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Entrepreneurial Orientation Behaviors in Predicting Intention to Quit Among Malaysian Engineering Talents

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Abstract: Entrepreneurial orientation (EO) behaviors play a crucial role in predicting the intention to quit (ITQ) among engineers in an organization. Engineers increasingly adopt an entrepreneurial mindset as technology rapidly advances, allowing them to harness their ideas and translate them into competitive strategic actions. This study aims to evaluate the impact of EO behaviors on ITQ among Malaysian engineers working in private sector organizations. Using EO theory, this research explores how individual entrepreneurial orientation influences engineers' intentions to leave their jobs. Data were collected from 104 engineers in manufacturing firms registered with the Board of Engineers Malaysia (BEM). The study employed purposive sampling, and analysis was carried out using Partial Least Squares-Structural Equation Modelling (PLS-SEM) to validate the research model and formulate hypotheses. The findings indicate that higher levels of innovativeness, proactiveness, and risk-taking in organizational contexts significantly reduce engineers' intentions to quit. Organizations can enhance engineers' specialized knowledge, experience and competencies by effectively fostering individual EO, enabling them to adapt to evolving job demands. Furthermore, recognizing engineers as entrepreneurial professionals aligns with their career aspirations and strengthens the talent pipeline within organizations. Theoretically, this study contributes to the understanding of EO as a predictor of ITQ among engineers. There is a need for further research to connect individual EO with engineers' behavioral expectations, particularly in response to ongoing talent shortages in a highly competitive labor market.

Keywords: *Individual entrepreneurial orientations, intention to quit, entrepreneurial orientation theory, engineers, talent*

1. Introduction

The rapid pace of industrial transformation driven by technological advancements, accelerated product development, service innovation, and increasing specialization in technical knowledge has significantly reshaped the expectations placed on engineering professionals (Fortes, Tenera, & Cunha, 2023; Liu, Gan, & Chen, 2024; Sahoo & Panda, 2019; Satar & Natasha, 2019). Engineers are now expected not only to possess strong technical expertise but also to develop behavioral competencies to succeed in dynamic, innovation-led work environments. As organizations adapt to the demands of the Fourth Industrial Revolution (IR4.0) and pervasive digitalization, competencies linked to entrepreneurial orientation (EO) have become increasingly relevant in professional engineering roles (Khan et al., 2024).

EO theory, originally conceptualized by Lumpkin and Dess (1996), identifies innovativeness, proactiveness, and risk-taking as core dimensions of entrepreneurial behavior at both the firm and individual levels. In the context of talent development and career sustainability, these entrepreneurial traits correlate with greater adaptability, creativity, and resilience in innovation-driven environments. EO serves not only as a performance-oriented capability but also as a behavioral framework that can influence critical career outcomes such as job engagement, satisfaction, and, notably, intention to quit (ITQ). Recent literature supports EO as a mediator between leadership style and job embeddedness, further reinforcing its behavioral value (Ahmed et al., 2025; Ching et al., 2024).

From this theoretical perspective, engineers who exhibit high EO are more likely to align with organizational innovation goals, pursue creative solutions, and respond proactively to change. These behavioral qualities contribute not only to organizational competitiveness but may also reduce ITQ by fulfilling key psychological needs for autonomy, mastery, and purpose. Conversely, engineers in rigid or unsupportive environments where EO is stifled are more likely to experience disengagement and contemplate leaving their roles (Williamson, Lounsbury, & Han, 2013; Liu et al., 2024). New empirical findings from the Asia-Pacific region have indicated that EO positively correlates with affective commitment and job embeddedness, acting as a buffer against turnover intentions.

In today's competitive job market, retaining engineers with EO traits has become a pressing challenge. EO reinforces essential components of an engineer's professional orientation, including technical mastery, managerial competence, and entrepreneurial drive (Igbaria & Siegel, 1992; Alavi, Moteabbed, & Arasti, 2012; Fathima & Umarani, 2023). When these components are not adequately supported by job design or organizational culture, job dissatisfaction can escalate into a strong ITQ, which is widely recognized as a precursor to actual turnover behavior (Tett & Meyer, 1993; Yi, Sheu, & Zhi, 2009). Recent research by Musa and Halim (2024) revealed that job environments that fail to support EO-related behaviors significantly contribute to burnout and disengagement, particularly among early-career engineers.

This issue is especially pronounced in Malaysia. The TalentCorp Critical Occupations List (2023) indicates ongoing shortages in key engineering disciplines, such as electrical, mechanical, and civil engineering. Alarmingly, nearly 30% of engineering graduates leave the profession within five years (DOSM, 2022), citing low salary growth, limited career progression, misalignment between academic training and industry needs, and a lack of support for innovation and entrepreneurial development (Abdul Rahman, 2012; Randstad Malaysia, 2024; Vasudevan et al., 2024). Furthermore, an increasing number of engineers are either migrating overseas or switching careers entirely in search of better professional fulfillment and autonomy. A recent nationwide survey by Lim, Yeo, and Roslan (2025) found that the highest attrition rates were observed in firms that failed to offer professional development opportunities aligned with EO competencies.

