

How Organizational Improvisational, Transformational Leadership Styles Impact Innovation Performance of Start-Up Companies in VUCA Environments

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Abstract: Entering the competitive VUCA environment, the traditional management model with prediction and control as the main measures has not adapted to the needs of the times in certain situations, and it has become a hot topic for start-ups to survive and grow in the current unpredictable environment and achieve breakthrough innovation. This study constructs a correlation model between organizational improvisation, transformational leadership, and innovation performance of start-ups, and uses the VUCA environment as a moderating variable. The findings confirm that all dimensions of organisational improvisation and transformational leadership significantly affect the innovation performance of start-ups; Organizational improvisation and transformational leadership positively interact to influence innovation performance of start-ups, i.e. organizational improvisation and transformational leadership reinforce each other's influence on innovation performance of start-ups; The VUCA environment positively moderates the impact of organizational improvisation and transformational leadership on innovation performance of start-ups. This study will help start-ups to fully grasp the fleeting opportunities and respond to the changing external environment in a timely manner to further enhance the competitive advantage of start-ups, and provide practical guidance for top managers of start-ups to enhance their innovation performance.

1 INTRODUCTION


The international situation is characterized by "Volatility", "Uncertainty", "Complexity" and "Ambiguity". VUCA environment characteristics are becoming more and more obvious. Under the VUCA era environment, how start-ups can turn crisis into safety, survive and grow in the crisis has become an issue of concern for all sectors of society.

The first thing that start-ups in dynamically changing environments need to do to achieve sustainable and healthy growth is to change the decision-making paradigm away from the traditional strategic thinking of planning, execution, feedback and review, and to think and act, practice and improve, innovate and integrate with more flexible and improvised strategies (Tang & Zhou, 2017).

The concept of organizational improvisation refers to the key elements of an organization's strategic actions in a complex environment, and it differs from the traditional strategic decision-making

model in that it integrates planning, decision-making, and execution. Organizational improvisation can help organizations better complete the decision-making process when unexpected events or changes in the environment deviate from expectations. Organizational improvisation also reflects the richness of a leader's experience, judgment, and decisiveness.

Weick (1993) points out that transformational leaders give their employees more autonomy and encourage them to think outside the box and promote improvisation. In today's competitive world, transformational leaders are one of the most responsive types of leaders and are valued more than ever for building strong confidence through advance learning and preparation, and for learning by experience without fear of failure, so that organizations can adjust quickly in a VUCA environment, calming immediate fluctuations while making intuitive and rational decisions to seize future opportunities.

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Based on this, this paper will focus on the relationship between organizational improvisation, transformational leadership and innovation performance of start-ups, and explore the mechanisms of organizational improvisation and transformational leadership on innovation performance of start-ups.

2 BACKGROUND OF THE STUDY

VUCA was first proposed by the U.S. military to describe the complex and changing military environment at that time, and with the development of information technology such as big data, artificial intelligence and cloud computing, as well as the constant changes in the international market, the external environment in which the organization operates has become more and more characteristic of VUCA. Bennett & Lemoine (2014) mentioned VUCA as "Volatility", "Uncertainty", "Complexity", "Ambiguity" in "Harvard Business Review", which will become a trend in the future, and explains its meaning. Troise et al. (2022) used digital technological capabilities, relational capabilities, and innovative capabilities premised on organizational agility - the ability to quickly anticipate or respond to external changes - is critical to surviving and competing in today's turbulent VUCA environment characterized by technological advancement and digitalization.

The study of improvisation first began with jazz metaphors, so early research on organizational improvisation was mainly based on the perspective of jazz metaphors. Through specific studies, researchers attempted to summarize the characteristics of the concept of improvisation in jazz improvisation, differentiate the degree and form of improvisation, explore the mechanisms of improvisational behaviors, and discover the role of improvisational metaphors in jazz performances in organizational practices. Weick (1998) firstly blended improvisation with organizational management by observing top managers and found that they would, like jazz musicians, identify and aim at the goals and make and follow rules, engage in directed activities, and suggested characteristics of groups with high improvisation skills. When improvisation is combined with team and environmental moderators, it has a positive impact on team innovation, as well as suggesting that organizational members can improve their improvisational skills through training. Fultzz &

Hmieleski (2021) established a model linking organizational improvisation with new venture performance, demonstrating that improvisation ability is a resourceful means for startups to identify new opportunities and gain performance advantages.

