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Digital bricolage in sanctioned tourism ecosystems

Zabih-Allah Torabi [a], Colin Michael Hall [b,c,d,e,f,g,*]

[a] Department of Geography and Rural Planning, Tarbiat Modares University, Tehran, Iran
[b] School of Management and Marketing, Massey Business School, Te Kura Whai Pakihi, Massey University, Private Bag 102904, North Shore, Auckland, 0745, New Zealand
[c] Sunway Business School, Sunway University, Kuala Lumpur, Malaysia
[d] The College of Hotel & Tourism Management, Kyung Hee University
[e] Geography Research Unit, University of Oulu, Oulu, Finland
[f] School of Business and Economics, Linneaus University, Kalmar, Sweden
[g] School of Hospitality and Tourism, University of Johannesburg, Johannesburg, South Africa

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ABSTRACT

This constructivist grounded theory study investigates how tourism stakeholders adapt to dual digital constraints: simultaneous international sanctions and domestic filtering. Drawing on 91 in-depth interviews with Iranian operators, we theorize the Perpetual Cycle of Digital Adaptation under Dual Siege. Three processes emerged: Forced Navigation (cognitive mapping generating psychological burden), Survival-Driven Bricolage (platform substitution degrading capabilities), and Striving for Digital Viability (maintaining operations while undermining competitiveness). The framework reveals entropic adaptation, where survival paradoxically accelerates decline through asymmetric feedback loops. Unlike single-constraint contexts where alternatives exist, dual siege creates institutional voids eliminating pathways. The study extends technology adoption theory from voluntary choice toward impossibility-based conditions, reconceptualizes resilience as pathological endurance, and introduces managed deterioration as a state between success and failure.

Introduction

Tourism depends on digital infrastructures for marketing, transactions, and service delivery (Liu & Jiang, 2025). Yet these infrastructures are neither freely accessible nor evenly distributed (Minoia & Jokela, 2022). Iran represents an extreme case where the tourism ecosystem faces a dual technological siege: international sanctions systematically block access to global payment systems (Visa, MasterCard, PayPal), booking platforms (Booking.com, Expedia), and analytics tools, while internal filtering restricts essential communication platforms (Instagram, WhatsApp, YouTube). This simultaneous external-internal constraint creates an institutional void that eliminates standard digital pathways (Khodadadi, 2025). The dual siege undermines assumptions about smart tourism ecosystems (Gretzel et al., 2015) and challenges technology adoption models that presuppose voluntary choice among accessible alternatives (Davis et al., 2024; Venkatesh & Thong, 2012). While prior studies examine sanctions (Seyfi & Hall, 2019) or filtering separately (Chi et al., 2024), the intersection of these constraints, and how tourism ecosystems navigate the resulting impossibilities,

* Corresponding author at: School of Management and Marketing, Massey Business School, Te Kura Whai Pakihi, Massey University, Private Bag 102904, North Shore, Auckland, 0745, New Zealand.
E-mail addresses: zabih.torabi@modares.ac.ir (Z.-A. Torabi), C.M.Hall@massey.ac.nz (C.M. Hall).

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remains unexplored. This study investigates how Iranian tourism stakeholders adapt, improvise, and sustain operations when both global and domestic digital solutions become simultaneously inaccessible.

Tourism ecosystems' exceptional vulnerability to technological constraints stems from their inherent digital dependency, with contemporary operations requiring continuous connectivity for reservation management, customer communication, payment processing, and market visibility (Gutierriz et al., 2025). When dual constraints simultaneously block global platforms and restrict domestic alternatives, tourism stakeholders confront what Santos et al. (2022) term 'forced bricolage' and innovation becomes a survival imperative rather than strategic choice. This constraint-driven adaptation creates ongoing operational challenges: accommodation providers lose booking channels, tour operators cannot access communication platforms, and digital marketing toolkits become obsolete overnight, transforming ecosystems from technology-enabled efficiency toward turbulent frugality (Dost et al., 2025). Three theoretical gaps limit understanding of these dual constraints. First, technology adoption models (the Technology Acceptance Model and Unified Theory of Acceptance and Use of Technology) assume voluntary choice among accessible options (Davis et al., 2024; Dwivedi et al., 2019), failing to explain forced adaptation when technologies become simultaneously inaccessible, a limitation even Karanasios et al.'s (2025) digital bricolage theory cannot address due to its single-constraint focus. Second, institutional complexity literature examines competing demands (Earl & Hall, 2021) but not institutional voids. Third, resilience frameworks in tourism presume eventual recovery (Prayag et al., 2024; Zhao & Li, 2023), yet dual siege represents potentially permanent constraint requiring perpetual adaptation capacity (Sarkar & Mateus, 2024). These gaps therefore necessitate the use of grounded theory to explore how tourism ecosystems navigate technological impossibilities rather than choices.

Unlike single-constraint contexts where substitutes may exist, the Iranian case illustrates converging impossibilities eliminating external and internal pathways. Existing technology adoption theories presuppose choice, rendering them inadequate for this context of complete absence. To capture this complexity, we employ a constructivist grounded theory (Charmaz, 2017). This methodological necessity allows theory to emerge directly from stakeholder practices rather than imposing ill-suited, pre-defined models. We focus on these two mechanisms as they are the most pervasive barriers, and their distinct logics (external-institutional vs. internal-platform) enable theoretical differentiation. Drawing on 91 in-depth interviews with Iranian tourism stakeholders, we examine the cognitive, operational, and adaptive dimensions of constrained digitalization. The study addresses three research questions:

RQ1. How do tourism stakeholders perceive and map the dual technological constraints across their operations?

RQ2. What digital bricolage mechanisms emerge when standard tools become inaccessible, and how frequently do they occur?

RQ3. How do these adaptations influence operational viability, market positioning, and psychological well-being, and through what feedback cycles?

We conceptualize the findings as the Perpetual Cycle of Digital Adaptation under Dual Siege, which extends beyond binary success–failure frameworks. By tracing cross-level mechanisms, we clarify how institutional voids cascade into behavioral adaptations. Our framework demonstrates a direct causal chain: macro-level constraints (sanctions/filtering) narrow platform availability, leading to meso-level contraction of option sets. This imposes micro-level cognitive load, triggering bricolage as a necessary survival response. This grounded theoretical contribution advances three domains. First, it reconceptualizes technology adoption from voluntary optimization toward forced improvisation in dual-constraint contexts. Second, it enriches institutional complexity literature by theorizing institutional voids where the *absence* (not multiplicity) of choice drives organizational behavior. Third, it reframes resilience from recovery-oriented toward perpetual adaptation, challenging assumptions of eventual stabilization. The emergent theory thus fills the identified gaps, providing a framework for organizational behavior under enforced technological absence. The findings also inform tourism stakeholders operating under technological constraints, policymakers managing digital ecosystems under sanctions, and international organizations supporting constrained destinations.

Literature review

Digital platforms mediate nearly all tourism transactions, creating structural rather than optional dependencies (Zeqiri et al., 2025). More than three-quarters of reservations are processed through platform-based systems, with such intermediaries generating the majority of international tourism revenue (Gutierriz et al., 2025). This dependence extends far beyond reservations: payment processing, customer communication, reputation management, and operational analytics are now inseparable from digital infrastructures (Tang, 2024). Tourism ecosystems have therefore become technology-dependent, where digital access functions as the condition of market participation rather than a source of competitive advantage. Small and medium-sized tourism enterprises are particularly exposed because they rely entirely on third-party platforms for visibility and transactions (He et al., 2023). The COVID-19 pandemic reinforced these vulnerabilities by eliminating many non-digital alternatives, establishing digital capability as a prerequisite for survival rather than a matter of strategic choice (Torabi et al., 2023). Across this literature, three interrelated forms of dependency are consistently highlighted: transactional (bookings and payments), communicational (customer engagement and marketing), and analytical (data-driven decision-making), each of which constitutes a potential failure point under disruption (C. Li et al., 2022; Seyfi & Hall, 2019). Taken together, these findings indicate that digital infrastructures no longer operate as neutral enablers but are gatekeepers of tourism ecosystem participation.

Institutional voids in digital infrastructure, i.e., the complete absence of viable technological solutions (Iaquinto et al., 2024), arise through two interlocking constraint layers: international sanctions, which sever access to global financial systems, reservation platforms, and analytical tools (Özdamar & Shahin, 2021), and domestic digital filtering, which blocks communication platforms central to tourism marketing and customer engagement, such as Instagram and WhatsApp (Chi et al., 2024; Zeqiri et al., 2025). Iran exemplifies

this dual siege: external sanctions remove access to Visa, MasterCard, PayPal, Booking.com, and Google business services, while internal filtering simultaneously obstructs the very channels travelers use for destination discovery and communication (Khodadadi, 2025; Seyfi & Hall, 2020). Unlike single-constraint environments where stakeholders can pivot toward substitutes, dual siege eliminates both external and internal pathways, transforming constraint from partial limitation into comprehensive exclusion (Karanasios et al., 2025). This institutional void exposes a profound theoretical gap. The Technology Acceptance Model's criteria of perceived usefulness and ease of use become inapplicable when technologies are absent rather than available for evaluation (Davis et al., 2024). Similarly, the Unified Theory of Acceptance and Use of Technology's assumption that users choose among accessible options collapses when tourism operators confront only blocked or inaccessible platforms (Venkatesh & Thong, 2012). Even crisis-adapted models presuppose temporary disruptions (J. Li et al., 2020), overlooking situations of ongoing absence. In dual-constraint contexts, the core question shifts from which technology should be adopted? to how can operations continue when no standard technologies are available? This shift necessitates new mid-range theories that conceptualize forced improvisation, bricolage, and ecosystem-level adaptation under permanent institutional voids, rather than voluntary selection among alternatives.

