they could have adverse effects if they hindered flexible reaction (Mirtsch et al., 2023). In 216 Thai automotive parts manufacturers, firm size, international orientation, tier level, export level and product branding were associated with more developed business continuity management, whereas automotive quality certification had little effect except on maintenance (Vanichchinchai, 2023). Ten in-depth interviews with manufacturing organisations in Northern Cyprus documented the operational effects of the pandemic, their causes and the response strategies adopted (Bastas & Garza-Reyes, 2022). Disruptions are not uniform: among 345 Ghanaian manufacturers, supply and infrastructure disruptions strengthened the positive relationship between resilience and supply chain performance, while catastrophic disruptions weakened it (Hamidu et al., 2023).

For high-value manufacturers, priorities can be made explicit. An analytical hierarchy study of an industrial valve manufacturer identified operations and risk management, together with circular and leagile supply chain design, as the essential resilience competencies. Building resilient supply chain actors and stages, and operations that are both sustainable and resilient, emerged as the critical strategies (Ambilkar et al., 2025). Maintenance illustrates the digital

requirements involved: interviews with 15 managers and technicians found that the data needed for predictive maintenance were often not captured or stored, that integrated information systems were lacking, and that a shift in management mindset and culture was necessary (Skoumpopoulou et al., 2025).

The answer to RQ2 is that resilience is built at three levels. At the individual level, managers' social capital, knowledge and cognition create visibility, responsiveness and flexibility. At the organisational level, digital capabilities, analytics and continuity arrangements contribute mainly by enabling innovation and faster response, while ambidexterity allows firms to maintain reliability and adapt at once. Across the network, collaboration and the design of supply chain stages determine how disruptions propagate. Resilience generally improves performance, but its value varies with the type of disruption and with the culture in which it is embedded.

From Resilience to Sustainable Business Performance:-

Competitiveness and resilience do not automatically become sustainable business performance, defined as the joint achievement of economic, environmental and social results. The evidence identifies transformation capabilities as the missing link. Among 99 Italian manufacturers, agile manufacturing improved sustainable business performance only through internal learning and reconfiguration capabilities. Learning fully mediated the effect on economic performance and partially on social performance, and reconfiguration fully mediated the effects on economic and environmental performance (Mohaghegh et al., 2024). Agility, a hallmark of resilient operations, thus requires deliberate learning and redesign before it pays off across all three dimensions.

Environmental practice can itself be a source of competitiveness. In 288 Chinese manufacturing SMEs, sustainable manufacturing practices built competitive capabilities that mediated their positive effect on sustainable performance, and environmental regulation strengthened the relationship (Ali et al., 2021). In Indian manufacturing firms, corporate environmental strategy and knowledge assessment were associated with greener design of products and processes and with greener manufacturing and logistics, and adopting green operations significantly improved competitiveness (Das, 2024). The meta-analytic evidence that lean practices relate positively to environmental as well as operational and financial outcomes points the same way (Antony et al., 2022).

Project-based industries show how engineering management tools can produce social as well as operational gains. In two rail infrastructure projects in Victoria, a digitalised last planner system was associated with improvements in schedules, cost, occupational health and safety, and quality. Survey respondents identified process improvement and social benefits as its main contributions, although implementation challenges were also reported (Gao et al., 2025). The emphasis on safety and stakeholder management in Australian construction engineering research (Ahmad et al., 2024) suggests that the social dimension of performance is a distinctive national strength on which industrial firms can build.

Public policy shapes the conditions for all three outcomes. Australian government support during the pandemic was associated with higher business profitability and savings and a robust rebound in employment and wages on payrolls, though with mixed effects on business dynamism. The SME Cashflow Boost alone cost an estimated $72,000 to $83,000 per job-year saved in its first year (Watson & Buckingham, 2023). Such support preserved capability through the shock, but the evidence on financial constraints and process innovation (Roche et al., 2022) suggests that longer-term competitiveness depends on finance directed at improvement rather than on survival alone. Tensions nonetheless remain. The benefits of resilience vary with the nature of the shock, and catastrophic disruptions can weaken the link between resilience and performance (Hamidu et al., 2023). Certification is no substitute for capability: in the Thai automotive sample, quality certification bore little relation to the maturity of continuity management (Vanichchinchai, 2023). And operational improvement can leave margins unchanged, which makes it harder to justify further investment in environmental or social initiatives from operating returns alone (Arcidiacono & Schupp, 2024). Engineering managers therefore need performance measures that capture resilience and sustainability benefits explicitly, so that these are not undervalued when only short-term financial results are reported.

