



Scarcity Driven Innovation How Resource Constrained Firms Create Competitive Possibility

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ABSTRACT

Innovation capability is not determined solely by the depth of resources a firm controls, but increasingly by its ability to extract exceptional value from resources that are limited, fragmented, or difficult to access. Resource constrained firms therefore present an important strategic paradox: the conditions that restrict conventional innovation can simultaneously provoke alternative forms of experimentation, recombination, and value creation. This article critically examines how firms navigate this paradox by integrating resource bricolage, frugal innovation, resource orchestration, external networks, digitalisation, and organisational resilience within a coherent perspective on innovation under constraint. The analysis reveals that competitive possibility does not arise from scarcity itself, but from the organisational capacity to distinguish productive constraints from destructive deficiencies, transform improvisation into repeatable capabilities, mobilise complementary resources beyond firm boundaries, and deploy technology where it generates the greatest strategic leverage. Equally important, excessive reliance on bricolage can institutionalise underinvestment, restrict scalability, and prevent firms from developing capabilities essential for sustained growth. The article consequently advances resource intelligence as a strategic orientation that moves beyond the conventional logic of either overcoming scarcity or simply doing more with less. Resource intelligence reflects the ability to determine what should be conserved, recombined, accessed externally, digitally amplified, or deliberately strengthened through investment. This perspective reframes innovation without abundance as a disciplined process of strategic choice through which firms can convert resource limitations into distinctive capabilities, scalable value creation, and sustainable competitive possibility.

Keywords: Bricolage, Frugality, Innovation, Resourcefulness, Scarcity

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1. INTRODUCTION

Scarcity does not always extinguish innovation. Under certain organisational conditions, it can force firms to question established assumptions, recombine overlooked resources, simplify solutions, and discover possibilities that abundance may leave unexplored. This perspective is particularly relevant to small and resource constrained firms, where shortages of finance, knowledge, technology, skilled personnel, and physical assets frequently restrict conventional innovation pathways. Rather than treating such limitations exclusively as disadvantages, emerging research suggests that resource constraints can stimulate alternative forms of problem solving when firms possess the capacity to mobilise what is already available. Chen and Shen (2023) demonstrate that financial and knowledge constraints can stimulate firm innovation through bricolage, indicating that scarcity may operate as an innovation catalyst rather than merely an impediment. Mateus and Sarkar (2024) similarly identify bricolage as an important mechanism through which organisations confront resource scarcity by creatively recombining resources at hand. Magobe et al. (2024) further establish the relevance of bricolage among innovative SMEs operating within resource constrained and uncertain environments. These findings challenge the conventional assumption that superior innovation necessarily originates from superior resource endowments. The more consequential question is how firms convert limitation into purposeful experimentation and ultimately into commercially meaningful innovation. This makes managerial resource judgement central to innovation quality under persistent organisational constraint.

Innovation under constraint becomes especially significant when scarcity is interpreted as a design condition rather than an excuse for inferior outcomes. Frugal innovation captures this logic by emphasising solutions that reduce resource requirements while preserving sufficient functionality, accessibility, and customer value. Escudero-Cipriani et al. (2024), drawing on 420 scholarly articles, demonstrate that frugal innovation has developed into an increasingly important research domain connecting resource efficiency with sustainability, social inclusion, cleaner technologies, and emerging applications of artificial intelligence. Zhang et al. (2024) similarly show that frugal innovation enables firms to develop cost effective and demand driven offerings capable of creating market opportunities, particularly within environments characterised by uncertainty and resource limitations. A configurational study of start ups further indicates that frugal innovation emerges through combinations of resources, entrepreneurial opportunities, and top management conditions rather than through resource scarcity in isolation. This distinction is crucial because scarcity itself does not guarantee creativity or competitive success. Severe constraints can equally suppress experimentation, reduce investment capacity, and weaken organisational survival. Competitive possibility emerges when managers transform restrictive conditions into disciplined innovation parameters that encourage simplification, selective investment, experimentation, and more intelligent deployment of scarce organisational resources.

Resourcefulness therefore represents a critical bridge between possessing fewer resources and extracting greater strategic value from them. Bricolage provides one explanation for this transformation because firms can construct novel responses by combining existing knowledge, relationships, technologies, materials, and capabilities in unconventional ways. Recent evidence shows that this process is influenced not only by the severity of resource limitations but also by the cognitive capabilities of decision makers. Shen and Chen (2025) find that entrepreneurial creative cognitive styles shape the relationship between resource constraints and bricolage, suggesting that

managers differ substantially in their ability to recognise possibilities within apparently inadequate resource environments. Research published in *Industrial Marketing Management* further demonstrates that bricolage can mediate the relationship between environmental dynamism and disruptive innovation among SMEs, although its effectiveness depends on the configuration of managerial ties and environmental conditions. Magobe et al. (2024) likewise show that SMEs in developing economies rely on bricolage when conventional resource mobilisation becomes difficult. Consequently, competitive possibility under scarcity should not be romanticised as spontaneous ingenuity. It depends on managerial judgement capable of identifying underutilised assets, recombining available resources, mobilising external relationships, and directing experimentation towards commercially relevant problems rather than allowing constraint to produce fragmented improvisation without strategic purpose.

Digitalisation has further altered what it means for a firm to be resource constrained because competitive capability increasingly depends on access to knowledge, networks, platforms, data, and digital infrastructure rather than ownership of extensive physical assets alone. Resource limited firms can potentially use digital technologies to extend market reach, coordinate external expertise, accelerate experimentation, improve information access, and redesign business models without reproducing the investment structures of larger competitors. Wang et al. (2025) demonstrate that resource bricolage can facilitate business model innovation through digital transformation, while entrepreneurial characteristics influence the strength of these relationships. Research on emerging markets similarly finds that strategic orientation and organisational ambidexterity contribute to the development of frugal innovation capability within increasingly digitalised business environments. Escudero-Cipriani et al. (2024) additionally identify artificial intelligence as an emerging mechanism capable of enhancing the scalability and efficiency of frugal solutions. Digital access, however, should not be confused with unlimited capability. Technology still requires complementary knowledge, managerial competence, organisational learning, and appropriate strategic direction. The competitive significance of digitalisation therefore lies in its ability to expand the combinations available to resource constrained firms, enabling them to access and orchestrate capabilities that would previously have required considerably greater internal investment.

External relationships provide another route through which firms can overcome the boundaries imposed by internal scarcity. When financial, technological, and knowledge resources cannot be developed internally at sufficient speed, networks can provide access to expertise, information, market knowledge, infrastructure, complementary capabilities, and collaborative opportunities. Evidence from Vietnamese SMEs demonstrates that resource scarcity, absorptive capacity, and social networking contribute to explaining self constructed innovation under constrained conditions, highlighting the importance of combining internal resourcefulness with external knowledge mobilisation. The frugal innovation literature similarly demonstrates that resource constrained innovation frequently depends on combinations of organisational, technological, market, and environmental conditions rather than on isolated internal capabilities. Ooi and Memon (2025) extend this perspective by showing that responsible innovation can contribute to sustainability performance among resource constrained SMEs through organisational resilience and sustainable competitive advantage. These findings suggest that scarcity can alter the architecture of innovation itself. Instead of attempting to own every capability required for innovation, smaller firms can construct flexible resource configurations through collaboration, learning, networking, and selective external access.

Such arrangements potentially allow constrained firms to compete through speed, adaptability, customer proximity, and resource intelligence rather than attempting to imitate the resource intensive innovation systems of substantially larger organisations.

2. LITERATURE REVIEW

Innovation under resource constraints reflects the ability of firms to create value despite limitations in financial, technological, human, and organisational resources. Recent studies show that constrained firms can respond through resource bricolage, frugal innovation, external collaboration, digitalisation, and creative resource configuration (Mateus & Sarkar, 2024; Shen & Chen, 2025). Network embeddedness and digital transformation can further strengthen access to knowledge, technology, and complementary capabilities beyond organisational boundaries (Li & Shafait, 2025; Wang et al., 2025). However, scarcity does not automatically generate innovation because its effectiveness depends on managerial judgement, resource recombination, learning capability, and opportunity recognition. The literature therefore examines how firms transform resource limitations into innovation capability, competitive possibilities, organisational resilience, and sustainable performance under persistent resource constraints.

