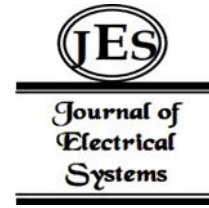


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Enterprise Managers' Critical Thinking Affecting Innovation Performance: Role of Motivation



Abstract: - This study aims to explore the impact of managers' critical thinking on firms' innovation performance using a theoretical framework of organizational behavior and to understand the mediation roles of intrinsic and extrinsic motivations. Using structural equation modelling (SEM), we analyzed data from 587 middle and senior managers across diverse industries via stratified random sampling.; furthermore, motivations mediate their relationship. This research contributes to organizational behavior by highlighting the pivotal role of critical thinking in enhancing innovation within firms. Hence, we encourage fostering environments that enhance both types of motivation, lead to superior innovation outcomes, and offer significant implications for managerial practices and strategic decision-making in business environments.

Keywords: Manager; Motivation; Critical Thinking; Innovation Performance

1 Introduction

Chinese enterprises are confronting a highly complex external environment in this era of rapid globalization and unexpected challenges such as the COVID-19 pandemic (Shan et al., 2023). These firms face intense competition and variable availability of essential natural resources like raw materials and labour (Li et al., 2023). The escalating labour costs within China have pushed many manufacturing operations towards Southeast Asia, where labour resources are more plentiful and cost-effective (Hong et al., 2024). These dynamics necessitate an unwavering commitment to innovation to address resource constraints, cater to evolving consumer demands, and maintain a competitive edge in the global marketplace.

For Chinese enterprises, continuous innovation is essential for maintaining a competitive advantage and ensuring long-term survival (Y. Zhang et al., 2023). Often, innovation is predominantly driven by the vision of top leadership or specialized teams, leading to sporadic and isolated improvements rather than a unified strategy (W. Zhang et al., 2023). This situation highlights a critical gap in systematic, ongoing innovation, underscoring the need for these enterprises to develop strong management innovation capabilities (Kyrdoda et al., 2023). Additionally, the innovation frameworks within these organizations frequently lack the sophistication of their Western counterparts, marked by a decline in risk-taking as entrepreneurs advance in age (Gulati et al., 2023).

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Managerial critical thinking involves the rigorous analysis, synthesis, and evaluation of information, enabling leaders to make strategic decisions that align with organizational goals (Song et al., 2024). This cognitive process is crucial for navigating complex business environments and fostering innovation. However, there is a significant research gap concerning the impact of managerial critical thinking on innovation outcomes. Critical thinking is vital for managers to analyze and synthesize information effectively, aiding in strategic decision-making aligning with corporate objectives (Chatterjee et al., 2023). Existing literature primarily focuses on education and psychology, with limited exploration into how critical thinking influences business innovation (Aston, 2023). Moreover, the interplay between critical thinking, intrinsic and extrinsic motivation, and their collective impact on innovation performance remains underexplored within organizational behavior (Acar et al., 2023).

Cities such as Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou, and Chengdu, are well-known for their solid industrial innovation vitality (Wang et al., 2023). Beijing leads in the number of high-tech enterprises, while Shenzhen boasts the highest ratio of high-tech enterprises per capita. Shanghai is noted for its highest number of small and micro enterprises per capita, indicating a thriving environment for innovation and entrepreneurship. Such characteristics make these cities ideal locales to study how the critical thinking of enterprise managers influences organizations' innovation performance, providing a diverse and dynamic context that is representative of China's innovative industrial landscape (Li et al., 2024).

This research uncovers critical issues concerning managerial influence on enterprise innovation performance within China and evaluates the potential role of human capital in addressing these challenges. The study identifies key factors affecting innovation outcomes, such as critical thinking abilities and motivational dynamics, and highlights their significant impacts on enterprise innovation performance. However, gaps remain, particularly in applying and systematically understanding how these attributes translate into tangible business outcomes. Additionally, there is a lack of comprehensive research on the interaction between intrinsic and extrinsic motivations in fostering innovation. Consequently, this study aims (1) to explore the influence of managers' critical thinking on enterprise innovation performance, (2) to analyze what role managers' motivation plays in the innovation process and how motivation affects the innovation performance of enterprises.