Prior studies highlight that under severe resource constraints, organizations engage in three recurring forms of bricolage: (a) recombining available tools for unintended purposes, (b) mobilizing social networks as technological substitutes, and (c) accepting degraded functionality to preserve continuity (Karanasios et al., 2025; Sarkar & Mateus, 2024). The cognitive mechanisms driving these bricolage selections under constraint include satisficing and availability heuristics. Under extreme cognitive load from dual constraints, stakeholders abandon systematic evaluation for rapid pattern-matching, explaining the persistent use of sub-optimal workarounds even when their inadequacies are recognized (Karanasios et al., 2025; Y. Li & Wang, 2025; Sarkar & Mateus, 2024). Iranian tourism stakeholders exhibit these patterns. For instance, hotels transform Telegram channels into quasi-booking systems despite lacking integrated payment functions; travel agencies operate customer service through personal WhatsApp accounts, blurring professional boundaries; and tour guides repurpose Instagram stories as virtual tours, often through VPNs (Virtual Private Network) that reduce video quality and increase costs (Ghaderi et al., 2018). These adaptations reflect what Santos et al. (2022) term forced bricolage, distinct from entrepreneurial bricolage: whereas entrepreneurs combine resources to innovate, forced actors combine resources to survive. This survival orientation carries not only operational implications but also psychological consequences. Mateus and Sarkar (2024) identify cognitive fatigue from constant workarounds, emotional strain from perceived technological inferiority, and frustration arising from the inability to meet service standards.

Empirical evidence from Iran confirms these dynamics (Torabi et al., 2023). Importantly, bricolage unfolds through iterative cycles: stakeholders map accessible resources, experiment with provisional combinations, and institutionalize those that prove viable (Baker & Nelson, 2005). Yet these institutionalizations are continually vulnerable to the next sanction escalation or platform restriction. Rather than reaching stability, this process sustains tourism ecosystems in a mode of perpetual adaptation, where resilience is redefined not as recovery but as endurance under recurring disruption. This dynamic reinforces why existing technology adoption and resilience frameworks premised on stability or recovery cannot fully account for the phenomena observed under dual constraints.

The existing literature reveals a profound theoretical void at the intersection of technology adoption, institutional theory, and organizational resilience. Three critical gaps emerge. First, dominant technology adoption models (e.g., Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology) are predicated on voluntary choice. They lose explanatory power in 'impossibility contexts' where technologies are absent, failing to answer the core question: how do organizations adapt when there is nothing to adopt? Second, institutional complexity literature explains navigating *competing* institutional logics but offers little guidance for 'institutional voids', contexts defined by the complete *absence* of viable pathways. Third, tourism resilience frameworks are overwhelmingly oriented toward recovery from temporary shocks. They fail to theorize 'perpetual adaptation' as a stable state or 'sustained deterioration,' where survival and decline occur in parallel. These gaps demonstrate the need for a new mid-range theory grounded in enforced absence. This study directly addresses these shortcomings by tracing how macro-level constraints (sanctions and filtering) translate into meso-level institutional voids and trigger micro-level adaptive behaviors. Rather than testing ill-suited pre-existing models, we employ grounded theory to build an explanatory framework, theorizing how tourism stakeholders navigate and survive when standard technological pathways are systematically eliminated.

Methodology

Research design and approach

This study employed constructivist grounded theory (Charmaz, 2017) to explain how Iranian tourism stakeholders navigate dual technological constraints of sanctions and domestic digital filtering. Grounded theory was methodologically necessary to allow concepts to emerge inductively from participants' lived practices. The analytic process unfolded through three structured stages: (1) open line-by-line coding of all 91 interview transcripts, which generated 287 discrete concepts representing specific actions, perceptions, and constraints mentioned by participants; (2) focused axial coding that systematically clustered these initial codes into 42 higher-order categories based on conceptual relationships and thematic similarities; and (3) theoretical coding integrating categories into the Perpetual Adaptation Cycle framework. Data were collected through 91 in-depth interviews across three iterative phases: exploratory (interviews 1–30), identifying constraint types and adaptation patterns, focused (31–75), examining bricolage mechanisms, and integrative (76–91), validating relationships and confirming theoretical saturation. This multi-level coding process ensures both empirical grounding and theoretical abstraction. This systematic and context-sensitive approach ensured empirical grounding while enabling access to sensitive information on sanctions circumvention and filtering workarounds.

Participant selection and recruitment

Participant selection followed theoretical sampling principles, evolving as conceptual categories emerged from ongoing analysis. Initial purposive sampling targeted tourism stakeholders with documented experience navigating both sanctions and filtering constraints. As patterns emerged, sampling became increasingly theoretically-oriented, seeking participants who could elaborate specific adaptive mechanisms or disconfirm emerging relationships. Recruitment employed trust-based strategies essential for discussing politically sensitive topics. Industry associations provided initial introductions, lending legitimacy when approaching participants about sanctions-related challenges with several explicitly stating they would not discuss workarounds without verified researcher credentials. Snowball sampling through established business networks accessed participants developing grey-market solutions unreachable through formal channels.

The final sample ($n = 91$) achieved variation across multiple dimensions (see Appendix B). Geographic distribution included Tehran (48), Isfahan (15), Shiraz (12), Mashhad (8), and Yazd (8), capturing differences in international tourist exposure and technological infrastructure. Organizational size ranged from solo entrepreneurs to enterprises with 200+ employees, ensuring diverse resource capacities. Gender distribution (31 female, 60 male) reflected industry leadership patterns while capturing female perspectives on gendered constraint impacts. Three stakeholder groups were deliberately excluded: international tourists (surveillance risks and visa complications), government officials (unwillingness to acknowledge operational difficulties), and tourism employees without decision-making authority (lacking comprehensive perspective). Recruitment continued until theoretical saturation, no new codes emerged after interview 86, with five additional interviews confirming saturation (Appendix C). Participants received information sheets explaining research purposes while avoiding terminology that might trigger surveillance concerns, emphasizing voluntary participation and withdrawal rights.

Data collection procedures

Data collection began with participant recruitment through trust-building channels essential for discussing politically sensitive topics. Initial contact was established via formal endorsements from the Iranian Tour Operators Association and Hotel Owners Society, whose validation proved crucial as participants would not discuss workarounds without verified institutional credentials. Each participant received information sheets emphasizing voluntary participation and anonymization, while avoiding terminology that might trigger surveillance concerns. Interviews followed a semi-structured protocol refined through three iterations, using neutral phrasing (alternative approaches rather than circumvention) (Appendix A). Sessions averaged 68 min (range: 45–95 min), conducted entirely in Persian to capture nuanced expressions of frustration and creativity. Recording protocols reflected security concerns: 43 participants permitted encrypted audio recording, 38 preferred detailed note-taking (particularly when discussing legally ambiguous solutions), and 10 requested no documentation beyond post-interview reconstruction. Interview settings balanced security with data quality: office meetings ($n = 42$) enabled demonstration of workaround systems, cafés ($n = 31$) provided anonymity, and encrypted video calls ($n = 18$) accommodated heightened surveillance periods (Appendix B).

Translation employed a modified back-translation protocol ensuring technical accuracy and conceptual fidelity. The primary translator produced initial English versions preserving precision and emotional nuance. An independent translator unfamiliar with the research context back-translated to Persian, revealing instances where literal translation compromised meaning. Discrepancies were resolved through panel discussions with both translators and practitioners, prioritizing conceptual equivalence.

Data analysis and quality assurance

Analysis followed the constructivist grounded theory approach (Charmaz, 2017), initiated concurrently with data collection to guide theoretical sampling and iteratively refined throughout the process. The analytic trajectory is documented in Appendix C, providing a transparent audit trail from raw text to codes, categories, and theoretical dimensions. Initial line-by-line coding of transcripts produced 287 substantive codes, preserving participants' original phrasing before translation. For instance, one participant remarked, *"I check five different VPNs every morning."* This statement was initially coded as daily VPN rotation, representing a routine behavioral workaround. Through axial coding, it was clustered within the broader category Technology Workaround Management, which later informed the higher-order concept Forced Navigation within the Constraint Maze. Constant comparison operated across three explicit levels: (1) incident-to-incident comparison identified recurring strategies such as VPN rotation, payment intermediaries, and platform substitution; (2) category-to-category comparison revealed relationships among forced navigation (cognitive), technological bricolage (behavioral), and digital viability (consequential); and (3) theoretical comparison with extant models highlighted the distinctiveness of dual-constraint adaptation relative to single-constraint contexts.