2.1 Resource Scarcity Catalysing Entrepreneurial Resourcefulness Innovation Capability

Constraints can fundamentally reshape managerial attention by forcing firms to reconsider what constitutes a usable resource and how existing assets might be deployed differently. Bricolage provides an important conceptual explanation for this behaviour because it centres on constructing solutions from resources already available rather than postponing action until ideal resources can be obtained. Mateus and Sarkar (2024) show through their systematic review that bricolage has become particularly prominent in entrepreneurship and innovation research involving resource scarce environments. Shen and Chen (2025) extend this understanding by demonstrating that entrepreneurial cognitive style influences the relationship between resource constraints and bricolage. Divergent thinking strengthens the ability to generate unconventional possibilities, while convergent thinking assists entrepreneurs in evaluating and selecting feasible responses. These findings are important because they establish that scarcity does not possess an inherently innovative quality. What matters is whether organisational actors can interpret limitation productively and recognise alternative combinations among existing resources. Recent research on disruptive innovation similarly finds that bricolage mediates the influence of environmental dynamism on disruptive innovation among SMEs, although managerial ties can strengthen or weaken these relationships depending on the form of environmental change. Consequently, firms facing similar shortages can experience radically different outcomes. Some become immobilised by insufficient resources, whereas others use scarcity to intensify experimentation, accelerate improvisation, and challenge conventional assumptions concerning what resources are actually necessary for innovation.

The strategic significance of resourcefulness becomes clearer when scarcity is separated from deprivation. Resource constrained firms still require a minimum base of knowledge, relationships, managerial competence, and organisational readiness from which creative recombination can occur. Research on Vietnamese SMEs provides compelling evidence for this distinction. Although weak infrastructure stimulates self constructed innovation, strong social networks and absorptive capacity enhance the ability of SMEs to obtain external knowledge and transform it into internally generated

solutions. Li and Shafait (2025) similarly demonstrate that network embeddedness improves SME innovation performance through resource bricolage, while organisational readiness shapes the strength of this relationship. Chong et al. (2026) further shows that small businesses operating under resource constraints do not necessarily follow a single entrepreneurial logic, but can combine effectuation, causation, and bricolage according to circumstances, available networks, and prior experience. The emerging interpretation is therefore considerably more sophisticated than the proposition that necessity simply produces invention. Scarcity can create pressure for alternative action, but firms require sufficient cognitive and organisational capacity to convert that pressure into productive experimentation. Resourcefulness becomes competitively valuable when managers can identify underutilised assets, access complementary knowledge, recombine existing capabilities, and commit limited resources selectively to opportunities where unconventional solutions can generate meaningful customer or operational value. Managerial judgement remains important under uncertainty because firms must distinguish constraints that stimulate disciplined adaptation from deficiencies that simply weaken organisational capacity (Yusof & Razali, 2020).

2.2 Frugal Innovation Creating Superior Value Resource Efficiency Gains

Frugal innovation provides one of the clearest mechanisms through which firms can transform scarcity from an operating restriction into an alternative innovation logic. Rather than attempting to reproduce resource intensive innovation models with smaller budgets, frugal innovators reconsider functionality, affordability, complexity, resource consumption, and customer requirements from the beginning of the innovation process. Escudero-Cipriani et al. (2024) demonstrate that contemporary frugal innovation research extends across product development, sustainability, cleaner technologies, social inclusion, and artificial intelligence, illustrating that the concept has developed substantially beyond its earlier association with low cost products for emerging markets. Pisoni et al. (2018) similarly position frugal innovation as an approach involving reduced complexity, essential functionality, and affordable solutions rather than merely inexpensive product development. The multidisciplinary review of frugal innovation further identifies substantial cost reduction, concentration on core functionality, and optimised performance as distinguishing characteristics within the literature. These characteristics suggest that resource constrained innovation can create competitive possibility through disciplined subtraction. Firms may generate distinctive value not by adding increasingly sophisticated features but by determining which functions genuinely matter to customers and eliminating expenditure that does not strengthen those functions. Such an approach can enable smaller firms to compete through affordability, accessibility, simplicity, responsiveness, and efficient resource utilisation rather than through the scale of research and development expenditure available to larger competitors. The concept therefore depends on purposeful resource choices rather than scarcity alone.

The commercial potential of frugality nevertheless depends on preserving customer value while reducing resource requirements. A solution that is merely inexpensive but unreliable, unattractive, difficult to scale, or unable to satisfy essential customer expectations does not constitute strategically valuable innovation. Research published in 2025 develops a frugal innovation framework specifically for microentrepreneurs facing financial, managerial, operational, and competitive limitations, identifying mindset, ecosystem support, and an adaptive innovation process as essential components for practical implementation. Zhang (2025) further demonstrates that bricolage capability positively influences frugal innovation among Chinese SMEs and that entrepreneurial

leadership strengthens the relationship between bricolage, frugal innovation, and circular supply chain adoption. Research examining frugal innovation in services similarly identifies information and communication technology, knowledge management, cost considerations, innovation management, and organisational practices as important dimensions for generating resource efficient service solutions. These findings reveal that frugality should not be confused with organisational austerity. Effective frugal innovation requires firms to make deliberate choices concerning where resources can be removed and where capability must be protected. Competitive advantage emerges when scarcity encourages firms to eliminate unnecessary complexity while concentrating scarce resources on functionality, customer problems, and capabilities that differentiate the resulting offering. Frugality therefore becomes strategically meaningful when doing more with less does not deteriorate into simply offering less. Innovation-driven development also shows that firms create stronger outcomes when limited resources are channelled toward clearly defined customer and product priorities (Yusof & Salleh, 2021).

2.3 Resource Bricolage Orchestration Driving Constrained Innovation Capability

Possessing limited resources does not necessarily determine competitive weakness when firms can configure, combine, and deploy those resources more effectively than better endowed rivals. Resource bricolage emphasises creative recombination, whereas resource orchestration directs attention towards how managers structure, bundle, and leverage resources to generate strategic outcomes. These perspectives complement one another because both shift attention from resource quantity towards managerial action. Research involving Indonesian micro, small, and medium enterprises demonstrates that effective resource orchestration strengthens innovation and supports post crisis performance, while diversification alone does not necessarily improve firm performance. Appiah et al. (2025) similarly show that the ability to orchestrate green process innovation is important for translating innovation into stronger financial performance among SMEs, particularly when supported by customer driven green strategies and value cocreation. Wang et al. (2025) provide additional evidence by demonstrating that resource bricolage positively influences business model innovation and facilitates digital transformation, which partially mediates the relationship between bricolage and business model innovation. Collectively, these findings indicate that competitive possibility depends less on accumulating an ideal stock of resources than on creating productive configurations from available and accessible resources. Resource constrained firms may therefore compensate partially for ownership disadvantages through superior combination, redeployment, sequencing, and exploitation of assets that competitors overlook or utilise conventionally.

Orchestration becomes particularly important because bricolage can generate fragmented improvisation if experimentation is not eventually connected to coherent strategic priorities. Firms may repeatedly solve immediate problems with available resources without building transferable capabilities, scalable processes, or defensible market positions. The literature therefore increasingly suggests that resourcefulness must progress from reactive improvisation towards deliberate capability formation. Li and Shafait (2025) demonstrate that resource bricolage links network embeddedness with innovation performance, indicating that resource combinations can become more productive when supported by organisational readiness. Zhang (2025) likewise shows that bricolage capability can support frugal innovation and circular supply chain implementation when reinforced by entrepreneurial leadership. Do Do Vale et al. (2021) provide complementary evidence

at the organisational practice level, demonstrating how managers employ bricolage during business model innovation and digital transformation while combining emergent experimentation with formal organisational design. This interaction between improvisation and strategic coordination is central to innovation without abundance. Firms require freedom to experiment with unconventional combinations, but successful discoveries must subsequently be integrated into routines, capabilities, technologies, or business models capable of generating repeatable value. Resource orchestration consequently converts isolated ingenuity into organisational competence. Scarcity becomes competitively productive when experimentation produces capabilities that remain valuable after the immediate resource problem has been resolved.

2.4 Networks Digitalisation External Access Expanding Strategic Resource Capacity

Competitive resource positions are increasingly determined by what firms can access rather than solely by what they own. This distinction is particularly consequential for SMEs because extensive internal investment in specialist knowledge, sophisticated technologies, research infrastructure, distribution networks, and digital systems may be financially unrealistic. External networks provide alternative access to information, expertise, market intelligence, complementary assets, and collaborative opportunities. Evidence from Vietnamese SMEs shows that social networking and absorptive capacity strengthen self constructed innovation by enabling firms to access and utilise external knowledge under resource constrained conditions. Li and Shafait (2025) similarly establish that network embeddedness contributes to SME innovation performance through resource bricolage, demonstrating how relationships can expand the effective resource base available for innovation. Research on resource constrained technological innovation in South African manufacturing firms also demonstrates that firms combine advanced internal manufacturing capabilities with multiple external knowledge collaborations to compensate for institutional limitations and develop frugal medical technologies. These findings challenge an ownership centred understanding of competitive resources. Small firms may remain resource constrained in accounting terms while possessing substantial strategic reach through suppliers, customers, universities, technology partners, communities, and entrepreneurial networks. The crucial capability is therefore not simply network participation, but the ability to identify, absorb, recombine, and commercialise externally accessible knowledge. Digital and entrepreneurial leadership can further strengthen SME performance when technology is combined with strategic direction and the ability to mobilise organisational capabilities (Yusof, 2026).