2 Literature review

2.1 Theoretical basis

Self-determination Theory (SDT), articulated by Deci and Ryan (2012), posits that autonomous and intrinsically motivated behaviors emerge from the fulfillment of three fundamental psychological needs: competence, relatedness, and autonomy. SDT distinguishes between intrinsic motivations, driven by inherent satisfaction or enjoyment, and extrinsic motivations, which are influenced by external rewards or pressure (Deci & Ryan, 2012). This theory asserts that satisfying these needs fosters intrinsic motivation and enhances subjective well-being, contributing to high-quality performance and positive energy. Further, SDT explores the internalization and integration of extrinsic motivations, suggesting that behaviors initially regulated by external factors can become self-determined through the internalization process, aligning with one's values and needs for autonomy, competence, and relatedness (Núñez-Regueiro et al., 2024). This framework has been instrumental in

understanding how motivational processes are cultivated and impact performance and satisfaction across various domains, emphasizing the role of autonomy-supportive environments in promoting better performance and psychological well-being (Hartnell et al., 2023).

Human Resources Theory, particularly human capital, originates from Plato's early discussions on enhancing abilities through education (Cope & Kalantzis, 2023). The framework was formalized by Schultz (1961), who posited that investments in education and health are crucial for developing human capital and spurring economic growth, providing returns surpassing physical investments. Becker (1985) further developed this theory, characterizing human capital as encompassing knowledge, skills, health, and life integral to individual productivity and economic outcomes. Later, economists like Lucas Jr (1988) and Romer (1990) integrated human capital into economic growth models, highlighting its pivotal role in sectoral and overall economic advancement through specialization and technology. More contemporary analyses, such as those by Chang et al. (2024), underscore the dual impacts of human capital on income distribution and economic growth, emphasizing its formation through individual educational choices and lifelong learning.

Enterprise resource-based theory, primarily developed by Wernerfelt (1984) and later expanded by scholars like Wernerfelt (1984) and Barney (1991), posits that the unique resources and capabilities within an organization are central to its competitive advantage and performance differentiation. This theory views firms as unique collections of tangible and intangible resources, which, if valuable, rare, inimitable, and non-substitutable, can sustain competitive advantages and drive organizational performance. It is underpinned by the notion that these resources are not evenly distributed across organizations and are challenging to transfer, allowing firms to maintain distinctiveness and competitive superiority over time (Newaz et al., 2023). Subsequent developments in this theory have incorporated dynamic capabilities and relational views, which suggest that competitive edge also derives from a firm's ability to adapt and manage relationships within the industry (J. Zhang et al., 2023). Resource-based theory has significantly influenced contemporary management practices by emphasizing strategic resource management, the importance of knowledge assets, and the role of organizational capabilities in fostering innovation and strategic planning within competitive markets (Shahin et al., 2024).

2.2 Hypothesis development

Innovation is crucial for corporate success and relies on creativity and critical thinking. Creativity involves generating new ideas, which is effectively complemented by critical thinking in evaluating and refining these ideas to yield innovation (Houssaini et al., 2023). Sternberg (1986) highlights the necessity of critical thinking in creative activities, while Sternberg (1999)'s Investment Theory of Creativity discusses its importance throughout various stages of problem-solving. Despite the focus on organizational traits in innovation performance studies, the role of managerial critical thinking has been relatively underexplored. This gap leads to the formulation of the following hypotheses:

H1: Managerial levels of critical thinking positively predict corporate innovation performance.

H2: Critical thinking positively predicts managers' intrinsic motivation.

H3a: Intrinsic motivation positively predicts innovation performance.

H3b: Intrinsic motivation mediates the relationship between critical thinking and corporate innovation performance.

The interplay between extrinsic and intrinsic motivations in shaping corporate innovation performance is intricate. According to Amabile (1993), extrinsic motivators such as rewards and deadlines might sometimes undermine intrinsic motivation—marked by personal interest and job satisfaction—can also enhance creativity under specific conditions. Amabile highlights that performance-related incentives exhibit an inverted U-shaped relationship with creativity, indicating that the effectiveness of extrinsic motivators is context-dependent. Additionally, intangible rewards like recognition and verbal praise can also bolster creativity, emphasizing that the type of extrinsic rewards significantly impacts their effectiveness. Given the ambiguous impacts of these motivation types on innovation performance, the following hypothesis is proposed:

H4: Extrinsic motivation mediates the relationship between critical thinking and corporate innovation performance.

