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HARNESSING ENTREPRENEURIAL KNOWLEDGE FOR CONSTRUCTION PROJECT SUCCESS

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ABSTRACT

The construction industry across emerging economies faces persistent volatility, exposing small, medium, and micro enterprises (SMMEs) to risks of reduced project success, declining income, and even closure. In South Africa, these challenges are particularly evident in the City of Tshwane, where construction SMMEs are under pressure to maintain performance in a competitive market. This study, therefore, explores how entrepreneurial knowledge, expressed through entrepreneurial orientation and customer satisfaction, contributes to project success in this critical sector. Adopting a quantitative descriptive design, data were collected from 251 construction project managers through a structured questionnaire. Analysis was conducted using SmartPLSv4, incorporating measurement model evaluation and structural equation modeling to test hypothesised relationships. The results reveal that two dimensions of entrepreneurial orientation, innovativeness and proactiveness, have significant positive effects on project success, while risk-taking shows no significant impact. Further, mediation analysis indicates that customer satisfaction does not significantly mediate the relationship between entrepreneurial orientation and project success. These findings highlight that entrepreneurial knowledge in the form of innovativeness and proactiveness plays a crucial role in driving construction outcomes, whereas reliance on risk-taking may not yield similar benefits in volatile markets. The study thus contributes to entrepreneurial knowledge by clarifying how orientation dimensions influence project success in an emerging economy context, while also addressing the limited empirical research on this relationship within the construction sector. The insights offer both theoretical implications and practical guidance for SMME construction firms seeking sustainable performance amid uncertainty.

KEYWORDS: Entrepreneurial knowledge, entrepreneurial orientation, customer satisfaction, construction project success, small, medium and micro enterprises (SMMEs), South Africa.

JEL CLASSIFICATION: L26, M13, O12

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INTRODUCTION

Entrepreneurial knowledge has become a critical driver of success in project-based industries such as construction, where firms must combine technical delivery with innovation, adaptability, and customer focus (Tariq *et al.,* 2024; Kraus *et al.,* 2021). In general, innovation in business has become of increased importance (Kuzior *et al.,* 2024). In this setting, entrepreneurial orientation, through innovativeness, risk-taking, and proactiveness, plays a central role in shaping project outcomes. Despite its potential, the construction industry remains highly vulnerable to market volatility worldwide (Kester, 2022). In South Africa, small, medium, and micro enterprises (SMMEs) are particularly at risk of reduced project success,

income loss, and closure. This study examines how entrepreneurial orientation and customer satisfaction contribute to entrepreneurial knowledge and, ultimately, construction project success in the City of Tshwane.

The construction industry is affected by market volatility in most parts of the world (Kester, 2022). This situation has left small, medium, and micro enterprise (SMME) construction organisations in South Africa (SA) grappling for survival in recent years (Hancock, 2022). Consequently, SMME construction organisations in SA are at risk of experiencing reduced project success, a decrease in income, and closure. The use of entrepreneurial orientation and customer satisfaction should be regarded as a panacea for SA SMME construction organisations that seek to retain project success (Martens *et al.,* 2018). There is an abundance of research that associates cost, quality and time with project success (Adnan *et al.,* 2013; Berssaneti & Carvalho, 2015). However, recent research has shown that entrepreneurial orientation and customer satisfaction are more robust in measuring project success than the aforementioned factors (Sabahi & Parast, 2020). Research shows that entrepreneurial orientation has a statistically significant positive relationship with project success (Martens *et al.,* 2015; Martens *et al.,* 2018). As already indicated, there is overwhelming research on the relationship between cost, quality, time, and project success (Adnan *et al.,* 2013; Berssaneti & Carvalho, 2015), however, research that links entrepreneurial orientation with project success is still in its infancy (Sabahi & Parast, 2020). Martens *et al.* (2018) argue that customer satisfaction is an undisputable measure of project success, predicting behavioural intention (Dawi *et al.,* 2018). It is also what determines a company's competitiveness (Suchanek & Kralova, 2018). Competitiveness ultimately results in increased productivity (Civelek *et al.,* 2023). However, there are limited studies that have tested the mediation effect of customer satisfaction on the relationship between entrepreneurial orientation and project success. This study identifies two theoretical gaps in the body of knowledge as follows: (i) limited studies on the relationship between entrepreneurial orientation and project success, and (ii) a shortage of studies that have tested the mediation effect of customer satisfaction on the relationship between entrepreneurial orientation and project success. To address these gaps in the body of knowledge, this study aims to (i) test the effect of entrepreneurial orientation on project success and (ii) test the mediation effect of customer satisfaction on the relationship between entrepreneurial orientation and project success.

Importantly, most existing empirical studies have been conducted in developed economies, leaving a shortage of context-specific insights from emerging economies such as South Africa. The South African construction sector is uniquely constrained by high unemployment, funding limitations for SMMEs, and institutional challenges within municipalities such as Tshwane. These contextual realities make it an ideal setting to test whether entrepreneurial knowledge, expressed through entrepreneurial orientation and customer satisfaction, can enhance project success despite systemic barriers. This provides both theoretical and practical justification for situating the study in South Africa. The remainder of the paper has the theoretical framework, followed by the research design and methodology, findings, managerial implications, conclusions and suggestions for future research.

