



The influence of critical thinking and self-efficacy on employees' creativity: A case study of enterprises in Pearl River Delta

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Abstract. With the rapid development of science and technology, the competition between enterprises is becoming more and more fierce. If an enterprise wants to remain invincible in the fierce competition, its competitiveness depends on its creativity. Creativity is the basis and premise of employees' innovation. More and more enterprise managers are aware of the importance of employees' critical thinking, and how employees' critical thinking affects creativity has become the focus of social attention. First, this paper will explore the impact mechanism of critical thinking and self-efficacy on employees' creativity; Secondly, from the perspective of self-cognition theory, this paper studies the mediating role of self-efficacy between critical thinking and employee creativity, and makes an empirical study to fill the literature gap. Thirdly, based on the dynamic theory, environmental uncertainty as an external situation variable is discussed to explore the adjustment effect, and how to strengthen the relationship between critical thinking and employee creativity; Finally, based on the theory of transformational leadership, this paper discusses the moderating effect of transformational leadership as an internal situational variable, and discusses how to strengthen the relationship between critical thinking and employee creativity. The research is expected to fill the above-mentioned research gaps, and to make academic contributions and practical implications to the research results.

Keywords: critical thinking, self-efficacy, creativity, transformational leadership, environmental uncertainty

1 Introduction

Critical thinking is the cornerstone of enterprise innovation, enabling employees to think about problems from multiple perspectives, analyze information, and find more comprehensive, flexible, and innovative solutions. In complex environments, employees with critical thinking abilities are more likely to propose new ideas and solutions, thereby bringing the necessary competitive advantage to the enterprise.

With the changes in the global economic landscape and the rapid development of technological progress, the continuous innovation in the Pearl River Delta region is also

facing a series of challenges. To maintain competitiveness, it is necessary to continuously increase investment in innovation, improve technological standards, and regulate the constantly changing business environment. Therefore, in-depth analysis of the critical thinking, self performance, and creativity of employees in Pearl River Delta enterprises has academic significance and practical value.

At present, a theoretical system for the effects and mechanisms of critical thinking has not yet been formed. There is relatively little in-depth research on critical thinking from the perspective of management, especially a lack of empirical research on the actual operation of enterprises.

This study will conduct empirical research to examine the direct and indirect impact mechanisms of critical thinking on employee creativity in the actual context of enterprise management. At the same time, it will also focus on examining the moderating role of external contextual factors (i.e. environmental uncertainty and transformational leadership) in the organization.

2 Research hypotheses

2.1 Critical thinking and self-efficacy

This study holds that critical thinking can positively promote self-efficacy.

The establishment of self-efficacy requires individuals' cognitive processing of various competency-related information (Bandura et al., 2003). Critical thinking can promote the processing of information related to self-ability, and then play a positive role in the formation of self-efficacy. Specifically, individuals with strong critical thinking have excellent critical thinking ability, rigorous and reliable logical reasoning, and can use a series of cognitive skills (such as elucidation, analysis, inference, evaluation, analysis, etc.) to make correct judgments about the work environment (Facione, 1990, 2011). Only through the phenomena of the objective world can individuals with critical thinking grasp the rational spirit of the nature and laws of the objective world. This spirit endows individuals with indomitable willpower and can effectively enhance their self-confidence. One of the important characteristics of critical thinking individuals is confidence in their reasoning process, that is, confidence in their ability to analyze rationally (Facione, 1990). Critical thinking individuals believe that they can make sound judgments and believe that others will trust them, which can strengthen individual self-confidence (Meinel et al., 2018; Qiang et al., 2018). Therefore, employees with strong critical thinking can face various problems in the work more confidently and cope with the dynamic environment.

Individuals with critical thinking often have an indomitable spirit of exploring truth (Facione, 1990), which is mainly manifested in daring to question, deny and surpass themselves, others and traditional theories, daring to persist and challenge in the face of difficulties, and persistently completing creative work, which gives individuals an unshakable sense of efficacy. Constantly strengthen the mental energy of individuals in the process of completing tasks.