For the transformational leadership research. At the individual level, the main areas involved are job performance, job satisfaction, employee happiness, individual knowledge sharing, employee creativity, employee emotions, and self-coordination. Stanescu et al. (2019) point out the positive and significant relationship between transformational leadership and employee innovative behavior and psychological empowerment by creating a greater sense of empowerment, leaders can have a higher positive impact on the employee's level of employee innovation. At the organizational level, current research focuses on the study of transformational leadership on organizational performance. Ng (2017) developed an integrative model using five theoretical driving mechanisms to explain the impact of transformational leadership on performance outcomes. Mach et al. (2021) explored how transformational leadership affects team performance through team cohesion and how this relationship is moderated by prior team performance. The results of the study indicated that transformational leadership indirectly affects team performance through the mediating role of team cohesion, and that when the level of prior performance is high, the this indirect effect is more significant.

In exploring the relationship between work environment and creativity, Amabile (1996) suggested that an innovative organizational climate promotes team support, which in turn promotes innovation. Scott & Bruce (1994) and Xie et al. (2007) argued that an innovative culture within an organization has a positive impact on performance in new tasks. The latter's empirical study found that a good innovation culture can improve the business quality and innovation level of the organization, which in turn can help firms to better improve their performance level. Leadership behavior is another important factor in influencing innovation performance. Scott (2011) supported this view by showing that innovative leadership behaviors are believed to promote an innovative and creative climate in the organization, which, in turn, improves employees' innovation ability. Wang (2021) points out that when individual employees have a higher degree of forgetfulness, it is more conducive to digital transformation to promote organizational innovation performance through dynamic capabilities.

In a VUCA environment filled with turbulence, disruption and uncertainty, start-ups are actively implementing change and innovation to cope with various changes, but encountering many difficulties and resistance in the process. These dilemmas of change and innovation have received increasing attention in management practices and theoretical studies, and have become the focus of attention for academics, researchers and managers. However, the current empirical research is still in a relatively imperfect stage, the existing research is not deep and systematic enough, and scholars and practitioners need to further integrate the research on transformational leadership and innovation performance. Meanwhile, scholars need to further integrate research on organizational change and innovation behavior and consider how to enhance transformational leadership in the spirit of organizational improvisation to promote innovation in startups; on the other hand, practitioners consider how to systematically introduce the theory of enhancing transformational leadership into the process of organizational improvisation. Overall, the relationship between organizational improvisation, transformational leadership, and innovation performance of start-ups in VUCA environments does not seem to have been systematically studied in academia.

To sum up, there are still certain black holes and deficiencies in the academic research on the related concepts, for example, the lack of integrated research on the relationship between organizational improvisation, transformational leadership and innovation performance, and the failure to organically combine the VUCA environment with organizational change and innovation management. Based on this, this paper will focus on the relationship between organizational improvisation, transformational leadership and innovation performance, and explore the mechanism of organizational improvisation and transformational leadership on the new performance of start-ups under the VUCA environment.

3 THEORETICAL MODEL AND RESEARCH HYPOTHESIS SECTION HEADINGS

3.1 Theoretical Model

In the VUCA environment, it brings great impact to the survival, competition and development of start-

ups. Faced with the coupling effect of external environment complexity and organizational complexity, it is especially important to create a diversified and inclusive internal environment to properly handle the crisis and turn it into a driving force for development. Responding quickly and ruling with dynamics is even more crucial for leaders of start-ups to lead their organizations to success. Based on dynamic capability theory, when an organization has the ability to react quickly to the internal and external environment, its core competitiveness will be greatly enhanced. In addition, practice has shown that in the face of new challenges and threats, the effectiveness of traditional response strategies is greatly reduced and may even fail.

