# Quantum-Native Design's Effect on South African Firm Agility, Innovation, and Advantage

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A B S T R A C T

*This study explores Quantum-Native Organisational Design (QNOD) and its impact on agility, innovation performance, and competitive advantage among 384 firms in South Africa. The concept of QNOD is operationally defined through the application of Structural Equation Modelling using Analysis of Moment Structures (AMOS) in the form of three dimensions: strategic superposition, structural fluidity, and quantum talent density. Results show that quantum-native organisations are more adaptable, have better innovative performance and possess improved competitive advantage than conventional organisations. Organisational agility plays a mediating role between QNOD and innovative performance, whereas quantum-native design also positively impacts competitive advantage directly. These findings reveal QNOD as a quantifiable and performance-augmenting organisational structure that boosts adaptability, innovation, and competitiveness, either directly or through agility. Moreover, it provides managers with a tangible roadmap of strategic superposition, structural fluidity, and quantum talent density for reorganising organisations under dynamic conditions.*

A B S T R A K

*Penelitian ini mengkaji *Quantum-Native Organisational Design* (QNOD) serta dampaknya terhadap ketangkasan, kinerja inovasi, dan keunggulan kompetitif pada 384 perusahaan di Afrika Selatan. Konsep QNOD didefinisikan secara operasional melalui penerapan *Structural Equation Modelling* menggunakan *Analysis of Moment Structures* (AMOS) dalam tiga dimensi: superposisi strategis, fluiditas struktural, dan kepadatan talenta kuantum. Hasil penelitian menunjukkan bahwa organisasi *quantum-native* lebih adaptif, memiliki kinerja inovasi yang lebih baik, serta memiliki keunggulan kompetitif yang lebih tinggi dibandingkan organisasi konvensional. Ketangkasan organisasi berperan sebagai mediator antara QNOD dan kinerja inovasi, sementara desain *quantum-native* juga berdampak positif secara langsung terhadap keunggulan kompetitif. Temuan ini mengungkapkan bahwa QNOD merupakan struktur organisasi yang dapat diukur dan mampu meningkatkan kinerja – serta mendorong kemampuan adaptasi, inovasi, dan daya saing – baik secara langsung maupun melalui ketangkasan. Selain itu, penelitian ini memberikan peta jalan konkret bagi para manajer mengenai superposisi strategis, fluiditas struktural, dan kepadatan talenta kuantum untuk melakukan reorganisasi organisasi di tengah kondisi yang dinamis.*

*Keywords:*
*Quantum-Native Design, Strategic Superposition, Organisational Agility, Quantum Management, South African Enterprises.*

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## 1. INTRODUCTION

The way the most successful organisations are built and operate is undergoing a massive shift. Quantum computing, artificial intelligence, and the incredible expansion of global connections are changing competition far more rapidly than most management approaches can keep pace with. And yet, most companies still use structures based on Isaac Newton's ideas: a straightforward cause-and-effect model, strict hierarchies, and solid planning. But that kind of straightforward, predictable approach wasn't intended for the complicated and unpredictable conditions of today's markets (Zhu, 2024). As quantum computing begins to solve complex problems in areas such as delivery, supply chain management, and overall strategy, a critical question arises: how should organisations restructure to benefit from these quantum-level capabilities?

South Africa is a particularly useful place to study this. As a developing economy with significant instability, complex regulations, and rapid adoption of new technology, South Africa places great pressure on businesses to find organisational structures that will succeed despite the uncertainty (Maharaj, 2024). Being Africa's most advanced economy while still retaining the characteristics of a developing economy makes it an ideal setting for examining how organisational change unfolds under significant stress (Department of Small Business Development, 2024). There is little research on 'Quantum-Native' management (in which departments are fluid and exist in multiple states simultaneously, rather than being separate and unchanging), and, in fact, it is notably absent from the literature.

Quantum-Native Organisational Design (QNOD) refers to a purposefully architected organisational configuration in which three interdependent structural properties are deliberately aligned with the non-linear, probabilistic logic of quantum-level analysis and decision-making (Xin et al., 2020; Davis, 2025). The first property, strategic superposition, denotes the simultaneous pursuit of multiple, potentially opposing strategies rather than a premature commitment to a single path, drawing conceptual inspiration from the quantum-physics principle that particles exist in multiple states until observed (Geok & Ali, 2021; Doz & Kosonen, 2021). The second, structural fluidity, refers to permeable departmental boundaries, adaptive team configurations, and roles that span functional domains, enabling rapid resource reallocation in response to changing analytical outputs (Teece, 2025; Eisenhardt & Martin, 2000).

