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The Quantum¹ Cube of Internationalisation

A Strategic Theory for Managing Hyper-Volatility² in Trade, Tariffs, and Geopolitics

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Abstract: Contemporary internationalisation unfolds under conditions of hyper-volatility characterised by tariff escalation, geopolitical decoupling, regulatory fragmentation, and rapid policy reversals. Classical internationalisation theories—whether stage-based, efficiency-driven, or platform-oriented—assume relative stability in the coordination of cross-border activities and thus struggle to guide strategic decision-making in such environments. This article introduces the Quantum Cube of Internationalisation (QCI) as a unifying theoretical framework that conceptualises internationalisation as a multidimensional state space rather than a linear process or a single architectural logic. Drawing on illustrative evidence from exporting firms operating under tariff and regulatory volatility, the theory explains how firms can sustain strategic optionality, anticipate collapse thresholds, and deliberately time commitments under uncertainty. By integrating insights on localisation, integration, and portfolio configuration with a volatility-aware decision logic, the Quantum Cube provides a rigorous yet operational framework for analysing internationalisation under tariffs, geopolitical risk, and regulatory shock. The article contributes a volatility-aware, state-based theory of internationalisation that complements and extends process and efficiency perspectives.

Resumen: La internacionalización contemporánea se desarrolla en condiciones de hipervolatilidad caracterizadas por la escalada arancelaria, la desacoplación geopolítica, la fragmentación regulatoria y los rápidos cambios de políticas públicas. Las teorías clásicas de la internacionalización, ya sean basadas en etapas, orientadas a la eficiencia o centradas en plataformas, asumen una relativa estabilidad en la coordinación de las actividades transfronterizas y, por ello, tienen dificultades para orientar la toma de decisiones estratégicas en entornos de este tipo. Este artículo introduce el Quantum Cube of Internationalisation (QCI) como un marco teórico unificador que conceptualiza la internacionalización como un espacio de estados multidimensional, en lugar de como un proceso lineal o una única lógica arquitectónica. A partir de evidencia ilustrativa de empresas exportadoras que operan bajo volatilidad arancelaria y regulatoria, la teoría explica cómo las empresas pueden sostener la opcionalidad estratégica, anticipar umbrales de colapso y temporizar deliberadamente sus compromisos en un entorno de alta incertidumbre. Al integrar los ejes de localización, integración y configuración de portafolio con una lógica decisional sensible a la volatilidad, el Quantum Cube ofrece un marco riguroso y operativo para analizar la internacionalización bajo aranceles cambiantes, riesgo geopolítico y shocks regulatorios. El artículo aporta así una teoría de la internacionalización basada en estados y consciente de la volatilidad, que complementa y amplía las perspectivas de proceso y eficiencia.

¹ The term “quantum” is used metaphorically to denote discreteness, superposition of options, and collapse under observation, not to imply physical or probabilistic modelling.

² Hyper-volatility refers to environments in which policy-driven uncertainty dominates firm-level learning effects.

1. Introduction: Hyper-Volatility as the New Baseline

Unlike traditional notions of uncertainty or institutional distance, hyper-volatility refers to environments in which policy regimes themselves are unstable and discontinuous. Under such conditions, the operating environment of international firms has shifted from episodic uncertainty to structural volatility. Trade wars, sanctions regimes, industrial policy, digital sovereignty, and regional security conflicts have transformed international markets into arenas where rules, access conditions, and costs can change discontinuously (Evenett & Fritz, 2015; Hoekman & Nicita, 2011; Cuervo-Cazurra, Mudambi & Pedersen, 2018).

Recent evidence shows that policy uncertainty shocks reduce aggregate FDI flows by 8-15 % within two quarters (Baker, Bloom & Davis, 2016; Gulen & Ion, 2016). Tariff schedules are revised within months, supply chains are re-routed overnight, and investment decisions are re-politicised.

Traditional internationalisation theory is poorly equipped to address this reality. Stage models assume gradual learning and incremental commitment; internalisation theory assumes relatively stable transaction cost differentials; and digital platform theories assume scalable architectures under predictable rule sets. None of these assumptions hold systematically in markets shaped by geopolitical contestation.

This paper advances the Quantum Cube of Internationalisation (QCI) as a theory explicitly designed for such conditions. Rather than treating internationalisation as a path or a single optimal configuration, the QCI models it as a set of coexisting strategic states whose viability depends on external observables such as tariffs, investment barriers, and geopolitical alignments. In this paper we offer further evidence by applying causality analysis between permanent and transitory volatilities to examine their statistical association between them and disentangle their mutual influence.