Digital transformation further expands this access based logic by reducing some of the traditional resource requirements associated with innovation and business model experimentation. Wang et al. (2025) find that resource bricolage facilitates digital transformation and that digital transformation partially mediates its positive relationship with business model innovation. The finding is significant because digital technologies can provide resource constrained firms with scalable access to information processing, communication, customer engagement, experimentation, coordination, and new market architectures without requiring ownership of extensive physical infrastructure. Escudero-Cipriani et al. (2024) additionally identify artificial intelligence as an emerging mechanism capable of improving the efficiency and scalability of frugal solutions. However, digital availability should not be mistaken for digital capability. Firms still require managerial judgement, absorptive capacity, organisational readiness, appropriate data, and strategic clarity to convert technological access into innovation outcomes. The evidence on network embeddedness reinforces

this requirement because external resources generate innovation benefits when firms possess sufficient readiness to mobilise them effectively (Li & Shafait, 2025). Digitalisation therefore does not remove scarcity. Instead, it changes its strategic boundaries by allowing firms to substitute selective access for ownership and to mobilise capabilities across organisational boundaries. Resource constrained firms can consequently build innovation architectures that are lighter in physical assets but richer in connectivity, knowledge exchange, and adaptive capacity. Technology adoption contributes more meaningfully to SME growth when digital investment is connected with innovation capability and longer term business sustainability (Yusof, 2025).

2.5 Constrained Innovation Building Sustainable Competitive Possibility Resilience

The ultimate strategic test of innovation under scarcity is whether resourceful solutions can progress beyond immediate problem solving and contribute to sustained organisational performance. Improvisation may enable firms to survive temporary shortages, but competitive possibility requires solutions that create customer value, strengthen resilience, improve efficiency, or establish capabilities that competitors cannot easily reproduce. Ooi and Memon (2025), using data from Malaysian SMEs, find that responsible innovation strengthens organisational resilience, which subsequently contributes to sustainable competitive advantage and improved sustainability performance. Their findings are particularly relevant because they demonstrate that innovation generated within resource constrained firms can contribute to performance through intermediate organisational capabilities rather than through innovation activity alone. Appiah et al. (2025) similarly show that effective orchestration of green process innovation contributes to financial performance among SMEs, reinforcing the importance of how innovative resources are deployed. Zhang (2025) connects bricolage capability and frugal innovation with circular supply chain implementation, illustrating how constrained innovation can simultaneously support operational transformation and sustainability objectives. Competitive possibility therefore emerges when scarcity driven experimentation develops into capabilities capable of producing repeatable economic or strategic benefits. Resource limitation may initiate the search for alternatives, but the resulting innovation must ultimately satisfy customers, support organisational objectives, and remain sufficiently robust to generate value beyond the immediate constraint that stimulated its creation.

Sustaining these advantages requires firms to avoid romanticising scarcity. Persistent underinvestment can weaken innovation capacity when organisations lack the minimum financial, technological, human, or managerial resources required for experimentation and implementation. The Vietnamese SME evidence is instructive because capital and human resource constraints do not independently stimulate self constructed innovation, while absorptive capacity and social networking play stronger enabling roles. Shen and Chen (2025) similarly demonstrate that the relationship between resource constraints and bricolage depends on entrepreneurial cognitive style, confirming that scarcity requires complementary capabilities before it can become productive. Ooi and Memon (2025) further connect responsible innovation with resilience and sustainable competitive advantage, indicating that innovation quality and organisational consequences matter as much as resource efficiency. Escudero-Cipriani et al. (2024) reinforce this broader interpretation by linking frugal innovation with sustainability, inclusion, cleaner technologies, and emerging artificial intelligence applications. The literature consequently supports a balanced conclusion. Abundance is not a prerequisite for meaningful innovation, but scarcity is not an innovation strategy by itself. Competitive possibility arises when constrained firms combine resourcefulness with knowledge,

networks, digital capability, entrepreneurial cognition, responsible innovation, and disciplined resource orchestration. Under these conditions, scarcity can cease to function purely as a boundary and instead become a catalyst for distinctive forms of value creation. Evidence from rural agro-food enterprises similarly indicates that digital adoption can support growth and resilience when constrained firms translate technology into adaptive business practices (Yusof, 2025).

3. RESOURCE CONSTRAINT INNOVATION TENSIONS SHAPING STRATEGIC COMPETITIVE OUTCOMES

The promise of creating more from less carries a contradiction that is often overlooked in discussions of constrained innovation. Limited resources can stimulate unconventional thinking and encourage firms to exploit resources more intelligently, yet the same limitations can restrict experimentation, technological development, commercialisation, and growth when they become too severe. Evidence indicates that financial and knowledge constraints can encourage innovation through bricolage, but the effectiveness of this response depends on how firms interpret and manage those constraints (Chen & Shen, 2023; Shen & Chen, 2025). Recent research also demonstrates that responsible innovation can strengthen organisational resilience and sustainable competitive advantage among resource constrained SMEs (Ooi & Memon, 2025). These findings move the debate beyond the simplistic assumption that scarcity either promotes or prevents innovation. The critical concern is whether firms possess sufficient capabilities to transform pressure into productive experimentation without allowing persistent shortages to erode their capacity for renewal. Five interconnected challenges are particularly significant: distinguishing productive constraint from damaging deprivation, scaling innovations created through improvisation, overcoming unequal access to external resources, converting digital accessibility into genuine capability, and transforming short term ingenuity into sustainable competitive advantage.

3.1 Productive Constraints Becoming Restrictive Innovation Capability Barriers

Not every limitation produces ingenuity, and not every shortage deserves to be celebrated as a source of creativity. Financial pressure can encourage firms to simplify innovation and search for unconventional alternatives, but inadequate funding can also prevent prototype development, technology acquisition, market testing, employee development, and commercial expansion. Chen and Shen (2023) demonstrate that knowledge and financial constraints can stimulate innovation through bricolage, with bricolage fully mediating the relationship between knowledge constraints and innovation and partially mediating the effect of financial constraints. This relationship, however, depends significantly on managerial cognition. Shen and Chen (2025) find that divergent and convergent creative thinking influence how entrepreneurs respond to resource constraints through bricolage, demonstrating that identical shortages can produce different organisational responses depending on how decision makers process limitations. Ooi and Memon (2025) provide further evidence that responsible innovation generates stronger sustainability outcomes through organisational resilience and sustainable competitive advantage rather than through scarcity alone. These findings reveal an important threshold problem. Moderate constraint may sharpen attention and discourage waste, whereas severe deprivation can eliminate the resources required to transform ideas into viable innovations. A firm cannot indefinitely substitute creativity for finance, specialised knowledge, technological infrastructure, or skilled human capital. Once scarcity begins preventing experimentation rather than disciplining it, the supposed innovation advantage of constraint becomes

increasingly difficult to sustain. The managerial risk is that short-term ingenuity can conceal capability gaps that later restrict scale and performance.

A more serious danger emerges when repeated improvisation normalises underinvestment and persuades firms that permanent resource deficiency represents an acceptable innovation model. Bricolage is valuable because it enables organisations to act despite imperfect conditions, but continuously making do can prevent the development of capabilities required for more sophisticated innovation. Wang et al. (2025) show that resource bricolage contributes to business model innovation through digital transformation, while entrepreneurship strengthens important relationships within this process. The implication is that bricolage produces stronger outcomes when supported by complementary organisational capabilities rather than functioning as an isolated substitute for them. Yu et al. (2025) similarly find that entrepreneurial bricolage positively influences disruptive innovation among Chinese SMEs, with learning from failure strengthening this relationship under institutional voids. Sacanamboy-Trujillo and Escandón-Barbosa (2025) further demonstrate that strategic flexibility, sustainability orientation, and institutional leverage capability are important drivers of frugal innovation. Resourcefulness should therefore function as a bridge towards stronger capability, not as justification for avoiding investment. Firms must determine which constraints encourage discipline and which shortages undermine future competitiveness. Failure to make this distinction can trap organisations in a cycle where immediate problems are repeatedly solved through ingenuity while the technological, financial, and managerial foundations required for substantial innovation remain persistently underdeveloped.