Memo-writing generated 156 analytical notes tracing concept evolution. Early memos captured the intensity of psychological burden; mid-phase memos examined bricolage creativity under resource scarcity; and late-phase memos theorized the self-reinforcing dynamics of the Perpetual Adaptation Cycle. While MAXQDA assisted with data organization, theory development was primarily memo-driven, with memos serving as the main vehicle linking codes to conceptual categories. Theoretical saturation was assessed in three layers: informational saturation (no new codes after interview 75), categorical saturation (all dimensions of *Forced Navigation*—cognitive mapping, uncertainty management, erosive burden—were fully specified), and theoretical saturation (relationships stabilized into the Perpetual Cycle model). Interviews 76–91 confirmed these saturation points and validated the emergent theory with participants (Appendix C).

Negative case analysis was systematically integrated throughout the analytical process to strengthen theoretical robustness. During

focused coding, two categories of deviant cases initially appeared to contradict the emerging Perpetual Cycle framework. First, three participants (P22, P48, P79) reported experiencing diminished psychological burden over time rather than cumulative erosion, suggesting potential habituation. Upon closer examination through follow-up probing and cross-case comparison, these cases revealed that reduced burden reflected strategic withdrawal from international markets rather than successful adaptation. This pattern was subsequently integrated into the "Strategic Regression" sub-dimension within Digital Viability. Second, two technology startup founders (P13, P66) demonstrated apparent competitive advantage through bricolage innovations, initially contradicting the deterioration thesis. Analytic resolution revealed these advantages were localized and temporary with both participants acknowledging their solutions remained non-scalable and vulnerable. These negative cases thus refined categorical boundaries thereby strengthening theoretical claims.

Ethical protocols guided all procedures. Information sheets employed neutral phrasing to minimize perceived risk; consent emphasized voluntariness and the absence of business impact; pseudonyms were randomly generated; and encrypted recordings were stored on secure servers in neutral jurisdictions. Trustworthiness strategies included member checking with 15 participants and formal inter-coder reliability testing on 20% of transcripts, achieving $\alpha = 0.87$ (Appendix D). Regular debriefings explicitly examined researcher positionality, thereby strengthening credibility, dependability, and confirmability.

Results and discussion

Forced navigation within the constraint maze

Forced Navigation within the Constraint Maze emerged as the foundational cognitive-operational process through which Iranian tourism stakeholders continuously interpret and respond to dual technological constraints, extending and challenging existing navigation and sensemaking theories. This core category, identified across 87 of 91 participants (95.6%), aligns with Weick and Weick's (1995) concept of environmental scanning but differs fundamentally in its involuntary nature. While Karanasios et al. (2025) describe digital bricolage as creative resource assessment, our participants engage in what we term *constraint reconnaissance*, mapping impossibilities rather than possibilities. A hotel chain manager (P34) captured this distinction: *"Every morning, my first task isn't checking emails or bookings—it's testing which digital doors are open today. I navigate not toward opportunities but around obstacles that multiply daily"*. This resonates with Özdamar and Shahin's (2021) network-based adaptation under sanctions, yet extends their economic focus to include cognitive and emotional dimensions. The *maze metaphor*, appearing spontaneously in 42 interviews (46.2%), contrasts sharply with Gutierriz et al.'s (2025) digital transformation *journey metaphor* which implies progress toward a destination. A digital marketing director (P19) elaborated: "*We're not choosing paths in this maze; we're discovering which walls appeared overnight and which passages still exist*". Unlike Prayag et al.'s (2024) resilience framework assuming eventual system stabilization, this perpetual navigation process encompasses three non-stabilizing dimensions: cognitive mapping (extending static maps to dynamic terrains), emotional processing (contradicting Tang's (2024) digital resilience model which predicts emotional adaptation), and strategic recalibration (challenging Iftikhar et al.'s (2023) assumption of resolution phases).

Cognitive mapping of impossibilities

The cognitive differentiation between sanctions and filtering both supports and fundamentally challenges assumptions about navigating multiple institutional pressures. Høiland and Klemsdal (2022) demonstrate how organizations manage competing institutional logics through selective coupling, yet 78 participants (85.7%) who differentiated constraint types faced not competing logics but converging impossibilities, a distinction requiring theoretical reconceptualization. A travel agency CEO (P12) articulated how this differs from choice-based models: "*Sanctions are like permanent walls—solid, visible, with clear boundaries. But filtering is like shifting sand—Instagram works Monday, blocked Tuesday, partially accessible Wednesday. This unpredictability drains us more than sanctions themselves*". This temporal variability contradicts Santos et al.'s (2022) forced bricolage framework which assumes stable, if limited, resource availability. Participants reported spending 2–3 h weekly testing filtered platforms versus zero for sanctioned services, a pattern partially explained by He et al.'s (2023) digital resilience building, though their model assumes testing leads to capability development while ours shows exhaustive elimination. A boutique hotel owner (P56) revealed the emotional distinction: "*With sanctions, I grieved once and moved on—like accepting a death. With filtering, I'm in constant negotiation, always hoping, always disappointed.*" This perpetual negotiation state contradicts Moayerian et al.'s (2022) resilience model which predicts collective acceptance. The risk differentiation noted by P67: "*Using VPN for Instagram might get fined; circumventing SWIFT could destroy my business,*" aligns with Sharp's (2021) institutional manipulation strategies but reveals a dual-risk calculation absent from single-constraint contexts. Female participants' emphasis on Instagram's visual culture ($n = 31$) supports Zeqiri et al.'s (2025) platform dependency theory while contradicting gender-neutral assumptions, suggesting platform characteristics interact with market segments in ways current theories don't capture.

Participants' systematic cataloging of technological blockages extends cognitive mapping theory while revealing fundamental limitations in existing digital transformation frameworks that assume progressive capability building. This mapping process, documented in 83 interviews (91.2%), superficially resembles Gutierriz et al.'s (2025) digital maturity assessment, yet crucially they map capabilities while our participants map impossibilities. A tour operator (P38) stated: "*Look, I've literally mapped it—green zones are freely accessible like LinkedIn, yellow zones need VPNs like Instagram, red zones are completely blocked like Booking.com, and black zones are sanctions-illegal like PayPal. My staff memorize this map, but it changes weekly.*" This weekly reconfiguration contradicts Davis et al.'s (2024) Technology Acceptance Model which assumes stable technology availability for evaluation. The hierarchical constraint impacts: payment systems (78%), booking platforms (70.3%), marketing channels (64.8%), analytics tools (47.3%), partially support Li

et al.'s (2022) tourism platform dependency hierarchy, though they assume voluntary platform selection while ours shows forced exclusion. A digital consultant (P71) quantified cascade failure: *"losing Google Ads means losing traffic analytics, which means blind marketing spending, which means 40% higher customer acquisition cost."* This cascade mechanism extends Sarkar and Mateus's (2024) bricolage systems theory but reveals negative rather than positive spillovers. Political contingency is absent from apolitical models like those of Venkatesh and Thong (2012) and Lim and Zhang (2022). Women entrepreneurs' micro-mapping practices ($n = 18$) align with Demers and Gond's (2020) micro-foundations of institutional complexity, yet their framework assumes agency in navigating complexity while our data shows constraint-determined navigation paths that eliminate rather than enable choice.

The psychological burden of perpetual navigation

The cumulative psychological burden from continuous constraint navigation fundamentally challenges resilience theories' core assumption that adaptation reduces stress over time, instead revealing an erosive process where each adaptation depletes rather than builds capacity. This burden, reported by 82 participants (90.1%), contradicts Prayag et al.'s (2024) dynamic capabilities model which predicts strengthening through iterative challenges. The three burden dimensions: decision fatigue, anticipatory anxiety, professional grief, extend beyond Staw's (1981) temporary threat-rigidity to reveal perpetual erosion. A technology director (P49) description of severe psychological strain: *"Every morning I wake with overwhelming anxiety about which systems will fail today,"* starkly contradicts He et al.'s (2023) assumption of psychological adaptation. The temporal intensification described by P03: "Each new restriction adds weight to years of accumulated frustration. I'm not adapting; I'm eroding, like stone under constant water," directly contradicts habituation predicted by resilience literature, instead supporting Özdamar and Shahin's (2021) cumulative sanctions impact theory, though extending it from economic to psychological domains.