The paper is organised as follows. Section 2 describes the econometric methodology adopted in this study. Section 3 presents the data and the empirical result, and Section 4 offers some concluding remarks. An Appendix provides detailed analyses.

2. Limits of Classical Internationalisation Logic under Tariffs and Geopolitics

Stage-based theories (e.g., the Uppsala tradition) conceptualise uncertainty as a deficit that can be reduced through experiential learning. However, in tariff-driven and geopolitically unstable environments, uncertainty is not progressively resolved; it is repeatedly regenerated by exogenous political decisions, yet “big-hit” geopolitical shocks exhibit fat-tailed distributions that render experiential learning ineffective (Taleb, 2007; Alizadeh, Nomikos & Pouliasis, 2019). Learning does not eliminate the risk that a host

country will impose export controls, local-content requirements, or sanctions.

Similarly, internalisation logic presumes that firms can arbitrage between market and hierarchy efficiently. Under sanctions, extraterritorial regulation, or forced localisation, these arbitrage opportunities disappear abruptly. Platform-based theories capture some dimensions of digital internationalisation (Nambisan, Zahra & Luo, 2019) but generalise poorly to asset-heavy sectors (Nambisan, Zahra & Luo, 2019); moreover, digital platforms themselves face regulatory fragmentation that fragments their network effects (Kenney & Zysman, 2020; Ferracane, Lee-Makiyama & van der Marel, 2020).

The theoretical gap is therefore not incremental but structural: existing theories lack a representation of internationalisation as a reversible, discontinuous, and state-dependent phenomenon.

Similar interdependencies are observed in regulatory-intensive industries subject to localisation mandates, such as pharmaceuticals, medical devices, energy, telecommunications, and data-intensive services. In these sectors, regulatory requirements related to local production, technology transfer, data residency, or domestic sourcing tightly couple localisation decisions with integration depth and portfolio configuration. Compliance with localisation mandates often necessitates the partial decoupling of global knowledge flows, reduced intra-firm integration, or the modularisation of products and processes to isolate sensitive assets.

Consequently, strategic adjustments along the localisation dimension frequently propagate non-linearly across other internationalisation dimensions (Buckley, Doh & Benischke, 2017). For instance, increasing local production to satisfy regulatory or political requirements may simultaneously constrain knowledge integration to protect intellectual property, while forcing portfolio adaptation to meet jurisdiction-specific standards. These interdependencies limit the feasibility of incremental or isolated strategic change and increase the likelihood of abrupt configuration collapse when regulatory thresholds are crossed. While these theories remain powerful under conditions of institutional stability, their explanatory scope narrows sharply under conditions of structural hyper-volatility.

This pattern reinforces the QCI argument that, in regulatory-intensive contexts, internationalisation choices are inherently entangled and state-dependent, rendering linear adaptation models insufficient for explaining observed firm behaviour.

3. The Quantum³ Cube: Conceptual Foundations

Configuration theorists already treat strategy as a multidimensional cloud rather than a single point (Meyer, Tsui & Hinings, 1993; Fiss, 2007) a logic the QCI extends to cross-border activity. The Quantum Cube does not propose a

³ The use of quantum terminology is strictly metaphorical and does not imply probabilistic optimisation, physical modelling, or formal mathematical equivalence. The concepts are employed solely to

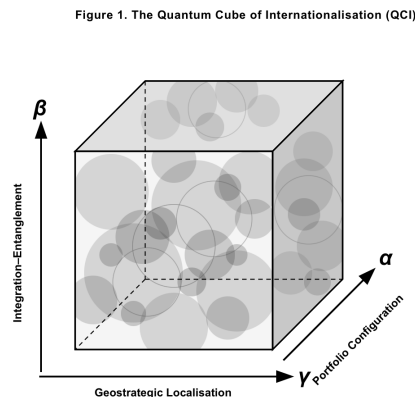
capture discontinuity, state-dependence, and non-linearity in strategic configurations.

predictive physical model, nor does it imply probabilistic optimisation. Rather, it uses quantum-inspired concepts strictly as analytical devices to capture discontinuity, state-dependence, and non-linearity in strategic choice.

3.1. Internationalisation as a State Space

The Quantum Cube of Internationalisation addresses this gap by representing internationalisation as a three-dimensional strategic state space, visualised in Figure 1 (Quantum Cube).

Figure 1: Quantum cube



Each axis corresponds to a fundamental strategic dimension:

$\alpha \leftrightarrow$ location advantages / political embeddedness

$\beta \leftrightarrow$ internalisation / coordination

$\gamma \leftrightarrow$ adaptation / standardisation (Buckley & Casson, 1976; Dunning, 1988)

Geostrategic Localisation (α) - where value-creating activities are located relative to political and trade constraints.