Despite the practical relevance of EO theory, its application at the individual level among engineers remains underexplored, particularly in Malaysia. While existing research has examined EO in the context of firm performance, entrepreneurship, and student intentions (Antoncic & Antoncic, 2001; Bolton & Lane, 2012; Wu, 2009), few studies have linked EO to ITQ in technical professions. A recent study by Osman (2025), using PLS-SEM, found a significant inverse relationship between individual EO and ITQ among Malaysian engineers. He emphasized that innovativeness and risk-taking effectively buffer against voluntary turnover among technical professionals, enhancing both career satisfaction and retention. These findings are echoed in the work of Zakaria et al. (2025), who advocate for embedding EO principles in engineering talent development frameworks to prevent early attrition.

Given this context, there is a clear gap in understanding how individual-level EO influences ITQ among engineers, especially within the Malaysian private sector. This study seeks to bridge that gap by investigating the impact of EO on the ITQ, thereby contributing to the behavioral literature in human resource management and engineering career development. By introducing EO and ITQ as central constructs within an integrated behavioral framework, the study aims to provide both theoretical insight and practical implications for talent retention strategies in Malaysia's engineering landscape.

2. Literature Review

This section provides an overview of employee turnover, turnover intentions (ITQ), and Entrepreneurial Orientation (EO) theory, based on prior research. It explores the relationship between engineers' EO and their ITQ, and formulates three hypotheses along with a research model to explain the direct relationships between these variables.

Intention To Quit (ITQ) Among Engineers

ITQ is widely recognized as a significant predictor of voluntary turnover (Rathi and Lee, 2015; Fathima & Umarani, 2023). The costs associated with replacing employees, the increased competition for talent, and the

potential damage to an organization's reputation present serious challenges for both employers and national economies (Flint, Haley, & McNally, 2013; Fathima & Umarani, 2023; Igbaria et al., 1992; Tymon, Stumpf, & Smith, 2011). Employees often engage in a deliberate process of planning their departure from a company, referred to as ITQ (Tett & Meyer, 1993). Research indicates that the costs related to turnover, such as hiring, training, and lost productivity, account for over 5% of operating expenditures. Factors like career advancement prospects, job satisfaction, and organizational support play a significant role in influencing employees' ITQ. According to Rathi and Lee (2015) and Fabi, Lacoursiere, and Raymond (2015), an organization's capacity to meet its workers' expectations greatly impacts their decisions to remain with the company.

Several studies have examined the factors that influence ITQ among talented employees (Gachter, Savage, & Torgler, 2013; Harhara, Singh & Hussain, 2015; Mitchell & Zatzick, 2015; Rathi and Lee, 2015, Wei, 2015). Findings suggest that leadership behaviors, opportunities for growth, work challenges, autonomy, and organizational justice all exhibit a negative correlation with ITQ. Some employees may perceive turnover intentions as a pathway to professional growth. Integrating EO activities, decision-making processes, and innovation-driven tasks into engineers' career progression may help alleviate undesirable ITQ.

In Malaysia, the mobility of engineers has exacerbated the brain drain issue, as the nation relies on foreign talent, hindering the development of its local workforce. National initiatives such as the Talent Roadmap 2020, the Economic Transformation Program (ETP), and the National Key Economic Area (NKEA) aim to strengthen the professional workforce. A significant shortage of engineers is one of the primary causes of increasing turnover rates in the industry, according to Talent Corporation Malaysia (TalentCorp). A survey of 336 Malaysian engineers conducted by Hashim (2015) revealed that two major factors contributing to turnover are job dissatisfaction and a lack of involvement in decision-making processes. However, engineers who actively participate in strategic planning and decision-making tend to exhibit improved problem-solving skills, strategic thinking, and career commitment (Hashim & Wok, 2015).

EO Theory

Entrepreneurial Orientation (EO) theory provides a framework for understanding engineers' tendencies toward creativity, initiative, and risk-taking in their job responsibilities (Lumpkin & Dess, 1996). Five essential characteristics, such as autonomy, risk-taking, innovativeness, proactiveness, and competitive aggressiveness, are crucial for the success of EO-driven businesses. These traits are vital for fostering organizational agility, enabling employees to take risks on significant initiatives, and empowering them to capitalize on economic opportunities (Covin & Slevin, 1986; Lumpkin et al., 1996). EO behaviors encourage entrepreneurial intentions and problem-solving skills while establishing a foundation for sustainable business growth.

Research shows that EO helps employees adapt to changing workplace dynamics and manage technological advancements (Bolton et al., 2012; Kollman, Christofor, & Kuckertz, 2007; Zhang & Bruning, 2011). By developing advanced technical skills, knowledge, and expertise through EO concepts, engineers are positioned as key industry professionals. Simultaneously, EO fosters an entrepreneurial mindset that enables engineers to identify and seize professional opportunities. This study examines three fundamental aspects of EO that significantly influence engineers' behaviors within organizations, as detailed in Table 1.

Table 1: EO Dimensions

Dimensions	Definition
Innovativeness	Support new ideas, novelty, experimentation for new products and services.
Proactiveness	Act in anticipation of future problems, needs, or changes.
Risk-taking	Proclivity to engage in risky projects and prefer bold actions for achieving the firm's objectives

Source: Covin & Slevin (1986); Lumpkin et al. (1996)

Relationships between EO and ITQ Among Engineers

Engineers' behavioral intentions regarding their current jobs are significantly influenced by their EO and ITQ. The three main components of EO—risk-taking, proactiveness, and innovativeness affect how engineers interact with their workplace and shape their career paths. Prior studies have shown that EO behaviors foster an entrepreneurial mindset, which in turn enhances job performance and overall work engagement (Bolton et

al., 2012; Elenurm, 2012; Zhang et al., 2011). Engineers who exhibit high EO characteristics tend to approach their work with greater flexibility, originality, and strategic vision. As illustrated in Figure 1, this study presents a research model that explores the relationship between engineers' ITQ and EO behaviors.