3.2 Commercialisation Gaps Separating Clever Solutions Scalable Innovation

A brilliant solution developed with almost nothing may still fail when confronted with the demands of commercial expansion. Resource constrained firms often innovate through rapid experimentation, personal knowledge, informal collaboration, flexible processes, and unconventional combinations of available resources. These approaches can generate effective prototypes or local solutions, but commercial success introduces different requirements involving consistency, capacity, quality assurance, distribution, financing, intellectual property, customer support, and organisational coordination. Yu et al. (2025) demonstrate that entrepreneurial bricolage can strengthen disruptive innovation, particularly when firms possess the ability to learn systematically from failure. The importance of learning suggests that successful bricolage requires more than repeated improvisation. Discoveries generated through experimentation must eventually become organisational knowledge capable of supporting subsequent innovation. Sacanamboy-Trujillo and Escandón-Barbosa (2025) similarly find that strategic flexibility contributes to frugal innovation, reinforcing the importance of adapting resource configurations as organisational requirements change. Research on microentrepreneurs published in 2025 further identifies the absence of actionable innovation processes as an important challenge for firms operating under financial, managerial, and operational limitations. The underlying issue is therefore not whether constrained firms can innovate. Many clearly can. The more difficult question is whether their innovations can survive the transition from entrepreneurial improvisation to repeatable commercial execution without losing the simplicity and resource efficiency that originally made them distinctive.

Scaling also changes the resource equation because growth frequently requires capabilities that were unnecessary during early experimentation. Increased demand may require formal production

systems, additional employees, stronger suppliers, regulatory compliance, sophisticated technologies, working capital, and professional management. Resource bricolage must consequently evolve as the organisation moves through different stages of development. Li and Wang (2025), examining rural tourism small enterprises longitudinally, identify an evolution from differentiated to integrative and eventually collaborative micro innovation strategies, with social capital and resource bricolage forming central mechanisms within that progression. Wang et al. (2025) similarly show that digital transformation can mediate the relationship between bricolage and business model innovation, indicating one mechanism through which informal resourcefulness can develop into broader organisational transformation. Zhang (2025) further demonstrates that bricolage capability supports frugal innovation and circular supply chain implementation among Chinese SMEs, while entrepreneurial leadership strengthens important relationships within the model. These findings expose a commercialisation dilemma. Excessive formalisation can destroy the agility that made constrained innovation effective, whereas insufficient formalisation can prevent scale. Firms therefore need to institutionalise successful knowledge without bureaucratising creativity. The competitive potential of scarcity becomes meaningful only when an improvised solution can progress into a dependable offering, process, or business model capable of generating value repeatedly across a larger market. The commercialisation challenge is also visible in Malaysian SMEs, where technological learning and innovation must ultimately be converted into economic growth rather than remaining isolated experimentation (Yusof et al., 2025).

3.3 Unequal Network Knowledge Access Restricting Complementary Resource Mobilisation

What a firm does not possess internally can sometimes be accessed through relationships, but such access is far from equally distributed. Networks can connect resource constrained firms with knowledge, technology, customers, suppliers, expertise, financing, and market opportunities that would be prohibitively expensive to develop independently. Li and Shafait (2025), using evidence from 379 SMEs, find that network embeddedness significantly influences innovation performance through the partial mediation of resource bricolage. Their findings demonstrate that external relationships can increase the productive possibilities available to firms with limited internal resources. Organisational readiness nevertheless moderates the relationship between bricolage and innovation performance, indicating that access itself does not guarantee successful exploitation. Research on disruptive innovation provides a similarly nuanced picture. The 2025 study published in *Industrial Marketing Management* finds that bricolage mediates the relationship between environmental dynamism and disruptive innovation, while different managerial ties produce contrasting effects depending on whether market or technological dynamism is involved. Networks therefore create opportunities and constraints simultaneously. Their value depends on what resources they provide, how those resources complement internal capabilities, and whether firms possess sufficient absorptive and managerial capacity to transform external access into innovation. Simply being connected does not ensure that strategically valuable resources will become available at the right time or on favourable terms.

Dependency represents the less visible side of network based resource access. Firms that rely extensively on external partners can expand their effective resource base, but they may also become vulnerable when critical knowledge, technology, distribution, or market access remains controlled by others. Li and Shafait (2025) demonstrate that organisational readiness strengthens the productive effect of resource bricolage, reinforcing the importance of internal capability even within highly

networked innovation environments. Li and Wang (2025) similarly show that social capital and resource bricolage evolve together as small enterprises progress through different innovation strategies, suggesting that relationships must be continuously reconfigured rather than treated as static resources. The findings of Yu et al. (2025) add another dimension by demonstrating that institutional conditions and failure based learning influence the effectiveness of entrepreneurial bricolage in producing disruptive innovation. Resource constrained firms should therefore avoid replacing internal scarcity with excessive external dependence. Relationships are strategically valuable when they extend organisational capability while simultaneously facilitating learning and knowledge accumulation. They become problematic when the firm cannot innovate without continuous access to particular individuals, partners, or institutions. The contemporary challenge is to construct networks that provide complementary resources while allowing firms to internalise strategically important knowledge. Competitive possibility depends not merely on borrowing what is missing, but on becoming progressively more capable through the process of external collaboration.

3.4 Digital Accessibility Failing Genuine Organisational Capability Development

Technology has lowered many barriers to innovation, yet affordability of digital tools has not eliminated the capability gap separating firms. Cloud applications, digital platforms, artificial intelligence, analytics, online marketplaces, and collaborative technologies can allow smaller organisations to perform activities that previously required substantial capital investment. Their availability creates significant possibilities for firms attempting to innovate without extensive physical or financial resources. Wang et al. (2025) demonstrate that resource bricolage positively affects business model innovation and that digital transformation partially mediates this relationship. The result indicates that digitalisation can amplify the strategic value extracted from existing resources rather than merely adding another technological asset. Nevertheless, the same study identifies entrepreneurship as an important conditioning factor, demonstrating that technology requires appropriate managerial orientation before it contributes fully to innovation. Sacanamboy-Trujillo and Escandón-Barbosa (2025) similarly identify strategic flexibility and institutional leverage capability as significant drivers of frugal innovation, highlighting the importance of complementary organisational capabilities when firms attempt to generate more value from fewer resources. Digital opportunity should consequently be interpreted as potential rather than capability. Firms can possess subscriptions, software, platforms, and connectivity while remaining unable to redesign processes, exploit data, integrate systems, or convert technological access into commercially meaningful innovation.

Poorly directed digital investment can be particularly damaging for resource constrained firms because unsuccessful technology expenditure consumes resources that are already difficult to replace. The attraction of new technology can encourage firms to acquire digital tools without first determining whether those technologies address meaningful customer, operational, or innovation problems. Wang et al. (2025) provide evidence that the value of digital transformation lies partly in its ability to translate bricolage into business model innovation, suggesting that technology should connect directly with strategic resource use rather than exist as an isolated modernisation project. Ooi and Memon (2025) further show that innovation contributes to stronger sustainability outcomes through resilience and sustainable competitive advantage, illustrating the importance of organisational mechanisms that convert innovative activity into performance. Sacanamboy-Trujillo

and Escandón-Barbosa (2025) likewise demonstrate that frugal innovation depends on strategic capabilities rather than resource efficiency alone. Resource constrained firms should therefore evaluate digital investments according to the specific capability they strengthen, such as customer insight, experimentation speed, process efficiency, market access, knowledge sharing, or scalability. Digitalisation becomes strategically useful when it expands what scarce resources can accomplish. When technology is adopted without complementary skills, data, processes, and strategic direction, it can simply introduce new expenditure, complexity, and dependency into an organisation already struggling with limited resources. Research on agro-food SMEs likewise indicates that digital innovation and smart technologies require complementary organisational capability before they can generate sustainable competitiveness (Yusof et al., 2025).

3.5 Temporary Ingenuity Struggling Sustain Lasting Competitive Advantage

The decisive test begins after the initial breakthrough, when an improvised solution must prove that it can generate value repeatedly. Scarcity may stimulate a novel product, unconventional process, or creative business model, but sustainable competitive advantage requires more than producing a successful response once. The firm must preserve useful knowledge, improve the innovation, protect customer value, strengthen resilience, and continue adapting as competitors imitate the original solution. Ooi and Memon (2025), using data from Malaysian SMEs, find that responsible innovation significantly enhances organisational resilience, which subsequently strengthens sustainable competitive advantage and sustainability performance. This evidence is important because it demonstrates that innovation becomes strategically consequential through capabilities that sustain performance beyond the original innovative act. Yu et al. (2025) similarly establish that entrepreneurial bricolage promotes disruptive innovation and that learning from failure strengthens this effect. Zhang (2025) connects bricolage capability with frugal innovation and circular supply chain implementation, further demonstrating that resourceful innovation can influence broader organisational transformation when supported by entrepreneurial leadership. The central issue is therefore one of conversion. Creativity must become capability, experimentation must generate learning, and successful improvisation must eventually contribute to a competitive position that remains valuable after the immediate constraint has disappeared or competitors have developed similar solutions.