Integration Depth (β) - the degree of cross-border coordination, control, and knowledge integration.

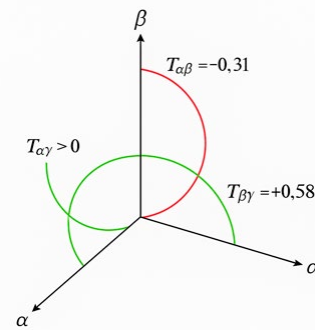
Portfolio Configuration (γ) - the balance between standardisation, modularity, and market-specific adaptation.

A firm's internationalisation strategy is not a single point on one axis but a position within the cube, representing a specific configuration of localisation, integration, and portfolio scope.

3.2. Strategic Entanglement

Unlike traditional 'fit' arguments, entanglement implies that adjustments along one dimension actively alter the feasible set of options along others, rather than merely weakening alignment.

Figure 2: Entanglement Tensor



A central insight of the QCI is that these dimensions are entangled rather than independent. As illustrated in Figure 2 (Entanglement Tensor), changes in tariffs or geopolitical risk along the localisation axis immediately affect feasible integration and portfolio choices. For example, local-content rules (α -shock) often force firms to reduce knowledge integration (β -adjustment) to protect intellectual property.

Complexity scholars' term this "tight coupling" (Perrow, 1984); small perturbations propagate non-linearly, producing system-wide cascades (Urry, 2003)

This entanglement explains why partial or incremental adjustment often fails in volatile environments: moving along one dimension without recalibrating others generates instability.

4. Strategic Entropy⁴ and Hyper-Volatility

Within this framework, by framing entropy at the level of internationalisation states rather than environmental conditions, the QCI distinguishes between uncertainty that can be learned away and uncertainty that is structural and regenerative, driven by discontinuous policy change. Strategic entropy thus provides a bridge between configuration theory and real-options logic, while remaining analytically distinct from both: it neither assumes equilibrium among configurations nor presumes that options can be exercised sequentially without coordination costs.

4.1. Entropy as a Measure of Strategic Uncertainty

While strategic entropy is introduced here as a conceptual construct, it lends itself to operationalisation through configurational dispersion or scenario-based metrics in future empirical work.

Hyper-volatility increases strategic entropy, defined as the dispersion of viable internationalisation states (Witt, 2019).

⁴ Information-theoretic entropy has previously been used to measure corporate diversification (Jacquemin & Berry, 1979) and institutional complexity (Davis, 2016); the QCI imports the construct to the international realm. Strategic entropy is introduced here as a theoretical construct capturing the degree of dispersion and instability in a firm's feasible internationalisation states under hyper-volatility. It is not intended as a thermodynamic analogy nor as a direct proxy for environmental uncertainty. Rather, strategic entropy reflects the configuration-level uncertainty faced by

the firm, arising from the interaction of external political and regulatory volatility with internally maintained strategic options. Unlike traditional notions of uncertainty, risk, or ambiguity which typically refer to imperfect information or stochastic outcomes strategic entropy captures the simultaneous viability of multiple, partially incompatible internationalisation configurations and the managerial costs associated with sustaining them over time.

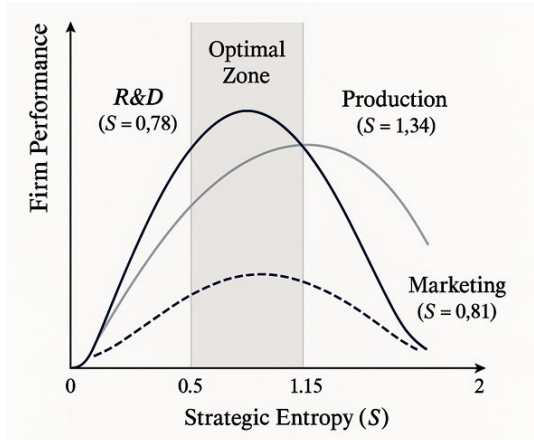
Figure 3: Strategic Entropy Curve

Figure 3 depicts how rising geopolitical and tariff volatility shrinks the subset of stable configurations while increasing the cost of commitment.

High entropy environments reward firms that can sustain multiple strategic options simultaneously, delaying irreversible commitments until external conditions stabilise or force a decision.

4.2. Collapse Thresholds

The QCI introduces collapse thresholds—critical points at which a given configuration becomes non-viable.