A review of the literature on leadership and team performance suggests that leadership behaviors are a key factor in team innovation performance and that the right leadership behaviors can maximize team innovation performance. Bass describes transformational leaders as "leaders who make subordinates aware of the importance and responsibility of the tasks they undertake by making them leaders whose needs are met, and who also create a greater vision for their subordinates, encourage and support them to go beyond themselves, adopt new ideas and approaches, creatively solve new challenges and problems, and create an atmosphere of mutual support and harmonious innovation within the organization to promote organizational innovation" (Bass, 1985). Therefore, transformational leadership style is important for accelerating organizational innovativeness and improving organizational innovation performance.

Based on the above review of the literature and related theories, this paper argues that organizational improvisation and transformational leadership may interact to produce influencing factors on innovation performance of start-ups, while the relationship between the two and innovation performance of start-ups may be mediated by the VUCA environment, therefore, the paper proposes the following theoretical model, as shown in Fig 1.

3.2 Theoretical Model

3.2.1 Organizational Improvisation and Innovation Performance of Start-Ups

Organizational improvisation as a "time pressure" and "environmental uncertainty" triggered by the ability to respond quickly to unexpected events has a strong immediate, spontaneous, creative characteristics,

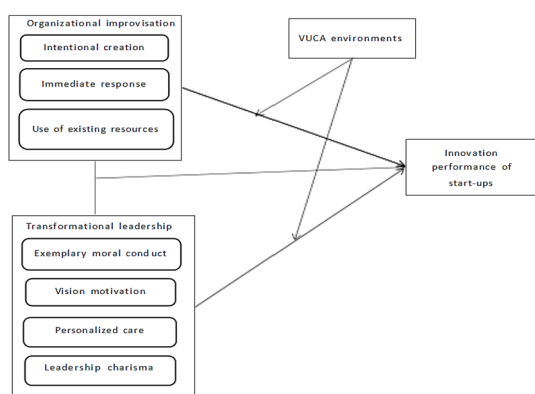


Figure 1: Conceptual model.

through the current problem facing the specificity of a timely response, and The existing resources are successfully integrated and utilized to avoid missed opportunities and problem complications. Based on the view of flexible human resource management and technological variability, Shan et al. (2021) pointed out that in an uncertain environment, technology-based firms use improvisation capabilities to enhance technology commercialization by efficiently integrating existing resources, thus positively influencing organizational innovation performance. Xiang (2021) confirmed a strong positive influence between organizational improvisational capabilities and innovation performance using the supportive incubation environment and environmental dynamics as moderating variables. Based on the moderating role of improvisational skills, Chen (2013) investigated the relationship between time-based competition and organizational performance and found that improvisational skills deepened the organization's understanding of time-based competitive cognition through rapid and immediate innovation responses, and the study found that improvisational skills effectively contributed to organizational innovation performance.

Based on this, this paper proposes the following research hypothesis: H1, H1a, H1b, as shown in Table 1.

3.2.2 Transformational Leadership and Innovation Performance of Start-Up Firms

In general, organizational development is influenced by the entrepreneurial leadership style, i.e., the leader's vision, wisdom and motivation to innovate affect the organization's performance indicators; therefore, innovation performance is closely related to the entrepreneur's values and beliefs, i.e., innovation

performance is influenced by the entrepreneurial leadership style. Transformational leaders, on the other hand, tend to actively cultivate their own innovation consciousness and capabilities, inspire organizational members through their own images, attitudes, beliefs and behaviors, correct employees' work attitudes, build employees' collective cognition and perceptions of the organization, help promote mutual cognition among members, and guide the organization to accomplish innovative tasks, which is a key factor in improving organizational innovation performance. Numerous studies have shown that transformational leaders have an impact on organizational innovation performance by influencing to increase the creativity of their subordinates. For example, Nguyen (2022) showed that there is a significant correlation between transformational leadership and employee creativity. Shafi et al. (2020) stated that transformational leadership has a significant positive effect on employee creativity through idealizing influence, intellectual stimulation and motivational motivation. Zhang & Wang (2020) showed that transformational leaders improve organizational innovation performance by increasing their own work engagement. Rong et al. (2018) stated that CEO transformational leadership style has a significant positive impact on organizational innovation performance.