Sustaining advantage also requires firms to abandon the assumption that remaining permanently resource poor is desirable. The purpose of constrained innovation should be to improve the productivity of resources, not to preserve scarcity as an organisational identity. Sacanamboy-Trujillo and Escandón-Barbosa (2025) demonstrate that frugal innovation is strengthened by strategic flexibility, sustainability orientation, and institutional leverage capability, showing that sophisticated organisational capabilities remain necessary even when innovation emphasises affordability and resource efficiency. Li and Shafait (2025) similarly establish that organisational readiness strengthens the relationship between resource bricolage and innovation performance. Ooi and Memon (2025) show that organisational resilience provides a critical pathway from responsible innovation towards sustainable competitive advantage. Together, these findings suggest that the strongest resource constrained firms eventually become selective about scarcity. They preserve the discipline to avoid unnecessary expenditure, the creativity to recombine resources, and the agility to experiment rapidly, while investing deliberately in capabilities that cannot remain underdeveloped. Financial capacity, specialist knowledge, digital competence, scalable processes, managerial

systems, and strategic partnerships may require purposeful accumulation as the firm grows. Competitive possibility therefore emerges not from having fewer resources indefinitely, but from learning how to distinguish resources that can be substituted through ingenuity from capabilities that must eventually be built. The enduring advantage of scarcity lies in the resource intelligence it can create, not in scarcity itself.

4. RESOURCE INTELLIGENCE ARCHITECTURE STRENGTHENING COMPETITIVE INNOVATION CAPABILITY

The central question is no longer whether firms can innovate with limited resources, but how they can prevent scarcity from defining the boundaries of their future competitiveness. Evidence increasingly suggests that constraints can stimulate innovation when firms respond through bricolage, learning, strategic flexibility, networks, and disciplined resource deployment rather than passive adaptation. Chen and Shen (2023) establish that knowledge and financial constraints can stimulate innovation through bricolage, while Li and Shafait (2025) demonstrate that network embeddedness strengthens SME innovation performance partly through the same mechanism. At the organisational level, resource orchestration provides an equally important explanation because effective resource management can improve innovation and subsequent MSME performance (Wang et al., 2025). Yet these findings should not encourage an uncritical celebration of scarcity. Bricolage can increase innovativeness while simultaneously generating additional operating costs, demonstrating that resourcefulness contains both productive and potentially restrictive consequences (An et al., 2024). The discussion therefore advances a more balanced interpretation. Competitive possibility emerges when firms recognise which constraints should stimulate creativity, which resources should be recombined, which capabilities should be accessed externally, and which deficiencies require deliberate investment. Scarcity becomes strategically valuable only when it improves resource intelligence without permanently limiting organisational ambition.

4.1 Selective Resource Discipline Preventing Permanent Organisational Deprivation

Not all shortages deserve the same managerial response. Some constraints can sharpen strategic priorities by forcing firms to distinguish essential activities from expenditure that contributes little to customer value, whereas others directly undermine the capabilities required for innovation. Chen and Shen (2023) provide empirical support for this distinction by demonstrating that financial and knowledge constraints can promote firm innovation through bricolage rather than exerting a uniformly negative effect. However, the positive relationship depends on the capacity to reorganise and exploit available resources, meaning that scarcity itself should not be interpreted as the source of competitive advantage. Ukbaeva et al. (2026) similarly show that constraints can be deliberately incorporated into new product development as inputs that stimulate creative responses and sustainable production. This perspective changes the managerial meaning of resource limitation. Instead of attempting to eliminate every constraint, firms can identify limitations that encourage simplification, experimentation, and sharper resource allocation while protecting capabilities whose absence would prevent innovation altogether. Financial discipline, for example, may reduce unnecessary experimentation, but insufficient working capital can prevent promising innovations from reaching commercialisation. Limited technological infrastructure may stimulate unconventional solutions, yet persistent technological deficiency can eventually restrict product sophistication. The critical capability is therefore discrimination, meaning the ability to determine which constraints create productive tension and which have crossed the threshold into damaging

deprivation. This interpretation places resource intelligence at the centre of strategic innovation under constraint.

Such discrimination becomes increasingly important as firms progress beyond early survival and attempt to build sustainable innovation capacity. Milanov et al. (2024) demonstrate the dual character of bricolage in new venture internationalisation. Their findings indicate that bricolage can contribute positively through greater innovativeness while simultaneously imposing negative consequences through higher operating costs. This evidence challenges the assumption that continuously improvising with existing resources represents an economically superior approach. Resource constrained firms can become highly effective at solving immediate problems while unknowingly accumulating inefficiencies, fragmented processes, and dependence on temporary solutions. Resource orchestration research provides an alternative trajectory. Wang et al. (2025) find that effective resource management promotes innovation among MSMEs and that innovation subsequently contributes to stronger performance, whereas diversification does not automatically deliver comparable benefits. Sacanamboy-Trujillo and Escandón-Barbosa (2025) likewise demonstrate that strategic flexibility, sustainability orientation, and institutional leverage capability contribute significantly to frugal innovation. Firms should consequently preserve the discipline created by scarcity without preserving scarcity itself. Resources that can be substituted through creativity should remain lean, while knowledge, technology, talent, systems, and market capabilities that determine future competitiveness require deliberate investment. Innovation without abundance becomes sustainable when resource efficiency reflects strategic choice rather than organisational inability.

4.2 Improvisation Transformation Creating Repeatable Scalable Innovation Capability

What succeeds once through ingenuity must eventually succeed repeatedly through organisational capability. This distinction separates temporary problem solving from innovation capable of supporting sustained growth. Bricolage encourages managers to experiment with resources already at hand, but successful experiments need to be translated into knowledge, processes, routines, and business models that can function beyond the individuals who created them. Do Do Vale et al. (2021) demonstrate that business model innovation during digital transformation involves an interaction between emergent bricolage practices and formal organisational design rather than being exclusively driven from either direction. Their findings are particularly relevant to resource constrained firms because they illustrate how informal experimentation can contribute to more structured organisational transformation. Li, Cao, and Li (2025) extend this argument by showing that resource bricolage promotes micro innovation in new ventures through ambidextrous learning, with customer participation and government support shaping important relationships within the innovation process. Learning therefore becomes the mechanism through which improvisation acquires organisational permanence. Firms that merely solve individual problems remain dependent on repeated improvisation, whereas firms that extract transferable knowledge from those solutions progressively strengthen their innovation capability. The challenge is not to replace experimentation with bureaucracy, but to preserve creative flexibility while ensuring that valuable discoveries become accessible beyond the immediate context in which they emerged.

Commercial scalability introduces a further requirement because an innovative solution can lose its economic attractiveness when production volume, customer diversity, regulatory obligations, and

operational complexity increase. Li and Wang (2025) provide useful longitudinal evidence by identifying an evolution from differentiated to integrative and eventually collaborative micro innovation strategies among small enterprises, with changing forms of social capital and bricolage driving that progression. This suggests that resource configurations appropriate during one development stage may become unsuitable during another. Wang, Zhang, and Chun (2025) similarly establish that resource bricolage facilitates digital transformation and that digital transformation partially mediates the relationship between bricolage and business model innovation. A 2025 framework for microentrepreneurs further emphasises that frugal innovation requires an actionable process capable of navigating financial, managerial, and operational limitations rather than relying solely on spontaneous creativity. Scaling constrained innovation therefore requires selective formalisation. Processes that protect quality, intellectual knowledge, customer experience, operational consistency, and learning should become more structured, while experimentation should remain sufficiently flexible to respond quickly to emerging opportunities. Firms that achieve this balance can transform bricolage from a survival behaviour into an innovation capability. Those that cannot may remain inventive but commercially fragile, continuously generating promising solutions without developing the organisational architecture required to capture their full economic value. Product-development evidence reinforces this logic by showing that innovation and growth depend on repeatable practices capable of coordinating knowledge, resources, and development decisions (Yusof et al., 2025).

4.3 External Relationships Building Sustainable Internal Organisational Capability

Ownership is no longer the only meaningful indicator of the resources available to a firm. Networks can effectively enlarge organisational resource boundaries by providing access to knowledge, customers, technology, expertise, suppliers, institutional support, and complementary capabilities. Li and Shafait (2025) demonstrate that network embeddedness improves SME innovation performance through the partial mediation of resource bricolage, while organisational readiness strengthens the relationship between bricolage and innovation performance. The implication extends beyond the conventional argument that networking is beneficial. External relationships generate competitive possibility when firms can convert accessible resources into combinations that produce meaningful innovation. Li and Wang (2025) similarly identify social capital and resource bricolage as central mechanisms explaining the evolution of micro innovation strategies among rural tourism small enterprises. Ur Rehman et al. (2024) add a knowledge dimension by demonstrating that sustainable leadership and knowledge sources contribute to frugal innovation, while information credibility influences relevant relationships. These findings collectively suggest that the effective resource base of a constrained firm extends beyond its balance sheet. A small enterprise possessing limited internal assets can still construct considerable innovation capacity when it is embedded within relationships that provide complementary knowledge and opportunities. Competitive weakness therefore arises not only from insufficient ownership, but also from isolation and an inability to mobilise resources available beyond organisational boundaries.

