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ASSESSMENT OF BARRIERS TO THE ADOPTION OF THE VUCA MODEL FOR EFFECTIVE MANPOWER MANAGEMENT IN BUILDING CONSTRUCTION FIRMS

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Abstract: This study investigates the barriers to adopting the Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) model for effective manpower management in building construction firms. A quantitative research design was employed, with data collected through structured questionnaires distributed to 240 construction professionals, including architects, builders, civil engineers, and quantity surveyors. Descriptive statistics and factor analysis were applied to evaluate and rank the factors impeding VUCA adoption. The findings reveal limited awareness and application of the VUCA model, as many respondents are unfamiliar with its relevance to manpower operations. Key barriers identified include technological limitations, inadequate infrastructure, ineffective implementation of development plans, evolving workforce dynamics, resistance to innovation, and ineffective leadership, coupled with a lack of shared vision. Additional challenges, such as regulatory pressures, global competition, and socio-economic uncertainties, further impede adoption. The study concludes that the successful implementation of VUCA-oriented manpower strategies necessitates an integrated approach involving digital transformation, leadership development, workforce upskilling, and institutional strengthening. Targeted investments in digital technologies, continuous training, adaptive leadership practices, and flexible organizational frameworks are recommended to enhance resilience and improve manpower efficiency in the construction industry.

Keywords: VUCA model, manpower management, construction firms, workforce planning, digital transformation, workforce dynamics.

1.0 INTRODUCTION

Construction firms face environments marked by rapid change, uncertainty, and increasing complexity in projects, workforce requirements, and regulatory demands. The VUCA framework (Volatility, Uncertainty, Complexity, and Ambiguity) has emerged as a central perspective for understanding challenges in human resource management (HRM) and manpower planning within the construction sector (Clegg et al., 2019; Dongqiao, 2024; Hendratmi et al., 2022). This framework has been applied to HRM transformation, talent development, and strategic workforce planning to demonstrate the limitations of traditional, linear approaches in volatile contexts and to underscore the necessity of agile, learning-oriented HR practices (Chowdhury, 2024; Maley et al., 2024; Dongqiao, 2024). Furthermore, the adoption of digital technologies, design thinking, and innovative workforce models, such as AI-augmented work, reinforces the need to adapt VUCA-oriented HR models to sustain organizational performance (Niehaus & Mocan, 2024; Biloslavo et al., 2024; Zhang & Chen, 2023). Recent research has connected VUCA to strategic management and organizational design for talent and performance management in complex projects, emphasizing the

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necessity for a structured, VUCA-based manpower framework tailored to the construction industry (Maley et al., 2024).

Despite growing recognition of VUCA as a valuable framework for HRM, empirical research and synthesis on the barriers to effective implementation of VUCA models in construction firms' manpower management remain limited. Key obstacles include organizational inertia, insufficient senior leadership support, shortages in digital HR capabilities, data interoperability challenges, and the need for new leadership and learning approaches to operationalize VUCA strategies in project settings (Chowdhury, 2024; Widowati et al., 2022; Troise et al., 2022). Additionally, there is a lack of comprehensive analyses linking these barriers to a dedicated manpower management model that addresses the unique, project-based, safety-critical, and multi-stakeholder characteristics of the construction industry. Although some studies address VUCA in general or in related sectors, few provide explicit guidance on translating the VUCA concept into actionable HR strategies, processes, and governance frameworks to enhance workforce deployment, skill development, performance, and resilience in construction projects (Maley et al., 2024; Biloslavo et al., 2024; Zhang & Chen, 2023).