Based on the above analysis, the following hypotheses are proposed in this study: H2, H2a, H2b, H2c, H2d, as shown in Table 1.

3.2.3 Interactive Effects of Organizational Improvisation and Transformational Leadership on Innovation Performance of Start-up Firms

By collating the existing literature in English and Chinese, there is a gap in the current research on the interaction between the two. However, based on the existing research by scholars, it is not difficult to find that both organizational improvisation and transformational leadership have a reinforcing effect on each other to positively influence organizational innovation performance.

From the perspective of organizational improvisation, when an organization has the ability to react quickly to the internal and external environment, its core competitiveness will be greatly enhanced. In addition, the organization or its members must meet challenges with new organizational strategies through the exercise of individual creativity and improvisation, and take advantage of market opportunities to creatively solve

problems, which also indirectly enhances the innovation capability of the whole organization. The transformational leader supports and facilitates the rapid growth of employees by providing them with personalized guidance, making them aware of their self-worth, and developing their ability to improve their self-leadership.

From the perspective of transformational leaders, the creative thinking, immediate responsiveness of organizational members is greatly enhanced when their behavior is unrestrained and maximizes their ability to improvise, which will help transformational leaders, through their personal charisma, build trust with employees, motivate them, and prompt them to further creatively solve new challenges and problems, creating in the organization a mutually supportive and harmonious innovation climate within the organization to achieve better organizational innovation performance. It is evident that organizational improvisation positively reinforces the role of transformational leaders on organizational innovation performance.

In summary of the analysis, the following hypothesis is proposed in this study: H3, as shown in Table 1.

3.2.4 Moderating Effect of VUCA

In the VUCA environment, various characteristics have brought a huge impact on the survival, competition and development of the company. Facing the coupling effect of external environmental complexity and organizational complexity, it is especially important to create a diverse and inclusive internal environment to properly handle the crisis and turn it into a driving force for development. Krupp & Schoemaker (2014), Bennett & Lemoine (2014), and Livingston (2014) have each made Troise et al. (2022) and others presuppose that organizational agility - the ability to quickly anticipate or respond to external changes - premised on digital technology capabilities, relational capabilities, and innovation capabilities, is essential in today's environment characterized by technological advancement and digitization as the hallmark of today's turbulent VUCA environment is critical to survive and compete. In addition to this, due to the rapidly changing domestic and international environment, start-up leaders must meet challenges with fresh organizational strategies and take advantage of market opportunities to creatively solve problems through the exercise of personal creativity and improvisation. Khan et al. (2021) showed that under the VUCA environment, knowledge workers enter the workplace more often,

so leader-member exchange and leader identification play a mediating role between authentic leadership and employees' innovative work behaviors, and states that by building strong relationships with employees, managers can motivate employees to pursue innovative work behaviors.

Therefore, the following research hypotheses are proposed in this paper: H4, H5, as shown in Table 1.

Table 1: Research hypothesis.

H1	Organizational improvisation has a positive effect on innovation performance of start-ups.
H1a	Intention creation has a positive effect on the performance of start-ups.
H1b	Immediate response has a positive effect on the performance of start-ups.
H1c	Leveraging existing resources has a positive impact on start-ups.
H2	Transformational leadership has a positive effect on innovation performance of start-ups.
H2a	Virtuous exemplary behavior has a positive effect on innovation performance of start-ups.
H2b	Visionary incentives have a positive effect on innovation performance of start-ups.
H2c	Personalized care has a positive effect on innovation performance of start-ups.
H2d	Leadership charisma has a positive effect on innovation performance of start-ups.
H3	Organizational improvisation and transformational leadership reinforce each other's effects on innovation performance of start-ups.
H4	The VUCA environment positively moderates the relationship between organizational improvisation and innovation performance of start-ups, i.e., the more influenced by the VUCA environment the more innovation performance of start-ups is influenced by organizational improvisation.
H5	The VUCA environment positively moderates the relationship between transformational leadership and innovation performance of start-ups, i.e., the more influenced by the VUCA environment the more innovation performance of start-ups is influenced by transformational leadership.