Entrepreneurial knowledge and the study context

Entrepreneurial knowledge refers to the capabilities, insights, and practices that enable firms to recognize opportunities, mobilize resources, and implement strategies for sustained performance (Al Mamun *et al.,* 2019; Kraus *et al.,* 2021). Entrepreneurial knowledge is also a key driver of entrepreneurial intention (Ilomo & Mwantimwa, 2023). In project-based industries such as construction, entrepreneurial knowledge goes beyond technical expertise to include the ability to innovate, take calculated risks, and act proactively in highly uncertain environments. These knowledge-driven capabilities shape how project managers and firms deliver value, adapt to market turbulence, and maintain client relationships. In the context of this study, entrepreneurial orientation dimensions innovativeness, risk-taking, and proactiveness are conceptualized as manifestations of entrepreneurial knowledge that influence project

success. Customer satisfaction is examined as a potential mediating mechanism, reflecting how knowledge-based practices translate into client perceptions and project outcomes. Through linking entrepreneurial orientation to construction project success in Tshwane, this study contributes to the growing body of research that positions entrepreneurial knowledge as a strategic asset in emerging economies.

Definition of entrepreneurial orientation

The existence of entrepreneurial orientation dates back decades, with credit going to Danny Miller for putting the concept into the literature spotlight in 1983 (Covin & Lumpkin, 2011). Definitions of entrepreneurial orientation have been put to light in the past decade by different authors (Covin & Lumpkin, 2011; Anderson *et al.,* 2015; Martens *et al.,* 2018). Covin and Lumpkin (2011) describe entrepreneurial orientation as an inclination or interest towards entrepreneurship. In further validating their description of entrepreneurial orientation, Covin and Lumpkin (2011) provide a scenario of a strategic business unit that varies from small to medium to a multi-business enterprise. These different business levels require some fusion of entrepreneurial orientation to function efficiently. Freitas *et al. (*2012) define entrepreneurial orientation as practices aimed at improving entrepreneurial activities with a deliberate attempt to achieve competitive advantage to attain the goals and vision of the organisation. Martens *et al.* (2018) explain entrepreneurial orientation as a set of policies and practices directed at establishing entrepreneurial actions that result in the formation of competitive advantage.

In their definition, Covin and Lumpkin (2011) liken entrepreneurial orientation to an approach that advances a culture of entrepreneurship across the different levels of the organisation. In essence, Covin and Lumpkin (2011) think that every organisation, regardless of its size, requires the adoption of an entrepreneurship culture to be successful. Freitas *et al.* (2012) do not associate entrepreneurial orientation with different organisational sizes like Covin and Lumpkin (2011) do. However, what Freitas *et al.* (2012) have sufficiently managed to pinpoint in the entrepreneurial definition is the need to improve entrepreneurial activities within an organisation. When looking at this angle, one can trace similarities between Covin and Lumpkin (2011) and Freitas et al. (2012) in the sense that they are all associating entrepreneurial orientation with the need to achieve competitive advantage of an organisation, despite its size. Although Martens *et al.* (2018) fit into this conversation that associates entrepreneurial orientation with competitive advantage, they went a step ahead by indicating the need to have policies and practices that promote the development of entrepreneurial orientation.

Despite the variations within Covin and Lumpkin (2011), Freitas *et al.* (2012) and Martens *et al.* (2018) suggest that they are unified by common dimensions of entrepreneurial orientation. These dimensions include innovativeness, risk-taking, proactiveness, autonomy, and competitiveness (Covin & Lumpkin, 2011; Freitas *et al.,* 2012; Martens *et al.,* 2018). The aforementioned authors indicate that entrepreneurial orientation is characterised by innovativeness, risk-taking, proactiveness, autonomy and competitiveness (Covin & Lumpkin, 2011; Freitas *et al.,* 2012; Martens *et al.,* 2018). Further understanding of the concept of entrepreneurial competence is attained through the evaluation of the entrepreneurial orientation theory.

1 THEORETICAL FRAMEWORK

1.1 Entrepreneurial orientation theory

This study is grounded in Entrepreneurial Orientation Theory (Lumpkin & Dess, 1996), which highlights key dimensions; innovativeness, risk-taking, proactiveness, autonomy, and competitive aggressiveness, as drivers of firm performance. EO captures how organisations pursue opportunities, tolerate risk, and

proactively shape markets (Rauch *et al.,* 2009; Covin & Wales, 2012). Innovativeness reflects a firm's commitment to creativity and experimentation. In construction, innovativeness enables the adoption of new materials, technologies, and methods, enhancing project delivery and client satisfaction (Kivilä *et al.,* 2017). Studies consistently link innovativeness with positive project outcomes (Martens *et al.,* 2018; Sabahi & Parast, 2020). Risk-taking refers to the willingness to commit resources under uncertainty (Martens *et al.,* 2018). While bold risk-taking can open opportunities, findings show mixed results, positive in some contexts (Sabahi & Parast, 2020), but less effective when unmanaged in volatile environments (Garcia *et al.,* 2021). Proactiveness denotes anticipating and acting on emerging opportunities ahead of competitors. Proactive firms adapt to changing client needs, adopt sustainable practices, and deliver superior project outcomes (Anderson *et al.,* 2015; Freitas *et al.,* 2012). Autonomy is the independence given to teams to pursue entrepreneurial initiatives (Rauch *et al.,* 2009). In construction projects, autonomy empowers managers to respond swiftly to challenges and innovate on-site (Rigtering & Weitzel, 2013).