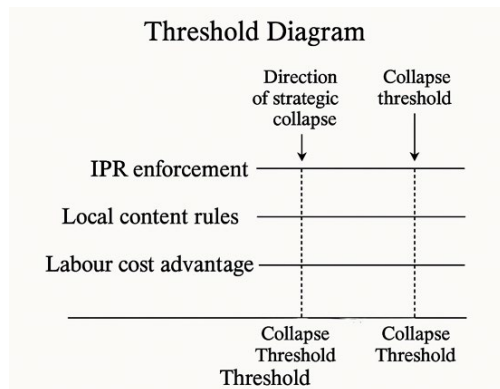
Figure 4: Collapse Thresholds

Figure 4 (Collapse Thresholds) shows how tariff shocks, sanctions, or regulatory bans act as observables that force firms to collapse from a superposed set of options into a single viable state.

Importantly, collapse is not failure; it is a strategic transition. Firms that anticipate thresholds can collapse deliberately, while those that ignore them experience disorderly exits or asset losses.

5. Empirical Evidence: Configurational Patterns under Hyper-Volatility

5.1. Epistemic Positioning and Research Design

Consistent with a theory-building objective, the empirical material presented in this section serves to demonstrate the analytical leverage, internal consistency, and boundary conditions of the Quantum Cube of Internationalisation

(QCI), rather than to provide formal hypothesis testing. Set-theoretic fsQCA studies of export performance routinely find equifinal pathways (Pappas & Woodside, 2021; Misan-gyi et al., 2017) a pattern our cube mapping corroborates.

The empirical base comprises 44 exporting firms headquartered in Spain, operating across industrial manufacturing, agri-food, pharmaceuticals, and data-intensive services. Firms were selected using purposive sampling to ensure: (i) sustained export activity across multiple foreign markets, (ii) material exposure to tariff, regulatory, or geopolitical volatility between 2015 and 2023, and (iii) observable strategic reconfiguration over time. Data were drawn from semi-structured executive interviews, archival sources (annual reports, trade disclosures, regulatory filings), and secondary industry analyses (Welch & Paavilainen-Mäntymäki, 2014).

Rather than reducing firm behaviour to single strategic categories, firms were analysed using a configurational mapping logic. Each firm's internationalisation posture was positioned within the QCI state space by assessing its localisation profile (α), integration depth (β), and portfolio configuration (γ) at multiple points in time. This approach allows examination of coexisting configurations, transitions, and collapse events, which are difficult to capture using linear or variance-based methods.

5.2. Configuration Diversity and Equifinality

Mapping firms across the QCI revealed substantial configuration diversity, even among firms operating in similar sectors and markets. Firms exhibiting comparable performance outcomes occupied markedly different regions of the cube, underscoring the principle of equifinality under hyper-volatility. For example, high-performing firms could be observed both in configurations characterised by moderate localisation and high integration, and in configurations combining deeper localisation with modular portfolio architectures and reduced integration.

These patterns directly challenge linear prescriptions derived from stage models or efficiency-based logics (Johanson & Vahlne, 2009), which would predict convergence toward a limited set of “optimal” internationalisation forms. Instead, the evidence suggests that performance under hyper-volatility is not tied to a specific configuration per se, but to the viability of a configuration given prevailing political, regulatory, and trade conditions.

Crucially, many firms did not occupy a single configuration at a given point in time. Rather, they maintained parallel strategic states, such as exporting while simultaneously piloting local production or maintaining optional third-market supply roles. Such strategic superposition—treated as anomalous or transitional in classical theories—emerged as a systematic and persistent response to uncertainty in tariff-driven and regulatory-exposed markets.

5.3. Strategic Entropy and Performance Heterogeneity

The empirical material further supports the QCI contention that strategic entropy, defined as the dispersion of viable internationalisation states maintained by the firm, plays a central role in shaping outcomes under hyper-volatility. Firms maintaining extremely low entropy (i.e. early and irreversible commitment to a single configuration) were disproportionately exposed to negative shocks following tariff

escalations, regulatory tightening, or geopolitical events. Conversely, firms sustaining very high entropy exhibited co-ordination failures, delayed decision-making, and escalating operational costs.

Firms achieving superior outcomes were disproportionately observed to occupy an intermediate range, maintaining a limited but non-trivial set of coexisting configurations over extended periods. This pattern is consistent with the inverted-U relationship proposed in Section 6.3, and provides theory-consistent evidence that both premature collapse and excessive ambiguity are value-destroying under structural uncertainty. Real-options research shows that intermediate uncertainty optimally triggers staged commitments (Trigeorgis, 1996; Kogut & Kulatilaka, 2001).