The third, quantum talent density, describes a workforce characterised by cognitive flexibility, tolerance for ambiguity, and capacity for collaborative sense-making under uncertainty qualities that parallel the multi-state thinking required in quantum computing environments (Caniëls & Vos, 2021; Xin et al., 2020). While QNOD draws conceptual inspiration from quantum physics principles superposition, entanglement, and non-locality it applies these as organisational metaphors rather than literal physical laws, grounded in a multi-disciplinary theoretical base spanning quantum management theory, dynamic capabilities, organisational ambidexterity, strategic

agility, and decentralised autonomous organisation (DAO) theory (Dyck & Greidanus, 2017; Bova et al., 2021; Geok & Ali, 2021). The theoretical architecture underpinning this construct is elaborated in Section 2 and synthesised in Table 1.

These structural incompatibilities constitute what this study terms a 'linearity roadblock', the empirically observable gap between an organisation's quantum analytical capabilities and its structural capacity to act on them (Phillipson & Bhatia, 2024). Despite the accelerating commercial deployment of quantum computing across logistics, financial services, and supply chain management (Bova et al., 2021), no prior large-sample empirical study has operationalised QNOD as a measurable construct or quantified its performance effects, a critical gap this research explicitly addresses. Existing scholarship on dynamic capabilities and organisational ambidexterity offers relevant but partial frameworks; neither operationalises quantum-native design features nor tests them using large-sample structural equation modelling in an emerging-market context. This study addresses that gap through four distinct and novel contributions: (1) it develops and validates the first empirical, multi-dimensional measure of QNOD, comprising strategic superposition, structural fluidity, and quantum talent density; (2) it provides large-sample empirical evidence (n = 384) linking quantum-native design to agility, innovation, and competitive advantage via SEM; (3) it identifies organisational agility as the primary mediating mechanism through which quantum-native design drives innovation performance; and (4) it generates context-specific, actionable guidelines for managers leading quantum-native transitions in volatile, developing-economy environments such as South Africa.

## 2. LITERATURE REVIEW

### 2.1 From Newtonian To Quantum Management Theory

The way we manage things today was really formed during the Industrial Revolution, and it is very directly based on ideas from Isaac Newton's physics, which emphasised being able to predict things, a simple one thing causing another, and getting things done as efficiently as a machine (Wegner et al., 2024). Taylor, Fayol and Weber, the early thinkers in management, thought of organisations as machines, very specifically planned systems with steps happening in a predictable way to get a certain result. For over a century, this 'Newtonian' way of thinking has underpinned how companies are structured, with strict top-down control, standardised ways of doing things, and clear reporting lines central to their design (Saurabh et al., 2025).

However, the faults of this approach are now glaringly obvious in our current volatile, uncertain, complex, and ambiguous (VUCA) world (Coughlin, 2025). Thinking in a straight line from cause to effect is not quick enough to deal with the interconnectedness and fast changes of the global marketplace. Companies are stuck in what you could call a 'paradigm paralysis'; they are not able to mentally change how they operate, even though things have clearly changed (Nemashakwe & Kayawe, 2024). Quantum management theory offers a distinct approach, drawing on principles from quantum physics:

superposition, entanglement, and non-locality (Geok & Ali, 2021). Unlike Newtonian physics, which assumes that something is in a single, definite place or state, quantum mechanics says that particles can be in many states at once until you look at them. When applied to organisations, this means successful companies need to keep several strategies open and genuinely respond to different future possibilities, rather than deciding on a single plan too early (Xin et al., 2020).

**2.2 Strategic Superposition: Navigating Multiple Realities in Market Entry**

At the core of Quantum-Native design is 'strategic superposition' - deliberately holding several potentially opposing strategies at the same time (Doz & Kosonen, 2021). Usual strategy work is about finding the single best plan and focusing resources on it. Strategic superposition, though, starts with a different idea: when things are uncertain, the best way to find the right route is to explore many routes at once rather than deciding too soon. This idea is directly from quantum superposition. In that, particles are in all possible states at once until 'measuring' them collapses them into a single state. For businesses, this means keeping multiple ideas for how to go about things active at the same time; this could mean entering a market by growing from within and by buying another company, creating products for different technical standards, or being both the cheapest and most luxurious option all at once (Busolo, 2025).