Competitive aggressiveness represents assertive rivalry to gain advantage (Hughes & Morgan, 2007). In project bidding or contract acquisition, this can strengthen market presence, though it is less central to day-to-day project delivery. Grounded in these insights, prior research finds that Entrepreneurial Orientation positively influences project success across dimensions such as scope, cost, and quality (Martens *et al.,* 2015; Kock & Gemünden, 2016). However, little work has examined the mediating role of customer satisfaction, despite evidence that customer factors significantly affect project outcomes (Sabahi & Parast, 2020; Dawi *et al.,* 2018). This study, therefore, tests (i) the direct effects of innovativeness, risk-taking, and proactiveness on project success, and (ii) whether customer satisfaction mediates these relationships in the South African construction sector.

2 LITERATURE REVIEW

2.1 Innovativeness

In line with the insight from the entrepreneurial orientation theory, innovativeness is a key dimension of entrepreneurial orientation. Martens *et al.* (2018) describe innovativeness as the need for an organisation to renew and seek new opportunities in line with the development of new products, services and processes. Innovativeness is described as an aspect that involves tolerance to experimentation with the quest to produce new products, services and processes (Sabahi & Parast, 2020). Marín-García *et al.* (2021) refers to innovativeness as an organisation's trend to promote creative and novel ideas through an experimentation process that lead to the development of new products, services and processes. When looking at the definitions of innovativeness put forward by Martens *et al.* (2018), Sabahi and Parast (2020) and Marín-García *et al.* (2021) one can realise variations in expression. While Martens *et al.* (2018) put forward the idea of renewal and seeking new opportunities, Sabahi and Parast (2020) are clear on the idea of tolerance to experimentation and Marín-García *et al.* (2021) emphasise the promotion of creative and novel ideas. However, Martens *et al.* (2018), Sabahi and Parast (2020) and Marín-García *et al.* (2021) are unified in the sense that they all point towards the creation of new products, services and processes. After looking at all the insights from the aforementioned authors (Martens *et al.,* 2018; Sabahi & Parast, 2020; Marín-García *et al.* 2021), this study provides its definition of innovativeness. Innovativeness is, therefore, defined as an art through which the organisation renew, and seeks new opportunities through an experimentation process that supports the inclusion of creative and novel ideas to develop new products, services and processes.

Table 1 **Innovativeness indicators**

In general, the top managers of my firm favour a strong emphasis on Research and Development
In general, the top managers of my firm favour a strong emphasis on technological leadership and innovations.
In general, the top managers of my firm favour a strong emphasis on innovations.
My firm marked very many new lines of services in the past 5 years.
Changes in services in my firm have usually been quite dramatic in the past 5 years.

(*Source*: Covin & Slevin, 1989)

2.2 Risk-taking

Another fundamental concept that emanates from the entrepreneurial orientation theory is risk-taking. Kapsali (2011) refers to risk-taking as the ability to act within uncertainty, complexity, and uniqueness with the changes of experiencing possible deviations from set plans. Martens *et al.* (2018) position risk-taking as the propensity to venture into the unknown while investing significant resources to acquire huge returns. Furthermore, Martens *et al.* (2018) argue that risk-taking is represented by dimensions that include general risk, decision-making risk, financial risk and business risk. Sabahi and Parast (2020) regard risk-taking as a process through which substantial resources are invested to carry out remarkable activities to achieve sizeable outcomes. Garcia *et al.* (2021) describe risk-taking as an exhibition of a risk behaviour with an expectation to add value to the organisation. There is a general agreement between Martens et *al.* (2018) and Sabahi and Parast (2020) regarding associating risk-taking with resource investment. However, different features can be traced across Kapsali (2011), Martens *et al. (*2018), Sabahi and Parast (2020), and Garcia *et al.* (2021) definitions of risk-taking. Kapsali (2011) links risk-taking to uncertainty, complexity, and uniqueness. Martens *et al.* (2018) associate risk-taking with the unknown, general risk, decision-making risk, financial risk and business risk. Sabahi and Parast (2020) connect risk-taking to the carrying out of remarkable activities and sizeable outcomes. Taking from different features of the aforementioned definitions, this study defines risk-taking as the organisation's ability to act within an uncertain, complex, unique environment while investing resources and remarkable activities to achieve sizeable outcomes.

Table 2 **Risk-taking indicators**

In general, the top managers of my firm have a strong proclivity for high-risk projects (with chance of very high return).
In general, the top managers of my firm believe that, owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives
When confronted with decision-making situations involving uncertainty, my firm typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities

(Source: Covin & Slevin,1989)

2.3 Proactiveness

Proactiveness is also one of the dimensions described in the entrepreneurial orientation theory. Freitas *et al.* (2012) refer to proactiveness as an orientation through which the organisation portrays a culture of anticipation, participation, problem-solving, and a constant search for opportunities. Martens *et al.* (2018) regard proactiveness as an organisation's inclination to be ahead of competition in terms of the production of new products, services, and processes. In addition, Martens *et al.* (2018) regard proactiveness as the ability of the organisation to anticipate and locate new opportunities. Sabahi et al. (2020) describe proactiveness as the willingness of the organisation to develop new products, services, and processes amid any existing challenges instead of following market trends. Garcia *et al.* (2021) outline proactiveness as a system through which an organisation seeks opportunities such as new products, services, and process development in light of the existence of competition while considering the need to create change and shape the environment. Freitas *et al.* (2012) and Martens *et al.* (2018) have similar definitions in the sense that they both point to the need for anticipation and search for opportunities. Anticipation shows that the organisation is forward-looking. Martens *et al.* (2018) and Garcia *et al.* (2021) highlight the existence of competition as one of the main reasons to be proactive. Martens *et al.* (2018), Sabahi *et al.* (2020), and Garcia et al. (2021) involve the development of products, services, and processes. However, salient features could be traced within each of the aforementioned definitions. In the case of Freitas *et al.* (2012), unique features include participation and problem-solving. Sabahi *et al.* (2020) emphasise the existence of challenges and following of market trends. In terms of Garcia *et al. (*2021), what comes out differently is the aspect of the need for the creation of change and shaping the environment. This study, therefore, defines proactiveness as an organisational culture that focuses on anticipation, and participation in problem-solving through the development of new products, services, and processes to take advantage of existing opportunities to be ahead of competition.