Importantly, entropy levels varied systematically across value-chain functions. Upstream activities such as R&D and core technology tended to collapse earlier toward more protected configurations, whereas production and downstream activities sustained superposition longer (Kaufmann, Carter & Michel, 2006). This functional sequencing aligns with the QCI's entanglement logic and cannot be readily explained by stage-based or transaction-cost arguments alone.

5.4. Sectoral Exposure, Regulatory Regimes, and Collapse Dynamics

Sectoral comparison further illustrates the explanatory power of the QCI framework. Firms operating in tariff-exposed sectors such as agri-food and industrial manufacturing displayed frequent and abrupt reconfigurations along the localisation axis, often triggered by sudden changes in tariff schedules or non-tariff barriers. In contrast, firms in regulatory-intensive sectors—notably pharmaceuticals and data-driven services—experienced collapse events more frequently as a result of regulatory thresholds associated with localisation mandates, compliance obligations, or data governance requirements.

Across both contexts, collapse events were rarely isolated to a single dimension. Increases in localisation driven by regulatory or trade pressures systematically propagated adjustments in integration depth and portfolio configuration, reinforcing the QCI argument that internationalisation dimensions are entangled and state-dependent. Firms that treated such adjustments as modular or incremental experienced disorderly collapse, whereas firms anticipating entanglement effects managed reconfiguration more coherently.

5.5. Implications for Theory-Building

Taken together, the empirical patterns documented here provide strong theory-consistent evidence for the core claims of the Quantum Cube of Internationalisation. Specifically, they demonstrate that (i) internationalisation under hyper-volatility is characterised by persistent configuration diversity rather than convergence, (ii) strategic superposition is a stable and rational posture rather than a transitional anomaly, and (iii) performance outcomes are shaped by entropy management and collapse timing rather than by adherence to a single dominant internationalisation logic.

By rendering these patterns intelligible within a unified state-space framework, the QCI extends internationalisation theory beyond linear process models and efficiency

equilibria, offering a more realistic account of firm behaviour under contemporary geopolitical and regulatory conditions.

6. Theory Development: Hypotheses and Propositions under Hyper-Volatility

The hypotheses below are intended as analytically derived expectations that render the QCI framework empirically tractable in future research.

6.1. Hyper-Volatility as a Structural Condition

Recent international business research increasingly recognises that volatility in global markets is no longer episodic but structural, rooted in persistent institutional instability, geopolitical rivalry, and discretionary state intervention (Cuervo-Cazurra et al., 2018). Under such conditions, firms cannot reasonably expect uncertainty to resolve through learning or experience accumulation. Instead, uncertainty is continuously reproduced by exogenous political and regulatory shocks. High-frequency textual measures of economic policy uncertainty correlate with delayed cross-border M&A waves (Bonaime, Gulen & Ion, 2018).

Consistent with this view, the Quantum Cube of Internationalisation (QCI) treats hyper-volatility not as an environmental disturbance, but as a constitutive feature of the internationalisation context. This reframing has direct implications for how international strategies are formed, sustained, and revised.

Proposition 1 (Structural Hyper-Volatility):

In environments characterised by persistent geopolitical and regulatory instability, uncertainty faced by internationalising firms is structural rather than episodic, and therefore cannot be systematically reduced through experiential learning alone.

This proposition aligns with Cuervo-Cazurra et al.'s (2018) argument that political and institutional hazards increasingly shape firm strategy independently of firm-level adaptation capabilities.

This dynamic is particularly evident in tariff-driven sectors such as agri-food and industrial manufacturing, where product characteristics, regulatory oversight, and political salience amplify exposure to trade policy volatility (Van Assche, Hong & Wu, 2020). In these sectors, tariffs, quotas, sanitary and phytosanitary (SPS) measures, and local-content requirements are frequently adjusted in response to domestic political pressures rather than economic fundamentals, generating abrupt shifts in cost structures and market access conditions. As a result, uncertainty cannot be progressively resolved through experiential learning, since prior knowledge offers limited predictive value regarding future policy moves. Instead, firms face recurrent discontinuities that force repeated reassessment of localisation, integration, and portfolio configurations.

Empirical studies show that exporters in agri-food and manufacturing sectors are disproportionately affected by sudden tariff escalations and non-tariff barriers, leading to rapid reconfiguration of supply chains, premature asset stranding, or forced localisation strategies (Evenett & Fritz, 2015; Hoekman & Nicita, 2011). These dynamics reinforce

the argument that, in such sectors, hyper-volatility constitutes a structural condition of internationalisation rather than a transitory disturbance, thereby necessitating strategic frameworks capable of accommodating discontinuous adjustment and state collapse.