Bringing the evidence together, Figure 1 organises engineering management strategies into a four-phase resilience cycle. During anticipation, firms build manager capabilities, visibility and continuity plans that enable rather than constrain response. When disruption strikes, they respond through flexibility, collaboration and digital information. Recovery restores operations while capturing lessons as incremental innovation, and renewal repurposes crisis capabilities for exploration and reconfigures operations towards environmental and social goals. Each phase draws on the broad operations capability base and planning discipline identified in Section 4.

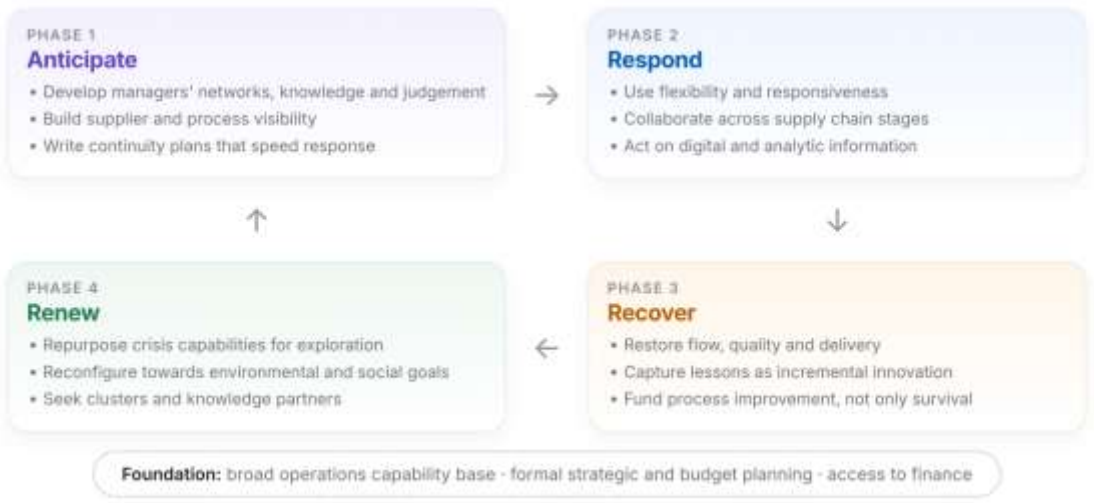


Figure 1. Four-phase resilience cycle of engineering management strategies.

Figure 2 presents a complementary portfolio view, arranging strategies by whether they emphasise exploitation or exploration and whether they act inside the firm or across its network. The portfolio reflects the repeated finding that ambidexterity underpins both resilience and performance (Herold et al., 2024; Iborra et al., 2020; Mamun, 2025). Firms that concentrate solely on internal exploitation, such as cost reduction and standardisation, risk brittleness; firms that pursue only exploration risk inconsistency. Table 2 links each strategy to its primary outcome, supporting evidence and indicative measures.



Figure 2. Ambidexterity portfolio of engineering management strategies by focus and scope.

Table 2. Engineering management strategy portfolio and indicative measures

Strategy	Primary outcome	Mechanism	Key evidence	Indicative measures
Broad operations capability base	Competitiveness	Combines quality, cost, time, flexibility and innovation	Sansone et al. (2020); Edh Mirzaei et al. (2021)	Capability profile against competitors; delivery and quality performance

Strategy	Primary outcome	Mechanism	Key evidence	Indicative measures
Formal planning and finance for improvement	Competitiveness	Disciplines resource commitments; funds process innovation	Rice et al. (2024); Roche et al. (2022)	Planning coverage; share of investment in process improvement
Manager capability development	Resilience	Builds visibility, responsiveness and flexibility	Nikookar and Yanadori (2022)	Supplier visibility; time to detect and respond to disruption
Digitally enabled incremental innovation	Resilience	Converts technology into adaptive routines	Nakandala et al. (2023); Bahrami and Shokouhyar (2022)	Improvement projects completed; recovery time
Ambidextrous portfolio	Resilience and performance	Balances reliability with exploration	Iborra et al. (2020); Herold et al. (2024); Mamun (2025)	Share of effort on exploration; performance stability
Learning, reconfiguration and green operations	Sustainable business performance	Turns agility and resilience into lasting change	Mohaghegh et al. (2024); Ali et al. (2021); Das (2024)	Economic, environmental and social scorecard

In answer to RQ3, competitiveness and resilience strategies yield sustainable business performance under three conditions: when firms invest in learning and reconfiguration capabilities that convert agility into durable change; when environmental and social practices are built into operations and supply chains rather than added afterwards; and when finance and policy support improvement as well as survival. The frameworks in Figures 1 and 2 show how these conditions can be built into strategic choices.