2.4 Autonomy

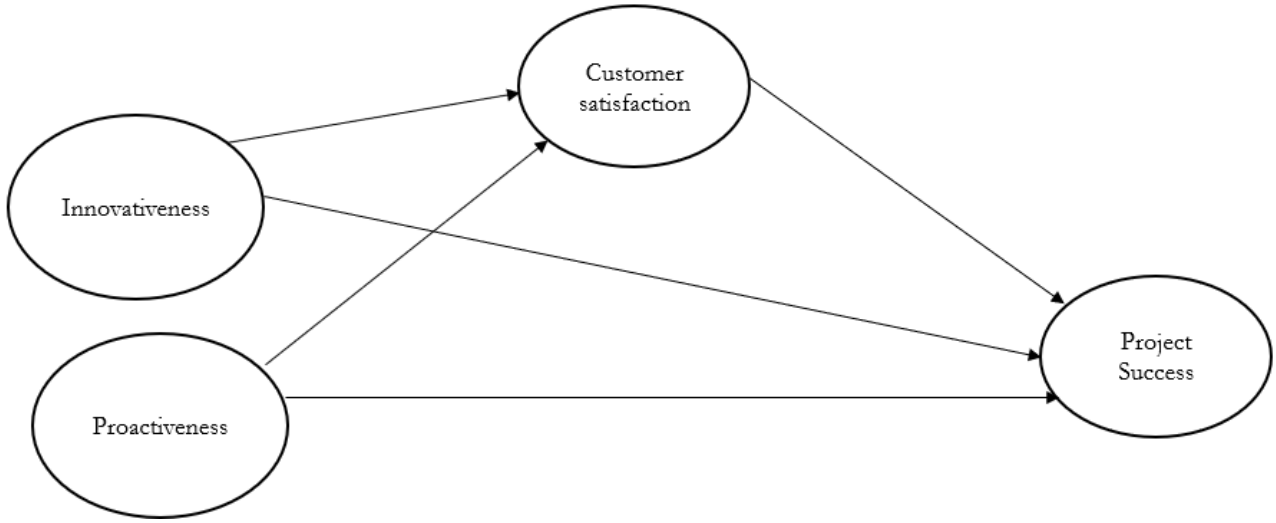
Autonomy is another dimension of entrepreneurial orientation, reflecting the extent to which individuals or teams within an organisation are empowered to develop and implement innovative ideas or projects independently. Lumpkin and Dess (1996) describe autonomy as the freedom and discretion granted to employees to pursue opportunities, make decisions, and act on entrepreneurial initiatives without excessive constraints. Autonomy enables organisations to foster creativity, encourage ownership of tasks, and respond quickly to environmental changes. Rauch *et al.* (2009) further emphasize that autonomy supports entrepreneurial action by reducing bureaucratic barriers, thereby enabling employees to transform innovative ideas into viable products, services, or processes. In the context of project-based industries such as construction, autonomy allows project managers and teams to adapt strategies and make timely decisions that contribute to overall project success.

2.5 Competitive aggressiveness

Competitive aggressiveness is defined as the firm's propensity to directly and intensely challenge competitors to improve market position or performance. Lumpkin and Dess (1996) explain that competitive aggressiveness entails a proactive posture in confronting competitors through strategies such as pricing, product launches, or marketing campaigns. This dimension is distinct from proactiveness, as it emphasizes the firm's response to competitors rather than anticipation of future demand. Kreiser *et al.* (2002) argue that competitive aggressiveness is critical in turbulent environments where firms must defend market share and capitalize on emerging opportunities. In construction industries, competitive aggressiveness can manifest in bidding strategies, rapid adoption of new technologies, or aggressive pursuit of contracts to maintain relevance and growth. As such, it remains a central aspect of entrepreneurial orientation that influences firm performance and project success.

While entrepreneurial orientation is often conceptualised as comprising five dimensions: innovativeness, risk-taking, proactiveness, autonomy, and competitive aggressiveness (Lumpkin & Dess, 1996; Rauch et al., 2009), this study focuses specifically on the three core dimensions of innovativeness, risk-taking, and proactiveness. These dimensions are regarded as the foundational elements of EO and have been most consistently applied in empirical research (Covin & Slevin, 1989; Kreiser *et al.,* 2002). In addition, they provide a parsimonious yet robust framework that captures the entrepreneurial behaviours most relevant to project-based contexts such as construction. Through narrowing the focus to these three dimensions, the study ensures theoretical clarity, empirical feasibility, and alignment with prior research, while still acknowledging the broader EO construct. This approach also allows the investigation to generate insights that are comparable across diverse studies while situating the findings within the unique dynamics of the South African construction industry. The study's conceptual model is presented in the section that follows.