4 STUDY DESIGN

4.1 Data Collection

AKumar & Das (2020) point out that enterprises that are active and founded within 8 years are new. Domestic scholars such as Cheng, Song-Song et al. (2019) and Zhang (2018) also generally define enterprises that have been established for less than 8 years as start-ups. Therefore, this study defines the investigated start-up enterprises as those whose enterprise age is less than or equal to 8 years.

In this study, 396 official questionnaires were distributed by telephone and email to the middle and senior management of a start-up enterprise in an industrial development zone in Chengdu, Sichuan Province (China) through the introduction of acquaintances, and 308 valid questionnaires were obtained after excluding invalid questionnaires such as incomplete completion or enterprises not meeting the conditions. From the viewpoint of the sample itself, the survey targets are widely distributed, covering manufacturing, service, information transmission, new energy materials, etc. From the

viewpoint of the enterprise characteristics, 38 questionnaires were distributed to state-owned enterprises, 130 to private enterprises, 102 to foreign-funded enterprises, and 38 to other enterprises. 42.5% of businesses with 100 or more employees, 32.5% with 51-100 employees, 10.7% with 21-50 employees and 14.3% with less than 20 employees.

4.2 Questionnaire Design

The reliability test of the scales often uses Cronbach's α coefficient. In this paper, the reliability of each variable scale was analyzed using SPSS 27.0, and the results showed that the reliability values of each scale of organizational improvisation, transformational leadership, VUCA, and innovation performance were 0.952, 0.983, 0.940, and 0.904, respectively. The total reliability value was 0.975, thus indicating a high quality of reliability of the study data.

The validity tests were divided into exploratory factor analysis and validation factor analysis. In the exploratory factor analysis, KMO and Bartlett's spherical tests were conducted for the scales of organizational improvisation, transformational leadership, VUCA, and innovation performance, and the results showed that the KMO of all variables was greater than 0.8, and the factor loadings of each measurement question item were greater than 0.6, indicating good structural validity of the scales, as shown in Table 1. Validation factor analysis was conducted for each variable and the model fit was tested by indicators, in which the value of chi-square degrees of freedom was 1.143, which was less than 3, the value of RMSEA was 0.022, which was less than 0.10, the value of RMR was 0.050, which was less than 0.08, and the values of CFI, GFI, NFI, and TLI were all greater than 0.9, indicating that the absolute and value-added fitness of the model was better.

5 EMPIRICAL STUDY

5.1 Results of the Regression Ana

As can be seen from the table 2, in model M0, the adjusted R^2 is 0.004, indicating that the explained variance of firm age and firm size on individual innovation performance is 0.4%, and after adding the intention creation variable in model M1, the adjusted from R^2 increases to 0.144, and the regression coefficient $P = 0.377$ of virtue draping on the innovation performance of new start-up firms in model M1 is significant at the $P = 0.001$ level It indicates that intention creation is significantly and

Table 2: Table of regression analysis (independent variable is organizational improvisation).

Variant	M0	M1	M2	M3
Control variable				
Age of business	0.090	0.081	0.081	0.084
Enterprise size	-0.058	-0.082	-0.090	-0.100
Independent variable				
Intentional creation		0.377***		
Immediate response			0.360***	
Utilization of existing				0.370***
R^2	0.011	0.152	0.139	0.146
F-value	1.680	18.204***	16.375***	17.280***
Adjusted R^2	0.004	0.144	0.131	0.137

positively related to innovation performance of start-ups, and hypothesis H1a holds; after adding immediate response variable in model M2, the adjusted R^2 is 0.131, which has significantly improved the explanatory strength of innovation performance of start-ups compared with the basic model M0, and the regression coefficient of immediate response on innovation performance of start-ups $P = 0.360$, which is significant at the $P = 0.001$ level. It indicates that immediate response is significantly and positively related to innovation performance of start-ups, and hypothesis H2b holds; the addition of personalized care in model M3 increases the moderated R^2 to 0.137 and the regression coefficient on innovation performance is 0.370 ($p=0.001$), indicating that using available resources is significantly and positively related to innovation performance, and hypothesis H2c holds.