3 Method

This study employed a questionnaire survey to investigate the critical thinking and innovation performance among middle and senior managers in major Chinese cities renowned for their industrial innovation. Specifically, the survey targeted managers from Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou, and Chengdu. To ensure a comprehensive analysis, a total sample size of 587 was determined using Monte Carlo Power Analysis, considering the requirements for robust statistical evaluation and the complexity of the tested mediation model.

The survey was conducted over 30 days, during which questionnaires were distributed and collected. Stratified random sampling was used to select 587 valid participants, a particularly effective method ensuring that different target population strata or segments were proportionately represented. This approach is critical in avoiding sampling biases that could distort understanding of how critical thinking impacts innovation performance across different management levels and business sectors.

In terms of sample recovery, an effective rate was achieved by leveraging the researchers' networks, including professional associations, alum groups, and direct business contacts. This network provided a reliable means of reaching and engaging potential respondents, which was instrumental in achieving a high response rate. The collection method involved both digital and physical distribution of questionnaires, accommodating the preferences and accessibility of the respondents to maximize participation and the validity of the data collected. The methodological approach of this study was carefully designed to capture a diverse and representative sample of innovation managers from China's leading cities in technology and business innovation.

4. Results

4.1 Initial Innovation Performance Scale Development

This study employs a structured Innovation Performance Scale (IPS) to systematically evaluate organizations' innovation capabilities, drawing from a comprehensive literature review and expert seminars to ensure the scale's robustness and relevance. The literature review began with an extensive search through Chinese and English databases using keywords like "enterprise innovation performance" and "innovation

measurement," among others. This phase helped to compile a broad spectrum of existing evaluation tools and theoretical frameworks for assessing innovation performance. Following this, an expert seminar was conducted involving 16 enterprise management and innovation research specialists. This seminar leveraged international frameworks and local business practices to refine the assessment tool, ensuring it captures the nuances of innovation culture and performance in contemporary organizational settings.

In addition to literature reviews and expert discussions, an open-ended questionnaire was developed to collect preliminary data, which was crucial in understanding the real-world application and challenges of measuring innovation performance. The questionnaire included a range of questions that allowed respondents to describe their company's innovation practices and outcomes. Responses were collected from various enterprises across multiple industries, including technology and finance, ensuring a diverse sample. The data collected was then subjected to text analysis using software, facilitating the identification of common themes and innovative practices across different organizations. This methodical approach to data collection and analysis, incorporating both quantitative and qualitative elements, not only enhances the validity and reliability of the research findings but also provides a deep insight into the factors driving innovation performance in the corporate sector.

4.2 Exploratory Factor Analysis of the Innovative Performance Scale

An exploratory factor analysis was conducted on the Innovation Performance Scale using responses from 587 valid questionnaires filled out by business managers. The demographic breakdown showed a nearly equal distribution of male (48.2%) and female (51.8%) participants, with an average age of 31.2 years ($SD = 3.37$). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis ($KMO = 0.774$), and Bartlett's test of sphericity confirmed that correlations between items were sufficiently significant for factor analysis ($p < 0.001$). Principal component analysis revealed five factors with eigenvalues greater than one, explaining 62.963% of the variance. However, focusing on the two most significant factors, which align with the theoretical framework, the analysis was refined to 20 items after removing one item based on factor loading and differentiation criteria. These factors, labelled 'Innovation Performance Attitude Assessment' (F1) and 'Innovation Performance Behavior Evaluation' (F2), explained 26.484% and 19.62% of the variance, respectively. F1 assessed the subjective attitudes of managers towards innovation performance, while F2 measured the objective behavioural efforts related to innovation activities. The results underscored that higher scores on these factors indicate more positive attitudes and greater alignment with innovation performance behaviours among enterprise managers.