Fig. 1 synthesizes Forced Navigation not as a static state, but as a dynamic, self-reinforcing cycle locking tourism stakeholders into managed decline. The process begins with the Dual Constraint Entanglement (Layer 1), an external reality eliminating standard operational choices. This forces stakeholders into a continuous loop of Cognitive Mechanisms (Layer 2), such as Mapping Blockage Territories. This cognitive work is not neutral; it directly generates the Psychological and Competitive Impact (Layer 3), notably the "Erosive Cognitive-Affective Burden". This burden shapes the Adaptive Outcomes (Layer 4), where survival is achieved through Expectation Adjustment and Ambition Reduction—ensuring continuity by lowering the definition of success. The model's critical contribution is revealing the asymmetric feedback dynamics that make this cycle perpetual. The dominant "erosive loop" (red arrow) is a vicious cycle: the psychological burden and competitive damage from one cycle deplete cognitive and financial resources for the

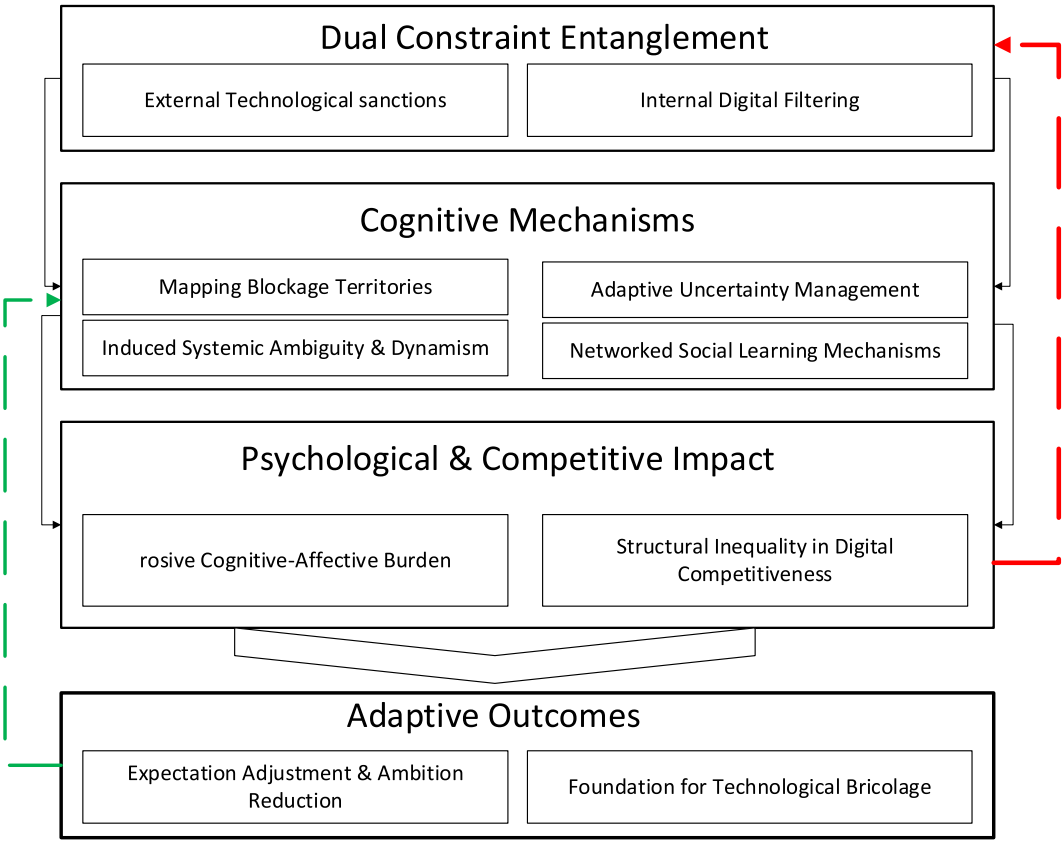

Fig. 1. Cognitive Navigation Mechanisms in Digital Constraint Environments.

next, making future adaptation progressively harder. In contrast, the "reinforcing loop" (green arrow) from occasional successes is weak, providing just enough positive feedback to sustain engagement but insufficient energy to escape the downward spiral. The result is neither recovery nor collapse, but a stable state of "sustained deterioration", a sub-optimal equilibrium where adaptation paradoxically entrenches competitive disadvantage over time.

Survival-driven technological bricolage

Survival-Driven Technological Bricolage emerged as the primary adaptive mechanism through which tourism stakeholders transform constraint recognition into operational continuity, representing a fundamental departure from voluntary innovation toward forced improvisation. This core category, manifested across 86 participants (94.5%), extends Baker and Nelson's (2005) entrepreneurial bricolage (making do with resources at hand) by revealing how dual constraints transform bricolage from creative opportunity into existential necessity. While Karanasios et al. (2025) conceptualize digital bricolage as strategic resource recombination in single-constraint environments, participants engage in *desperation-driven assemblage*, combining inadequate resources not for innovation but for survival. A hotel operations director (P41) distinguished this forced creativity: *"What we do is emergency surgery with kitchen knives—we know it's wrong, dangerous, inefficient, but the patient dies without it."* This distinction critically challenges Santos et al.'s (2022) frugal innovation framework which assumes resource scarcity motivates efficiency gains; instead, dual constraints create efficiency losses where each workaround requires more resources while delivering less functionality. The bricolage process under dual siege differs from Mateus and Sarkar's (2024) three-mechanism model (cognitive, behavioral, social) by adding a fourth dimension: emotional bricolage—the psychological work of accepting ongoing inadequacy. A travel agency owner (P18) articulated: *"Every solution is a compromise, every workaround a step backward from global standards. We're not building toward something better; we're preventing complete collapse."* Unlike Gutierriz et al.'s (2025) digital transformation through creative combination, our participants experience turbulent frugality, Dost et al. (2025) assume eventual stabilization while ours reveals ongoing instability where, rather than a transitional strategy, bricolage becomes the 'normal' operational mode.

Imperfect tool substitution and systematic downgrading

The systematic replacement of inaccessible global platforms with domestic or alternative tools revealed a complex substitution hierarchy where each replacement degraded functionality while increasing operational complexity, a pattern contradicting technology adoption theories that assume functional equivalence among alternatives. Among 86 participants practicing substitution, 79 (91.9%) reported functionality losses exceeding 40%, challenging Davis et al. (2024) who presumes substitute technologies offer comparable utility. The substitution process followed predictable patterns: Instagram to domestic Rubika (68% engagement loss), Booking.com to local Sepehr360 (55% booking capability reduction), Google Analytics to Piwik (triple analysis time for half the insights). A boutique hotel manager (P52) quantified the degradation cascade: *"Booking.com gave us integrated reservation, payment scheduling, review management, and channel distribution. Its 'replacement' Sepehr360 only handles basic reservations—no reviews, no channel management, no international interface. We need four different platforms to replace one, each requiring separate logins, training, and maintenance."* This fragmentation directly contradicts He et al.'s (2023) digital transformation efficiency model which assumes technology consolidation improves performance.

VPN usage for accessing filtered platforms, reported by 89 participants (97.8%), introduced additional complexity layers: speed reduction averaging 70%, connection drops during peak operations, and legal vulnerability. A digital marketing specialist (P73) described the perpetual tool audition: *"I've tested 47 VPNs in two years. Each works temporarily—NordVPN lasted three months, ExpressVPN five weeks, obscure Chinese ones maybe days. I maintain subscriptions to twelve simultaneously, never knowing which will function tomorrow."* This continuous tool churn extends Zeqiri et al.'s (2025) platform dependency theory by revealing dependency without reliability; stakeholders depend on tools they cannot trust. Female entrepreneurs reported gendered substitution challenges, with a women's tour organizer (P29) explaining: *"Instagram alternatives like Rubika have predominantly male users. Marketing women-only tours there is like advertising vegetarian cuisine at a butcher convention—wrong audience, wrong cultural codes, wrong visual language."* Unlike Santos et al.'s (2022) resource substitution leading to innovation, our data reveals substitution as systematic downgrading, where Moayerian et al.'s (2022) community capacity building becomes collective acceptance of inferiority.

Functional reconfiguration: Misusing platforms for survival

Platform reconfiguration, creatively misusing accessible tools for unintended tourism functions, emerged as the most innovative yet problematic bricolage mechanism, simultaneously demonstrating human creativity and systemic dysfunction. This practice, documented in 71 participants (78.0%), extends Sarkar and Mateus's (2024) behavioral bricolage beyond resource combination to include resource transformation, though rather than efficiency gains, we observed functionality compromise averaging 60%. Telegram transformation represented the most common reconfiguration: 61 participants converted messaging channels into booking systems, marketing platforms, and payment coordinators despite lacking essential commerce features. A travel agency director (P44) detailed this: *"We built our entire business on Telegram—channel for marketing with 30,000 followers, bot for automated booking that breaks weekly, group chats for customer service without threading capability, and payment coordination through voice messages. It's like performing surgery with carpenter tools—possible but painful for everyone."*

Functional stretching contradicts platform design principles in Gutierriz et al.'s (2025) digital architecture framework which emphasize purpose-fit technology use. LinkedIn emerged as an unexpected tourism platform, with 43 participants using professional networking for travel marketing, a reconfiguration absent from Tang's (2024) platform purpose taxonomy. A startup founder (P66) observed: *"LinkedIn isn't blocked, has international reach, allows long-form content. So I post 'business travel insights' that are actually tourism*

packages... We've corrupted every feature for tourism purposes." Educational platforms showed surprising tourism applications, with 28 participants using online course systems for virtual tours. A heritage tour guide (P81) explained: *"I create 'courses' on Iranian architecture that are actually virtual tours, 'assignments' that are booking requests, 'certificates' that serve as travel confirmations. The platform thinks I'm teaching; I'm actually selling tourism."* This educational masquerade extends Iftikhar et al.'s (2023) crisis adaptation beyond temporary adjustment. The reconfiguration process also revealed gendered innovation patterns, with female participants showing a third higher platform creativity, possibly due to experience navigating social restrictions. These reconfigurations, while demonstrating remarkable adaptability, violate platform terms of service, creating legal vulnerabilities that Sharp's (2021) institutional manipulation framework doesn't address; stakeholders risk account termination for creatively surviving.