**2.3 The Role of Quantum-Native Talent in 2026 Organisations**

To truly move to a Quantum-Native way of doing things, people's skills will need to change significantly. Traditional job descriptions, skill requirements, and career progression paths assume relatively stable jobs, fixed organisational structures, and predictable environments (Xin et al., 2021). Quantum-native organisations, however, require individuals who can thrive amid constant flux and operate across multiple domains simultaneously; this study refers to such individuals as 'quantum-native talent'. At the core of quantum-native talent is cognitive flexibility, the ability to switch between different perspectives and simultaneously hold several, sometimes conflicting, ideas in mind (Caniëls & Vos, 2021). Individuals with high cognitive flexibility are better equipped to manage the uncertainty inherent in strategic superposition and to maintain opposing strategic possibilities without feeling pressured to prematurely collapse them into a single choice. Additional important characteristics include tolerance for ambiguity, willingness to shift roles fluidly, and strong collaborative problem-solving skills (Nemeth & Ormiston, 2007).

**2.4 DAOs as a Precursor to Quantum Design**

The main theoretical perspectives that support the conceptual framework of QNOD are summarised in Table 1, which highlights their major ideas and particular contributions to this innovative organisational paradigm. These perspectives range from quantum management to DAO theory.

**Table 1.** Theoretical Foundations of QNOD

| Theoretical Lens | Key Concepts | Contribution to Quantum-Native Design | Key References (State of the Art) |
|---|---|---|---|
| Quantum Management Theory | Superposition, entanglement, non-locality | Conceptual foundation for non-linear, multi-state organisational logic; justifies simultaneous strategy pursuit and adaptive decision-making | Geok & Ali (2021); Davis (2025); Xin et al. (2020); Dyck & Greidanus (2017); Zhu (2024); Cai et al. (2024) |
| Dynamic Capabilities | Sensing, seizing, transforming | Mechanisms for maintaining strategic optionality; explains how QNOD enables rapid resource reconfiguration and adaptive response | Teece et al. (1997); Teece (2025); Eisenhardt & Martin (2000); Helfat & Peteraf (2015) |
| Organisational Ambidexterity | Exploration, exploitation | Empirical foundation for balancing multiple strategic orientations simultaneously; extends dual-mode logic to multi-state superposition | He & Wong (2004); Hwang et al. (2021); Zhou et al. (2021); O'Reilly & Tushman (2013) |
| Strategic Agility | Strategic sensitivity, resource fluidity | Operational capabilities translating QNOD into competitive performance; explains sensing and resource reallocation under uncertainty | Doz & Kosonen (2010, 2021); Busolo (2025); Augustine et al. (2025) |

### 2.5 Hypothesis Development

#### H1: QNOD and Organisational Agility

Dynamic capabilities theory establishes that organisations with superior sensing, seizing, and transforming capabilities demonstrate greater adaptability in volatile environments (Teece et al., 1997). Research on strategic agility shows that organisations maintaining multiple strategic options simultaneously, a core feature of strategic superposition, exhibit faster and more effective responses to environmental change (Doz & Kosonen, 2010, 2021). Cai et al. (2024) empirically demonstrated that quantum-oriented leadership positively influences organisational innovation through organisational intelligence, indicating that quantum management approaches enhance organisational responsiveness. Xin et al. (2020) further showed that quantum leadership dimensions are positively associated with employees' adaptive behaviours in uncertain contexts.

Structurally fluid organisations, in which roles and team boundaries are permeable, have been shown to reallocate resources more rapidly than hierarchically rigid counterparts (Eisenhardt & Martin, 2000). Based on the cumulative theoretical and proximate empirical evidence, the following is proposed:

**H1: QNOD has a significant positive effect on organisational agility.**

#### H2: Organisational Agility and Innovation Performance

The relationship between organisational agility and innovation performance is well grounded in both theory and empirical research. Doz and Kosonen (2010, 2021) argue that strategic sensitivity, leadership unity, and resource fluidity, the core components of agility, are prerequisites for rapid experimentation and iterative learning, both of which drive innovation. Hwang et al. (2021) demonstrated

empirically that organisational ambidexterity, a close empirical correlate of agility, mediates the relationship between open innovation orientation and firm performance. He and Wong (2004) showed that firms balancing exploration and exploitation outperform single-orientation firms on innovation outcomes. This convergent body of evidence supports the expectation that agile organisations systematically translate adaptive capacity into superior innovation performance:

**H2: Organisational agility has a significant positive effect on innovation performance.**

**H3: Innovation Performance and Competitive Advantage**

The link between innovation performance and competitive advantage is among the most consistently supported relationships in strategic management research. Barney (1991) established rare, inimitable, and non-substitutable resources, of which innovation capability is a prime example, form the foundation of sustained competitive advantage. Porter (1985) argued that differentiation achieved through innovation enables firms to command superior positioning and pricing power relative to competitors. He and Wong (2004) provided empirical evidence that ambidextrous innovation positively predicts sales growth and competitive outcomes. Yeniaras et al. (2021) confirmed that strategic flexibility, partly enabled by innovation, is a significant predictor of firm performance both financially and in terms of market share. Within emerging markets specifically, Hidayat and Rahayu (2024) showed that resource-based capabilities, including innovativeness, are among the strongest determinants of competitive advantage for firms operating under conditions of institutional volatility, a finding directly applicable to the South African context:

**H3: Innovation performance has a significant positive effect on competitive advantage.**

**H4: The Mediating Role of Organisational Agility**

Mediation theory in organisational studies holds that structural and strategic antecedents influence distal outcomes through intermediate mechanisms that translate design choices into behavioural and operational outputs (Baron & Kenny, 1986; Hayes, 2018). Dynamic capabilities research positions organisational agility as precisely such a mechanism: Teece et al. (1997) argue that the abilities to sense, seize, and transform constitute the pathway through which organisational design ultimately shapes performance outcomes, including innovation. Doz and Kosonen (2021) further propose that agility serves as the operational translation layer between strategic intent and the capacity to execute innovation. Indirect empirical support comes from Hwang et al. (2021), who demonstrated that ambidexterity mediates the innovation–performance relationship, and from Mwangi and Boinett (2022), who found that adaptive organisational capacity mediates the relationship between leadership approaches and performance outcomes. It should be transparently acknowledged that the specific mediating role of organisational agility in the pathway from QNOD to innovation performance has not been directly tested in prior empirical

research; this hypothesis is therefore grounded in theoretically derived reasoning applied to a novel construct and represents an explicit contribution of the present study:

**H4: Organisational agility mediates the positive relationship between QNOD and innovation performance.**

**H5: QNOD and Direct Competitive Advantage**

Beyond the indirect pathways through agility and innovation, QNOD may generate competitive advantages through mechanisms that do not depend solely on innovation outputs. Resource-based view theory holds that rare and inimitable organisational configurations are themselves sources of competitive advantage, independent of specific downstream performance outcomes (Barney, 1991; Barney & Hesterly, 2012). Open, collaborative decision-making structures, a feature of structurally fluid, quantum-native organisations, have been associated with lower transaction costs and stronger inter-organisational relationships, both of which confer competitive benefits (Williamson, 1991; Porter, 1985). Hidayat and Rahayu (2024) demonstrated that resource-based organisational capabilities directly affect competitive advantage in emerging-market firm contexts, consistent with the view that structural uniqueness, not innovation outcomes alone, drives performance differences. It must be explicitly acknowledged, however, that the direct effect of QNOD on competitive advantage, controlling for agility and innovation, is a theoretically deduced extension for which no prior direct empirical evidence exists. This hypothesis is therefore offered as a conceptual proposition that this study is specifically designed to test:

**H5: QNOD has a significant positive direct effect on competitive advantage.**

## 3. RESEARCH METHODOLOGY

### 3.1 Research Design and Sample

The study examines how "Quantum-Native" design features relate to companies' performance and uses Structural Equation Modelling (SEM) to analyse these relationships. The research was conducted in South Africa and included businesses in the financial services, technology, manufacturing, and professional services sectors (Statistics South Africa, 2024). A total of 384 employees from various companies were chosen for the sample using a stratified random approach. This ensured there were companies of all sizes - small, medium, and large and from each industry. Hair et al. (2019) state that a sample size of at least 200 is required for SEM, and this sample size is sufficient to detect a moderate-sized effect. Data were collected from January to June 2025 using questionnaires completed by top and middle managers who understand their company's plans and how it is organised.