Relationships between Innovativeness and ITQ Among Engineers

Retaining high-performing engineers is crucial for promoting organizational innovation, as they contribute to technological advancements and process improvements (Long, Ajagbe, & Kowang, 2014). One key aspect of EO is inventive behavior, which refers to an individual's ability to conceive, propose, and implement new ideas within a workgroup. Engineers with strong inventive inclinations not only enhance organizational creativity but also positively influence leadership effectiveness, decision-making processes, and overall workplace dynamics. Research indicates that creative work behaviors ($\alpha = 0.92$) are negatively correlated with turnover intentions ($ß = -20.23$; $p < 0.01$). This suggests that employees who actively engage in innovation are less likely to leave their jobs. Open-minded engineers who are willing to learn new skills and share ideas demonstrate greater adaptability to changing job demands, which increases their resilience to external labor market shifts (Williamson et al., 2013). In the context of a hierarchical organizational culture, Choi (2025) recently investigated employee turnover among South Korean public employees through the lens of innovative work behaviors. The study found that while innovative work behaviors in the public sector can enhance creativity, they may also increase the intention to leave due to a mismatch with established hierarchical work norms. However, this impact can be mitigated by a strong hierarchical culture. Therefore, we hypothesized that:

H1: *Innovativeness behavior has negatively influenced engineers' ITQ.*

Relationships between Proactiveness and ITQ Among Engineers

Another important trait of EO is proactive behavior, which empowers employees to take charge of their career paths. Proactivity allows individuals to identify opportunities for professional growth, seek superior job options, and set strategic career goals (Yang, Ma, & Hu, 2011). It also fosters a positive attitude towards work, motivating individuals within the organization to engage in continuous development efforts. Highly proactive individuals are more likely to experience job satisfaction and maintain stable careers, as their proactive behavior encourages knowledge sharing and teamwork. Increases in proactivity have been shown to significantly lower turnover intentions ($ß = 20.20$; $p < 0.01$). Developing a proactive workforce not only reduces the risks of employee turnover but also enhances collaboration and information sharing. In another study, Kim and Oh (2024) examined the relationship between a nurse's proactive personality and their intention to quit, considering the effects of their supervisor's proactive personality and professional recognition. They found that proactive nurses who receive professional recognition are less likely to consider leaving their positions. This implies that proactive employees are more likely to remain in their roles if they feel valued and acknowledged for their contributions. Similarly, Wang et al. (2024) agreed that proactive employees tend to set higher professional goals, which may lead to increased expectations regarding their careers. These higher aspirations could spark a stronger desire to seek opportunities outside their current organization, thereby raising turnover intentions. Consequently, we propose the following hypothesis:

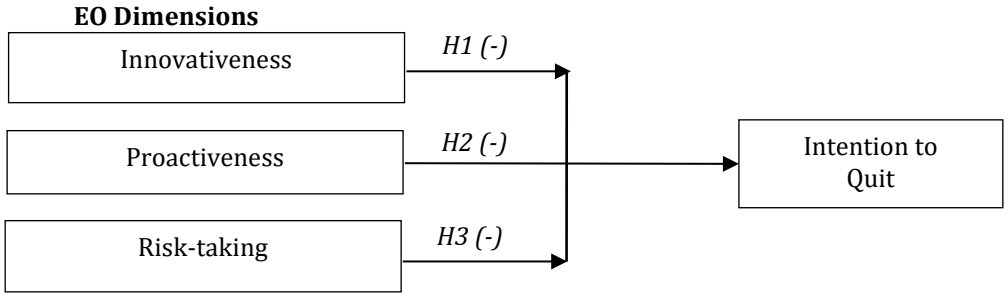
H2: *Proactiveness behavior has negatively influenced engineers' ITQ.*

Relationships between Risk-taking and ITQ Among Engineers

Risk-taking, the third component of entrepreneurial orientation (EO), refers to an individual's willingness to face uncertainty when making decisions and fulfilling their responsibilities. Engineers, due to the technical nature of their work, often encounter challenging problems and must make critical choices in high-stakes situations. Individuals who take on difficult assignments typically enhance their problem-solving abilities, which reinforces their commitment to their organizations. According to Tremblay, Wils, and Proulx (2002), job challenges encourage engineers to engage actively in decision-making, fostering a risk-taking attitude that is inversely related to ITQ and positively related to career satisfaction. In simpler terms, engineers who find their work engaging and stimulating are less likely to seek other job opportunities. Ladelsky and Lee (2023) investigated the distinct impacts of job satisfaction and risk-taking tendencies on the intentions and actual turnover of IT professionals. Their findings suggest that employees who are inclined to make risky decisions are more likely to leave their jobs. This indicates that those who are comfortable with taking risks may be more open to the uncertainties associated with changing careers. Therefore, we propose the following hypothesis:

H3: *Risk-taking behavior has negatively influenced engineers' ITQ.*

Figure 1: Conceptual Framework



3. Methodology

This section discusses the details of the research that was conducted for this study. The details included the sample and procedure, data analysis, and variables and measurements used for the data analysis.