Individuals with critical thinking can find the importance of things through interpretation, and make correct inferences about the most likely and unlikely things according

to the information and situation at hand (Peter et al., 2009), ensuring the rigor and reliability of logical reasoning, and strengthening their belief in completing work tasks, thus enhancing self-efficacy. In addition, critical thinking is a kind of introspective thinking, and the process of introspection contributes to the formation of individual self-efficacy (Ennis, 1987).

Critical thinking individuals can explain to themselves and others the reasons and evidence that lead us to adhere to the beliefs or suggestions we put forward, evaluate the quality of the analyses, interpretations, inferences and explanations we or others give (Fichwan, 2009), help individuals overcome difficulties and challenges, and make individuals more confident in dealing with various problems. Perform tasks better. According to the self-regulation theory proposed by Facione (1990), individuals who master critical thinking skills attach importance to the evaluation of the process of self-cognition, and correct wrong views in the evaluation process, which can also help employees face the mistakes and faults in innovation, strengthen their psychological energy in the process of completing tasks, and promote employees to enhance their sense of self-efficacy.

Uzuntiryaki-Kondakci (2013) found a significant positive correlation between critical thinking and general self-efficacy. Basereh and Pishkar (2016) demonstrated a significant relationship between EFL learners' critical thinking and general self-efficacy. Kim, Lee, and Park (2015) found that nursing students' critical thinking tendencies were positively correlated with their self-efficacy. Nemat Tabrizi and Jafari (2015) show that critical thinking of Iranian EFL learners is significantly and positively correlated with their self-efficacy. Huang Liping et al. (2013) proved the positive correlation between critical thinking and self-efficacy of college students through an empirical study of college students in Hangzhou. These empirical conclusions provide a basis for verifying the impact of critical thinking on self-efficacy.

Based on the above analysis, this study believes that critical thinking can enhance self-efficacy. Therefore, the following hypothesis is proposed:

Research hypothesis 1 (H1): Critical thinking has a positive and significant impact on self-efficacy

2.2 Critical thinking, self-efficacy and creativity

This study believes that there is a corresponding logical relationship between the three variables of employees' critical thinking, self-efficacy and creativity, that is, employees' critical thinking can promote the increase of self-efficacy and thus enhance employees' creativity. Based on social cognitive theory, self-efficacy, as an internal driving force of employees, plays a key role in explaining how Chinese enterprise leaders affect employees' creativity (Ding Donghong, Zhang Xiang (2016)).

First of all, self-efficacy has a positive impact on employees' creativity. When individuals perform certain behaviors, they need to evaluate their ability to solve problems and resource constraints (Xiang Changchun, 2012). Only when employees have firm self-confidence and self-efficacy can they correctly face the complexity and uncertainty of the innovation process.

Bandura (2001) argues that unless people believe that they can achieve the desired result and avoid negative consequences through their actions, they have no motivation to act or persevere in the face of difficulties. Ford (1996) pointed out that in order to be more creative at work, employees must believe that they have the ability to complete tasks. Social cognitive theory holds that self-efficacy is an important driving force for individuals to set goals, make continuous efforts and cope with challenges. Individuals with high self-efficacy are more likely to set challenging goals that change the status quo, generate new and useful ideas, work hard in the process of achieving goals, and persevere in the face of difficulties and failures. Therefore, individuals with high self-efficacy have the confidence and ability to change the status quo and generate creative ideas.

Many scholars believe that self-efficacy has a positive effect on employee creativity through research. Among them, Gong et al. (2009) proved through empirical research that self-efficacy has a positive impact on employee creativity, and plays an intermediary role between learning-oriented, transformational leadership and employee creativity. Based on the theoretical model of the formation and mechanism of self-efficacy proposed by Gist et al. (1992), Tierney et al. (2002) analyzed the formation and mechanism of self-efficacy and empirically tested the positive effects of self-efficacy on individual creativity. Some scholars have also confirmed that self-efficacy has a positive predictive effect on creativity through empirical studies (Liao, Liu, & Loi, 2010; Farmer, 2002). Karwowski and Lebuda (2017) have demonstrated that self-efficacy has a positive impact on creative activity. In the relationship between openness and creative behavior, Chen (2016) fully reflects that self-efficacy has a significant positive impact on creative behavior.