Figure 1 **Conceptual model**



(Source: Researchers' conception)

3 RESEARCH DESIGN AND METHODOLOGY

The primary objective of this study is to examine how the three dimensions of entrepreneurial orientation, innovativeness, risk-taking, and proactiveness, influence construction project success, and to determine whether customer satisfaction mediates these relationships within the context of the City of Tshwane, South Africa.

3.1 Research design

This study adopted a quantitative research design underpinned by the positivist paradigm, which assumes that social phenomena can be measured objectively and analyzed statistically (Saunders *et al.,* 2019). A cross-sectional survey design was selected as it allows the collection of standardized data from a relatively large sample at a single point in time, enabling hypothesis testing and the examination of relationships between constructs (Malhotra, 2016).

3.2 Population and sampling

The target population consisted of construction project managers registered or contracted under the City of Tshwane municipality. Respondents were eligible if they had at least one year of managerial experience in overseeing construction projects and were directly involved in project planning, implementation, or evaluation. A non-probability convenience sampling technique was applied due to limited access to the entire project manager database and resource constraints, consistent with prior research in similar contexts (Panuwatwanich & Nguyen, 2017). A total of 300 questionnaires were distributed electronically and in person in 2024. Of these, 267 were returned, and after data screening, 251 valid responses were retained, yielding an effective response rate of 83%. This sample size exceeds the recommended minimum of 200 for PLS-SEM analysis (Hair *et al.,* 2019).

3.3 Measurement instrument

Data were collected using a structured self-administered questionnaire consisting of two main sections. The first part captured demographic data such as the age and gender of construction project managers, while the second part measured the entrepreneurial knowledge constructs spread across 20 items using a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The constructs for assessing entrepreneurial knowledge were adapted from various sources. Starting with entrepreneurial orientation, which was measured through three dimensions, namely, innovativeness, risk-taking, and proactiveness, adapted from Covin and Slevin (1989). Customer Satisfaction was measuring using the scale proposed by Fornell et al. (1996). As for project success, this construct was assessed through scope, time, cost, and quality performance, adapted from Pinto and Slevin (1988) and further validated in project management studies. A complete version of the questionnaire is presented in Appendix A to allow for replication and validation.

3.4 Data collection procedure

Data were collected through both electronic surveys (Google Forms) and face-to-face distribution at project coordination offices within Tshwane. Respondents completed the questionnaire individually, taking approximately 20 minutes. Prior to the main data collection, a pilot study involving 15 project managers was conducted to refine wording and improve instrument reliability. Data collection occurred over a three-month period in 2024. Ethical clearance was obtained from the relevant institutional review board. Participation was voluntary, and respondents were informed of confidentiality and anonymity.

3.5 Justification for Data Analysis Method (PLS-SEM)

Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed using SmartPLS v4. PLS-SEM was selected because the study's objective was prediction-oriented rather than purely confirmatory, and the model included multiple latent constructs with formative-reflective characteristics (Hair *et al.,* 2019). In addition, the sample size (n = 251) was moderate and did not meet the large-sample assumptions required by covariance-based SEM. PLS-SEM also allows simultaneous estimation of measurement and structural models, making it appropriate for testing mediation relationships (Sarstedt *et al.,* 2021).

3.6 Statistical Hypotheses

The following statistical hypotheses were formulated and tested:

$H1_0$: Innovativeness has no significant effect on project success.
$H1_a$: Innovativeness has a significant positive effect on project success.

$H2_0$: Risk-taking has no significant effect on project success.
$H2_a$: Risk-taking has a significant positive effect on project success.

$H3_0$: Proactiveness has no significant effect on project success.
$H3_a$: Proactiveness has a significant positive effect on project success.

$H4_0$: Customer satisfaction does not mediate the relationship between innovativeness and project success.
$H4_a$: Customer satisfaction mediates the relationship between innovativeness and project success.

$H5_0$: Customer satisfaction does not mediate the relationship between proactiveness and project success.
$H5_a$: Customer satisfaction mediates the relationship between proactiveness and project success.

4 FINDINGS

4.1 Sample profile and descriptive statistics

Table 3 presents the demographic profile of the respondents together with descriptive statistics for the study constructs. The majority of respondents were between 26-35 years of age (46.6%), with males comprising 76.8% of the sample. Descriptive statistics indicate relatively lower perceptions of Innovativeness (M=2.60, SD=1.25) and Proactiveness (M=2.14, SD=1.11), and comparatively higher perceptions of Risk-taking (M=3.72, SD=0.90). Project Success averaged 2.98 (SD=1.19), while Customer Satisfaction showed a moderately positive mean of 3.38 (SD=1.20). These values provide an initial indication of the sample's attitudes toward entrepreneurial orientation and project outcomes in the construction sector**.**

Table 3 **Sample profile and construct descriptives**

Biographical profile	**Frequency**	**Per cent**	**Construct**	**Mean**	**SD**
Age 18–25 years	36	14.3	Innovativeness	2.60	1.25
Age 26–35 years	117	46.6	Risk-taking	3.72	0.90
Age 36–45 years	73	29.0	Proactiveness	2.14	1.11
Age 46–55 years	18	7.1	Project Success	2.98	1.19
Age 56–65 years	7	2.7	Customer Satisfaction	3.38	1.20
Male	193	76.8			
Female	51	20.3			
Other	7	2.7			

(Source: Researchers' conception)

4.1.1 Explanation of abbreviations

In Figures 1 and 2, each abbreviation corresponds directly to the measurement items listed in Appendix A. For example, "IN1–IN5" denote the five items measuring Innovativeness, "RT1-RT3" measure Risk-taking, "PR-PR5" measure Proactiveness, "CS1-CS5" measure Customer Satisfaction, and "PS1-PS5" measure Project Success. The numerical suffix represents the individual indicator within that construct, as shown in the questionnaire (Appendix A). This clarification allows readers to trace every observed variable to its original survey statement, thereby enhancing construct transparency.