5.2 Results of Regression Analysis of Transformational Leadership and Innovation Performance

From the table 3, it can be seen that after adding the virtue pendant variable in model M1, the adjusted from R^2 increases from 0.004 in M0 to 0.213, and the regression coefficient $P = 0.459$ of virtue pendant on innovation performance of start-up firms in model M1 is significant at the 0.001 level, indicating that virtue pendant positively affects innovation performance of start-up firms, and hypothesis H2a holds; after adding the vision incentive variable in model M2, the adjusted from R^2 variable in model M2, the adjusted R^2 is 0.186, which has significantly improved the explanatory strength of innovation performance of start-ups compared with the basic model M0, and the regression coefficient $P = 0.428$ for vision incentive innovation performance of start-ups is significant at the 0.001 level, indicating that

Table 3: Results of regression analysis of transformational leadership and innovation performance).

Variant	M0	M1	M2	M3	M4
Control variable					
Age of business	0.090	0.090	0.070	0.075	0.088
Enterprise size	-0.058	-0.056	-0.071	-0.060	-0.07
Independent variable					
Set an example by virtue and behavior		0.459***			
Vision Motivation			0.428***		
Personalized Care				0.431***	
Leadership Charisma					0.445***
R ²	0.011	0.221	0.194	0.196	0.209
F-value	1.680	28.766***	24.358***	24.764***	26.698***
Adjusted R ²	0.004	0.213	0.186	0.188	0.201

vision incentive positively affects innovation performance of start-ups, and the hypothesis H2b holds; adding personalized care in model M3, the adjusted R² increases to 0.188 and the regression coefficient on innovation performance is 0.431 (p=0.001), indicating that personalized care is significantly and positively related to innovation performance, and hypothesis H2c holds; after adding leadership charisma in model M4, the adjusted R² is 0.201 and the regression coefficient on innovation performance is 0.445 (p=0.001), indicating that leadership charisma and innovation performance also show a significant positive correlation, and the hypothesis H2d holds.

5.3 Results of Interaction Effect Analysis

From the table 4, we can see that the adjusted R² values are 0.004,0.151,0.246,0.271, i.e., the model can explain 0.4%,15.1%,24.6%,27.1% of the variance, i.e., the model fits well; this paper constructs model M0 as the regression equation with the control variable as the independent variable, model M1 as the regression equation with the introduction of the independent variable organizational improvisation, and M2 is the regression equation with the introduction of the independent variable change-oriented leadership, and M3 is the product term with the introduction of organizational improvisation and change-oriented leadership. According to the table 4, the regression coefficient of M1 independent variable organizational improvisation is 0.386 (p < 0.001),

Table 4: Test table of the relationship between organizational improvisation, transformational leadership and innovation performance.

Variant	M0	M1	M2	M3
Control variable				
Age of business	0.090	0.081	0.078	0.09
Enterprise size	-0.058	-0.093	-0.078	-0.07
Independent variable				
Organizational improvisation		0.386***		-0.673**
New Leaders for Change			0.493***	-0.326
Organizational improvisation* Transformational Leadership				1.407***
R ²	0.011	0.159	0.253	0.283
F-value	1.680	19.142***	34.338***	23.845***
Adjusted R ²	0.004	0.151	0.246	0.271

based on the results of this analysis, it can be concluded that organizational improvisation positively affects organizational innovation performance, i.e., the hypothesis H1 of this study is verified. the regression coefficient of M2 independent variable transformational leadership is 0.493 (p < 0.001), which indicates that transformational leadership positively affects organizational innovation performance, i.e., the hypothesis H1 of this study is verified. The regression coefficient of M3 product term was 1.407 (p < 0.001), and the hypothesis H3 of this study was supported.