Localized solutions and network activation

The development of localized solutions through network activation revealed how social capital substitutes for technological infrastructure, transforming personal relationships into operational systems. This mechanism, employed by 73 participants (80.2%), extends bonding and bridging capital concepts beyond supplementary resources to primary infrastructure, though our data reveals zero-sum dynamics where network exhaustion threatens relationship sustainability. Family networks emerged as payment processing systems, with 67 participants routing international transactions through relatives abroad, a pattern partially explained by Özdamar and Shahin's (2021) diaspora remittance networks, though they assume voluntary support while our data shows reluctant obligation. A hotel chain owner (P35) mapped his payment network: "*My brother in Toronto processes Canadian bookings, cousin in Dubai handles Middle Eastern clients, nephew in Istanbul manages European payments. Each takes 5-7% commission—they're family but this is business. Last month my brother said he's tired of being my payment gateway; if he stops, I lose 30% of revenue overnight."* This precarious dependency contradicts Moayerian et al.'s (2022) community resilience through collective action, revealing instead network fragility where single relationship failures cascade into operational crises.

Professional networks transformed into technology support systems, with 58 participants sharing workarounds through informal channels that violate both sanctions and filtering regulations. A travel coordinator (P77) described the underground knowledge economy: "*We share adaptation strategies through informal networks—though we're aware this carries risks. The uncertainty around what's permitted creates additional stress."* Such knowledge sharing extends Sharp's (2021) institutional manipulation into legally hazardous territory absent from his framework. Localized solutions included developing simplified internal tools, with 31 participants creating basic databases and booking systems, innovations that Sarkar and Mateus (2024) would celebrate as entrepreneurial bricolage but

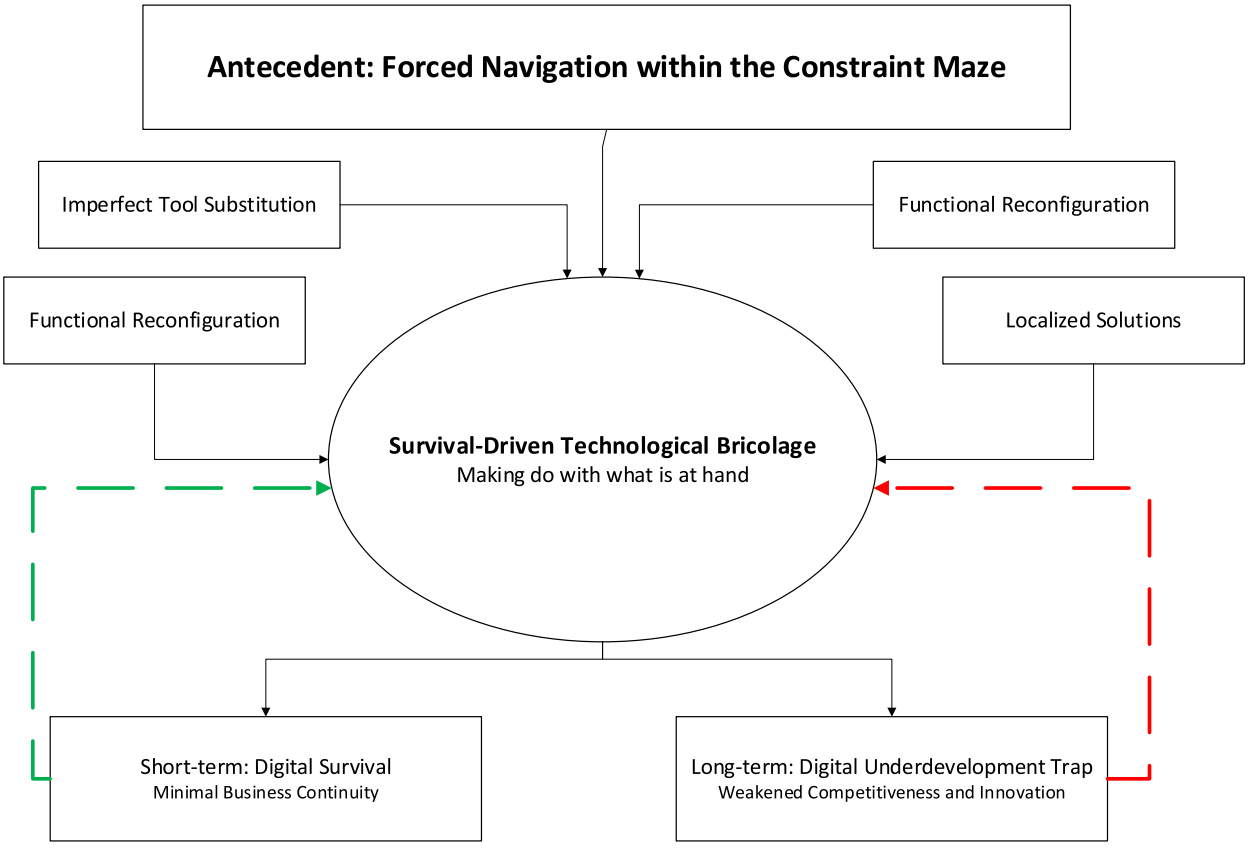

Fig. 2. Technological Bricolage Framework: Mechanisms and Outcomes.

which participants experienced as technological regression. A developer turned tourism operator (P83) captured this ambivalence: *"I built our own booking system—it works, barely. No integration, no automation, no scalability. It's 1990s technology in 2024."* These solutions, while enabling survival, create what Li et al. (2020) didn't anticipate: digital isolation, where custom solutions prevent integration with global systems, transforming temporary workarounds into long-term technological exile.

Fig. 2 synthesizes Survival-Driven Technological Bricolage not as a set of isolated tactics, but as a paradoxical process with conflicting temporal outcomes. Triggered by the antecedent condition of Forced Navigation, bricolage manifests through interconnected mechanisms like 'Imperfect Tool Substitution' and 'Functional Reconfiguration.' These actions produce an immediate, positive outcome: 'Short-term Digital Survival,' which maintains business continuity and prevents organizational collapse. However, this very survival mechanism concurrently fuels a negative, long-term trajectory: the 'Digital Underdevelopment Trap.' The model's core insight lies in its dual feedback dynamics, which explain why this trap is so difficult to escape. A weak positive reinforcement loop (successful workarounds, shared knowledge) provides just enough operational success to keep stakeholders engaged in the bricolage cycle. Yet, this is overwhelmed by a dominant negative feedback loop where each workaround adds to technical debt, widens the gap with global standards, and exhausts social networks. This feedback asymmetry (estimated at a 3:1 negative-to-positive ratio from our data) reveals a process of 'creative degradation' where innovation and capability erosion occur simultaneously. Bricolage, therefore, is not a stepping stone to recovery but a mechanism of entrenchment, locking firms into a stable state of perpetual sub-optimization and technological marginalization.

Striving for digital viability under pressure

Striving for Digital Viability Under Pressure emerged as the paradoxical outcome state where tourism enterprises maintain operational existence while experiencing progressive capability deterioration, a condition that challenges binary conceptualizations of organizational success versus failure. This state, experienced by all 91 participants though with varying intensity, transcends Prayag et al.'s (2024) resilience framework which predicts either recovery or collapse, revealing instead a third possibility: a sustained sub-optimal equilibrium where survival itself becomes the trap. Unlike Tang's (2024) digital economic resilience assuming progressive capability building through challenges, our participants experience viable decay, maintaining enough functionality to continue while losing ground daily. A hotel group executive (P14) commented: *"We're profitable on paper, rooms are occupied, staff are employed. But we're ghosts of what we could be—our technology is five years behind, service quality drops monthly, and younger staff leave for companies using real digital tools. We're successfully failing."* This paradoxical state extends beyond He et al.'s (2023) digital transformation challenges which assume temporary setbacks, revealing instead long-term capability gaps that widen despite continuous effort.

The viability paradox: successfully failing in organizational purgatory

The viability paradox manifests through three simultaneous yet contradictory dynamics: operational continuity alongside service degradation (reported by 79 participants, 86.8%), financial survival despite escalating hidden costs (84 participants, 92.3%), and market presence with diminishing competitiveness (71 participants, 78.0%). A travel technology consultant (P88) quantified this contradiction: *"My clients show interesting patterns—revenue maintains at 70% of potential, costs run 140% of optimal, innovation drops to near zero. They're alive but not living, functioning but not thriving. It's organizational purgatory."* This state differs from Iftikhar et al.'s (2023) crisis management phases which assume movement toward resolution; instead, participants describe temporal suspension where neither progress nor failure occurs, only persistence. The gendered experience of this paradox revealed additional complexity, with female entrepreneurs (n = 31) reporting higher psychological costs for maintaining viability as they performed additional emotional labor to maintain team morale. This paradoxical viability, rather than representing a transitional phase toward recovery or failure, has become a stable organizational form that existing theories cannot adequately explain, suggesting the need to reconceptualize success metrics under permanent constraint conditions.

Strategic regression and service degradation

Market access restrictions, documented across 71 participants (78.0%), created cascading exclusions: payment barriers eliminated North American and European segments (average booking loss: 68%), platform inaccessibility removed backpacker and youth markets dependent on Hostelworld (45% loss), and communication restrictions severed connections with digitally-dependent travelers (52% reduction in inquiries). A hotel owner (P62) reported: **"Five years ago, 60% of guests were Western Europeans booking through global platforms. Now 70% are regional visitors from Iraq, Armenia, Azerbaijan—markets with lower spending, shorter stays, different service expectations. We've shifted from serving global explorers to regional businesspeople. It's survival but not our vision."** This forced market repositioning contradicts Zeqiri et al.'s (2025) platform-enabled market expansion, revealing instead platform-enforced market contraction.