Table 1: Factor Loadings of Enterprise Innovation Performance Scale

Item	Factor	
	F1 (Attitude)	F2 (Behavior)
1. Current year input-output		0.703
2.1. Increase in innovation input		0.713
2.2. Increase in innovation profit		0.514
2.3. Comparison of input-output ratio to last year		0.548
3. Comparison of new employees to last year		0.589

4. Comparison of patents to last year		0.801
5. Comparison of innovation documents to last year		0.525
6. Comparison of innovation performance to last year		0.554
7. Proportion of innovative employees		0.644
8. Innovative market	0.661	
9. First to use technology	0.716	
10. First to use system	0.698	
11. First to use service	0.704	
12. Increase in innovation share	0.749	
14. Innovation core competitiveness	0.625	
15. Innovation cultural atmosphere	0.563	
16. Talent attraction	0.673	
17. Management emphasis on innovation	0.763	
18. Employee emphasis on innovation	0.708	
19. Team emphasis on innovation	0.55	
<hr/>		
Eigenvalue	5.361	3.86
Variance contribution rate (%)	26.484	19.62
Cumulative variance contribution rate (%)	26.484	46.71

4.3 Validation Factor Analysis as Well as Reliability and Validity Tests of Innovation Performance Scale

The validation of the Innovation Performance Scale involved 406 participants sourced through the Questionnaire Star sample service, with a demographic spread of 43.1% male and 56.9% female, and ages ranging from 26 to 66 years ($M=33.25$, $SD=7.93$). Confirmatory factor analysis confirmed the two-dimensional structure of the scale, with indices indicating an acceptable fit ($\chi^2=720.769$, $p<0.001$; $\chi^2/df=4.265$; $RMSEA=0.09$; $CFI=0.874$; $GFI=0.839$). Reliability and validity tests further established the scale's robustness: the internal consistency reliability, measured by Cronbach's α , was notably high at 0.926. The aggregation validity was supported by Composite Reliability (CR) values of 0.927 and 0.866 for attitude and behaviour dimensions, respectively, exceeding the 0.7 threshold. Discriminant validity was also satisfactory, with Average Variance Extracted (AVE) values of 0.539 and 0.418, indicating clear differentiation between the constructs. These results affirm the reliability and validity of the Enterprise Innovation Performance Scale as an effective measurement tool for assessing innovation performance in corporate settings.

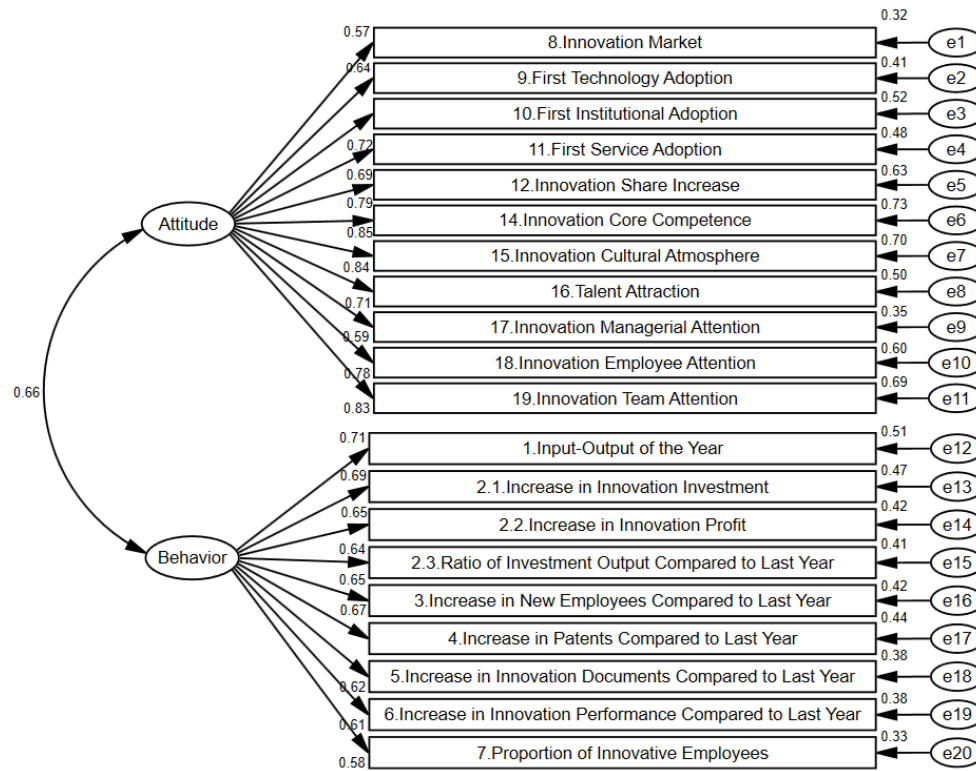


Figure 1 Validated factor analysis model for the Firm Innovation Performance Scale