4.2 Reliability and validity (measurement model, PLS-SEM)

Following best-practice guidance for variance-based SEM, we assessed indicator reliability (standardized loadings), internal consistency (Cronbach's alpha, composite reliability), convergent validity (average variance extracted, AVE), and discriminant validity (HTMT). After item screening, CS1 was removed due to its loading falling below the recommended 0.70 threshold. The Risk-taking construct failed reliability requirements ($\alpha = 0.644$; CR = 0.691) and was therefore excluded from the final model. All retained constructs, Innovativeness, Proactiveness, Customer Satisfaction, and Project Success, met the conventional criteria (α/CR $\geq$ 0.70; AVE $\geq$ 0.50), and HTMT values ranged from 0.244 to 0.522, supporting discriminant validity for the measurement model. Consistent with the literature, we adopted thresholds of $\geq$.70 for loadings (retain $\geq$ 0.60 when theoretically essential), CR $\geq$ 0.70, AVE $\geq$ 0.50, and HTMT < 0.85 (conservative) or < 0.90 (liberal) to establish construct validity (Hair *et al.,* 2019; Henseler *et al.,* 2015; Franke & Sarstedt, 2019).

Table 4 **Evaluation of the measurement model**

Constructs	**Items**	**FL**	**CA**	**CR**	**AVE**
Customer satisfaction	CS1	0.650	0.801	0.817	0.621
	CS2	0.789			
	CS3	0.786			
	CS4	0.822			
	CS5	0.704			
Innovation	IN1	0.863	0.886	0.895	0.685
	IN2	0.824			
	IN3	0.781			
	IN4	0.839			
	IN5	0.832			
Proactiveness	PR1	0.855	0.905	0.915	0.725
	PR2	0.856			
	PR3	0.893			
	PR4	0.796			

	PR5	0.854			
Project success	PS1	0.794	0.851	0.857	0.626
	PS2	0.767			
	PS3	0.745			
	PS4	0.843			
	PS5	0.802			
Risk-taking	RT1	0.716	0.644	0.691	0.574
	RT2	0.701			
	RT3	0.846			

(*Source*: PLS-SEM algorithm calculation results)

4.3 Collinearity and model fit (PLS-SEM)

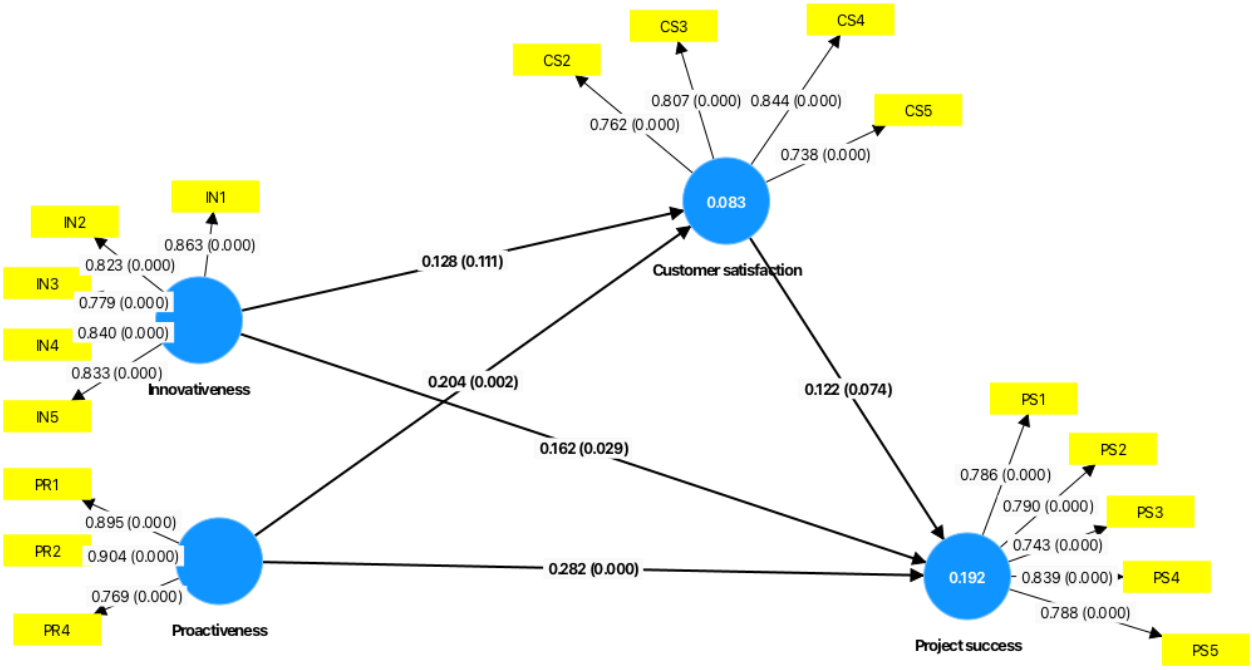
Collinearity diagnostics revealed elevated variance inflation for PR3 and PR5 (VIF ≥ 3), prompting their removal prior to structural testing. In line with PLS-SEM conventions, the study emphasises SRMR (≤ 0.08), dULS/dG, and NFI for model fit rather than covariance-based indices (CFI, TLI, GFI and χ^2), unless a parallel CB-SEM estimation is reported (Hair *et al.,* 2019). The structural model accounted for approximately 19% of the variance in Project Success ($R^2 \approx .19$), indicating a meaningful yet conservative explanatory power suitable for cross-sectional field data in project-based contexts.