The strategic problem begins when external access becomes dependency rather than capability development. Firms can borrow expertise, technologies, market channels, or institutional relationships, but excessive reliance on external actors can leave innovation vulnerable when those relationships weaken or disappear. Organisational readiness is important precisely because externally obtained resources require internal mechanisms capable of evaluating and exploiting them (Li & Shafait, 2025). The longitudinal evidence of Li and Wang (2025) further demonstrates that

the role of social capital changes across stages of enterprise development, moving through different combinations of bridging, bonding, and linking relationships. This dynamic interpretation suggests that firms should not simply accumulate contacts. They need portfolios of relationships that evolve alongside innovation requirements. Ur Rehman et al. (2024) reinforce the importance of knowledge quality by showing that credible information matters to the development of frugal innovation. External collaboration should consequently produce two outcomes simultaneously. The first is immediate access to resources that the firm cannot efficiently own. The second is internal learning that strengthens future independence and absorptive capacity. Partnerships that deliver only the first outcome may solve current shortages while reproducing future dependency. Relationships that achieve both can progressively convert borrowed resources into organisational capability, enabling firms to expand their innovation possibilities without abandoning the efficiency advantages associated with selective external access.

4.4 Digitalisation Amplifying Organisational Resource Intelligence Innovation Capability

Technology creates its greatest advantage for constrained firms when it increases the productivity of resources they already possess. Digital transformation can extend customer reach, accelerate experimentation, improve information flows, connect dispersed knowledge, automate repetitive activities, and support new approaches to value creation without necessarily requiring the physical infrastructure traditionally associated with organisational scale. Wang, Zhang, and Chun (2025) provide empirical evidence that resource bricolage positively influences both digital transformation and business model innovation, while digital transformation partially mediates the relationship between the two. This relationship indicates that digitalisation can act as a conversion mechanism through which resourceful behaviour develops into broader innovation. Research on digital bricolage provides an important qualification. Microenterprises operating in resource constrained environments can follow different digitalisation pathways, including parallel bricolage, selective bricolage, and more deliberate digital planning, demonstrating that small firms do not necessarily digitalise through highly engineered transformation programmes (Madon et al., 2025). The implication is particularly important for firms with limited financial capacity. They do not need to imitate the technological architecture of large corporations to benefit from digitalisation. A more appropriate approach is to select technologies according to specific problems, resource gaps, and value creation opportunities. Digital sophistication should therefore be judged by strategic usefulness rather than the quantity or novelty of technologies adopted.

Technology nevertheless becomes counterproductive when firms digitise faster than they develop the organisational capability required to exploit it. The availability of inexpensive platforms and artificial intelligence can create the impression that technological scarcity has disappeared, yet access does not automatically produce competence. Wang, Zhang, and Chun (2025) show that entrepreneurship strengthens the relationships connecting resource bricolage, digital transformation, and business model innovation, indicating that managerial orientation remains critical even when technology is available. Karanasios et al. (2025) similarly reveal limits to digital bricolage, demonstrating that emergent and frugal approaches to digitalisation follow distinct pathways rather than producing uniform outcomes. Recent research on ambidextrous market orientation further finds that digital resource bricolage partially mediates relationships between market orientation and digital business model innovation, while environmental turbulence shapes resource responses (Zhang et al., 2025). Digital investments should consequently be evaluated according to the organisational

leverage they provide. A modest technology that substantially improves customer insight or operational coordination may create greater value than a sophisticated system that employees cannot integrate into everyday decisions. For resource constrained firms, the relevant objective is not digital abundance. It is digital precision, meaning the deliberate use of technology to multiply the value generated from scarce knowledge, relationships, time, capital, and managerial attention. Digital participation can also widen entrepreneurial opportunity when technology is used to extend market access, information exchange, and innovation activity among resource-constrained business owners (Yusof et al., 2025).

4.5 Resource Intelligence Building Sustainable Competitive Innovation Advantage

The enduring advantage is not the shortage itself, but the organisational intelligence developed while learning to operate within it. Firms exposed to resource constraints can become more attentive to waste, more willing to challenge established assumptions, and more capable of recognising alternative uses for existing assets. However, these behaviours become strategically valuable only when they contribute to superior innovation and performance. Flaminiano (2024) finds that entrepreneurial bricolage significantly increases the probability of product, process, and marketing innovation among SMEs, confirming that creative recombination can generate innovation across multiple organisational domains. Appiah et al. (2025) provide a complementary perspective by demonstrating that the ability to orchestrate green process innovation contributes to SME financial performance, particularly under supportive customer driven green strategies and value cocreation conditions. Zhang, Liu, and Zhao (2024) likewise show that frugal innovation can emerge through different configurations of organisational and environmental conditions, illustrating that no single resource formula explains successful constrained innovation. Competitive possibility should therefore be interpreted as a configurational outcome. Resourceful firms succeed because they combine scarcity awareness with appropriate leadership, learning, external relationships, technology, and resource deployment. Their advantage lies in making better strategic combinations, not simply in possessing fewer inputs. Sustainable SME growth is similarly strengthened when entrepreneurial competencies are developed and applied as organisational capabilities rather than treated as isolated individual attributes (Yusof et al., 2025).

Sustainable competitiveness ultimately requires firms to preserve resource discipline even as their access to resources improves. Growth can gradually weaken the behaviours that originally supported constrained innovation by encouraging organisational complexity, unnecessary expenditure, and increasingly rigid processes. Frugal innovation offers an important counterweight because it maintains attention on essential functionality, affordability, and resource efficiency. Sacanamboy-Trujillo and Escandón-Barbosa (2025) show that institutional leverage capability, sustainability orientation, and strategic flexibility significantly drive frugal innovation, demonstrating that sophisticated organisational capabilities can coexist with resource conscious innovation. Wang et al. (2025) similarly demonstrate that effective resource orchestration strengthens innovation and MSME performance, reinforcing the proposition that resource management remains strategically important beyond the period of acute scarcity. Zhang, Liu, and Zhao (2024) further establish that firms can achieve frugal innovation through multiple configurations, suggesting that competitive pathways need not depend on a single resource profile. The most capable firms should therefore evolve from involuntary scarcity towards deliberate resource selectivity. They invest where additional capability creates strategic leverage, remain frugal where expenditure adds little value,

collaborate where ownership is unnecessary, and continuously recombine resources as opportunities change. Under this logic, abundance ceases to be the objective and scarcity ceases to be the constraint. The genuine competitive capability is knowing precisely what the firm needs, what it can creatively substitute, what it should access externally, and where investment is indispensable for the next stage of innovation.

5. SCALABLE INNOVATION CAPABILITY PATHWAYS STRENGTHENING RESOURCE CONSTRAINED FIRMS

Creating competitive advantage with limited resources requires more than encouraging firms to become creative under pressure. The evidence developed across the current issues and discussion indicates that scarcity becomes strategically productive only when organisations possess mechanisms for distinguishing useful constraints from damaging deficiencies, converting improvisation into repeatable capabilities, accessing complementary external resources, deploying technology selectively, and preserving resource discipline as they grow. Recent studies demonstrate that bricolage can stimulate innovation, yet its benefits depend on learning, organisational readiness, leadership, networks, and effective resource orchestration (Li & Shafait, 2025; Yu et al., 2025). Frugal innovation likewise offers firms an alternative pathway for creating customer value with fewer resources, but successful implementation requires strategic flexibility, knowledge access, sustainability orientation, and disciplined managerial processes (Ur Rehman et al., 2024; Labanie & Pusparini, 2026). The strategic objective should therefore move beyond surviving resource limitations towards developing an organisational architecture that deliberately converts constraints into learning and innovation. Five priorities are proposed: establishing a resource constraint portfolio, institutionalising scalable bricolage, constructing external resource ecosystems, applying selective digitalisation, and transforming resource intelligence into a lasting organisational capability.