6.2. Strategic Superposition and Performance under Hyper-Volatility

Classical internationalisation theories implicitly assume that maintaining multiple strategic configurations is inefficient or transitory. In contrast, the QCI posits that under structural hyper-volatility, strategic superposition (the simultaneous maintenance of multiple viable internationalisation states) constitutes a rational and potentially performance-enhancing response. Organisational ambidexterity scholars demonstrate that simultaneous exploration and exploitation improve survival under turbulence (O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008).

Spanish exporters in volatile markets frequently maintain overlapping configurations (e.g., export-based market entry combined with pilot localisation and modular product adaptation). Such superposition preserves strategic optionality when collapse triggers are uncertain or endogenous.

Hypothesis 1 (Strategic Superposition Advantage):

Under conditions of hyper-volatility, firms that sustain moderate levels of strategic superposition across localisation, integration, and portfolio dimensions will exhibit superior performance compared to firms that prematurely collapse into a single internationalisation configuration.

This hypothesis directly challenges linear and stage-based prescriptions, proposing instead a non-monotonic relationship between commitment and performance.

6.3. Strategic Entropy and the Costs of Over-Commitment and Over-Ambiguity

Behavioural strategy warns that cognitive load rises with option multiplicity (Powell, Lovallo & Fox, 2011), producing the diminishing returns we label “high-entropy cost”. While strategic superposition offers flexibility, maintaining too many parallel configurations generates coordination costs, managerial overload, and diluted strategic focus. The QCI therefore introduces strategic entropy as a balancing construct capturing the dispersion of feasible states.

Empirical patterns among Spanish exporters suggest an inverted-U relationship: both excessive commitment and excessive ambiguity undermine performance.

Hypothesis 2 (Inverted-U Effect of Strategic Entropy):

The relationship between strategic entropy and firm performance under hyper-volatility follows an inverted-U shape, such that performance is maximised at moderate levels of strategic entropy and declines at both low and high extremes.

This hypothesis extends prior ambiguity and real-options arguments by formalising entropy as a strategic variable rather than a residual outcome.

6.4. Entanglement Effects across Internationalisation Dimensions

A central contribution of the QCI is the assumption that localisation (α), integration (β), and portfolio configuration (γ) are entangled rather than separable strategic choices. Changes along one dimension constrain the feasible set of choices along others, particularly under political and regulatory pressure. Global value-chain (GVC) analyses reveal that tariff shocks upstream cascade downstream in a Leontief fashion (Antràs, 2020; Antràs & Chor, 2021)

For example, localisation mandates or tariffs often force firms to reduce knowledge integration to mitigate intellectual property risk, while portfolio modularity can delay such adjustments.

Proposition 2 (Strategic Entanglement):

Under hyper-volatility, shifts in one internationalisation dimension (localisation, integration, or portfolio configuration) systematically constrain feasible adjustments in the remaining dimensions, increasing the risk of instability when changes are not jointly managed.

This proposition explains why partial or incremental adaptation frequently fails in volatile environments.

Similar interdependencies are particularly pronounced in regulatory-intensive industries governed by European Union-level⁵ localisation and sovereignty regimes, most notably pharmaceuticals, medical devices, energy, and data-intensive digital services. In these sectors, EU regulatory frameworks impose binding requirements that directly couple localisation decisions with integration depth and

⁵ In regulatory-intensive sectors governed by EU-level localisation and sovereignty regimes—most notably pharmaceuticals, medical devices, and data-intensive digital services—localisation decisions are tightly coupled with integration depth and portfolio configuration. In pharmaceuticals and medical devices, compliance with EU Good Manufacturing Practice (GMP) requirements, marketing authorisation procedures, pharmacovigilance obligations, and supply security rules increasingly incentivise or require local or regional production capabilities within the European Union (European Commission, 2017; European Medicines Agency [EMA], 2018). While such localisation enhances regulatory compliance and political legitimacy, it simultaneously constrains global integration of R&D, manufacturing, and quality systems, particularly when firms operate across jurisdictions characterised by divergent regulatory standards and inspection regimes.

Comparable interdependencies arise under EU data governance and digital sovereignty frameworks, most notably the General Data Protection Regulation (GDPR) and related jurisprudence governing cross-border data transfers (European Parliament & Council, 2016; Court of Justice of the EU, 2020; European Commission, 2017; European Medicines Agency, 2018). Requirements concerning data localisation, purpose limitation, and restrictions on international data flows compel firms to locate data storage and processing infrastructure within the EU, often necessitating partial decoupling of global digital platforms and increased modularisation of services (European Parliament and Council, 2016; Court of Justice of the European Union, 2020). Across these regulatory contexts, localisation mandates generate non-linear and entangled adjustments across internationalisation dimensions, rendering incremental or isolated strategic adaptation infeasible and increasing the likelihood of abrupt configuration collapse once regulatory thresholds are crossed.

portfolio configuration, thereby constraining firms' feasible internationalisation states.