Strategic recalibration involved fundamental business model transformation, with 64 participants restructuring operations around constraints rather than market opportunities. A tour operator (P26) described strategic downsizing: **"We've abandoned multi-country tours requiring international coordination, stopped adventure tourism needing real-time communication, eliminated luxury segments expecting seamless digital service. We now offer simple, domestic, cash-based tours—basically returning to 1990s tourism models."** Iranian firms face technological regression, systematically widening competitive gaps, with the local focus as a forced limitation being a strategic regression that extends beyond Moayerian et al.'s (2022) assumption that local focus enhances authenticity.

Service degradation accompanied market restriction, with quality metrics declining across all dimensions: booking convenience (rated 3.2/10 versus 8.1/10 for international competitors), communication responsiveness (average 4.7-h delay versus 30 min

globally), and payment security (31% of transactions fail or require multiple attempts). A digital services manager (P70) suggested: **"Each service degradation loses 5-10% of potential customers. Slow website? 10% gone. Complex payment? Another 10%. Can't use WhatsApp? 10% more. Death by a thousand digital cuts."** This systematic degradation contradicts Santos et al.'s (2022) frugal innovation creating value through constraints; instead, constraints destroy value despite innovation efforts, suggesting dual technological siege creates economic logic where adaptation accelerates rather than mitigates decline.

Pyrrhic resilience: The human cost of adaptation

The simultaneous development of organizational resilience capabilities alongside intensifying psychological burden revealed how survival under dual constraints demands continuous emotional and cognitive investment that gradually deplete human resources, a finding that challenges assumptions that adaptation reduces stress over time. Resilience, documented in 58 participants (63.7%), manifested through enhanced technical capabilities (VPN management, platform switching, network activation), operational flexibility (hybrid online-offline models, multi-platform presence), and crisis anticipation (maintaining multiple backup systems). Yet these capabilities were developed at severe psychological cost, with 82 participants (90.1%) reporting chronic stress. A family business owner (P47) captured this paradox: *"We're incredibly resilient now—we can switch platforms in hours, route payments through three countries, operate with half our systems down. But this resilience is killing us. My son developed anxiety disorders, my daughter left the business, I take anxiety medication. We've learned to survive everything except ourselves."* The psychological toll manifested through specific symptoms: chronic fatigue (76%), decision paralysis (61%), innovation aversion (73%), and professional cynicism (84%).

A female CEO (P92) articulated the gendered burden dimension: "Beyond managing my own exhaustion, I absorb my team's frustration, especially younger women who see global opportunities they can't access. I spend 40% of my time on emotional management—unpaid, unrecognized, unsustainable labor." This emotional labor extends beyond individual impact to organizational culture, with 67 participants reporting resilience fatigue where teams resist further adaptation.

A resort manager (P08) reported: "My staff no longer suggest improvements or innovations. They've learned that every solution creates new problems, every adaptation demands more energy. We've become resilient but lost hope—surviving but not living, adapting but not advancing." The temporal dimension is critical: resilience capabilities stabilized after 18–24 months, but psychological burdens continued increasing, creating widening gaps between capability and wellbeing. This divergence contradicts resilience models assuming parallel development of operational and psychological resilience (Zhao & Li, 2023). Instead, our findings reveal pyrrhic resilience, winning the battle of survival while losing the war of organizational vitality, suggesting that organizations develop makeshift solutions and gradually accept digital inequality as an operational norm. Together, these dynamics reveal how viability under pressure is less a stage toward recovery and more a stabilized condition of managed decline.

Fig. 3 synthesizes Digital Viability Under Constraint, revealing it not as an endpoint but as a paradoxical state of equilibrium. Positioned at the heart of the model is the Core Duality: a 'Continuous Struggle for Survival amid Gradual Erosion.' This duality is fueled by the outputs of the previous stages: Forced Navigation and Technological Bricolage. The model bifurcates into two parallel, yet interconnected, sets of outcomes: (1) negative Operational and Market Outcomes, such as 'Market Access Restriction' and 'Digital Service Degradation,' and (2) costly Strategic and Cost Outcomes, like 'Constrained Strategic Readjustment.' These outcomes, in turn, generate the model's key dynamic: asymmetric capacity development. They build 'Adaptive Resilience Capacities,' creating a weak positive feedback loop sufficient for continued survival but not for growth. Simultaneously, they produce 'Chronic Psychological Burdens,' which create a powerful, intensifying negative feedback loop. This feedback asymmetry establishes an 'entropic equilibrium', a condition where an organization maintains its structure while progressively losing its substance and energy. The ultimate result is 'Forced Conservatism in Innovation' and 'Weakened Long-term Competitiveness.' The model thus reveals a third organizational state beyond simple success or failure: perpetual sub-optimization, where the very strategies enacted for survival become insurmountable barriers to future advancement.

Observed patterns of heterogeneity

Although grounded theory was not designed for systematic subgroup comparison, several heterogeneity patterns were observed across cases. Smaller firms faced proportionally higher adaptation costs and heavier dependence on personal digital skills, whereas larger organizations could redistribute tasks and buffer disruptions through team-based management. Gendered variations were also visible: female entrepreneurs frequently described stronger emotional fatigue and anxiety when coping with digital surveillance or unstable payment channels. Moreover, enterprises with higher digital criticality—those relying on constant platform access—experienced greater operational stress than those with limited online exposure. These differences do not alter the core mechanisms of the Perpetual Digital Adaptation Cycle but illustrate that adaptation under constraint is unevenly distributed across resources, gender, and digital intensity.

Theoretical integration

Fig. 4 presents the Perpetual Digital Adaptation Cycle Under Dual Technological Siege as an integrated theoretical framework revealing how tourism stakeholders become trapped in self-reinforcing cycles of adaptation that ensure survival while guaranteeing progressive decline. The dual siege, comprising external technological sanctions and internal digital filtering, establishes the context within which all adaptation occurs, creating what Høiland and Klemsdal (2022) term institutional complexity but extending beyond competing demands to converging near impossibilities. The cycle initiates with Forced Navigation within the Constraint Maze (A), where stakeholders engage in continuous cognitive mapping of blockage territories, uncertainty management, and network-based

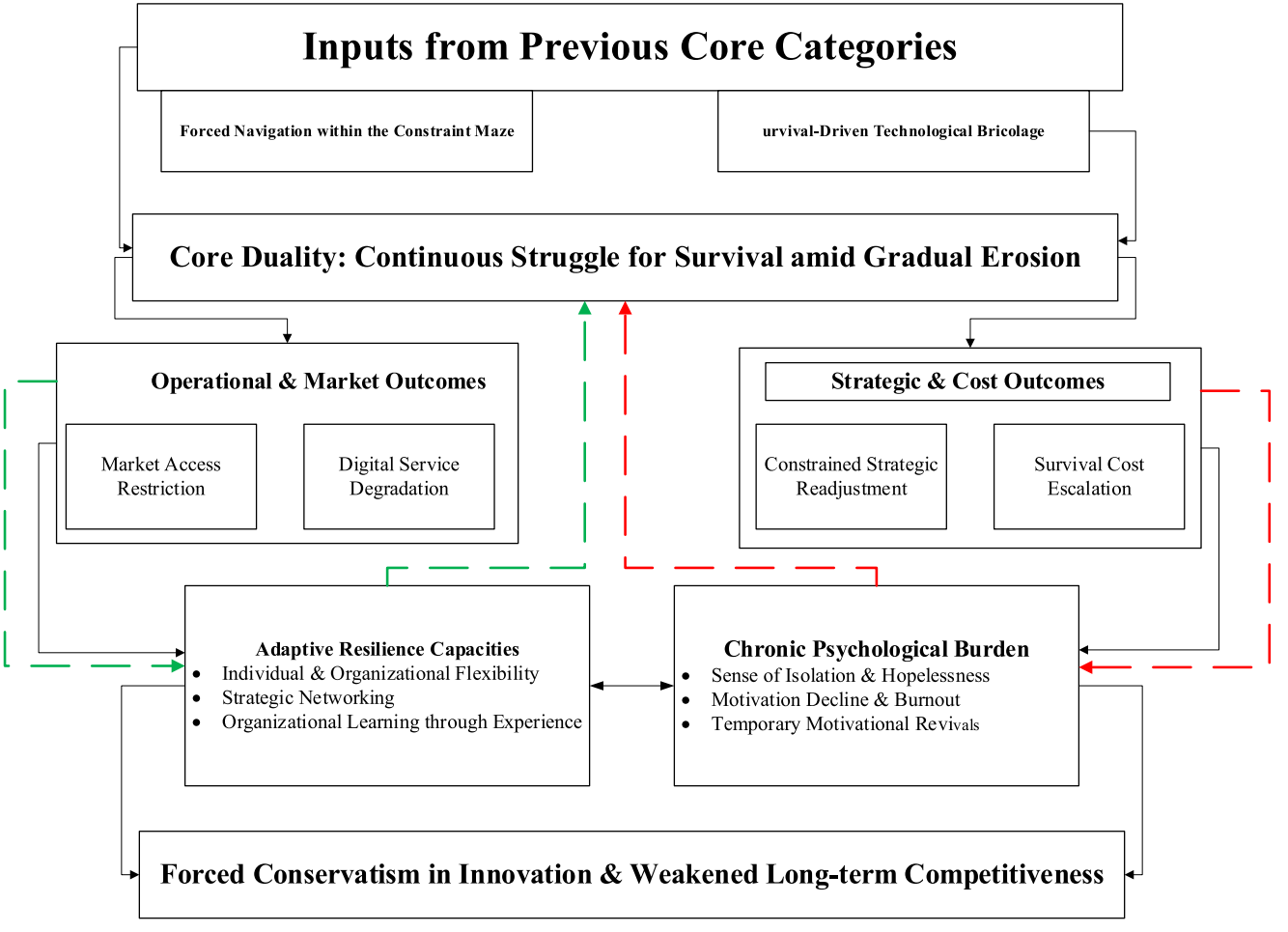

Fig. 3. Digital Viability Under Constraint: Paradoxical Adaptation Dynamics.