The list of companies to contact was sourced from the South African Companies and Intellectual Property Commission (CIPC) and supplemented with details from industry group member lists. Companies were divided into groups by the number of staff they have (small = 50-249, medium = 250-999, large = 1000 or more) and by their industry. 42.3% of the companies contacted returned the

questionnaires. This study examined whether early and late respondents differed on the important points using independent-samples t-tests and found no significant differences ($p > 0.05$). Armstrong and Overton (1977) would say that this means people who did not reply are unlikely to have substantially altered the results.

**3.2 Measurement Instruments**

The researcher measured everything using questionnaires with multiple questions for each idea. These questions were derived from previous research and refined after initial trials. People answered the questions on a scale of 1 to 7, where 1 meant 'strongly disagree' and 7 meant 'strongly agree'. The questionnaire was in English, the main language of business in South Africa. QNOD was considered a broader concept comprising three parts: Strategic Superposition (6 questions), Structural Fluidity (5 questions), and Quantum Talent Density (5 questions). The Strategic Superposition questions assess how much an organisation holds several possible plans at once, does not settle too quickly on one direction, and is open to ideas that seem to contradict each other (Doz & Kosonen, 2021). Structural Fluidity questions assessed how easily people move between departments, how flexible jobs are, and how teams change and form (Teece, 2025). Quantum Talent Density questions looked at how many employees can think flexibly, are comfortable with uncertainty, and work together to understand things (Xin et al., 2020).

Organisational Agility was measured using an 8-item questionnaire adapted from Doz and Kosonen (2021), which assessed strategic sensitivity (3 items), leadership unity (2 items), and resource fluidity (3 items). As an example, one question asked whether the organisation is quick to notice changes in the market, and another asked whether it quickly reallocates resources to different strategic goals. How well an organisation innovates was assessed using a 6-question questionnaire measuring both seeking entirely new things (3 questions) and improving what it already has (3 questions) (He & Wong, 2004). The questions for new things focus on introducing new products, services, and ways of doing things; the questions for improving what they have measure how much they refine and improve current products and services.

Competitive Advantage was measured using 7 questions. These looked at financial success, return on investment, how much sales are increasing, and how much profit is being made compared to competitors and also at things that are not about money, like how much of the market they have, how happy customers are, and how good the brand's name is (Yeniaras et al., 2021). People were asked to compare their organisation's performance with that of their main competitors over the last three years. This study also considered firm size (measured by the log of the number of employees), how long the firm has been in business, the industry it is in, and how fast the business environment changes. The speed of environmental change was measured using 4 questions about how quickly customer choices, competition, and new technology are changing (Jansen et al., 2006). An

overview of the measurement constructs employed in this investigation is presented in Table 2, along with the number of items for each construct and the relevant sources from the current literature.

**Table 2.** Measurement Constructs and Items

| Construct | Items | Source |
|---|---|---|
| **Strategic Superposition** | 6 | Adapted from Doz & Kosonen (2021) |
| **Structural Fluidity** | 5 | Adapted from Teece (2025) |
| **Quantum Talent Density** | 5 | Adapted from Xin et al. (2020) |
| **Organizational Agility** | 8 | Doz & Kosonen (2021) |
| **Innovation Performance** | 6 | He & Wong (2004) |
| **Competitive Advantage** | 7 | Yeniaras et al. (2021) |
| **Environmental Dynamism** | 4 | Jansen et al. (2006) |

### 3.3 Analysis of Moment Structures (AMOS) Structural Equation Modelling

The data analysis was done using AMOS (v.29). According to Byrne (2016), the software helps to simultaneously assess the validity of measures as well as determine the nature of relationships between the study constructs while considering the measurement error. The analysis was done following a two-step procedure outlined by Anderson & Gerbing (1988). The measurement model was examined first to establish whether the survey tools effectively and consistently measure the required constructs. The structural model was then examined to establish whether there is evidence of relationships between the constructs.