4.4 Mediation Affects Tests as Well as Structural Equation Modeling

This study used software to perform correlation analysis on various variables to establish foundational relationships for hypothesis testing. The analysis revealed significant positive correlations among critical thinking dimensions—Skill, Openness, and Belief—with coefficients as high as 0.90. Additionally, these dimensions showed correlations with innovation performance, particularly with the Behavioral dimension at 0.18. Intrinsic motivation displayed strong links with all critical thinking dimensions, notably 0.62 with the Skill dimension. Similarly, extrinsic motivation showed significant correlations, especially with intrinsic motivation at 0.67. The Manager's Critical Thinking Total Score and the Innovation Performance Total Score also demonstrated significant associations with respective dimensions, underscoring the interconnectedness of critical thinking, motivation, and innovation outcomes in organizational contexts. These results highlight these variables' integral roles in shaping innovation performance, providing a solid basis for further exploration of their impacts within enterprise settings.

Table 2: Results of the Correlation Test Between Variables

Variable	Critical Thinking Skill Dimension	Critical Thinking Openness Dimension	Critical Thinking Belief Dimension	Innovation Performance Dimension (Behavior)	Innovation Performance Dimension (Attitude)	Intrinsic Motivation	Extrinsic Motivation	Manager's Critical Thinking Total Score	Innovation Performance Total Score
Critical Thinking Skill Dimension	1								
Critical Thinking Openness Dimension	0.86**	1							
Critical Thinking Belief Dimension	0.90**	0.83**	1						
Innovation Performance Dimension (Behavior)	0.18**	0.23**	0.24**	1					
Innovation Performance Dimension (Attitude)	0.09	0.1	0.12*	0.13*	1				

n									
(Attitude)									
Intrinsic									
Motivatio	0.62**	0.61**	0.63**	0.29**	0.15*	1			
n									
Extrinsic									
Motivatio	0.47**	0.54**	0.47**	0.26**	0.14*	0.67**	1		
n									
Manager									
Critical									
Thinking	0.97*	0.94**	0.96**	0.22**	0.11	0.65**	0.515**	1	
Total									
Score									
Innovatio									
n									
Performa	0.16**	0.21**	0.20**	0.63**	0.48**	0.32**	0.32**	0.20**	1
nce Total									
Score									
Mean	4.49	4.73	4.53	4.89	5.04	4.46	21.61	4.59	42.6
Standard									
Deviation	0.74	0.68	0.76	1.56	1.6	0.76	2.55	0.69	6.22
(SD)									

Note: * indicates $P < 0.1$, ** indicates $P < 0.05$, *** indicates $P < 0.01$.

This study conducted a one-way linear regression analysis to explore the relationship between managers' critical thinking and enterprise innovation performance, achieving a confidence level of 95%. The analysis revealed a strong linear correlation, with a determination coefficient $(R^2 = 0.39)$, indicating that critical thinking accounts for 39% of the variance in innovation performance. The regression model, $(Y = 34.447 + 1.779X)$, passed the F-test $(F = 12.031)$, $(p = 0.001)$, confirming the significant predictive power of managers' critical thinking on enterprise innovation performance. A scatterplot visually confirmed this significant linear relationship, illustrating that enhanced managerial critical thinking is associated with improved innovation outputs.

The study built on these findings by testing the mediating effects of intrinsic and extrinsic motivation on the identified relationship, employing structural equation modeling to deepen the analysis. Three models were proposed: Model 1 posits that intrinsic motivation solely mediates the relationship; Model 2 suggests a sole mediation by extrinsic motivation; and Model 3 considers both intrinsic and extrinsic motivations as parallel dual mediators. Utilizing software and the bias-correction bootstrap method, the study aimed to validate these mediation hypotheses, thus providing a comprehensive understanding of the dynamics between critical thinking, motivation types, and innovation performance within firms.

Table 3: Simple Linear Regression Results of Corporate Innovation Performance

Item	Manager's Critical Thinking
Multiple R	0.199
R Square	0.039
Adjusted R	0.036
F	12.031
Significance F	0.001
Fitted Equation	$Y = 34.447 + 1.779X$

In the mediation analysis using a sample of 295, intrinsic motivation was examined as a mediator between managers' critical thinking (independent variable) and firms' innovation performance (dependent variable).