Sample and Procedures

This study utilized a quantitative research approach, employing multi-item measures scaled from 1 (strongly disagree) to 7 (strongly agree). Respondents were selected using a purposive sampling strategy, focusing on engineers working in private firms that are registered with the Board of Engineers Malaysia. To facilitate data collection, consent letters were sent to HR managers of targeted companies, requesting permission for survey distribution. The data gathering process took three months and employed both self-administered and postal survey methods to maximize responses. A total of 300 questionnaires were distributed, resulting in 112 replies (37.3%). After data screening, 104 valid responses (34.7%) were selected for analysis. For hypothesis testing, this study employed Partial Least Squares Structural Equation Modelling (PLS-SEM) using SmartPLS 3.2.6. PLS-SEM is a second-generation multivariate analysis technique that allows for the simultaneous evaluation of both measurement and structural models, minimizing variance error. The decision to use PLS-SEM as the primary analytical method was based on three key factors: (a) its variance-based approach to predicting relationships among constructs, (b) its suitability for small sample sizes, and (c) its ability to handle non-normally distributed data. These criteria aligned well with the characteristics of the study's data.

Data Analysis

The present study used the PLS-SEM approach with SmartPLS 3.2.8 to test the developed hypotheses. This method of structural equation modeling is recognized as a second-generation multivariate analysis and provides a means to estimate composites that represent latent variables in path models (Hair, Hult, Ringle, & Sarstedt, 2017). It is particularly advantageous for non-normal data, small sample sizes, and formative constructs (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). A two-step PLS-SEM process was utilized to validate both the outer (measurement) and inner (structural) models using the full sample of 104 respondents. Model validation is crucial in ensuring the quality of empirical work based on both measurement and structural models (Urbach & Ahlemann, 2010). Validation of the measurement model is achieved by testing its internal consistency, indicator reliability, convergent validity, discriminant validity, and multicollinearity. For the structural model of PLS-SEM, explanatory power and predictive power were assessed. Explanatory power was evaluated using two criteria: the coefficient of determination and effect size, while predictive power was assessed through path coefficients, predictive relevance, and relative impact.

Variable and Measurement

The study variables were measured using validated instruments adapted from existing literature, with modifications made to fit the study's objectives. The dependent variable, ITQ, was assessed using three items developed by Govaerts, Kyndt, Dochy, and Baert (2011). For independent variables, items measuring entrepreneurial orientation (EO) were framed from the perspective of individual engineers by incorporating "my organization" into each statement. The EO scale, derived from Covin and Slevin (1986) and Lumpkin and Dess (1996), measured three key dimensions: innovativeness, proactiveness, and risk-taking. Seven items assessed innovativeness and proactiveness, while six items captured risk-taking behaviors. All variables were measured using a seven-point Likert scale. Table 2 provides an overview of the measurement items used in the study.

Table 2: Questionnaire Items

Variables	No. of Items	Scale	Sources
1. Innovativeness	7	Seven-point Likert scale	Covin et al. (1986); Lumpkin et al. (1996)
2. Proactiveness	7	Seven-point Likert scale	Covin et al. (1986); Lumpkin et al. (1996)
3. Risk-taking	6	Seven-point Likert scale	Covin et al. (1986); Lumpkin et al. (1996)
4. Intention to Quit	3	Seven-point Likert scale	Govaerts et al. (2011)

4. Findings

Table 3 provides a detailed overview of the participants' backgrounds. The majority of participants were graduate engineers, accounting for 81.7 percent, while 18.3 percent (19 individuals) were professional engineers. The sample predominantly consisted of males, representing 81.7 percent, with only 18.3 percent (19 individuals) being female. In terms of age, the largest group was comprised of participants aged 26 to 35 years old, making up 55.8 percent of the sample. This was followed by those aged 36 to 45 years, who represented 25 percent. Regarding ethnicity, Malays made up the majority, with 82 participants (78.8 percent), while Chinese participants numbered 17 (16.3 percent), and Indians represented 5 participants (4.8 percent). Most respondents held a bachelor's degree (79.8 percent), with 16 participants (15.4 percent) having obtained diplomas, 4 participants (3.8 percent) earning master's degrees, and only one participant holding a PhD. As for work experience, 43.3 percent (45 participants) had 1 to 5 years of experience, 24 percent (25 participants) had 6 to 10 years, 20 percent (21 participants) had 11 to 15 years, and 12.5 percent (13 participants) had more than 16 years of experience. Additionally, the majority of participants were employed in Melaka (57.7 percent), followed by Selangor (20.2 percent) and Johor (18.3 percent). The manufacturing sector was the most represented industry at 38.5 percent, compared to other sectors such as oil and gas (23.1 percent), building and construction (13.5 percent), and electronics (12.5 percent).