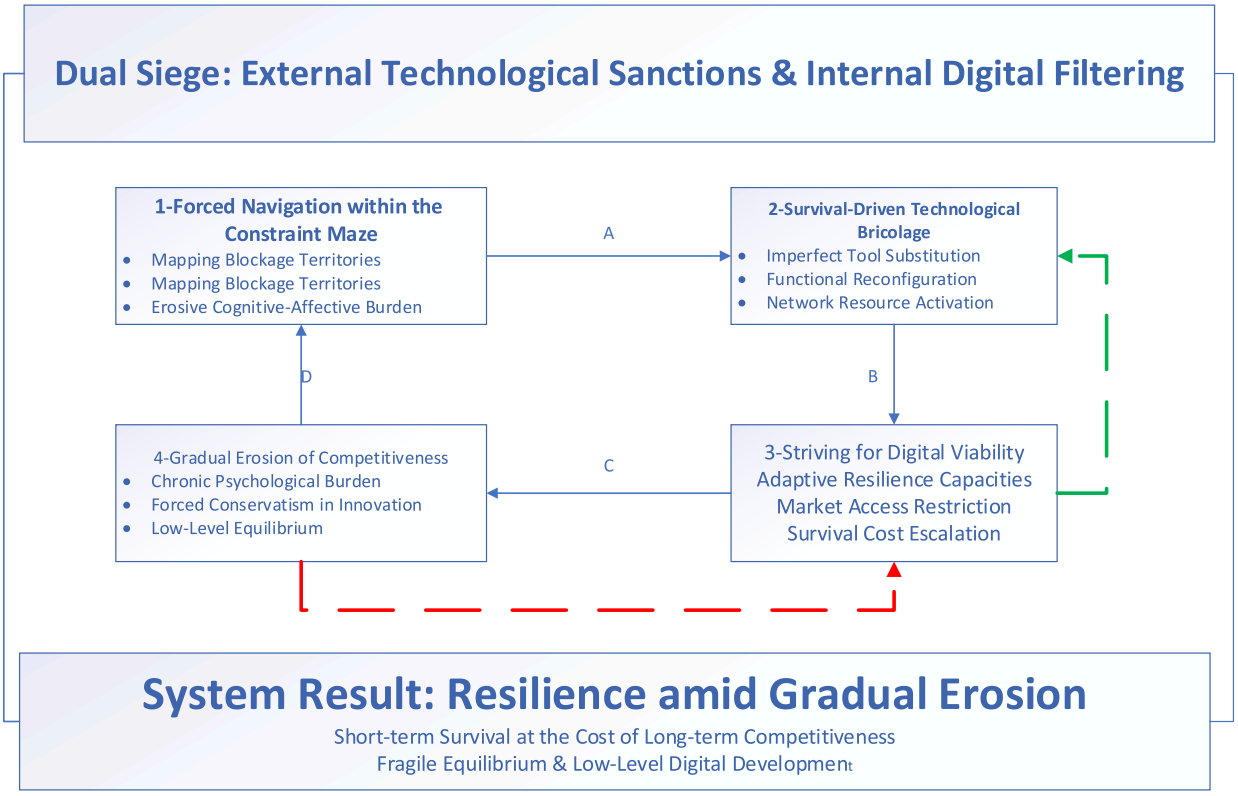

Fig. 4. The Perpetual Digital Adaptation Cycle Under Dual Technological Siege.

learning, generating the psychological burden that both motivates and constrains subsequent action. This cognitive-emotional state triggers Survival-Driven Technological Bricolage (B), manifesting through imperfect tool substitution, functional reconfiguration, and network resource activation, mechanisms that Santos et al. (2022) celebrate as frugal innovation but which our model reveals as desperate assemblage with compound negative consequences. The bricolage outcomes feed directly into Gradual Erosion of Competitiveness (C), where forced compromises accumulate into systematic disadvantage through innovation paralysis and low-level equilibrium traps that contradict Prayag et al.'s (2024) resilience recovery trajectories. This erosion paradoxically necessitates Striving for Digital Viability (D), where adaptive resilience capacities develop alongside market access restrictions and service cost escalation, creating the fundamental tension between survival and decline that digital transformation frameworks do not explain (He et al., 2023). The cycle's critical insight is that each stage deepens entrenchment rather than enabling transcendence, with stakeholders returning to forced navigation (A) with depleted resources, accumulated technical debt, and diminished psychological reserves, transforming adaptation from solution pathways to 'imprisonment' mechanism.

The system result—Resilience amid Gradual Erosion (short-term survival at the cost of long-term competitiveness, fragile equilibrium, and low-level digital development)—emerges through asymmetric feedback mechanisms that reconceptualize organizational adaptation theory. Weak reinforcing loops (successful navigation building confidence (A → B), creative bricolage yielding functional solutions (B → D), achieved viability providing temporary psychological relief (D → A)) provide minimal positive reinforcement (est. 20–25% of system energy). However, dominant erosive loops overwhelm these modest gains: navigation depletes cognitive resources and intensifies psychological burden (A → C), each bricolage solution widens the global standards gap and creates new dependencies (B → C), competitive disadvantage forces desperate adaptations (C → D), and sustained viability demands ever-greater effort for diminishing returns (D → A) (accounting for 75–80% of system dynamics). This feedback asymmetry creates organizations that are simultaneously resilient and eroding, adapting and declining, surviving and failing. Unlike theories of sensemaking (Weick & Weick, 1995), threat-rigidity (Staw, 1981), or resilience (which presume recovery), our model reveals entropic adaptation: energy continuously dissipates despite constant input. The fragile equilibrium and low-level digital development are not transitional states but stable system attractors, trapping organizations in perpetual motion without progress. This reconceptualizes dual technological constraints not as challenges to overcome but as system-defining parameters, transforming organizations from growth-oriented to decline-managing entities. Under such conditions, traditional success metrics become meaningless, and new frameworks for understanding viability under permanent constraint are required.

Implications

Theoretical implications

The Perpetual Cycle of Digital Adaptation under Dual Siege extends technology adoption literature by theorizing organizational behavior when technological choice ceases to exist. While the Technology Acceptance Model and Unified Theory of Acceptance and Use of Technology assume users evaluate technologies by perceived usefulness and ease of use, our grounded theory reveals dual constraints generate institutional voids eliminating both global and domestic alternatives. Decision-making shifts from voluntarily selecting options to navigating enforced constraints. We extend the Technology Acceptance Model through three modifications. First, adoption decisions become forced improvisation, shifting from *which technology to adopt?* to *which workaround to deploy?* Second, we introduce constraint-induced bricolage capability as a mediating construct capturing how organizations develop competencies to repurpose technologies beyond recognition. Third, we identify ongoing provisionality as the outcome state, technological arrangements remain temporary and fragile, unlike the Technology Acceptance Model's stable routinization. These extensions differentiate from existing digital bricolage frameworks assuming creative recombination of scarce resources. Our findings theorize forced recombination of inadequate resources, shifting from innovation under constraint to deterioration through constraint. The broader significance lies in establishing 'impossibility'-based frameworks alongside possibility-based ones, reflecting digital fragmentation where traditional adoption theories no longer suffice.

Our study contributes to organizational adaptation theory by introducing entropic adaptation as a distinct state challenging the binary resilience–failure framework. Much resilience literature conceptualizes adaptation as building capacity to bounce back or forward. Our grounded theory reveals organizations neither recovering nor collapsing but inhabiting sustained deterioration, where adaptive cycles enable survival while eroding resources. Three mechanisms underpin this state: managed deterioration (organizations accept decline as survival's cost), pyrrhic resilience (successful adaptations ensure long-term obsolescence), and capability erosion through use (bricolage competencies weaken through repeated deployment). These mechanisms interact through dual feedback loops—weak positive reinforcement maintaining minimal functionality, and strong negative reinforcement driving cumulative decline—producing perpetual adaptation without progress.

The dual constraint framework generates insights generalizable beyond Iranian tourism whenever multiple non-substitutable restrictions eliminate operational alternatives. Three foundations support broader applicability. First, converging impossibilities apply when compound constraints—technological (sanctions plus censorship), regulatory (federal plus state restrictions), or resource-based (financial plus human capital shortages)—erase rather than reduce options. Second, the perpetual cycle mechanism explains behavior where temporary adaptations ossify into permanent features. Third, our analysis demonstrates how bricolage becomes a trap under dual constraints, locking organizations into suboptimal adaptation cycles.