Discussion, Research Agenda and Limitations:-

The review challenges the assumption that competitiveness, resilience and sustainability compete for the same scarce resources. The evidence suggests instead that a common foundation, consisting of broad operations capabilities, capable managers, ambidexterity and learning, supports all three. Trade-offs do arise, for instance when contingency plans reduce flexibility (Mirtsch et al., 2023) or when operational gains from smart manufacturing fail to reach the bottom line (Arcidiacono & Schupp, 2024), but they reflect how strategies are designed rather than an inherent conflict between goals.

Theoretically, the synthesis supports a dynamic capabilities interpretation of engineering management. The strategies with the strongest evidence are not specific techniques but higher-order capabilities: managers' social capital and cognition (Nikookar & Yanadori, 2022), the conversion of technology into incremental innovation (Nakandala et al., 2023), ambidexterity (Iborra et al., 2020), and learning and reconfiguration (Mohaghegh et al., 2024). Operational practices such as lean, smart manufacturing and continuity planning appear as resources whose value depends on these capabilities. The concept of exaptation (Herold et al., 2024) extends this view by showing that capabilities developed for one purpose can be redeployed for another, which links resilience research with work on strategic renewal.

For Australia, three implications stand out. First, the country has a substantial evidence base on resilience, with large surveys of manufacturers and supply chain managers (Herold et al., 2024; Nikookar & Yanadori, 2022), which should inform industry programmes. Second, finance and planning deserve more attention in industrial policy: constrained access to finance reduces process innovation, and formal planning is associated with growth (Rice et al., 2024; Roche et al., 2022). Third, the gap between expected impact and planned investment in digital technologies, and the lower readiness of smaller firms (Hopkins, 2021), call for targeted support that links technology adoption to incremental innovation and resilience rather than to automation alone.

For managers, the analysis suggests developing supply chain and operations managers' networks, knowledge and judgement as deliberate resilience investments; designing continuity plans that accelerate response rather than prescribe it; treating digital projects as vehicles for incremental innovation; and reviewing crisis-era capabilities for

their exploratory potential. Engineering managers in project industries can draw on digital planning tools, which in one Australian rail programme were associated with better schedules, cost, safety and quality.

Five research priorities follow. First, longitudinal Australian studies should test whether resilience capabilities built during the pandemic are retained and repurposed, and with what effect on performance. Second, research should examine how financial constraints interact with resilience and digital investment in smaller firms. Third, the four-phase cycle and the ambidexterity portfolio should be tested empirically, for example through case comparisons of firms that emphasise different quadrants. Fourth, the conversion of resilience into environmental and social outcomes deserves direct measurement rather than inference. Fifth, comparative work across Australian industries, including manufacturing, construction and resources, would clarify which strategies transfer between sectors.

Several limitations should be noted. Only 30 journal articles were synthesised, and reports and conference papers fell outside the scope. Many studies rely on cross-sectional, self-reported survey data, which restricts causal inference, and several international studies come from economies whose conditions differ from Australia's. Two Australian studies concern construction rather than manufacturing. Some claims rest on abstracts where full texts were inaccessible, and selection and coding were undertaken by one reviewer. The frameworks are interpretive syntheses that require empirical validation.

Conclusion:-

Engineering management strategies sit at the centre of the Australian industrial challenge of being competitive, resilient and sustainable together. The evidence reviewed here indicates that competitiveness in a high-cost economy depends on a broad operations capability base supported by planning and finance. Resilience is built through managers' capabilities, digitally enabled innovation and ambidexterity, and both lead to sustainable business performance when firms invest in learning, reconfiguration and embedded environmental practice.

The four-phase resilience cycle and the ambidexterity portfolio translate these findings into tools for strategic choice. For Australian managers, the central message is to treat resilience and sustainability as extensions of operational capability rather than as separate programmes. For policymakers, it is to direct support towards improvement, finance and capability building that outlast the next disruption.

The review also leaves a caution. Much of the supporting evidence is cross-sectional and was gathered during or shortly after the pandemic, so the durability of the capabilities it describes is not yet established. Whether Australian firms retain and redeploy what they learned in that period, rather than reverting to lean configurations that leave little slack, will determine whether the integrated view of competitiveness, resilience and sustainability set out here becomes established practice or remains an aspiration.

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