Table 4: Model 1 PROCESS Distribution Regression Method Mediating Effect Test Results

Step	Dependent Variable	Independent Variable	R	R-sq	F	β	t
Step 1	Innovation Performance	Critical Thinking	0.199	0.04	12.031***	1.779	3.469***
Step 2	Intrinsic Motivation	Critical Thinking	0.648	0.42	212.550***	0.706	14.580***
Step 3	Innovation Performance	Critical Thinking	0.318	0.101	16.384***	-0.112	-0.172
		Intrinsic Motivation				2.681	4.468***

Note: * indicates $P < 0.1$, ** indicates $P < 0.05$, *** indicates $P < 0.01$.

The PROCESS Distribution Regression Method revealed significant relationships across three steps. Initially, critical thinking substantially affected innovation performance ($\beta=1.779$, $p<0.001$), demonstrating a valid total effect. Subsequently, critical thinking significantly influenced intrinsic motivation ($\beta=0.706$, $p<0.001$). In the final step, while critical thinking's direct effect on innovation performance was not significant ($\beta=-0.112$, $p>0.05$), intrinsic motivation showed a strong positive impact on innovation performance ($\beta=2.681$, $p<0.001$), confirming its complete mediation role. The bootstrap mediation test further supported these findings, with the indirect effect (1.891) having a confidence interval of [0.991, 2.360] that did not include zero, affirming the significant mediating effect of intrinsic motivation. Conversely, the direct effect's confidence interval ([-1.397, 1.172]) included zero, indicating no significant direct impact. This analysis underscores the critical role of intrinsic motivation in linking critical thinking to enhanced innovation performance in firms.

Table 5: Bootstrap Mediation Effect Test Results

Effect	Effect Value	Lower Limit of Confidence Interval (LLCI)	Upper Limit of Confidence Interval (ULCI)
Total Effect	1.779	0.77	2.788
Direct Effect	-0.1123	-1.397	1.172
Indirect Effect	1.891	0.991	2.63

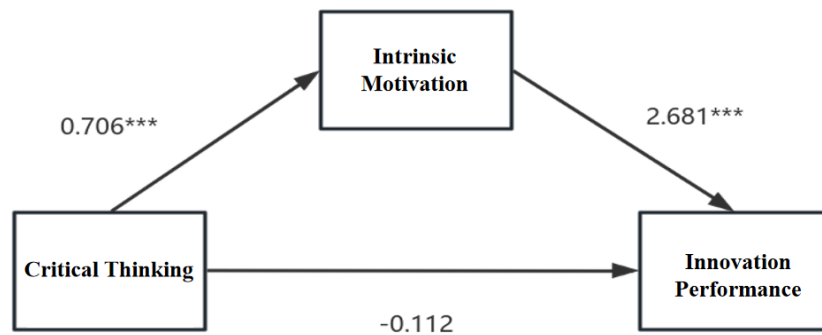


Figure 2 Plot of the mediating effect pathway relationship of intrinsic motivation

This study examined the mediation effect of extrinsic motivation between managers' critical thinking and firms' innovation performance using a sample size of 295. The initial regression analysis confirmed a significant direct effect of critical thinking on innovation performance ($\beta=1.779$, $p<0.001$), establishing a valid total effect. Subsequently, a strong positive impact of critical thinking on extrinsic motivation was observed ($\beta=1.890$, $p<0.001$). However, in the final step of the analysis, while critical thinking alone showed a non-significant direct effect on innovation performance ($\beta=0.438$, $p>0.05$), the effect of extrinsic motivation on innovation performance was significant ($\beta=0.708$, $p<0.001$), confirming its role as a complete mediator in the model.