4.4 Structural model and hypothesis testing

Bootstrapping with 5.000 resamples was used to evaluate path significance. Innovativeness to Project Success was positive and significant ($\beta = 0.162$, $t = 2.184$, $p = 0.029$), and Proactiveness to Project Success displayed a stronger, highly significant effect ($\beta = 0.282$, $t = 4.034$, $p < 0.001$). The Risk-taking path was not tested in the final model due to its reliability failure and is therefore reported as rejected for hypothesis purposes. These results collectively indicate that capability-oriented EO dimensions, innovative renewal and proactive market/action orientationare the primary drivers of project outcomes in this setting.

Table 5 presents the hypothesis-testing results derived from the PLS-SEM structural model. The β coefficients, t-statistics, and p-values are reported for each tested path, indicating the strength and significance of the relationships. All hypotheses were accepted with the exception of hypothesis 2 (H_2). H_2 was rejected because the risk-taking construct failed to meet acceptable reliability thresholds during measurement-model assessment. Figure 2 visually illustrates the validated model, showing standardized loadings for each indicator and the overall explained variance ($R^2 = 0.192$) for Project Success.

Figure 2 **Structural model**



(Source: Researchers' conception)

Table 5 **Hypotheses outcomes**

Hypotheses	β	t-statistics	p-values	Decision
H1: Innovativeness has a positive effect on Project Success.	0.162	2.184	0.029	Accepted
H2: Risk-taking has a positive effect on Project Success.	-	-	-	Rejected
H3: Proactiveness has a positive effect on Project Success.	0.282	4.034	0.000	Accepted
H4: Innovativeness to Customer Satisfaction to Project Success.	0.016	1.105	0.269	Rejected
H5: Proactiveness to Customer Satisfaction to Project Success.	0.025	1.543	0.123	Rejected

4.5 Mediation analysis (Customer Satisfaction)

Specific indirect effects through Customer Satisfaction were not significant. The Innovativeness to CS to Project Success indirect path (β = 0.016, t = 1.105, p = 0.269) and the Proactiveness to CS to Project Success path (β = 0.025, t = 1.543, p = 0.123) failed to reach significance; mediation via Risk-taking was not examined, given its exclusion from the measurement model. These findings suggest that, within the current cross-sectional frame and context, EO influences project outcomes directly rather than indirectly through customer evaluations, an interpretation consistent with execution-centric project environments.

5 DISCUSSION

This study examined how three dimensions of entrepreneurial orientation, innovativeness, risk-taking, and proactiveness, affect project success in construction projects in the City of Tshwane, South Africa, and whether customer satisfaction mediates these relationships. The findings show that innovativeness and proactiveness significantly enhance project success, while risk-taking did not pass reliability thresholds, and customer satisfaction did not mediate the link between entrepreneurial orientation and project success. These results are consistent with international evidence that highlights the importance of capability-building over boldness in project environments. For example, Martens *et al.* (2018) found that entrepreneurial orientation dimensions relating to innovation and proactive market orientation had stronger associations with project performance than risk-taking in Brazilian engineering firms. Similarly, Anderson *et al.* (2015) and Wales (2016) emphasise that innovativeness and proactiveness are the most stable entrepreneurial orientation predictors of performance across sectors and geographies. In contrast, risk-taking often yields mixed or context-dependent effects, especially in resource-constrained or highly regulated environments (Garcia *et al.,* 2021). The current findings, therefore, align with the global pattern that risk-taking may not translate into measurable project success unless accompanied by robust risk assessment mechanisms.

The absence of a significant mediation effect through customer satisfaction also mirrors some international project-management research showing that, in highly execution-driven settings, internal organisational practices drive outcomes more strongly than post-delivery client perceptions (Sabahi & Parast, 2020; Dawi *et al.,* 2018). However, this does not diminish the strategic importance of client relationships; rather, it suggests that in South African municipal construction projects, the primary performance lever lies in strengthening internal capabilities to deliver scope, time, cost, and quality targets. Overall, these findings contribute to the international entrepreneurial orientation literature by providing evidence from an emerging-economy municipal context, where volatility and institutional constraints shape how entrepreneurial knowledge is enacted. They demonstrate that even under such conditions, innovativeness and proactiveness remain robust drivers of project success, extending the generalisability of entrepreneurial orientation theory beyond private-sector and developed-country samples.