Addressing these barriers is essential, given that construction projects require a skilled workforce, operate in safety-sensitive contexts, and involve complex supply chains, making agile and resilient HRM critical for success in volatile environments (Chowdhury, 2024; Dongqiao, 2024). The ongoing digital transformation and post-pandemic challenges further underscore the necessity for systematic HR reforms in recruitment, learning, succession planning, performance evaluation, and workforce analytics aligned with VUCA principles (Maley et al., 2024; Biloslavo et al., 2024). Effective adaptation to VUCA conditions demands not only technological advancements but also shifts in leadership, organizational culture, and employee competencies, all of which influence manpower planning and project outcomes (Chowdhury, 2024; Maley et al., 2024; Horstmeyer, 2020). Successful project delivery in VUCA environments depends on an organization's capacity to detect changes, make informed decisions, and respond rapidly. Therefore, identifying and overcoming barriers is vital for promoting agility, continuous learning, and flexible workforce strategies in construction (Niehaus & Mocan, 2024; Troise et al., 2022). Ultimately, it is imperative to evaluate and clearly articulate the barriers to adopting a VUCA-based manpower management model in construction firms and to develop evidence-based strategies to address these challenges.

2.0 LITERATURE REVIEW

2.1 The Construction Industry as a VUCA Environment

The construction sector operates under volatile, uncertain, complex, and ambiguous (VUCA) conditions, which influence leadership requirements, risk management strategies, and project performance. Recent literature highlights the importance of blockchain-enabled and agile leadership in both VUCA and Fourth Industrial Revolution (4IR) contexts to facilitate rapid adaptation and resilience (Long et al., 2023; Albuquerque Pai et al., 2023). For example, Vietnam's 4IR leadership models demonstrate that blockchain leadership can enhance adaptability in VUCA environments (Long et al., 2023). Empirical studies further support the adoption of emergent technologies, particularly blockchain, as effective tools for risk management and supply chain optimization under VUCA conditions, linking these factors to perceived usefulness and intentions to implement blockchain-based risk controls (Chowdhury et al., 2022). Additionally, resilience, strategic flexibility, and knowledge complexity are identified as key drivers of performance in uncertain environments. For small and medium-sized enterprises (SMEs) and construction-related firms, managerial and operational expertise, combined with resilience, are essential for maintaining performance during disruptions (Audretsch & Belitski, 2021). Systemic governance and strategic foresight frameworks provide mechanisms to improve readiness and foster collaboration in VUCA projects, including public-private partnerships in volatile contexts (Bouckaert, 2024; Alfiandri et al., 2024). Collectively, the literature emphasizes agile leadership, technology-enabled resilience, and proactive governance

as fundamental strategies for the construction sector in the VUCA era (Long et al., 2023; Chowdhury et al., 2022; Okonkwo et al., 2024).

2.2 Manpower Operations in Building Construction Firms

Workforce planning and labour deployment are fundamental in project-driven construction, where demand fluctuates, and skilled trade labour remains limited (Biruk et al., 2022; Micheli et al., 2023). Simulation-based manpower planning enables the analysis of order flow variability, determination of optimal employment levels, and evaluation of internal versus subcontractor staffing strategies, thereby reducing delays and penalties (Biruk et al., 2022). Trade-specific project-level forecasting facilitates scheduling and resource leveling within critical path methods, which is essential for timely project completion (Lai, 2017). Workforce planning frameworks in project-driven organizations establish comprehensive guidelines for data management, stakeholder roles, and procedural alignment across design, procurement, and field operations (Micheli et al., 2023). Workforce diversity, skill gaps, and training requirements significantly affect productivity; research indicates that skilled supervision, robust planning, and ongoing training enhance productivity, performance, and project outcomes (Won et al., 2020; Ofori et al., 2021). The COVID-19 pandemic and the Fourth Industrial Revolution have intensified labour constraints but have also accelerated the adoption of digital technologies such as Building Information Modeling (BIM), digital twins, and the Internet of Things (IoT) to optimize workforce deployment and safety (Maddikunta et al., 2022). Regional analyses identify labour cost determinants, training deficiencies, and policy interventions as pivotal factors in maintaining productivity within volatile markets (Luo et al., 2018).