Second, self-efficacy plays a mediating role between critical thinking and employee creativity. Bandura (1977) believes that the level of efficacy determines the extent to which a person is involved in an activity and the extent to which he or she can continue to work hard when encountering difficulties and setbacks during the activity. In the process of innovation, individuals with high critical thinking can exert their subjective initiative to find and solve problems, and are willing to face difficulties and challenge themselves, so as to improve their self-efficacy and promote their creativity. In the theoretical model of the formation and mechanism of self-efficacy, Tierney et al. (2002) believed that both individual factors (work knowledge and work efficacy) and environmental factors (work complexity and leadership behavior) could promote the generation of self-efficacy. Critical thinking individuals have continuous internal motivation to use critical thinking to analyze problems deeply and make decisions (Facione, Sanchez, 1994), which can enhance employees' cognition of work knowledge. Moreover, a series of skills such as clarification, analysis, inference, evaluation, analysis and self-management are used to strengthen employees' competence at work (Facione, 1990), so as to improve their own work efficiency.

Finally, following social cognitive theory, individuals, behavior, and the environment continue to interact. Among them, "individual" refers to the content of individual cognition. Individual self-efficacy is the cognitive variable that best reflects individual behavior, and it is also an important mediating variable between environment and be-

havior (Bandura, 2001). Self-efficacy is an individual's subjective judgment on the ability, efficiency and confidence to display innovative behavior (Tierney & Farmer, 2002). Critical thinking can enhance self-efficacy and promote creativity by strengthening employees' cognition of work knowledge and work effectiveness. In addition, Dewey believes that the process of critical thinking is the process of reflection (John, 1991), while Bandura (1977) believes that individual efficacy beliefs are derived from experience and reflective thinking.

Nosratinia & Zaker (2015) found that there is a strong correlation between learners' critical thinking and creativity. Turner & Howarth (2016) found that critical thinking has a significant impact on the creativity of nursing students. Qiang et al (2018) studied the tendency of critical thinking and scientific creativity and found that self-efficacy has an intermediary effect; Jiang Jing et al (2014) found that self-efficacy has an intermediary effect on critical thinking and creativity.

Therefore, this study believes that individuals with critical thinking can enhance their own effectiveness in the innovation process through reflection, so as to enhance individual creativity. Critical thinking, mediated by self-efficacy, promotes employee creativity and proposes the following hypotheses:

Hypothesis 2 (H2): Self-efficacy has a positive and significant effect on creativity.

Hypothesis 3 (H3): Self-efficacy plays an intermediary role in critical thinking and creativity.

2.3 The moderating effect of transformational leadership

Burns (1985) believes that transformational leadership refers to the process in which leaders and members raise their morals and motivations to a higher level. Transformational leadership also includes leadership charisma, charisma, intellectual stimulation and personalized care, which can make employees trust, respect and loyalty to their superiors (Bass, 1985). As explained by Maslow's hierarchy of needs theory, transformational leaders attach great importance to improving the intrinsic motivation of subordinates, and strive to raise the hierarchy of needs of subordinates to the realm of self-realization, so as to complete work tasks and even exceed the expected level of effect, rather than simply exchanging interests (Chen Wenjing and Shikan, 2007). Transformational leaders are able to motivate employees by virtue of their high ideals and moral values, so that they can fully engage in their work.

Wang and Howell (2010) proposed that transformational leadership includes two different leadership behaviors: team focus and individual focus. Individual-focused TFL Behavior refers to setting different work goals and adopting different guidance methods according to different characteristics of subordinates, aiming at motivating subordinates to achieve their full potential. Improve their abilities and self-efficacy (Kark & Shamir, 2002; Wu, Tsui & Kinicki, 2010).