Table 3: Demographic Profile (*n-104*)

Category	Frequency	Percentage
Status of Designation		
Graduate Engineer	85	81.7
Professional Engineer	19	18.3
Gender		
Male	85	81.7
Female	19	18.3
Age		
<25 years old	9	8.7
26-35 years old	58	55.8
36-45 years old	26	25.0
46-55 years old	9	8.7
>56 years old	2	1.9
Marital Status		
Single	46	44.2
Married	57	54.8
Divorced	1	1.0
Race		
Malay	82	78.8
Chinese	17	16.3
Indian	5	4.8
Education Level		
Diploma	16	15.4
Bachelor's degree	83	79.8
Master's degree	4	3.8
PhD	1	1.0
Length of Service		
1-5 years	45	43.3
6-10 years	25	24.0

11-15 years	21	20.0
> 16 years	13	12.5
Location		
Johor	19	18.3
Kuala Lumpur	4	3.8
Melaka	60	57.7
Selangor	21	20.2
Specification of Business		
Accounting/Finance/Banking	1	1.0
Arts/Media/Communication	1	1.0
Building/Construction	14	13.5
Computer/IT	2	1.9
Electrical & Electronics	13.	12.5
Manufacturing	40	38.5
Oil & Gas	24	23.1
Sciences	1	1.0
Others	8	7.7

Model Assessments Using PLS-SEM

There are two steps to assess a model using PLS-SEM: a) measurement model and b) structural model. The assessment of a structural model concerns the relationships between constructs. The next section explains these two assessments.

Assessment of Measurement Model

The evaluation of a model using Partial Least Squares Structural Equation Modeling (PLS-SEM) involves two main steps: (a) assessment of the measurement model and (b) assessment of the structural model. The measurement model focuses on the reliability and validity of the constructs, while the structural model examines the relationships between these constructs. This section will detail the assessment of the measurement model. The measurement model was evaluated in terms of internal consistency (Composite Reliability), indicator reliability, convergent validity (Average Variance Extracted, AVE), discriminant validity (Heterotrait-Monotrait Ratio, HTMT), and multicollinearity (Hair et al., 2011; Wong, 2013; Yap, Ramayah, & Wan Nushazelin, 2012). Composite reliability (CR) assesses the reliability of indicators, with loadings of 0.70 or higher considered acceptable. Items with loadings below 0.40 should be removed (Hair, Hult, Ringle, & Sarstedt, 2014).

Items with loadings between 0.40 and 0.70 were retained only if their removal would negatively affect CR or AVE. Table 4 shows that the CR values for all constructs ranged from 0.834 to 0.938, exceeding the 0.70 threshold and confirming satisfactory internal consistency. To ensure indicator reliability, items with loadings below 0.70 (Nunnally & Bernstein, 1994) were removed, including INNO1, INNO6, PROAC4, RISK2, RISK5, and RISK6.

Convergent validity is considered established when the AVE for each construct exceeds 0.50. Table 4 confirms that the AVE values ranged from 0.575 to 0.752, indicating sufficient convergent validity. Discriminant validity was assessed using the Heterotrait-Monotrait Ratio (HTMT), which is a recommended method for variance-based SEM (Henseler, Ringle, & Sarstedt, 2015). To confirm discriminant validity, HTMT values must be below 0.85. Table 5 presents the correlation estimates, showing that all values were within the acceptable range, which indicates that the constructs are distinct from one another. Multicollinearity was evaluated using the Variance Inflation Factor (VIF), where a VIF value below 5.00 suggests that multicollinearity is not a concern. Table 4 reports VIF values ranging from 1.139 to 3.392, confirming that the independent variables (innovativeness, proactiveness, and risk-taking) do not exhibit multicollinearity with the dependent variable (ITQ), as illustrated in Figure 2.

Table 4: Assessment results of the measurement model

Constructs	Loadings	CR	AVE	VIF
Innovativeness (INNO)		0.938	0.752	3.392
INNO1	0.799			
INNO2	0.906			
INNO3	0.931			
INNO4	0.860			
INNO5	0.835			
INNO6	0.799			
INNO7	0.906			
Proactiveness (PROAC)		0.932	0.695	3.212
PROAC1	0.813			
PROAC2	0.771			
PROAC3	0.794			
PROAC4	0.891			
PROAC5	0.856			
PROAC6	0.869			
PROAC7	0.813			
Risk-taking (RISK)		0.843	0.575	1.139
RISK1	0.765			
RISK2	0.859			
RISK3	0.694			
RISK4	0.703			
RISK5	0.765			
Intention to Quit (ITQ)		0.899	0.749	-
ITQ1	0.868			
ITQ2	0.899			
ITQ3	0.827			

[a] *CR = (square of the summation of the factor loadings)/ (square of the summation of the factor loadings) + (summation of error variances).*
[b] *AVE = (summation of the square of the factor loadings)/ summation of the square of the factor loadings + (summation of error variances).*

Table 5 reports the correlation estimates for the HTMT evaluations. The results of HTMT of each construct were less than 0.85: Innovativeness (0.197), Proactiveness (0.232), and Risk-taking (0.514). It shows there was no discriminant validity problem in the measurement model.

Table 5: Discriminant Validity: Heterotrait-Monotrait (HTMT) Results)

Latent Constructs	INNO	ITQ	PROAC	RISK
INNO				
ITQ	0.197			
PROAC	0.900	0.232		
RISK	0.575	0.427	0.514	

Assessment of Structural Model

Each hypothesis was tested to examine the relationships among constructs, which were operationalized as latent variables (LVs). A bootstrapping technique with 5,000 resamples was employed for 104 cases to estimate path coefficients and calculate t-statistics, enabling the assessment of the significance of relationships between variables. PLS-SEM was utilized in this analysis due to its capability to handle complex models, non-normal data, and small sample sizes (n=104). To determine the significance of the relationships between the dimensions of entrepreneurial orientation (EO) and information technology quality (ITQ), the bootstrapping technique was applied again in the subsequent step. This procedure allowed for the estimation of path coefficients, t-statistics, and confidence intervals without relying on the assumption of normality, thereby providing robust results consistent with small-sample behavioral research (Hair et al., 2021; Sarstedt et al., 2022).