We specify scope conditions to guide applicability. The model applies in contexts where (a) constraints persist long enough to become institutionalized, (b) digital operations constitute critical rather than peripheral organizational functions, and (c) duality exists such that both global and domestic pathways are simultaneously blocked. Conversely, the model's explanatory power is limited in contexts of: (1) temporary or short-term disruptions, where recovery rather than entropic adaptation is the likely outcome; (2) single-constraint contexts, where viable substitutes often remain accessible; or (3) sectors where digital operations are peripheral rather than critical to core functions. Within these parameters, our framework explains overlooked organizational dynamics offering conceptual tools for understanding the growing population of organizations living in perpetual sub-optimization.

Practical and policy implications

Our findings indicate that tourism organizations operating under persistent dual digital constraints require management strategies fundamentally distinct from those in open digital environments. Rather than prioritizing growth optimization, managers must sustain viability under conditions of perpetual sub-optimization, treating constraint navigation as a permanent operational reality. Drawing on evidence from 91 stakeholders, three feasible interventions are proposed. First, to counter fragmented and short-term problem-solving, managers should institutionalize secure yet decentralized organizational knowledge. This involves cultivating encrypted peer-to-peer communication networks and developing low-tech adaptation strategies. Crucially, to mitigate surveillance risks, this shared knowledge must utilize neutral terminology. Second, addressing psychological strain is a prerequisite for continuity. Rotating digital-navigation duties to prevent burnout, scheduling mandatory detachment periods, and creating peer-support groups help distribute emotional load and sustain morale. Third, instead of pursuing inaccessible high-margin markets, organizations can reposition toward segments with lower digital expectations. These measures convert unmanaged decline into intentional, sustainable adaptation.

For policymakers, the study suggests that tourism support strategies in constrained environments must be reframed to balance necessity and oversight. In contexts where unregulated workaround practices dominate, carefully designed intermediary mechanisms can reduce dependence on informal networks while ensuring regulatory accountability. Development programs appear most effective when emphasizing locally viable, resilient solutions, such as open-source booking systems that operate without foreign servers and peer-to-peer training in practitioner validated adaptive digital practices. Equally, the psychological dimension of technological exclusion demands formal recognition. Integrating resilience training, confidential counseling, and monitoring systems into development initiatives can help mitigate long-term well-being risks associated with operating under chronic constraint.

At the international level, the findings underscore the need to tailor capacity-building models to conditions of structural digital asymmetry. Knowledge-transfer efforts should emphasize human-centered methods less dependent on blocked online infrastructures, i.e., in-person workshops and physical resource dissemination that bypass restricted channels. Evaluation metrics likewise require

recalibration: resilience indicators such as continuity of network access or speed of recovery after disruptions provide more meaningful measures than adoption rates. International organizations and technology partners can promote inclusion by offering lightweight service versions functional under restricted connectivity and enable controlled access for verified small operators within compliance frameworks. Ultimately, the strategic and ethical imperative is to enable dignified operation amid enduring digital exclusion.

Limitations and future research directions

This study is contextually bound to Iran's intersection of international sanctions and domestic digital filtering, limiting transferability. Access restrictions and evolving sanctions constrained capturing the full temporal sequencing of adaptation. Moreover, heterogeneity (e.g., firm size adaptation costs) was noted but not systematically theorized. The entropic adaptation framework therefore remains provisional and falsifiable. Future research could address these limitations. Comparative studies, longitudinal analyses and mixed-methods approaches could enrich understanding of the adaptation–decline relationships. Future work should systematically investigate heterogeneity (firm size, digital literacy, market orientation) and the human dimension of adaptation. Specifically, our findings on women's disproportionate emotional management responsibilities point to the need for deeper analysis of gendered emotional labor and resilience fatigue. Such research would move beyond binary success–failure models to theorize sustained deterioration as a distinct organizational state requiring new conceptual and policy tools.

CRediT authorship contribution statement

Zabih-Allah Torabi: Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Colin Michael Hall:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors have no interests to declare in relation to this work.

Appendix A

Appendix A
Integrated interview protocol and participant overview.

Stakeholder Group	n	Primary Selection Criteria	Key Adaptation Focus
Accommodation Managers	29	≥3 years platform experience; Multi-channel distribution	Platform substitution, payment routing
Travel Agencies	22	International clients ≥30%; Alternative payment systems	Client communication, booking workarounds
Tech Startups	13	Tourism digital solutions; ≥2 years market presence	Technical bricolage, API workarounds
Digital Marketers	12	Platform restriction experience; Tourism specialization	Content distribution, SEO alternatives
Tour Guides	10	Digital operations; International tourist interaction	Communication tools, virtual tours
Association Representatives	5	Industry-wide perspective; Policy engagement	Collective responses, knowledge sharing

Table A2
Semi-structured interview framework.

Phase	Duration	Core Questions	Adaptive Probes
Context Mapping	10 min	• Describe your digital operations • Which platforms are inaccessible? • When did restrictions begin?	• What changed after 2018? • How do you differentiate sanctions vs. filtering?
Constraint Navigation	20–25 min	• How do restrictions affect bookings, payments, marketing? • What is the operational/psychological burden?	• Walk through a typical workaround • What hidden costs emerged?
Adaptive Mechanisms	20–25 min	• What creative solutions have you developed? • How do networks help find alternatives?	• Describe your biggest failure and success • Who helped you find solutions?
Viability Assessment	15 min	• How do adaptations affect service quality? • Compare competitive position now vs. 5 years ago	• What would make business unsustainable? • How do customers react?
Future Outlook	5–10 min	• How has forced creativity changed you? • What single change would help most?	• What haven't I asked that's important?

Appendix B
Participant distribution and selection criteria.

Phase	Duration	Focus Areas	Initial Questions	Evolved Probes
Opening	5–10 min	Context, rapport building	Describe your typical day managing digital operations	What changed most dramatically after 2018?

(*continued on next page*)

Appendix B (*continued*)

Phase	Duration	Focus Areas	Initial Questions	Evolved Probes
Constraint Mapping	20–30 min	Specific blockages, timeline	Which platforms can you not access?	When did each restriction begin? How did you discover it?
Adaptation Strategies	25–35 min	Workarounds, resource mobilization	What alternative solutions have you developed?	Who helped you find these solutions? What failed before succeeding?
Consequences	15–20 min	Costs, quality, sustainability	How do adaptations affect service quality?	What hidden costs emerged? How do customers react?
Future Outlook	5–10 min	Resilience, breaking points	How do you see digital operations evolving?	What would make you abandon international markets?

Appendix C

Coding evolution and saturation evidence.

Analysis Stage	Example / Evidence	Outcome
Open Coding	*We lost 70% bookings when Booking.com blocked our accounts* → coded as Platform exclusion impact	287 initial open codes capturing discrete actions, perceptions, and constraints
Focused / Axial Coding	Codes such as *Platform exclusion* + *Payment blocks* clustered into the category Market access restriction	42 focused categories showing higher-order relationships
Theoretical Coding	Categories such as *Market restriction* + *Workarounds* integrated into the theoretical dimension Digital Viability Under Pressure	3 core categories: Forced Navigation, Technological Bricolage, Digital Viability
Saturation Evidence	Interview Blocks: 1–40 = 215 new codes; 41–60 = 28 new codes; 61–75 = 15 new codes; 76–91 = 4 new codes	Informational saturation reached at interview 75; subsequent interviews confirmed categories without generating new insights

Appendix D

Trustworthiness and ethical protocols.

Criterion	Implementation	Verification / Evidence
Credibility	Member checking with 15 participants; Monthly peer debriefing sessions	Summaries of key findings and conceptual models shared with participants; all confirmed interpretations reflected their lived experiences. Peer colleagues critically challenged assumptions, ensuring robustness.
Dependability	Full audit trail of coding decisions; Team coding of 20% transcript sample	Inter-coder reliability established using Krippendorff's alpha ($\alpha = 0.87$). Discrepancies documented and resolved through iterative discussion, ensuring procedural transparency.
Confirmability	Reflexive journaling across research phases; Balanced insider–outsider team composition	47 reflexive entries maintained; insider researchers ensured contextual sensitivity while outsiders safeguarded analytical distance, producing a balanced interpretive stance.
Ethics	IRB approval (#2023–147); Pseudonymization; Encrypted recordings; Offshore secure storage protocols	No security breaches reported; strict adherence to protocols protected all participants, particularly in sensitive contexts of sanctions and filtering.

Data availability

The data that has been used is confidential.

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Dr. Zabih-Allah Torabi is a faculty member in the Department of Geography and Rural Planning at Tarbiat Modares University. His Ph.D. from the University of Tehran in 2018 won the university's Best Thesis award. His research uses qualitative methodology to focus on village experiences in Iran regarding tourism development. He is particularly interested in rural development through tourism, poverty reduction in rural areas through tourism, smart rural tourism technologies, and rural second-home tourism.

C. Michael Hall holds the Dean's Chair in Marketing, Sustainability and Society at Massey University, New Zealand. He also holds visiting positions at the University of Oulu, Sunway University, Kyung Hee University, Linneaus University, Lund University, Taylor's University, and the University of Johannesburg. Editor of *Current Issues in Tourism* and Field Editor of *Frontiers in Sustainable Tourism* he has published widely on tourism, regional development, sustainability, global environmental change, and food and wine.