2.3 Application of VUCA Principles in Workforce Management

VUCA-informed workforce strategies prioritize agile planning, flexible skill development, digital integration, and adaptive leadership within manpower operations. Empirical and conceptual studies demonstrate that simulation-based and advanced workforce planning (WFP) frameworks facilitate dynamic staffing in project-driven construction, enabling rapid reallocation, effective subcontractor coordination, and enhanced resilience amid variability in orders (Biruk et al., 2022; Micheli et al., 2023; Lai, 2017). The COVID-19 pandemic and Fourth Industrial Revolution (4IR) drivers highlight the importance of digitalization, including Building Information Modeling (BIM), digital twins, and the Internet of Things (IoT), as essential for agile deployment and safety, reducing operational bottlenecks, and supporting real-time resource allocation (Tekin, 2022; Maddikunta et al., 2022). Studies on workforce diversity, training deficiencies, and inter-organizational collaboration emphasize the productivity gains associated with adaptable skill sets and cross-disciplinary learning in volatile environments (Won et al., 2020; Ofori et al., 2021). Perspectives from strategic leadership and human resource development (HRD) advocate for transformative, agile leadership and the cultivation of a learning-oriented culture to maintain performance in uncertain contexts (Chowdhury, 2024; Ramakrishnan, 2021). Overall, the literature supports integrating AI-augmented planning, strategic foresight for occupational safety and health (OSH), and policy-aligned governance to enhance workforce agility in VUCA environments (Yawson & Goryunova, 2025; Mintrom & O'Connor, 2024).

2.4 Organisational Readiness for VUCA Adoption: Key Internal Factors

A comprehensive readiness profile integrates leadership commitment, organizational culture, technological capacity, and change management, as supported by literature in human resource development, project management, and strategic leadership. Commitment to agile, transformational, and responsible leadership styles facilitates rapid decision-making and organizational learning in volatile environments (Chowdhury, 2024). A culture characterized by continuous learning, psychological safety, and cross-functional collaboration supports effective adoption of VUCA principles and ongoing capability development (Maponya & Naidoo, 2023; Groves & Feyerherm, 2022). Technological

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capacity, including digital HR architecture, AI-assisted planning, adoption of BIM and IoT, and advanced data analytics, enables real-time resource allocation, enhances safety, and supports adaptive workforce practices essential in VUCA contexts (Chowdhury, 2024). Readiness for change management, encompassing scenario planning, war-gaming, and continuous learning, facilitates transitions to flexible roles and upskilling, thereby reducing resistance and enabling rapid organizational pivots (Streit et al., 2021; Dobrowolska & Śliż, 2023). The literature identifies leadership development, agile HR practices, and strategic foresight as key enablers of readiness, while noting skill gaps, governance challenges, and limited inter-organizational coordination as barriers to maturity (Chowdhury, 2024; Kumar & Kumar, 2024). In summary, organizational readiness for VUCA depends on aligned leadership, a learning-oriented culture, digitally enabled processes, and proactive change management capabilities (Chowdhury, 2024; Groves & Feyerherm, 2022).