To assess the explanatory power of the structural model, we calculated the coefficient of determination (R^2), which represents the variance explained by the exogenous variables on the dependent variable (ITQ). Additionally, we evaluated predictive power through path coefficients (β), predictive relevance (Q^2), and relative impact (q^2). The latent variables, namely innovativeness, proactiveness, and risk-taking, accounted for 33.8% of the variance in ITQ, resulting in an R^2 value of 0.338. According to Hair et al. (2011) and Henseler, Ringle, and Sinkovics (2009), R^2 values are classified as follows: substantial (≥0.67), moderate (≥0.33), and weak (≥0.19). We calculated the effect size (f^2) to determine the impact of exogenous variables on the endogenous variable. Hair et al. (2014) provided the following effect size guidelines: large (≥0.35), medium (≥0.15), and small (≥0.02). The results indicated that proactiveness had a small effect size (f^2 = 0.04), while risk-taking exhibited a large effect size (f^2 = 0.410). Innovativeness, however, had a negligible effect size (f^2 = 0.008). The effect size was computed using the formula: f^2 = (R^2 included - R^2 excluded) / (1 - R^2 included).

Table 5 presents the path coefficients, observed t-statistics, and significance levels of the hypothesized relationships. The analysis revealed that innovativeness did not significantly predict ITQ (β = -0.134; t = 1.036), indicating that H1 (the negative relationship between innovativeness and ITQ) was not supported. In contrast, both proactiveness and risk-taking demonstrated significant influences on ITQ. Proactiveness negatively predicted ITQ (β = -0.293; t = 2.004, p < 0.05), thus supporting H2. Similarly, risk-taking negatively impacted ITQ (β = 0.556; t = 5.983, p < 0.001), supporting H3. To assess predictive relevance, we applied the Stone-Geisser Q^2 test using the blindfolding procedure. The resulting Q^2 value of 0.217 confirmed the predictive relevance of the PLS path model. Figure 3 illustrates the bootstrapping results.

Figure 2: The PLS-Algorithm Results

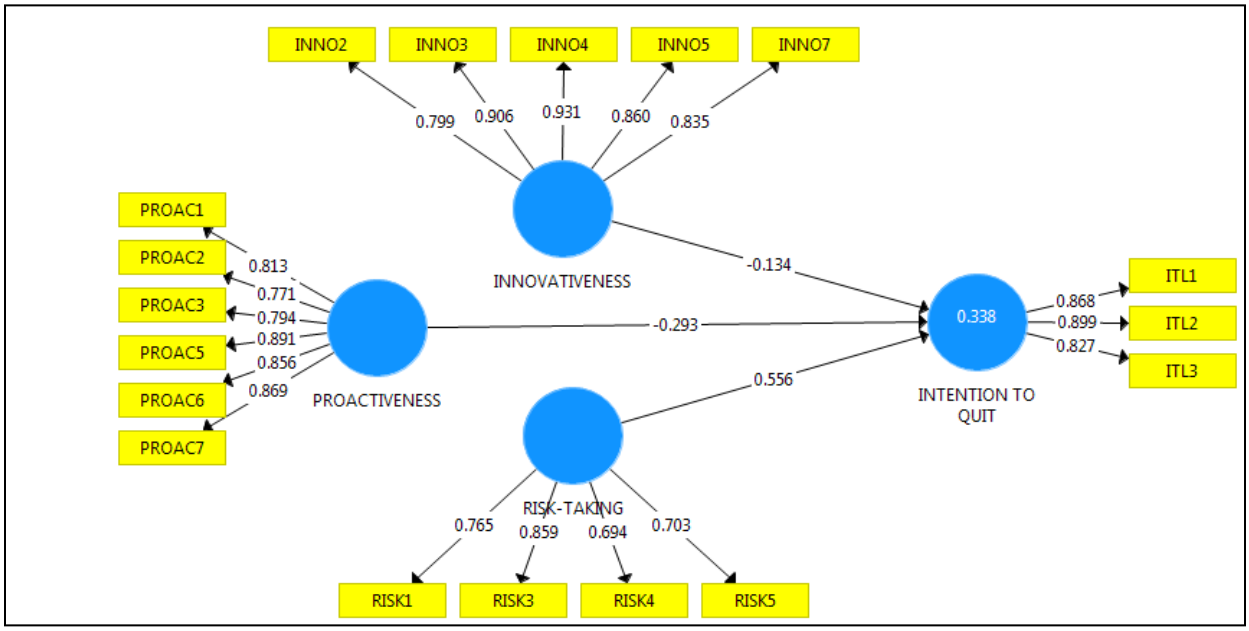
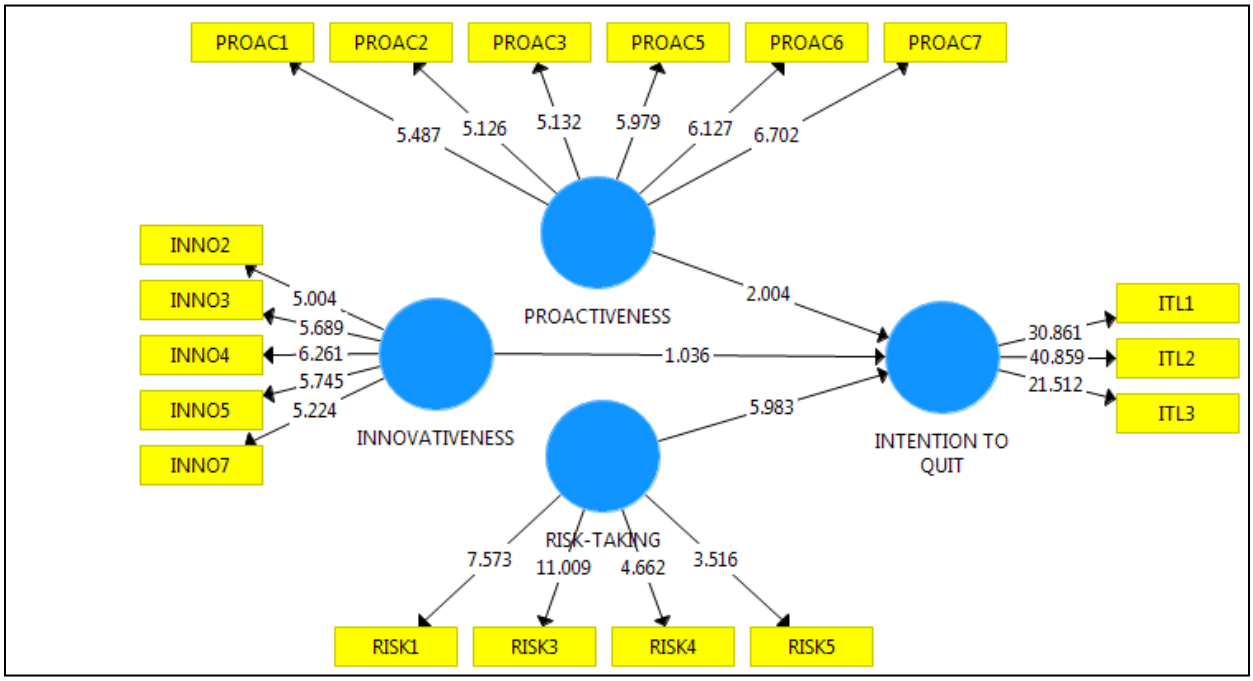