The assessment of the measurement model quality involved the evaluation of several important metrics. These include factor loadings higher than 0.70, AVE above 0.50, and CR over 0.70 in accordance with the recommendations of Fornell & Larcker (1981). The distinctiveness of the measures was tested through two methods – the Fornell-Larcker criterion and the HTMT ratio – with the threshold value set to be lower than 0.85 based on Henseler et al. (2015). For testing the internal reliability of the scales, the Cronbach's alpha was calculated, with the required coefficient being higher than 0.70 according to Nunnally & Bernstein (1994). Additionally, the quality of the overall model fit was estimated based on several conventional fit indices, such as the chi-square/df ratio (< 3), CFI and TLI (> 0.90), RMSEA (< 0.08), and SRMR (< 0.08) in accordance with Hu & Bentler (1999).

To control common method biases, the following measures for collecting the data were employed (such as reversing some variables, isolating the predictors from the dependent variable and ensuring the anonymity of the respondents). Further, Harman's one-factor test has been used statistically (Podsakoff et al., 2003). There is no one single factor that accounts for more than 28.4% of the total variance. This complies with Harman's criterion of 1976 for controlling common method biases.

## 4. RESULTS AND FINDINGS

### Profile of Research Respondents

The sample of executives selected for this research comprised 384 individuals holding top and middle management positions in South

African firms that are in the financial services, technology, manufacturing, and professional services industries. A stratified random sampling technique was used in such a way that a proportional representation of small organisations (having between 50 and 249 employees), medium organisations (having between 250 and 999 employees) and large organisations (with 1000+ employees) was ensured in terms of the size of organisation. Respondents were required to be at a certain level in their organisation so that they could give information about the characteristics of their strategy and structure, see Table 3.

**Table 3**. Respondent and Firm Profile (N = 384)

| Characteristic | Category | n | % |
|---|---|---|---|
| **Gender** | Male | 219 | 57.0 |
| | Female | 165 | 43.0 |
| **Age (years)** | 25–34 | 96 | 25.0 |
| | 35–44 | 154 | 40.1 |
| | 45–54 | 98 | 25.5 |
| | 55 and above | 36 | 9.4 |
| **Managerial level** | Top management | 142 | 37.0 |
| | Middle management | 242 | 63.0 |
| **Firm size (employees)** | Small (50–249) | 121 | 31.5 |
| | Medium (250–999) | 158 | 41.1 |
| | Large (1000+) | 105 | 27.3 |
| **Industry sector** | Financial services | 108 | 28.1 |
| | Technology | 96 | 25.0 |
| | Manufacturing | 101 | 26.3 |
| | Professional services | 79 | 20.6 |
| **Firm age (years in operation)** | Less than 10 | 89 | 23.2 |
| | 10–20 | 167 | 43.5 |
| | More than 20 | 128 | 33.3 |

Note. n = 384. Percentages may not sum to exactly 100 due to rounding.

The sample was relatively balanced regarding important demographic and firm-level variables, except that the number of males (57.0%) was greater than that of females (43.0%). Many respondents belonged to the age category of 35-44 years (40.1%), which meant that they were a set of managers who had considerable experience with organisational operation and decision-making. As far as managerial levels are concerned, the greatest proportion of the sample comprised middle managers (63.0%) and top managers (37.0%). Concerning industry type, the representation of industries within the sample was quite balanced across all target industries, with financial services (28.1%) and manufacturing (26.3%) industries being the most frequent types. Also, with respect to firm size categories, the distribution was relatively balanced among the three categories, with medium firms (41.1%) being the highest category. A large proportion of firms (76.8%) had been in existence for ten years or more, implying that most of the organisations of the respondent sample had enough operational life to develop certain patterns relevant to the constructs in question.

**Research Variables**

In this research, seven key variables were studied. Specifically, QNOD was conceptualised as a broad variable comprising three dimensions – strategic superposition (6 items), structural fluidity (5 items) and quantum talent density (5 items). Organisational agility acted as a mediator (8 items), being located between QNOD and the dependent variables. Innovation performance (6 items) and competitive advantage (7 items) were used as dependent variables, with innovation performance also serving as a mediator on the way from QNOD to competitive advantage. Size, age, industry and environmental dynamism (4 items) were considered as control variables because the influence of those variables on the performance is not caused by QNOD. All variables except for the categorical control variables were measured via a multi-item, seven-point Likert-type scale, as presented in Table 2.