The broader implication is that firms should ultimately pursue resource intelligence rather than resource abundance. Competitive advantage does not arise because an organisation has learned to survive with less, nor because it eventually possesses more than its competitors. It emerges from superior judgement concerning how resources are selected, combined, accessed, developed, protected, and redeployed as circumstances change. Iqbal and Piwovar-Sulej (2025) demonstrate that organisational networking can support frugal innovation through entrepreneurial bricolage, illustrating how external relationships and internal resourcefulness can operate together rather than as competing approaches. Ledi (2024) likewise shows that competitive intelligence and frugal innovation contribute to SME value creation during crisis, with absorptive capacity strengthening the ability to transform information and innovation into meaningful outcomes. Appiah et al. (2025) further establish that effective orchestration determines whether innovative resources ultimately generate financial performance. These insights provide a coherent strategic direction for resource constrained firms. Constraints should stimulate questions, bricolage should generate experiments, networks should expand access, digitalisation should multiply capability, and learning should convert temporary solutions into repeatable organisational strengths. When these mechanisms operate together, scarcity no longer determines what the firm cannot achieve. Instead, it becomes the discipline through which the organisation learns to identify what truly deserves resources and how those resources can generate the greatest possible strategic value.

5.1 Resource Constraint Portfolios Separating Productive Scarcity Strategic Deficiency

Managers should begin by abandoning the assumption that all resource shortages should either be eliminated or celebrated. Different constraints produce different strategic consequences, and organisations require a systematic mechanism for distinguishing those that encourage ingenuity from those that suppress innovation. A resource constraint portfolio can classify financial, technological, human, knowledge, operational, and market limitations according to their severity, strategic importance, substitutability, and potential influence on innovation. Flaminiano (2024) demonstrates that entrepreneurial bricolage can increase the probability of product, process, and marketing innovation among SMEs, confirming that creative recombination offers a legitimate response to inadequate resources. However, Milanov et al. (2024) identify a dual effect whereby bricolage supports internationalisation through greater innovativeness while simultaneously creating disadvantages through higher operating costs. This evidence implies that making do is not inherently economical. Managers should therefore identify constraints that encourage simplification, experimentation, and sharper prioritisation while separately identifying shortages that damage product quality, learning, technological competence, or commercial execution. Productive constraints can remain deliberately tight, whereas strategically destructive deficiencies should trigger investment, collaboration, financing, recruitment, or capability development. This classification prevents scarcity from becoming an indiscriminate management philosophy and allows firms to preserve resource discipline without institutionalising organisational weakness. Implementation should therefore connect resource discipline with explicit investment thresholds, learning routines, and performance review.

Resource allocation should subsequently be governed by strategic leverage rather than equal distribution across competing needs. Investments deserve priority when they remove bottlenecks that prevent several other resources from generating value. For example, additional technology may have limited impact when employees lack the knowledge required to exploit it, while stronger managerial competence or absorptive capacity may unlock benefits across several existing resources. Appiah et al. (2025) demonstrate that the financial benefits of green process innovation depend on a firm's capability to orchestrate and deploy innovative resources rather than merely possessing them. Similarly, research on post crisis MSMEs shows that effective resource management strengthens innovation and subsequent performance, whereas diversification alone does not automatically generate superior results. Firms should consequently conduct recurring resource audits examining what they possess, what remains underutilised, what can be recombined, what can be accessed externally, and what must genuinely be acquired. Resource decisions should then be connected to clearly defined innovation objectives rather than incremental budgeting based on historical expenditure. This approach creates a more precise form of frugality. Instead of spending less everywhere, firms spend selectively where additional resources produce disproportionate strategic benefits. Scarcity is consequently transformed from an uncontrolled condition into a managed portfolio of deliberate constraints and carefully chosen investments.

5.2 Bricolage Transformation Creating Repeatable Scalable Organisational Innovation Systems

Successful improvisation should be captured before the knowledge that produced it disappears. Resource constrained firms frequently depend on founders, experienced employees, informal relationships, and situational problem solving to create solutions quickly. These behaviours are

valuable during experimentation but become fragile when innovations must be reproduced across larger volumes, additional employees, new customers, or different locations. Yu et al. (2025) establish that entrepreneurial bricolage positively influences disruptive innovation and that learning from failure strengthens this relationship, particularly under institutional voids. This finding suggests that the competitive value of bricolage depends partly on whether firms learn systematically from experimentation rather than merely repeating improvised responses. Research on SMEs operating in dynamic environments further demonstrates that bricolage mediates the relationship between environmental dynamism and disruptive innovation, although managerial ties can influence the effectiveness of this mechanism. Organisations should therefore document successful experiments, unsuccessful attempts, resource combinations, customer responses, implementation difficulties, and lessons generated during innovation activities. The objective is not to bureaucratised creativity but to prevent valuable knowledge from remaining exclusively within individuals. Short learning reviews, innovation repositories, prototype records, process documentation, and cross functional discussions can progressively convert individual ingenuity into organisational memory. Bricolage then becomes a repeatable capability rather than an accidental response to scarcity.

A structured pathway should also connect experimentation with commercialisation because an inventive solution has limited strategic value if it cannot be delivered reliably to customers. The 2025 frugal innovation framework for microentrepreneurs identifies the need for an actionable process capable of navigating financial, managerial, and operational constraints rather than relying solely on spontaneous creativity. Firms should consequently establish progressive stages covering problem identification, minimum viable experimentation, customer validation, technical refinement, cost evaluation, operational standardisation, and commercial scaling. Each stage should require only the resources necessary to resolve the most important uncertainty before additional investment is committed. This preserves frugality while reducing the danger of scaling weak ideas prematurely. Iqbal et al. (2025) further demonstrate that sustainable development through frugal innovation is influenced by leadership, entrepreneurial bricolage, and knowledge diversity, reinforcing the importance of combining resourcefulness with broader organisational capabilities. The transition from bricolage to scalable innovation should therefore remain selective. Activities affecting safety, quality, intellectual property, customer experience, and operational consistency require formalisation, while exploratory activities should retain sufficient flexibility for rapid experimentation. Such an architecture allows constrained firms to preserve the speed and unconventional thinking associated with bricolage while gradually developing the reliability required for commercial growth.

5.3 External Resource Ecosystems Expanding Organisational Capability Access

What cannot be economically developed internally should be accessed through deliberately designed relationships. Resource constrained firms can extend their effective resource base through customers, suppliers, universities, technology providers, government agencies, industry associations, consultants, financial institutions, and other entrepreneurial firms. Li and Shafait (2025) demonstrate that network embeddedness significantly improves SME innovation performance through resource bricolage and that organisational readiness strengthens the relationship between bricolage and innovation. Xie et al. (2024) similarly find that both market and technology network embeddedness enhance green innovation performance among manufacturing SMEs, with resource orchestration capability strengthening important relationships. Rather than

regarding networks as peripheral social activities, firms should therefore construct resource ecosystems around specific capability gaps. A business lacking specialised technology may develop relationships with technology providers or universities, while another lacking market knowledge may prioritise customers, distributors, and industry partners. External relationships should be evaluated according to the knowledge, technology, credibility, market access, infrastructure, or complementary expertise they provide. This approach allows firms to remain structurally lean while gaining access to resources that would otherwise require substantial investment. Competitive possibility consequently expands without requiring the organisation to replicate the extensive internal resource ownership of larger competitors.

Access, however, should be designed to generate learning rather than permanent dependency. Annamalah et al. (2025) show that open innovation can enable SMEs to utilise external knowledge and collaborative relationships to strengthen technological and sustainable innovation outcomes. Their findings reinforce the strategic potential of organisational relationships but also highlight the importance of internal competencies for successful participation in open innovation. Ur Rehman et al. (2024) similarly demonstrate that knowledge sources contribute to frugal innovation and that information credibility influences relationships surrounding knowledge utilisation. Firms should therefore evaluate external resources according to both immediate contribution and capability transfer. Partnerships should ideally leave the organisation more knowledgeable after collaboration than before it. Joint experimentation, employee exchanges, supplier development, collaborative prototyping, shared digital platforms, and structured knowledge transfer can help convert externally accessed expertise into internal learning. Strategic dependence should also be monitored by identifying capabilities whose sudden withdrawal would significantly disrupt innovation. Where exposure becomes excessive, firms should develop alternative partners or gradually internalise critical knowledge. The objective is not independence from external ecosystems, since such independence may be inefficient, but intelligent interdependence. Resource constrained firms can remain asset light while becoming knowledge rich when external collaboration simultaneously provides immediate capability and strengthens the organisation's future capacity to innovate. Technology-enabled entrepreneurship further illustrates how firms can combine internal capability with external knowledge and digital resources instead of attempting to internalise every resource required for innovation (Yusof et al., 2025).