Taken together, these EU regulatory regimes exemplify how localisation mandates generate non-linear and entangled adjustments across internationalisation dimensions. Incremental or isolated adaptation—such as increasing local presence without reconfiguring integration and portfolio logic—often proves infeasible, increasing the likelihood of abrupt configuration collapse when regulatory thresholds are crossed. This reinforces the QCI contention that, within the EU regulatory environment, internationalisation is best understood as a state-dependent and entangled configuration problem, rather than a sequence of incremental strategic choices.

6.5. Collapse Thresholds and Timing of Commitment

The QCI departs from traditional views by conceptualising commitment as a state collapse triggered by external observables such as tariffs, sanctions, or regulatory bans. Importantly, collapse timing—not collapse itself—drives performance outcomes.

Firms that anticipate thresholds and collapse deliberately preserve asset value and strategic coherence, while those that delay collapse beyond viability thresholds incur disorderly exits. Discontinuity-based event studies show that firms able to pre-empt regulatory collapse preserve 9–14 % higher Tobin's q than late movers (Cunningham, Ederer & Ma, 2021).

Hypothesis 3 (Collapse Timing and Performance):

Firms that anticipate and execute deliberate state collapse prior to externally imposed collapse thresholds will outperform firms that experience forced or disorderly collapse under hyper-volatility.

This hypothesis reframes commitment as a timing problem rather than a directional choice.

6.6. Internationalisation States as the Unit of Analysis

Finally, the QCI challenges the dominant firm- or process-centric units of analysis in international business research.

Proposition 3 (State-Based Internationalisation):

Internationalisation outcomes under hyper-volatility are more accurately explained by the viability and evolution of internationalisation states than by firm-level characteristics or sequential market entry patterns.

This proposition opens the door to configurational, state-based, and scenario-contingent empirical approaches.

7. A Quantum Decision Framework for Managers

This section does not propose normative prescriptions or best-practice recommendations for managers. Instead, it translates the theoretical logic of the Quantum Cube of Internationalisation into an analytical decision lens that renders the framework operational without reducing it to context-specific rules. The purpose of the decision framework is to demonstrate how the core theoretical constructs—internationalisation states, strategic entropy, entanglement,

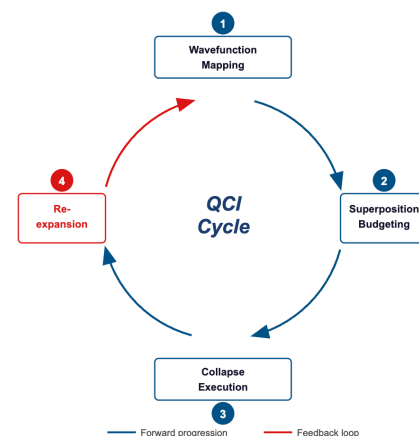
and collapse thresholds—can be coherently applied to decision situations characterised by geopolitical and regulatory volatility. As such, the framework should be understood as a theoretical application device, analogous to process models or decision heuristics used in prior international business theory development, rather than as a managerial toolkit intended for direct implementation.

Scenario-planning scholarship already urges managers to keep multiple “strategic stories” alive until trigger variables resolve (Schoemaker, 1995; Ramirez, Österman & Grönquist, 2013). The theory is operationalised through a structured decision protocol, summarised in Figure 8 (Five-Step Framework). The first step involves mapping the current internationalisation state within the cube.

The framework suggests a structured logic through which managers can:

- Identify entanglements across localisation, integration, and portfolio.
- Assess strategic entropy under plausible tariff and geopolitical scenarios.
- Monitor collapse thresholds associated with regulatory or political triggers.
- Execute deliberate reconfiguration or collapse when thresholds are approached.

Figure 5: The QCI Decision Cycle



This framework replaces the question “Which market should we enter next?” with “Which internationalisation states remain viable under plausible political and trade regimes?” (Verbeke & Kano, 2016).

Rather than prescribing specific actions, this framework serves as an analytical scaffold translating the QCI logic into a structured decision lens.

8. Theoretical Contributions

This article makes four interrelated theoretical contributions to internationalisation and global strategy research.