6 MANAGERIAL IMPLICATIONS

The findings of this study provide several important implications for managers in the construction industry. First, the evidence that innovativeness and proactiveness significantly enhance project success suggests that firms should invest in strengthening their internal cultures of renewal, experimentation, and anticipation. Managers can achieve this by allocating resources to research and development, encouraging creative problem-solving, and ensuring that teams are empowered to anticipate future project demands rather than reacting to them. Moreover, the lack of significant effects for risk-taking indicates that indiscriminate or poorly structured risk strategies may not translate into project outcomes. Instead, managers should focus on carefully balancing opportunity-seeking behaviours with robust risk assessment and control mechanisms. Additionally, since customer satisfaction did not mediate the "entrepreneurial orientation" and "success" relationship, managers should recognise that project outcomes in construction may be more strongly driven by internal organisational practices and execution capability than by external perceptions. Nevertheless, maintaining customer relationships remains critical, and firms can still leverage innovativeness and proactiveness to signal reliability, efficiency, and adaptability to clients. Overall, construction managers and executives should integrate entrepreneurial knowledge practices into project management routines to improve delivery, adaptability, and long-term competitiveness, aligning with findings from (Adewumi, 2022).

CONCLUSIONS

This study investigated how entrepreneurial orientation influences project success in the City of Tshwane's construction sector. Results show that innovativeness and proactiveness significantly enhance project success, while risk-taking lacked reliability, and customer satisfaction did not mediate the relationships. These findings suggest that capability-based entrepreneurial practices, rather than bold risk-taking, drive success in resource-constrained municipal environments. The study is limited by its cross-sectional design, single-source data, and context-specific measures of risk-taking. Nonetheless, it provides valuable insights for managers seeking to strengthen innovation and proactive execution within construction projects, and for policymakers supporting SME contractors through capability-building initiatives. In summary, the study extends international evidence on entrepreneurial orientation by demonstrating that, in emerging-economy construction contexts, innovativeness and proactiveness remain the most consistent predictors of project success.

SUGGESTIONS FOR FUTURE RESEARCH

In terms of theoretical directions, future research should seek to refine the dimensionality of entrepreneurial orientation within construction by developing and validating context-specific measures of risk-taking, distinguishing between strategic and operational risk behaviours. Such refinements would help address the reliability challenges observed in this study. In addition, scholars should examine higher-order entrepreneurial orientation structures (reflective-formative or hierarchical models) to better capture how the interplay of innovativeness, proactiveness, autonomy, and competitive aggressiveness translates into project outcomes. Another promising direction lies in adopting process-oriented perspectives. Longitudinal or panel models could track how entrepreneurial orientation capabilities influence customer satisfaction and benefits realisation over time, allowing researchers to capture lagged and mediated effects that are not visible in cross-sectional designs.

Stemming from both a practical and empirical perspective, future studies should also extend the scope of inquiry by incorporating multiple informants, such as clients, site engineers, contractors, and executives, to triangulate insights into both customer satisfaction and project success. This would reduce single-source bias and provide a more holistic understanding of how entrepreneurial orientation operates across stakeholders. Methodologically, mixed-methods research is strongly encouraged. For instance, qualitative incident mapping and case studies could help uncover how innovativeness and proactiveness are enacted on site through tooling, work methods, or vendor co-creation, thereby complementing survey-based analyses. Finally, comparative studies across different metropolitan areas, provinces and even international contexts would be valuable in testing the generalisability of findings. Such research could also identify contextual moderators, such as market turbulence, procurement frameworks, or contract types, that condition the strength of entrepreneurial orientation's effects on project outcomes.

RESEARCH ETHICS, INFORMED CONSENT AND CONFLICT OF INTEREST STATEMENT

Ethical clearance for this study was obtained from the relevant institutional review board of the authors' institution, and the research was conducted in accordance with applicable national regulations. All participants were adult construction project managers who took part voluntarily and were informed about the purpose of the study, the assurance of confidentiality and anonymity, and their right to withdraw at any time; by completing the questionnaire, they provided their informed consent. The authors declare no conflict of interest.

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Appendix A

Research Questionnaire

Section A: Place (X) to select the appropriate age and gender category.

Biographical profile		
Age	18 – 25 years	
	26 – 35 years	
	36 – 45 years	
	46 – 55 years	
	56 – 65 years	
Gender	Male	
	Female	
	Other	

Section B: Five-point Likert scale (1 = strongly disagree; 5 = strongly agree)
Choose the number you believe best describes your views.

	Constructs and items
	Innovation
IN1	In general, the top managers of my firm favour a strong emphasis on Research and Development
IN2	In general, the top managers of my firm favour a strong emphasis on technological leadership and innovations.
IN3	In general, the top managers of my firm favour a strong emphasis on innovations.
IN4	My firm marked many new lines of services in the past 5 years.
IN5	Changes in services in my firm have usually been quite dramatic in the past 5 years.
	Proactiveness
PR1	In dealing with its competitors, my firm typically initiates actions which competitors then respond to.
PR2	In dealing with its competitors, my firm is very often the first business to introduce new services.
PR3	In dealing with its competitors, my firm is very often the first business to introduce new administrative techniques.

PR4	In dealing with its competitors, my firm is very often the first business to introduce new operating technologies, etc.
PR5	In general, the top managers of my firm have a strong tendency to be ahead of other competitors in introducing novel ideas.

Project success

PS1	The project was implemented and used by the business
PS2	The project was delivered within the allocated time
PS3	The project was delivered within the budgeted cost
PS4	The project was delivered within the agreed scope. Scope changes to be approved by the business
PS5	The project achieved/realized the business's expected commercial and user benefits as outlined in the business case

Customer satisfaction

CS1	The product improved the customer's performance.
CS2	The customer was satisfied.
CS3	The product met the customer's requirements.
CS4	The customer is using the product.
CS5	The customer will come back for future work.