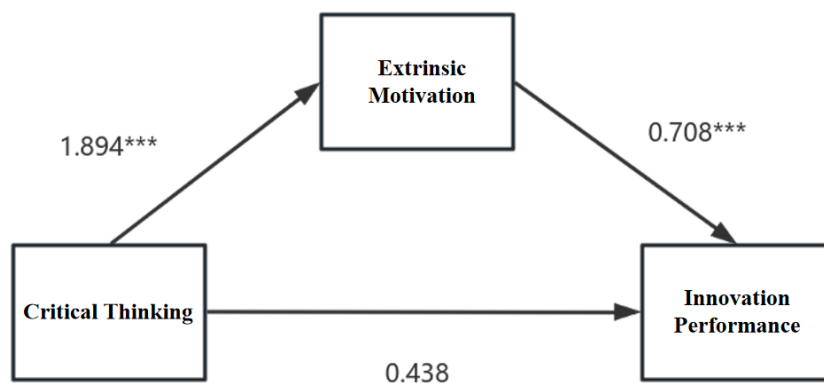


Figure 5 Plot of the path relationship of the mediating effect of extrinsic motivation

Further validation through Bootstrap mediation effect testing revealed an indirect effect of 1.341 with a 95% confidence interval of [0.606, 2.054] that did not include zero, indicating a substantial and significant mediating role of extrinsic motivation. The direct effect's confidence interval of [-0.703, 1.579] included zero, suggesting the direct effect was insignificant. The analysis also quantified the relative contributions of direct and indirect effects, with direct effects accounting for 24.62% and indirect effects for 75.38% of the total effect. This substantial mediation underscores the critical influence of extrinsic motivation in linking managerial critical thinking to enhanced innovation performance within firms.

Table 6: Bootstrap Mediation Effect Test Results

Effect Relationship	Effect Value	Lower Limit of Confidence Interval (LLCI)	Upper Limit of Confidence Interval (ULCI)	Proportion of Effect (%)
Total Effect	1.779	0.0006	0.769	
Direct Effect	0.438	-0.703	1.579	24.62%
Indirect Effect	1.341	0.606	2.054	75.38%

This study evaluated the parallel double-mediation effect of intrinsic and extrinsic motivation between managers' critical thinking and firms' innovation performance using software. The structural model showed good fit indices ($\chi^2=40.006$, $p<0.001$; $\chi^2/df=4.445$; $RMSEA=0.05$; $CFI=0.994$; $GFI=0.991$), suggesting robust model adaptability. Direct effect tests confirmed that managers' critical thinking positively influences both firm innovation performance ($\beta=0.7$, $p=0.331$) and intrinsic motivation ($\beta=0.659$, $p<0.01$), with intrinsic motivation in turn positively affecting innovation performance ($\beta=0.361$, $p<0.01$). Mediation analysis revealed significant indirect effects, with intrinsic motivation contributing 54.80% and extrinsic motivation 29.10% to the total mediated effect, accounting for 83.90% of the total effect on innovation performance (Total Effect $\beta=0.476$). Bootstrap sampling validated these mediating roles, indicating that intrinsic and extrinsic motivations significantly bridge the impact of critical thinking on innovation outcomes.

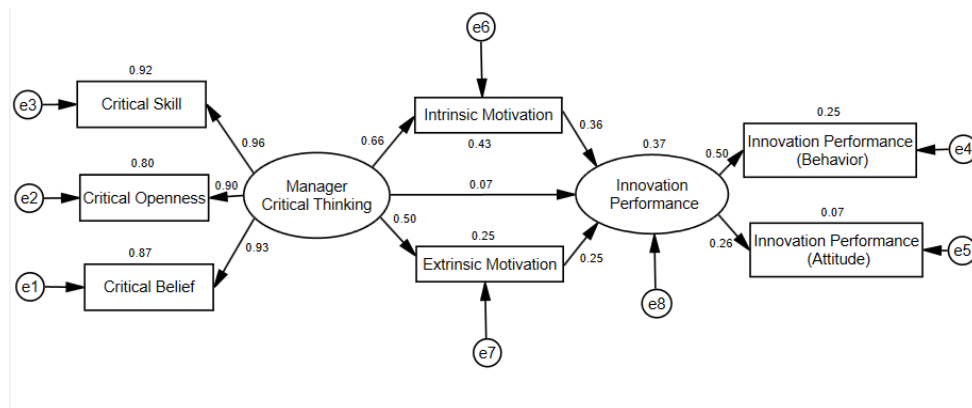


Figure 6 Plot of the dual-mediated effects of intrinsic motivation and extrinsic motivation in critical

5 Discussion and Conclusion

This study explores the impact of managers' critical thinking on firms' innovation performance and examines the mediating roles of intrinsic and extrinsic motivation within organizational behaviour. The research substantiates how managerial cognitive abilities drive corporate innovation by utilizing literature review and quantitative analysis, filling a notable gap in existing business-focused research predominantly concentrated in educational contexts. The analysis confirmed strong model fit and validated the proposed hypotheses through significant path coefficients by employing software for structural equation modelling.