2.5 Barriers to the Adoption of the VUCA Model in Manpower Operations

The adoption of the VUCA (volatility, uncertainty, complexity, ambiguity) framework in manpower operations is impeded by multifaceted barriers, including organizational culture, capability gaps, governance, technology, and workforce well-being. Evidence from diverse sources suggests that successful implementation requires: (a) clear conceptual alignment of VUCA with human resources (HR) practices and manpower planning; (b) robust leadership and change-management capabilities to address volatility and uncertainty; (c) investments in skills, learning ecosystems, and design-thinking approaches to foster adaptive capabilities; (d) infrastructural and resource readiness, such as data, analytics, and digital platforms; and (e) attention to workforce well-being and equitable access to training and opportunities. The following sections synthesize findings across domains, highlight areas of consensus and nuance, and propose actionable considerations for practitioners. Multiple studies indicate that translating the VUCA framework from military or macro-organizational contexts into concrete HR practices presents significant challenges. The literature underscores that, without a coherent HR system design encompassing recruitment, training, deployment, and performance management, the VUCA perspective remains abstract and does not yield measurable improvements (Dongqiao, 2024; Hanine & Dinar, 2022; Okonkwo et al., 2024). This misalignment impedes adoption, as managers encounter difficulties in applying VUCA concepts to routine manpower decisions such as staffing models, succession planning, and capability development (Dongqiao, 2024; Hanine & Dinar, 2022). Furthermore, some authors argue that, despite widespread discussion of VUCA, there is a need for contextualized, industry- and region-specific conceptualizations (e.g., healthcare, public sector, and low- and middle-income country (LMIC) contexts) to make VUCA actionable in manpower operations (Jacomina et al., 2024; Okonkwo et al., 2024; Lundy et al., 2024). This variation is significant because a generic VUCA framework may not adequately capture the unique drivers of volatility and uncertainty in specific labor markets. Leadership competencies specifically designed for VUCA environments are consistently identified as essential for successful adoption. Leaders are required to move beyond traditional transformational leadership and instead demonstrate agility, vision, and rapid decision-making in ambiguous situations (Brennan, 2022; Hanine & Dinar, 2022). In practice, the inability to translate leadership capability into sustained organizational change can impede VUCA adoption. Disruptive and agile leadership models have emerged as necessary responses to the pandemic and ongoing volatility; however, debate persists regarding which leadership approaches most effectively translate VUCA insights into manpower strategies, such as workforce redesign, flexible staffing, and rapid reskilling (Brennan, 2022; Morgan-Gorman et al., 2025). This complexity indicates that leadership development represents a multifaceted barrier rather than a straightforward solution.

Lifelong learning and continuous upskilling are consistently identified as critical for success in VUCA contexts. Barriers to these practices include limited awareness of training opportunities, restricted access to

flexible learning, and insufficient integration of design-thinking approaches with workforce development (Lim et al., 2024; Seevaratnam et al., 2023). These obstacles hinder the development of adaptable and competent manpower capable of performing effectively in volatile environments. While design thinking and design-based learning present promising strategies for cultivating adaptability, their adoption remains inconsistent, with higher education and industry sectors experiencing slow uptake and institutional resistance. Without embedding design thinking within a comprehensive lifelong-learning framework, its influence on manpower operations remains constrained (Seevaratnam et al., 2023). However, many organizations are either hesitant to adopt HR analytics or lack the capacity to integrate it into daily HR operations (Dasari & Devi, 2025). This deficiency limits the ability to forecast volatility, assess risk, and implement adaptive staffing and development initiatives. Although digital transformation of human resource management (HRM) is recognized as essential in the VUCA era, barriers such as insufficient digital literacy, inadequate technical support, fragmented information systems, and governance challenges impede cross-functional coordination (Dongqiao, 2024). Unless these obstacles are addressed, digital tools will not effectively translate VUCA insights into improvements in manpower operations. Resource constraints, including staffing shortages, limited access to advanced technology, and insufficient financial support, restrict the implementation of VUCA-informed manpower strategies, especially in low- and middle-income countries (LMICs) or resource-limited settings. Research on healthcare training programs and public-sector environments demonstrates that resource gaps hinder expansion, skill development, and system-wide readiness required for VUCA adoption (Jacomina et al., 2024; Okonkwo et al., 2024). Systems-thinking approaches emphasize that the absence of a comprehensive strategy and agile organizational structures results in ineffective implementation of VUCA-driven HR initiatives. When organizations function in silos and lack consistent governance, adapting to volatile conditions becomes increasingly difficult (Korlipara & Raju, 2025). The VUCA environment places heightened stress and burnout pressures on frontline workers, with implications for talent stability, morale, and performance. Well-being is therefore both a consequence of VUCA exposure and a moderator of adoption success; neglecting worker resilience can undermine manpower initiatives in volatile contexts (Okonkwo et al., 2024; Raghavan et al., 2021). Integrating well-being initiatives with VUCA-driven HR practices is essential for sustainable adoption. The adoption of the VUCA model in manpower operations is impeded by a range of interconnected barriers, including conceptual misalignments, leadership deficiencies, capability and learning gaps, data and digital readiness issues, resource limitations, well-being concerns, and contextual variability. Overcoming these challenges requires an evidence-based, integrated approach that combines clear operationalization of VUCA within HR domains, strong leadership, robust learning ecosystems, data-driven practices, and comprehensive well-being support. This perspective is consistent with the broader VUCA literature and sector- and country-specific findings, underscoring the necessity for context-sensitive, multifunctional strategies to fully realize the benefits of VUCA-informed manpower operations.