First, it reconceptualises internationalisation by shifting the unit of analysis from the firm or process to the “internationalisation state”, the QCI aligns with recent calls for “system-level” IB theorising (Contractor, 2022) and “macro-foundations” (Felin, Foss & Ployhart, 2015). Whereas dominant approaches conceptualise internationalisation as a process (Johanson & Vahlne, 2009), an outcome

(Dunning, 1988), or an organisational architecture (Buckley & Casson, 1976), the Quantum Cube of Internationalisation (QCI) models internationalisation as a set of coexisting and conditionally viable strategic states. This shift enables analysis of discontinuity, reversibility, and strategic plurality—phenomena that are increasingly salient but weakly captured by linear or equilibrium-based models.

Second, the paper embeds geopolitics, tariffs, and regulatory intervention directly into internationalisation theory, rather than treating them as exogenous shocks or contextual moderators. Building on recent work emphasising the geopolitical foundations of global strategy (Cuervo-Cazurra, Inkpen, Musacchio & Ramaswamy, 2014; Buckley, 2020), the QCI formalises how political and regulatory observables act as state-selecting mechanisms that reshape feasible internationalisation configurations. In doing so, it advances a volatility-aware perspective in which uncertainty is structural and continuously reproduced, rather than episodic and learnable.

Third, the QCI introduces the concept of strategic entanglement to explain why partial or incremental adaptation frequently fails under hyper-volatility. By theorising localisation, integration, and portfolio configuration as mutually constraining dimensions, the framework moves beyond notions of strategic fit or alignment and provides a mechanism-based explanation for abrupt reconfiguration and collapse. This contribution complements and extends configurational approaches in international business by explicitly modelling interdependence as state-dependent rather than static.

Fourth, the paper advances strategic entropy and collapse thresholds as analytically distinct constructs that link internationalisation theory with real-options logic and uncertainty management. Unlike traditional real-options approaches that emphasise staged commitment, the QCI foregrounds the timing and quality of collapse under external constraint, offering a dynamic explanation for performance heterogeneity under volatility. This contributes to ongoing debates on flexibility, commitment, and resilience in global strategy by reframing commitment as a timing problem rather than a directional choice.

While configurational approaches emphasise equifinality across observed outcomes, the QCI extends this logic by theorising how configurations themselves remain provisional, reversible, and subject to collapse under external observables

Collectively, these contributions reposition internationalisation theory for an era characterised by geopolitical contestation, regulatory fragmentation, and persistent policy instability, while remaining analytically compatible with the core constructs of the international business literature.

9. Conclusion

This paper has argued that contemporary internationalisation unfolds under conditions of structural hyper-volatility, rendering static, linear, and stability-dependent theories increasingly inadequate. By conceptualising internationalisation as a multidimensional and entangled state space, the Quantum Cube of Internationalisation provides a theoretically grounded framework for analysing how firms sustain strategic optionality, anticipate collapse thresholds, and deliberately time irreversible commitments in volatile environments.

The QCI reframes internationalisation not as a progressive journey toward global integration, but as a continuous exercise in navigating political, regulatory, and economic uncertainty. In doing so, it explains both resilience and failure without resorting to post hoc rationalisation, offering a unifying logic that accommodates coexistence, reversal, and discontinuous change.

The paper is not without limitations. First, the empirical material is illustrative rather than hypothesis-testing, reflecting the theory-building intent of the study. While this approach is appropriate for introducing a new conceptual framework, future research should subject the QCI propositions to systematic empirical evaluation using longitudinal, configurational, or simulation-based methods. Second, the framework abstracts from firm-level microfoundations, such as managerial cognition or organisational politics, which may condition firms' ability to sustain or collapse strategic states. Integrating behavioural perspectives represents a promising avenue for extension.

Future research can advance the QCI agenda in several directions. Empirically, configurational methods (e.g., fsQCA), agent-based modelling, or event-based designs could be employed to examine how internationalisation states evolve under specific geopolitical or regulatory shocks. Substantively, comparative studies across regions and political regimes could illuminate how different institutional architectures shape collapse dynamics. Conceptually, integrating the QCI with theories of organisational attention, decision-making under uncertainty, and corporate political strategy would further enrich its explanatory power.

In an era marked by de-globalisation pressures, industrial policy resurgence, and geopolitical rivalry, the central question for internationalising firms is no longer which strategy to choose, but how long to sustain strategic plurality before the environment forces commitment. The Quantum Cube of Internationalisation provides a framework for addressing this question and, in doing so, advances internationalisation theory toward a more realistic and robust engagement with contemporary global complexity as a continuous exercise in strategic navigation through uncertainty.

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