**Measurement Model Assessment**

The researcher checked how well the measurement model worked using CFA and maximum likelihood estimation. The final version of the model fits the data well, with a chi-square divided by degrees of freedom of 1.87, a CFI of 0.96, a TLI of 0.95, an RMSEA of 0.052 (the 90% confidence interval being 0.044 to 0.060), and an SRMR of 0.048 (as Byrne, 2016, explains). The standardised factor loadings, ranging from 0.71 to 0.89 and all exceeding 0.70, indicate that the construct explains a substantial proportion of the variance in the indicators, thereby supporting convergent validity. AVE figures ranged from 0.52 to 0.68, above the required 0.50 level, and Construct Reliability (CR) ranged from 0.84 to 0.92, comfortably over 0.70 (according to Hair et al., 2011). All reliability and validity scores are presented in full in Table 4.

**Table 4.** Reliability and Validity Indices

| Construct | Cronbach's α | Composite Reliability | AVE | Factor Loadings Range |
|---|---|---|---|---|
| **Strategic Superposition** | 0.88 | 0.89 | 0.58 | 0.72–0.85 |
| **Structural Fluidity** | 0.86 | 0.87 | 0.55 | 0.71–0.83 |
| **Quantum Talent Density** | 0.89 | 0.90 | 0.61 | 0.75–0.87 |
| **Organizational Agility** | 0.91 | 0.92 | 0.58 | 0.73–0.89 |
| **Innovation Performance** | 0.87 | 0.88 | 0.56 | 0.72–0.84 |
| **Competitive Advantage** | 0.90 | 0.91 | 0.57 | 0.74–0.88 |

Note. AVE = Average Variance Extracted; CR = Composite Reliability.

The researcher assessed whether the study's constructs were truly distinct (discriminant validity) using the method described by Fornell and Larcker in 1981. Essentially, for each of our core concepts, the square root of its AVE (average variance extracted) was bigger than its correlation with every other concept, which does show they're different. HTMT values ranged from 0.42 to 0.78, all below the 0.85 threshold suggested by Henseler and colleagues in 2015. Table 5 shows the correlations between the concepts and has the square roots of the AVE values along its diagonal.

**Table 5**. Correlation Matrix and Discriminant Validity

| Construct | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **1. Strategic Superposition** | (0.76) | | | | | |
| **2. Structural Fluidity** | 0.58** | (0.74) | | | | |
| **3. Quantum Talent Density** | 0.52** | 0.61** | (0.78) | | | |
| **4. Organisational Agility** | 0.48** | 0.55** | 0.62** | (0.76) | | |
| **5. Innovation Performance** | 0.44** | 0.49** | 0.58** | 0.67** | (0.75) | |
| **6. Competitive Advantage** | 0.41** | 0.46** | 0.54** | 0.63** | 0.71** | (0.76) |

Note. Square roots of AVE on the diagonal in parentheses. ** $p < 0.01$ (two-tailed).

### Structural Model Results

The way the model was put together worked well: the chi-square statistic was 548.64 with 312 degrees of freedom (and so chi-square divided by degrees of freedom was 1.76), the CFI was 0.95, the TLI was 0.94, and the RMSEA was 0.049 (with a 90% confidence interval between 0.042 and 0.056). The SRMR was 0.052. All these figures are at or above the levels commonly accepted as good (as per Hu & Bentler, 1999). The model explains a considerable portion of the variation in Organisational Agility (45%), Innovation Performance (52%), and Competitive Advantage (58%). Chin (1998) said that these proportions of explained variation are more than enough for structural equation modelling in the social sciences. The complete standardised path coefficients, their standard errors, t-values and how important (significant) each one is are in Table 6.

**Table 6.** Structural Model Path Coefficients

| Hyp. | Path | β | SE | t-value | p-value | Result |
|---|---|---|---|---|---|---|
| **H1** | QNOD → Organisational Agility | 0.67 | 0.08 | 8.38 | < 0.001 | Supported |
| **H2** | Organisational Agility → Innovation Performance | 0.58 | 0.09 | 6.44 | < 0.001 | Supported |
| **H3** | Innovation Performance → Competitive Advantage | 0.49 | 0.10 | 4.90 | < 0.001 | Supported |
| **H5** | QNOD → Competitive Advantage (direct) | 0.31 | 0.11 | 2.82 | 0.005 | Supported |

### Hypothesis Testing Results

Table 6 shows that all four paths specified directly in the model were statistically significant and worked in the expected direction. QNOD had a very positive impact on organisational agility ($\beta = 0.67$, $t = 8.38$, $p < 0.001$), thus supporting H1 and demonstrating that organisations with higher strategic superposition, structural flexibility, and quantum talent density exhibit greater organisational agility. Furthermore, organisational agility showed a statistically significant positive relationship with innovation performance ($\beta = 0.58$, $t = 6.44$, $p < 0.001$), which supported H2. In contrast, innovation performance showed a statistically significant impact on competitive advantage ($\beta = 0.49$, $t = 4.90$, $p < 0.001$), which supported H3. QNOD also showed a statistically significant impact on competitive advantage without considering the indirect impact through the agility–innovation path ($\beta = 0.31$, $t = 2.82$, p

= 0.005).