3.0 RESEARCH METHODS

The research design establishes the foundational framework for planning, implementing, and analyzing data collection processes. Kothari and Gaurav (2014) define research design as a strategic plan that guides the approach to addressing research questions, while Creswell (2014) emphasizes the importance of selecting both the research subject and the most appropriate methodology. This study employs a quantitative design to assess the barriers to the adoption of the VUCA model for effective manpower management in building construction firms. Insights from the literature review informed the development of a structured questionnaire used to rank respondents' opinions on the VUCA dimensions. Numerical data were systematically analyzed to identify patterns and relationships, with self-administered questionnaires serving as the primary data collection instrument. The accessible population comprised 300 core building professionals involved in construction project

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management, including architects, builders, civil engineers, and quantity surveyors. Due to the heterogeneous nature of the study population, simple random sampling was not feasible. Therefore, a convenience sampling technique was adopted to access available respondents and to reflect the population's proportional distribution, consistent with Sambo's (2008) assertion. Kothari and Gaurav (2014) define a research population as encompassing all relevant elements within a study field, while Singh (2006) describes it as the total number of individuals possessing pertinent characteristics. A pilot study was conducted by administering questionnaires to twenty respondents in Abuja to assess the reliability of the research instrument and identify potential weaknesses in the design. Observed flaws and ambiguities in question wording were corrected prior to the final field survey. The results of the first and second pilot studies were correlated to determine the Cronbach alpha (α) value, and pre-tests were conducted before the final administration. Data collection utilized a structured, closed-ended questionnaire, validated for consistency and reliability in accordance with Kothari and Gaurav (2014). Descriptive statistics, including frequencies and percentages, were used to analyze respondents' demographic characteristics, while mean scores and standard deviations were calculated. The study achieved an 80% response rate, exceeding the typical 20–30% average in management research (Creswell 2014).

4.0 RESULTS AND DISCUSSION

4.1 The factors hindering the adoption of VUCA model in building construction firms for effective manpower operations

Table below shows the ranking of the eighteen (18) factors hindering the adoption of VUCA Model in building construction firms according to the mean scores and standard deviation in descending order. The mean scores of the factors hindering the adoption ranges between 1.0958 – 4.5421. Standard deviation from 0.71152 – 1.57818. These factors include: technology (mean score = 4.5421; St.D = 1.57818) ranked 1st, poor infrastructure and implementation of development plans (mean score = 4.5157; St.D = 1.38456) ranked 2nd, changing nature of the workforce/demographic and social forces and employee dissatisfaction (mean score = 4.3750; St.D = 1.37255) ranked 3rd, new ideas in building construction (mean score = 3.9813; St.D = 1.45502) ranked 4th, ineffective leadership/performance failure and shared vision (mean score = 3.8637; St.D = 0.99257) ranked 5th, agile global competitors (mean score = 3.7475; St.D = 1.37622) ranked 6th, social and financial uncertainties (mean score = 3.6842; St.D = 1.30303) is ranked 7th, rampant structural (operational) in the business (mean score = 3.5407; St.D = 1.01433) ranked 8th, imagination to adapt and flexibility (mean score = 3.4328; St.D = 1.16844) is ranked 9th, political issues in the business world (mean score = 3.3129; St.D = 1.28557) is ranked 10th, government and international regulation (mean score = 3.2083; St.D = 1.05335) is ranked 11th, globalization (mean score = 2.9867; St.D = 0.95491) is ranked 12th, sectorial terrorism (mean score = 2.8675; St.D = 1.30266) is ranked 13th, Shifts in client and stakeholder expectations (mean score = 2.5458; St.D = 0.99264) is ranked 14th, High levels of unemployment leading to poverty and insecurity (mean score = 2.5167; St.D = 0.95928) is ranked 15th, Devastating levels of corruption (mean score = 1.5167; St.D = 1.23399) is ranked 16th, growth in economy (mean score = 1.1292; St.D = 0.71152) is ranked 17th, and ecological (environmental) dilemma (mean score = 1.0958; St.D = 1.46478) which is ranked 18th.