5.4 Results of Analysis of Moderating Effects

To reduce the problem of non-essential multicollinearity in the regression analysis, this study decentered the independent variable Organizational Improvisation and Transformational Leadership and the moderating variable VUCA Environment (mean center) before constructing the interaction terms, and then calculated the product of the independent and moderating variables after decentering and constructed interaction term 1 and interaction term 2, respectively. From the table 5, we can see that the adjusted R² values are 0.004, 0.248, 0.271, 0.304, 0.315, i.e. the model can explain 4%, 24.8%, 27.1%, 30.4%, 31.5% of the variance, i.e. the model fit is good; model M0 is constructed as the regression equation with the control variable as the independent variable, model M1 is the regression equation with the introduction of the independent variable Organization improvisation and the regression equation of equation of the moderating variable VUCA environment, M2

Table 5: Table of tests for moderating effects.

Variant	M0	M1	M2	M3	M4
Control variable					
Age of business	0.090	0.09	0.089	0.085	0.071
Enterprise size	-0.058	-0.058	-0.044	-0.056	-0.051
Independent variable					
Organizational improvisation		0.233***	0.182		
Transformational Leadership				0.359***	0.282***
VUCA		0.35***	0.333***	0.279***	0.268***
Interaction 1			0.172***		
Interaction 2					0.141**
R ²	0.011	0.257	0.283	0.313	0.326
F-value	1.680	26.257***	23.881***	34.523***	29.197***
Adjusted R ²	0.004	0.248	0.271	0.304	0.315

is the regression equation of the interaction term 1 after the introduction of the independent variable organizational improvisation, the moderating variable VUCA environment, and decentering, model M3 is the regression equation of the introduction of the independent variable transformational leadership and the moderating variable VUCA environment, and M4 is the regression equation of the interaction term 2 after the introduction of the independent variable organizational improvisation, the moderating variable VUCA environment, and decentering . According to the above table, the regression coefficient of interaction term M2 is 0.172 ($p < 0.001$), and based on the results of this analysis, it can be concluded that VUCA environment reinforces the positive effect of organizational improvisation on innovation performance, thus supporting this paper's research hypothesis H4. The regression coefficient of interaction 2 in the M4 model is 0.141 ($p < 0.01$), thus being able to support this paper's research hypothesis H5, thus it can be concluded that the VUCA environment positively moderates the positive effect of transformational leadership on innovation performance.

6 CONCLUSION

Firstly, Organizational improvisation can positively affect the innovation performance of start-ups: if an organization facing uncertain environmental conditions and time pressures can efficiently coordinate internal and external organizational resources based on integrating and reconfiguring

existing resources, react quickly and effectively, and dare to break the rules and respond to unpredictable environmental changes in innovative ways and means, it can take advantage of the business opportunities brought by environmental changes and create new competitive advantages and thus improve the innovation performance of the firm, which is consistent with the study of Cunha & Vera (2005) .

Secondly, transformational leaders can positively influence the performance of start-ups: transformational leaders tend to actively develop their own innovative awareness and capabilities, inspire organizational members through their own images, attitudes, beliefs and behaviors, correct employees' work attitudes, build employees' collective perceptions and ideas about the organization, help promote mutual perceptions among members, and guide the organization to accomplish innovative tasks, which is a key factor in improving organizational innovative performance A key factor in improving organizational innovation performance.

Thirdly, Organizational improvisation and transformational leadership can positively interact to influence the innovation performance of start-ups: transformational leaders create the conditions for organizational improvisation through personal leadership charisma, thereby gaining the trust of employees while they strive to create a harmonious, supportive, innovative and entrepreneurial culture within the organization that promotes change and innovation.