5.1 Theoretical implication

This study enhances the understanding of the pivotal role of managers' critical thinking in driving corporate

innovation, expanding the theoretical discussion beyond the educational sphere into the domain of organizational behaviour. By empirically demonstrating that critical thinking significantly influences innovation performance through direct and mediated paths, the research fills a notable gap in the existing literature that predominantly focuses on educational outcomes. The validation of intrinsic and extrinsic motivations as mediators not only elucidates their complex roles but also integrates psychological and behavioural dimensions into the innovation process (Hao et al., 2024). This approach provides a comprehensive framework that underscores the importance of managerial cognitive capabilities in fostering an environment conducive to innovation and strategic thinking (Memon & Ooi, 2023).

Furthermore, the findings of this study contribute to a deeper theoretical appreciation of how critical thinking can be systematically nurtured within corporate structures to enhance innovation capabilities. By identifying the specific impacts of intrinsic and extrinsic motivations, the research offers insights into how these motivational forces can be leveraged to bolster critical thinking among managers. This dual-layered exploration helps construct a more detailed understanding of the interplay between managerial behavior and innovation outcomes, suggesting that critical thinking is beneficial and essential for sustaining competitive advantage in rapidly evolving markets (Phraknoi et al., 2024). This enriched theoretical perspective encourages ongoing research into the mechanisms through which critical thinking can be cultivated and harnessed within diverse organizational contexts.

5.2 Practical implication

This study is substantial for industry practitioners and stakeholders seeking to enhance organizational innovation. The straightforward demonstration that managers' critical thinking significantly boosts innovation performance underscores the need for businesses to cultivate these skills deliberately. Companies should consider integrating critical thinking training into their professional development programs, emphasizing the acquisition of technical skills and fostering analytical and strategic thinking abilities among management. Moreover, the mediation effect of intrinsic and extrinsic motivations suggests that aligning motivational strategies with encouraging critical thinking can lead to more profound innovative outcomes. Therefore, tailored incentive systems that reward outcomes and innovative thinking processes can be instrumental in enhancing overall corporate innovation.

Additionally, this study offers actionable insights for stakeholders shaping corporate strategies and organizational policies. Given that intrinsic motivation has a notable impact on innovation, organizations should strive to create environments that inherently motivate managers by offering meaningful and challenging work that stimulates intellectual curiosity and professional growth. On the other hand, recognizing the role of extrinsic motivation implies that external rewards and recognition should be thoughtfully designed to complement intrinsic drives rather than undermine them. This balanced approach to motivation could foster a more innovative organizational culture and empower managers to push the boundaries of traditional thinking and practice, thereby driving sustained innovation and competitive advantage in their respective markets.

5.3 Conclusion

This study systematically explored the impact of managers' critical thinking on firms' innovation

performance, employing a robust theoretical framework rooted in organizational behaviour. By integrating intrinsic and extrinsic motivation concepts, the study constructed a nuanced model to elucidate how these motivational factors mediate the relationship between critical thinking and innovation outcomes. The findings revealed that both types of motivation significantly mediate this relationship, emphasizing the profound influence of critical thinking on innovation. The research confirmed, using structural equation modelling, that critical thinking not only directly contributes to innovation performance but also fosters a conducive environment for intrinsic motivation to flourish, thereby enhancing organizational innovation capabilities.

However, the study's scope and findings are subject to certain limitations that warrant consideration for future research. The study predominantly drew the sample from middle and senior managers within specific industries, which may limit the generalizability of the findings across different organizational contexts and economic sectors. Additionally, while statistically significant, the relationships between the variables might exhibit different dynamics under varying cultural and economic environments, suggesting that the findings might not be universally applicable. Future studies could enhance the robustness of these findings by expanding the demographic and geographic diversity of the sample, incorporating a broader array of industries, and considering external environmental factors that could influence managerial critical thinking and innovation outputs. Such expansions would address the current study's limitations and enrich the understanding of the intricate dynamics at play in the nexus of critical thinking and innovation across different organizational landscapes.

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