H4 proposes that organisational agility serves as a mediator in the effect of QNOD on innovation performance. The indirect effect is assessed using a bootstrapping procedure of 5,000 iterations, following Hayes (2018). The indirect effect of QNOD on innovation performance through organisational agility was significant (indirect $\beta = 0.39$, SE = 0.06, 95% CI [0.28, 0.51]) since the confidence interval did not include 0. Since there is no direct effect of QNOD on innovation performance in the proposed structural model, it can be concluded that there is a full mediation. Therefore, hypothesis H4 is supported and organisational agility is confirmed as the main mediator that transforms the properties of the quantum native structure into improved innovation performance. In total, the results presented in Table 6 and the mediation analysis prove the validity of all five hypotheses (H1–H5). The research finds empirical support for the effect of QNOD on firm performance through organisational agility development and its direct impact on competitive advantage.

## 5. DISCUSSION

This research provides initial empirical evidence, set within the specific context of South African enterprises, that QNOD is positively associated with agility, innovation performance, and competitive advantage. These findings are consistent with the proposition that quantum-native principles strategic superposition, structural fluidity, and quantum talent density constitute a distinctive and performance-relevant organisational configuration. However, the claim that Quantum-Native design represents a categorically and universally superior or "fundamentally different" way of managing should be interpreted with measured caution: the results support statistically significant associations between the proposed constructs within this study's sample, rather than establishing definitive superiority over traditional organisational approaches across all industries, institutional environments, or firm types (Peng & Heath, 1996).

For managers, this research translates into three interlocking structural priorities. First, practise strategic superposition by deliberately maintaining multiple, potentially opposing strategic options in parallel rather than committing prematurely to a single direction; this enables more responsive adaptation to unexpected market shifts without requiring full organisational restarts (Doz & Kosonen, 2021). Second, build structural fluidity by reducing rigid departmental silos, encouraging cross-functional team configurations, and designing roles flexible enough to be redeployed as analytical priorities evolve (Teece, 2025; Eisenhardt & Martin, 2000). Third, invest in quantum talent density by recruiting and developing individuals with cognitive flexibility, tolerance for ambiguity, and strong collaborative problem-solving skills; these capabilities constitute the human infrastructure without which QNOD principles cannot be operationalised (Caniëls & Vos, 2021; Ho et al., 2023).

## 6. CONCLUSIONS AND IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

This study is an early empirical contribution to the emerging field of QNOD, examining its associations with organisational agility, innovation performance, and competitive advantage among 384 South African enterprises. Within this sample and context, organisations with higher levels of strategic superposition, structural fluidity, and quantum talent density demonstrated statistically significant and practically meaningful performance advantages across all three outcome constructs. These findings are theoretically grounded and contribute to the growing literature on non-linear, adaptive organisational forms; however, they should be read with caution, given the study's cross-sectional design and single-country scope, which constrain causal inference and limit immediate generalisability beyond the sampled context.

There are a few drawbacks to this study, but they do point to some really good ideas for future research. Because we looked at things at a single point in time, we cannot say for sure what causes what. Following companies as they transition to quantum-native ways of working (as Podsakoff et al. noted in 2012) would provide much more convincing evidence. This study specifically looked at South Africa, which was intentional and gave us valuable insight into the situation there, but it means our results might not apply elsewhere. Testing these findings in richer, developed countries, rapidly growing countries, and places with very different cultures would show whether they hold up (Peng & Heath, 1996). Now, how we measure quantum-native design is based on what one person at a company thinks is happening. Later research should include measurable factors such as how often a company changes strategy and how quickly teams are reorganised (Boyd et al., 2013). Lastly, this study treats quantum-native design as a whole and does not consider what you might lose or where it is not suitable.

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