Table 6: Results of Path Coefficients, Observed T-Statistics and p-Values

Hypothesis	Relationships	Path Coefficient	t-value	Results
H1	Innovativeness → Intention to Quit	-0.134	1.036	Not Supported
H2	Proactiveness → Intention to Quit	-0.293	2.004*	Supported
H3	Risk-taking → Intention to Quit	0.556	5.983***	Supported

Note: *p <0.05 (t ≥ 1.96), **p <0.01 (t ≥ 2.58), ***p <0.001 (t ≥ 3.29)

Figure 3: The PLS-Bootstrapping Results



Discussion

In this study, we aimed to investigate the influence of EO behaviors, specifically innovativeness, proactiveness, and risk-taking, on engineers' ITQ in Malaysian private organizations. The results indicated that proactiveness ($\beta = -0.293$; $p < 0.05$) and risk-taking ($\beta = 0.556$; $p < 0.001$) were significantly related to predicting engineers' ITQ. These findings are consistent with previous studies by Ahmed, Lee, and Park (2025), Al-Kwifi et al. (2023), and Lim, Yeo, and Roslan (2025). However, the relationship between innovativeness and ITQ ($\beta = -0.134$; $t = 1.036$) was found to be nonsignificant.

The lack of impact of innovation on engineers' ITQ suggests that unless specific organizational factors, such as social ties, support, and fairness, are adequately integrated, creative behavior alone cannot reliably predict turnover intention. In environments where employees feel valued, encouraged, and treated fairly, innovative behavior is more likely to thrive. Strong organizational support and fair distributive justice lead key personnel to be less inclined to seek other employment opportunities. For engineers, innovation is closely related to their ability to leverage ideas, foster originality, and develop technological solutions that yield tangible products and services. An innovative workplace generates positive responses, which fuel the continuous generation of new technical concepts and solutions. Such an environment enhances an engineer's sense of purpose and engagement, subsequently reducing the likelihood of them leaving the organization (Vasudevan et al., 2024; Zakaria, Ahmad, & Rahman, 2025). Since innovative behavior boosts company innovation and competitiveness, engineers with a high EO are more likely to remain with their firms (Williamson et al., 2013). Additionally, it is believed that engineers need to be innovative to enhance their analytical flexibility and problem-solving skills.

The technical nature of engineering work, where problem-solving and creativity are often integral to daily tasks, may explain the lack of significance in the association between innovativeness and ITQ. Unlike roles that require discretionary creativity outside job descriptions, engineers are frequently expected to innovate as part of their professional responsibilities. Consequently, engineers may not perceive their innovative behavior as significantly impacting their decisions to stay or leave a company. Instead, their intentions to exit are likely influenced more by other factors, such as work environment, career development, and job stability. The degree to which engineers can express innovative behavior also depends heavily on the organization's innovation culture. To effectively compete in the market, innovative organizations leverage the human capital of engineers, who are vital contributors to new company policies due to their sensitivity to operational procedures, business strategies, and technical advancements. Through their focus on problem-solving and continuous improvement,

engineers view daily challenges as opportunities for enhancement rather than as reasons for dissatisfaction or resignation.