Fourthly, the VUCA environment plays a significant moderating role between organizational improvisation and innovation performance of start-ups: the more volatile, uncertain, complex and ambiguous the competitive environment is, the greater the role of organizational improvisation on innovation performance of start-ups, which proves that the volatility of the environment is one of the necessary conditions for organizational improvisation. The degree of VUCA in the environment is an external factor that is difficult for the organization to control, but by improving the dynamic capabilities of the organization, the organization can take advantage of market opportunities, creatively solve challenges, and improve the innovative performance of start-ups.

Fifthly, the VUCA environment plays a significant moderating role between transformational leadership and innovation performance of start-ups: the more volatile, uncertain, complex and ambiguous the competitive environment in which a company is operating, the greater the role of transformational leadership on innovation performance of start-ups.

7 DISCUSSION

7.1 Theoretical Significance

Firstly, we explore the role relationship and evolution mechanism between transformational leadership style and innovation performance from the perspectives of management, leadership, organizational behavior, and innovation performance of start-ups, and explore the effective path and influencing factors to enhance the innovation performance of start-ups under the perspective of organizational improvisation from the perspective of transformational leadership style.

Secondly, the concept of organizational improvisation is still in its infancy in China, and most of the qualitative studies on the relationship between organizational improvisation and performance have been conducted. In addition to this, the current research mainly focuses on organizational performance and competitive advantage, and few scholars have conducted research on the impact of organizational improvisation on the innovation performance of start-ups.

Thirdly, because start-ups are less able to withstand risks compared to mature firms, start-ups usually face problems such as fierce market competition and difficulty in predicting current market demand (Li & Cao, 2021), and with the further intensification of the VUCA environment, start-ups face even more serious competitive pressures and threats to their resources

7.2 Research Limitations and Future Directions

Firstly, due to objective reasons in terms of time and funding, the sample of this study is mainly from Southwest China, while the degree of environmental turbulence and the organisations themselves exist in different countries and regions with large characteristics. In addition, the industries in this study include both high-tech and traditional industries, and whether or not there are large differences caused by different industries may all affect the generalizability of the study's findings. One of the directions for future research is to conduct comparative studies by industry as well as by region.

Secondly, the questionnaire research method mainly used in this study, the scales are scoring mode, some employees may have concerns when it comes to the leader and the company performance related questions, which can not fully reflect the objective facts of the enterprise, with the limitations of first-hand data, and at the same time, the index of the

organization's innovation performance is also subjective measurement, which inevitably causes the bias of the research data. Future research can combine rooted theory with questionnaire research, thus making up for the shortcomings in this area.

Third, the data obtained in this study were only static cross-sectional data, which were analyzed to explore the relationship between the independent and dependent variables, without longitudinal data collection and dynamic tracking analysis. In order to obtain more accurate research results, future research needs to conduct longitudinal studies with specific time spans, as well as case studies exploring deeper associations between variables, in order to reduce errors arising from single cross-sectional data with a multi-faceted, cross-level research approach.

7.3 Management Suggestions for Practice

Firstly, this study confirms that innovation performance of start-ups is positively and positively influenced by transformational leadership. Therefore, organizations can determine whether existing leaders need transformational leadership training by analyzing the different needs of team leaders, develop training programs based on their needs and change behaviors in practice after training, create scenarios conducive to transformational leadership traits, and strengthen the effectiveness of the training by recognizing and rewarding transformational leadership behaviors.

Secondly, using modern Internet technology and other means, the company can effectively simulate and practice the difficulties and blows it may face, and require the employees of the new venture to make timely responses, and shorten the response time each time through repeated training, thus putting forward more requirements for improving the improvisation ability of the company's employees.

Thirdly, new start-ups should detach themselves from the previous independent perspective of transformational leadership and organizational improvisation, and pay attention to the positive effects generated by the integration of the two, and give full play to the complementary advantages of the two in the VUCA environment. At the same time, this paper finds that the impact of both on the innovation performance of start-ups is moderated by VUCA, and the role of both has a strong correlation with the turbulent environment in which the enterprise is located. At the same time, it is necessary to focus on the cultivation of innovation ability, break the inherent routine, avoid the rigidity of the

organization, and maintain the creativity of the organization.

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