5.4 Selective Digitalisation Multiplying Scarce Resource Productivity Innovation Capability

Technology investment should begin with a resource problem rather than with the attraction of a fashionable digital solution. Digital tools create strategic value for constrained firms when they multiply the productivity of scarce managerial attention, employee knowledge, customer information, operational capacity, or market access. Wang et al. (2025) demonstrate that resource bricolage contributes positively to digital transformation and business model innovation, with digital transformation partially mediating the relationship between bricolage and business model innovation. Peretz-Andersson et al. (2024) similarly show that artificial intelligence implementation in manufacturing SMEs requires firms to structure, bundle, and leverage AI resources and capabilities rather than simply acquire technology. These findings suggest that constrained firms should prioritise technologies according to leverage rather than sophistication. Low cost cloud applications, digital marketplaces, customer analytics, collaborative platforms, automation, or artificial intelligence may produce substantial benefits when directed towards clearly identified

bottlenecks. Each proposed investment should therefore answer a specific question: which scarce resource will become more productive because of this technology? If the answer cannot be demonstrated, implementation should be postponed. Such discipline prevents digitalisation from consuming scarce capital without strengthening innovation capability.

Digital readiness must simultaneously receive greater attention because access to technology does not eliminate capability constraints. Clemente-Almendros et al. (2024) find that managerial education, internationalisation, and firm size significantly influence digital transformation among SMEs, demonstrating that digital adoption depends on organisational characteristics and knowledge rather than technological availability alone. Sagala and Ori (2024), through a systematic review of SME digital transformation, similarly identify the complexity of achieving successful digital transformation and emphasise the interaction of organisational, technological, and environmental factors. Digital bricolage research adds another important perspective. Karanasios et al. (2025) identify different digitalisation pathways among microenterprises operating in resource constrained environments, demonstrating that smaller firms frequently digitalise through emergent and frugal processes rather than conventional large scale transformation programmes. Firms should consequently adopt modular digital strategies that allow experimentation before extensive financial commitment. Small pilots can test whether a technology improves productivity, customer engagement, innovation speed, or decision quality. Successful applications can then be expanded progressively, while ineffective technologies can be abandoned before substantial resources are consumed. This approach aligns digitalisation with the broader philosophy of innovation without abundance. Technology becomes an amplifier of resource intelligence rather than a substitute for it, enabling firms to achieve greater capability without reproducing the expensive digital infrastructures of substantially larger organisations.

5.5 Resource Intelligence Building Sustainable Organisational Competitive Capability

The final priority is to preserve the strategic behaviours learned under constraint even when the firm eventually gains access to greater resources. Growth can unintentionally weaken frugal discipline as expanding organisations accumulate unnecessary processes, technologies, personnel, and features that contribute little to customer value. Resource intelligence should therefore become an explicit organisational capability concerned with knowing where to economise, where to experiment, where to collaborate, and where substantial investment is unavoidable. Ooi and Memon (2025), using evidence from Malaysian SMEs, demonstrate that responsible innovation strengthens organisational resilience, which subsequently contributes to sustainable competitive advantage and sustainability performance. Dost et al. (2025) likewise show that entrepreneurial bricolage encourages frugal innovation and circular economy implementation, with technological turbulence strengthening important relationships within this process. Frugality can consequently contribute to sustainability and resilience when it is embedded within a broader strategic architecture rather than treated solely as cost reduction. Firms should incorporate resource productivity into innovation reviews by assessing customer value generated per unit of financial, material, technological, and managerial resources committed. Innovation teams should be recognised not merely for producing more ideas, but for producing solutions that create stronger value with intelligently configured resources.

Competitive possibility also becomes stronger when resource conscious innovation is connected explicitly to learning and growth. Sant'Ana et al. (2026) position frugal innovation as a strategic

mechanism connecting learning, international growth orientation, and performance, reinforcing the importance of moving beyond short term resource savings towards broader competitive outcomes. Labanie and Pusparini (2026) similarly find that strategic flexibility and sustainability orientation contribute to frugal innovation, which subsequently improves operational performance through greater efficiency and reduced waste. The most recent evidence from Ye et al. (2026) further demonstrates how entrepreneurial bricolage can evolve across opportunity oriented, customer oriented, and strategic forms as resource constrained ventures progress from market entry towards expansion and ecosystem level growth. These findings suggest that resourcefulness should mature alongside the organisation. Early stage firms may depend heavily on improvisation, while growing firms require increasingly sophisticated combinations of learning, partnerships, technology, formal capabilities, and selective investment. Management should therefore periodically reassess whether existing frugal practices continue to create value or have become constraints inherited from an earlier stage of development. The purpose is not to escape scarcity by pursuing abundance. It is to retain the discipline learned from scarcity while acquiring only those resources that materially expand competitive possibility. Green innovation in the automotive context also demonstrates that competitive advantage can be strengthened when innovation choices are connected with sustainability priorities and disciplined resource deployment (Jamaludin et al., 2024).

6. CONCLUSION

Possibility is not reserved for firms with the deepest pockets, the most sophisticated technologies, or the largest pools of talent. The analysis developed in this study demonstrates that firms operating under resource constraints can create meaningful innovation when limitations are met with resourcefulness, strategic judgement, and the capacity to discover value in assets that might otherwise remain overlooked. Bricolage, frugal innovation, resource orchestration, external networks, and digitalisation provide alternative pathways through which constrained firms can recombine existing capabilities, simplify innovation without sacrificing essential value, access complementary resources, and pursue opportunities beyond the apparent limits of their internal resource base. Yet the relationship between scarcity and innovation remains conditional rather than inherently beneficial. Constraints can sharpen priorities and stimulate experimentation, but persistent deficiencies in finance, technology, knowledge, talent, or managerial capability can equally restrict commercialisation and future growth. The strategic significance of scarcity therefore lies not in deprivation itself, but in the quality of organisational judgement exercised in response to it. Firms capable of distinguishing productive constraints from capability destroying shortages are better positioned to preserve the discipline of scarcity while avoiding the stagnation that chronic underinvestment can produce.

Greater strategic importance emerges when improvised responses are converted into capabilities that survive beyond the circumstances that originally created them. Experimentation conducted through bricolage can generate valuable solutions, but sustainable competitiveness requires firms to capture what has been learned, formalise what deserves replication, and strengthen what must eventually operate at scale. The article consequently establishes that external collaboration and digitalisation should not function merely as substitutes for resources that firms cannot afford to own. Networks should progressively strengthen internal knowledge and absorptive capacity, while digital technologies should amplify the productivity of scarce resources rather than consume capital through poorly directed transformation. Equally, frugality should not deteriorate into indiscriminate cost

minimisation. Its strategic value lies in eliminating unnecessary complexity while protecting the capabilities that determine customer value, learning, resilience, scalability, and competitive differentiation. This distinction allows firms to evolve from reactive improvisation towards deliberate resource orchestration. Innovation under constraint then becomes more than an immediate response to shortage. It becomes an organisational capability for continuously deciding where existing resources can be recombined, where external access is sufficient, where technology can create leverage, and where additional investment is essential for future competitiveness.

Ultimately, the most consequential lesson is not that firms can succeed despite having less, but that possessing more does not automatically create a superior capacity to innovate. Competitive possibility emerges from the intelligence with which resources are recognised, prioritised, combined, accessed, and renewed as organisational circumstances change. This understanding moves the strategic conversation beyond the familiar ambition of doing more with less towards a more sophisticated principle of resource intelligence, where firms develop the judgement to know what they genuinely need and how each resource can generate its greatest possible value. Such intelligence enables organisations to preserve the creativity, discipline, adaptability, and sensitivity to opportunity cultivated under constraint while progressively acquiring the capabilities necessary for scale and renewal. Innovation without abundance should therefore not be understood as an argument for permanent scarcity. Its deeper significance lies in demonstrating that competitive strength can originate from superior resource judgement rather than superior resource ownership. When firms learn to treat limitations as signals for sharper choices rather than fixed boundaries on ambition, scarcity can cease to define what is missing and instead reshape what becomes strategically possible.

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The authors declare that there are no financial, professional, or personal interests that could have influenced the preparation or publication of this article.

3. Author Contribution Statement

Mohamed Aslam Pawit: Conceptualization, literature review, development of the conceptual arguments, manuscript preparation, and critical revision.

Mohd Firdaus Osman: Literature synthesis, conceptual development, intellectual input, manuscript review, and refinement.

Both authors reviewed and approved the final manuscript for publication. The manuscript identifies both authors as affiliated with the Faculty of Business and Accountancy, Universiti Poly-Tech Malaysia.

4. Ethics Statement

This article is conceptual in nature and is based entirely on published scholarly literature. It does not involve human participants, surveys, interviews, experiments, or the collection of primary, confidential, or identifiable data. Therefore, institutional ethical approval and informed consent were not required. All scholarly sources were

appropriately acknowledged and cited in accordance with established standards of academic integrity and responsible scholarly practice.

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