Other EO behaviors, such as proactiveness and risk-taking, significantly impact ITQ, as they directly influence career growth and decision-making. Proactiveness enables engineers to anticipate changes, identify opportunities, and align their skills with future business needs. Engineers with a proactive mindset seek solutions, promote innovation, and take charge of their career development rather than waiting for opportunities to arise. This attribute is essential for maintaining competitiveness in an ever-evolving commercial and technological landscape. As technology advances, engineers must continually adapt, innovate, and implement new technical solutions (Ching, Tan, & Khalid, 2024; Kharbanda & Stallworthy, 1990). Engineers benefit from an organizational climate that encourages experimentation with new ideas and positions them strategically in a competitive marketplace. A supportive organizational culture fosters initiative by providing engineers with the tools, guidance, and opportunities to enhance their skills. By instilling a sense of purpose and job security, the ability to take the initiative to improve processes and drive technological advancements not only enhances job satisfaction but also reduces the desire to leave the company.

Additionally, risk-taking is crucial for sustaining the engineering learning process. This quality is common and essential for engineers, who often tackle technological problems and conduct product-related research (Campbell, Gluesing, & Perelli, 2012). Engineers who take calculated risks are more likely to engage in research and development, propose innovative techniques, and explore new methods. Such behaviors are necessary for driving technological advancements and maintaining industry competitiveness. Taking risks fosters development and growth, which are key to both individual and organizational success. Engineers who demonstrate resilience and adaptability by taking calculated risks position themselves as valuable assets to their companies. Their commitment to the organization is further strengthened by their ability to address both engineering and non-engineering issues, which reduces their intention to leave. Furthermore, companies that encourage and reward risk-taking create an environment where engineers feel empowered to innovate and make meaningful contributions. This, in turn, enhances their loyalty and decreases the likelihood that they will seek opportunities elsewhere.

While innovation is a vital aspect of engineering roles, the inherent nature of engineering work, the necessity of a supportive organizational culture, and the significant influence of other entrepreneurial behaviors, such as proactivity and risk-taking, may lessen the impact of innovativeness on turnover intentions. To retain engineers, companies should focus on fostering a creative culture while ensuring that there are adequate support systems, fair policies, and opportunities for career advancement (Kim & Oh, 2024).

5. Conclusion and Recommendations

The EO processes of an organization are significantly shaped by the attitudes and behaviors of its engineers. A major challenge lies in fostering EO behaviors among engineers and aligning them with official organizational regulations. Engineers' perspectives on EO can help organizations identify business opportunities and drive growth through creativity, innovation, and the adoption of new business and engineering methods. Most importantly, understanding engineers' behavioral expectations enhances the validity of their intentions related to ITQ. The objectives, attitudes, and behaviors of engineers are strongly linked to their decisions to leave an organization.

To explore how EO behaviors influence engineers' decisions to stay in or leave their current positions, this study utilizes EO theory. By emphasizing the importance of EO behaviors such as creativity, initiative, and risk-taking in managing ITQ among engineers in Malaysian private organizations, the findings contribute to existing research (Al-Kwifi et al., 2023; Vasudevan et al., 2024). To effectively reduce engineers' ITQ, collaboration among employers, policymakers, and industry stakeholders is essential. Integrating EO concepts into organizational practices requires a comprehensive strategy. From a personal perspective, analyzing EO provides valuable insights into engineers' anticipated behaviors. This study suggests that management should support engineers in incorporating EO into their regular engineering tasks. Additionally, employers and HR managers should recognize how engineers' behaviors align with EO and provide opportunities for its practice (Musa & Halim, 2024).

Organizations could also consider adding EO components to performance evaluation criteria, as this could enhance work performance and inform career goals. As a result, engineers may be more inclined to engage in entrepreneurial activities, such as taking on responsibilities, seizing opportunities and risks, demonstrating effort, and proactively generating creative ideas that can lead to successful outcomes (Buekens, 2014; Williamson et al., 2013). Furthermore, fostering EO among engineers can increase productivity, development, creativity, and overall competitiveness within an organization (Lim, Yeo, & Roslan, 2025). Despite these contributions, this study has several limitations. Firstly, it includes only engineers within a small sample size. To enhance generalizability, future studies should consider expanding the sample to include professionals from various disciplines, such as doctors, architects, educators, and IT specialists. Secondly, this study examines ITQ and EO behaviors from the perspective of Malaysian engineers.

Future research could explore the relationships between EO behaviors and job or career satisfaction, while considering moderating variables (such as personality traits, age, and gender) and mediating factors (like commitment and self-efficacy). A deeper understanding of employee behavioral intentions might be achieved by combining EO theory with other behavioral frameworks, such as the Theory of Planned Behavior. Comparative studies across different genders and countries could also refine EO strategies within organizations. Moreover, future research might incorporate qualitative methods, such as interviews, to complement survey data, as this study mainly employs a quantitative research approach. Insights gained from interviews could serve as additional variables to enhance the consistency and reliability of data analysis. Utilizing a mixed-methods approach in future research may provide more comprehensive insights into how EO behaviors influence ITQ, ultimately contributing to the development of more effective organizational initiatives.

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