Factors hindering the adoption of VUCA Model in building construction firms

Factors hindering the adoption of VUCA model in building construction industry	Mean	St. D	Ranking
Technology.	4.5421	1.57818	1
Poor infrastructure & implementation of development plans.	4.5157	1.38456	2
Changing nature of the workforce/demographic and social forces and employee dissatisfaction.	4.3750	1.37255	3

New ideas in building construction.	3.9813	1.45502	4
Ineffective leadership/performance failure and shared vision.	3.8637	.99257	5
Agile global competitors.	3.7475	1.37622	6
Social and financial uncertainties.	3.6842	1.30303	7
Rampant structural (operational) in the business.	3.5407	1.01433	8
Imagination to adapt and flexibility.	3.4328	1.16844	9
Political issues in the business world.	3.3129	1.28557	10
Government and international regulation.	3.2083	1.05335	11
Globalization.	2.9867	.95491	12
Sectorial terrorism.	2.8675	1.30266	13
Shifts in client and stakeholder expectations.	2.5458	.99264	14
High levels of unemployment leading to poverty and insecurity.	2.5167	.95928	15
Devastating levels of corruption.	1.5167	1.23399	16
Growth in economy.	1.1292	.71152	17
Ecological (environmental) dilemma.	1.0958	1.46478	18

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Rotated Component Matrix[a] of Extraction method (Principal Components Analysis) & Rotation method (Varimax with Kaiser Normalization)

	Component						
	1	2	3	4	5	6	7
Imagination to adapt and flexibility.	.859						
Ineffective leadership/performance failure and shared vision.	.831						
Rampant structural (operational) in the business.	.680						
New ideas in building construction.	.624			.523			
Shifts in client and stakeholder expectations.		.986					
High levels of unemployment leading to poverty and insecurity.		.986					
Social and financial uncertainties.			.850			-.309	
Growth in economy.			.835				
Ecological (environmental) dilemma.			-.676			-.306	
Government and international regulation.				.743	-.333		
Political issues in the business world.				-.693			.474
Poor infrastructure & implementation of development plans.				.547		-.476	
Sectorial terrorism.					.838		
Technology.	.344				-.612		-.317
Changing nature of the workforce/demographic and social forces and employee dissatisfaction.						.785	.311
Devastating levels of corruption.					.407	.770	
Agile global competitors.							.865
Globalization.		.343					.480

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 11 iterations.

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Total Variance Explained the initial Eigenvalues, extraction sums of squared loadings & rotation sums of squared loadings

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.263	18.130	18.130	3.263	18.130	18.130	2.579	14.326	14.326
2	2.474	13.746	31.876	2.474	13.746	31.876	2.122	11.787	26.113
3	2.004	11.133	43.009	2.004	11.133	43.009	2.112	11.733	37.847
4	1.685	9.359	52.369	1.685	9.359	52.369	1.786	9.923	47.770
5	1.635	9.084	61.453	1.635	9.084	61.453	1.694	9.413	57.183
6	1.397	7.759	69.212	1.397	7.759	69.212	1.692	9.400	66.582
7	1.115	6.193	75.405	1.115	6.193	75.405	1.588	8.823	75.405
8	.882	4.903	80.308						
9	.789	4.383	84.691						
10	.620	3.443	88.134						
11	.551	3.060	91.194						
12	.411	2.282	93.476						
13	.350	1.947	95.423						
14	.282	1.568	96.991						
15	.231	1.281	98.272						
16	.176	.977	99.249						
17	.135	.751	100.000						
18	-4.441E-16	-2.467E-15	100.000						

Extraction Method: Principal Component Analysis.

Tables above clearly displays the factor analysis for the factors hindering the adoption of VUCA Model in building construction firms for effective manpower operations. The combined two tables of rotated components matrix[a] and the total variance explained the factor analysis with the initial Eigenvalues, extraction sums of squared loadings & rotation sums of squared loadings. Imagination to adapt and flexibility is determined with initial eigenvalues of 3.263, extraction sums of squared loadings of 3.263 and rotation sums of squared loadings of 2.579; Shifts in client and stakeholder expectations & High levels of unemployment leading to poverty and insecurity is determined with initial eigenvalues of 2.474, extraction sums of squared loadings of 2.474 and rotation sums of squared loadings of 2.122 each; Social and financial uncertainties is determined with initial eigenvalues of 2.004, extraction sums of squared loadings of 2.004 and rotation sums of squared loadings of 2.112; Government and international regulation are determined with initial eigenvalues of 1.685, extraction sums of squared loadings of 1.685 and rotation sums of squared loadings of 1.786; Sectorial terrorism is determined with initial eigenvalues of 1.635, extraction sums of squared loadings of 1.635 and rotation sums of squared loadings of 1.694; Changing nature of the workforce/demographic and social forces and employee dissatisfaction is determined with initial

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eigenvalues of 1.635, extraction sums of squared loadings of 1.635 and rotation sums of squared loadings of 1.694; and, Agile global competitors are determined with initial eigenvalues of 1.115, extraction sums of squared loadings of 1.115 and rotation sums of squared loadings of 1.588.

4.2 Discussion of Findings

These findings are consistent with the VUCA literature, which identifies digital readiness and structured development frameworks as essential for building resilient manpower systems in volatile and complex environments (Chowdhury, 2024). Workforce effectiveness is closely associated with policy support, development pathways, and leadership capacity to convert technological investments into improved outcomes (Putro et al., 2022). The identification of technology as the primary barrier underscores its centrality in achieving VUCA readiness. Existing research emphasizes that managing volatility and uncertainty requires digital competence, data-driven decision-making, and AI-enabled systems. Nevertheless, these advantages are frequently limited by organizational challenges such as inadequate data governance, skill shortages, and resistance to change (Chowdhury, 2024; Biloslavo et al., 2024; Yawson & Goryunova, 2025). From a lifelong-learning perspective, the adoption of digital tools such as BIM, IoT, and digital twins must be accompanied by continuous training and adaptive learning cultures to be effective (Seevaratnam et al., 2023; Lim et al., 2024). Furthermore, research on digital HR systems demonstrates that leadership alignment and organizational culture are critical for ensuring that technological investments lead to improved manpower performance in VUCA contexts (Chowdhury, 2024; Biloslavo et al., 2024; Groves & Feyerherm, 2022).

The second-ranked barrier, poor infrastructure and ineffective implementation of development plans, highlights a disconnect between strategic intent and operational capacity. The effectiveness of VUCA-oriented manpower strategies relies on robust training systems, institutional support, and coordinated development initiatives. Evidence from lifelong-learning programs indicates that well-designed policies can bridge skill gaps and enhance workforce adaptability, whereas weak systems impede progress (Lim et al., 2024). Additionally, research suggests that comprehensive, system-wide reforms are more effective than isolated training initiatives in achieving readiness within dynamic environments (Putro et al., 2022; Chowdhury, 2024). In the construction sector, where labor demand is project-based and variable, inadequate development planning diminishes the capacity to respond effectively to changing conditions (Putro et al., 2022).

The third major barrier concerns the increasing complexity of workforce dynamics, including demographic transitions and evolving social expectations. Research on VUCA-ready organizations underscores the importance of competencies such as learning agility, adaptability, and cross-cultural collaboration for managing diverse, multi-generational teams (Shet, 2024). Leadership and human resource development literature further emphasize the necessity of transformational leadership, robust learning cultures, and a shared organizational vision to maintain engagement in uncertain environments (Groves & Feyerherm, 2022). Ongoing upskilling is required to address changing job roles and emerging work arrangements, including hybrid and digitally mediated teams (Seevaratnam et al., 2023; Lim et al., 2024). In the absence of these systems, workforce-related changes present significant barriers to effective manpower management.

The fourth barrier involves the introduction of new ideas in building construction, which highlights the challenges of integrating innovation within established organizational structures. The implementation of advanced methods such as modular construction and Industry 4.0 technologies frequently necessitates more flexible and collaborative organizational designs. Research indicates that agile structures, including cross-functional teams and matrix systems, can enhance responsiveness, though they may also increase coordination complexity (Raghavan et al., 2021). From the perspective of dynamic capabilities, organizations must develop the capacity to adapt by reconfiguring resources and processes in response to environmental changes (Hoeft, 2021; Joussen et al., 2024). In the absence of such capabilities, innovation may function as a barrier rather than an enabler.

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Ineffective leadership and the lack of a shared vision represent the fifth barrier, underscoring the critical role of leadership in VUCA environments. Adaptive leadership, defined by strategic thinking, collaboration, and learning agility, is vital for navigating uncertainty (Groves & Feyerherm, 2022). Leadership development, supported by human resource development systems and digital competencies, enables organizations to implement VUCA strategies successfully (Chowdhury, 2024; Groves & Feyerherm, 2022). In contexts where leadership capacity is insufficient, technological and strategic initiatives frequently fail to enhance manpower outcomes.

Several barriers originate from external factors, including global competition, financial uncertainty, political conditions, and regulatory pressures. The VUCA literature highlights the necessity of strategic foresight, resilience, and coordination in addressing these complexities. Scenario planning and anticipatory governance are recognized as essential tools for aligning organizational capabilities with external dynamics (Baran & Woznyj, 2021; Streit et al., 2021; Singh et al., 2020). Furthermore, research on Fourth Industrial Revolution readiness emphasizes the significance of leadership capability, analytical skills, and AI literacy in adapting to evolving policy environments (Maponya & Naidoo, 2023).

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The results show that implementing a VUCA-focused model for manpower management in building construction firms is limited by interconnected factors related to technology, structure, workforce, leadership, and the external environment. Technology emerges as the primary obstacle, highlighting the importance of digital preparedness in handling volatility and complexity in today's construction sectors. Still, its success depends on sufficient infrastructure, effective development strategies, and robust institutional support. Workforce issues such as demographic changes, shifting expectations, and dissatisfaction add further challenges, while organizational rigidity hampers the adoption of innovative construction methods. Moreover, weak leadership and the lack of a shared vision undermine strategic coherence, with external factors like regulatory uncertainty and global competition amplifying these difficulties. Ultimately, achieving VUCA readiness calls for an integrated strategy that includes digital transformation, workforce enhancement, flexible leadership, and solid institutional frameworks.

5.2 Recommendations

To enhance the adoption of VUCA-oriented manpower management, construction firms and policymakers should prioritize a comprehensive strategy that integrates technological advancement with the development of human and institutional capacities. Investments in digital tools such as Building Information Modeling (BIM), the Internet of Things (IoT), and Artificial Intelligence (AI) should be supported by continuous training programs that foster lifelong learning, digital literacy, and workforce adaptability. Strengthening infrastructure and ensuring the effective implementation of development policies are essential to bridging the gap between strategy and practice. Leadership development initiatives should aim to cultivate leaders who can navigate uncertainty and align organizational objectives. Furthermore, firms should promote a learning-oriented culture that supports innovation, collaboration, and knowledge sharing, while adopting flexible organizational structures to enhance responsiveness. Initiatives to improve employee engagement and satisfaction, combined with strategic foresight and scenario planning, will further enable firms to manage external uncertainties and build resilience in VUCA environments.

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