Bandura's interactive decision theory further provides a theoretical basis for the moderating effect of transformational leadership stimulation. Self-efficacy reflects an individual's confidence in completing a certain work goal, and is an important internal motivation (Bandura et al., 1981; Bandura, 1986). The indirect promotion of employees'

critical thinking to work performance through self-efficacy also depends on the degree of intellectual stimulation of employees by leaders.^[1]

According to the self-determination theory, the strengthening of employees' ability can increase their internal motivation and thus improve their self-efficacy. Intellectually stimulating behaviors of transformational leaders can expand employees' knowledge boundaries more (Gong et al, 2009; Yong Wei et al., 2012; Wang et al, 2016), and then adjust the relationship between critical thinking and self-efficacy. Specifically, for employees with higher critical thinking, a higher level of intellectually stimulating behavior shown by leaders to subordinates can enhance their cognitive and understanding ability, interest in problem identification and problem-solving ability (Ennis, 1987; Facione et al., 1996). At the same time, they are more willing to put forward new ideas and viewpoints that challenge the status quo (Gong et al, 2009; Bai et al, 2016; Wang et al, 2016; Jiang et al, 2018) inspires employees to upgrade to the level of self-realization and strengthen their belief in completing work tasks, so as to surpass the "ordinary self" and realize "more self", thus promoting the improvement of their self-efficacy.^[2]

Bass and Avolio (1995) believe that transformational leadership has "exemplary influence", which means that leaders enhance the centripetal force of their subordinates through their own charismatic traits or related charismatic behaviors. Leadership role model is an important situational factor for employees to enhance self-efficacy in more complex and challenging tasks, thus promoting employee innovation (Bandura, 1997). Under the influence of the leadership charm and example of transformational leaders, employees with critical thinking are more willing and able to accept and complete complex and challenging tasks with their strong analytical, reasoning and argumentative abilities, thus improving self-efficacy.

The formation of self-efficacy is mainly derived from achievement performance, vicarious experience, verbal persuasion and emotional arousal (Bandura and Adams, 1977; Bandura, 1986). Verbal persuasion means that praise or incentives (such as encouragement, trust, praise, reward, etc.) from others (such as superiors or leaders) confirm an individual's ability to complete a task, and verbal persuasion helps to stimulate an individual's sense of self-efficacy (Prem et al., 2017). Leadership motivation helps to improve individual self-efficacy (Gist & Mitchell, 1992). Transformational leaders are more likely to verbally persuade employees with critical thinking, and eliminate their anxiety, fear and other emotions through personalized care, so as to improve their self-efficacy.

On the contrary, if there is no role model of transformational leaders, or they cannot effectively stimulate employees' minds, they cannot effectively persuade subordinates by words.^[3] The cognition and understanding of employees with critical thinking will be limited, and employees with critical thinking will not be willing to take over complex work, and they are easy to stop when dealing with challenges or new things, which is not conducive to the improvement of self-efficacy. It will even increase employees' anxiety, fear, fatigue, etc., thus reducing self-efficacy.

Based on the above analysis, this study proposes the following hypotheses:

Hypothesis 4 (H4) : Transformational leadership has a moderating effect on critical thinking and self-efficacy.

2.4 The regulatory role of environmental uncertainty

Based on dynamic theory, uncertainty refers to an unpredictable event that can disrupt the current situation of work. Weick (1995) pointed out that when the environment is ambiguous, unknown or changed, the actions taken by an organization are decisions made based on the information available to it to understand its environment. Barrett, Mesquita, Ochsner, and Gross (2007) found that people can realize how much capacity they have to deal with unknown situations. Therefore, employees are faced with more uncertainties in the process of development. They should enhance their existing knowledge through continuous learning, so as to better perceive the external environment and seize opportunities in time, so as to better realize the improvement of dynamic capabilities.^[4]

Lazarus and Folkman (1984) describe uncertainty as "confusion or confusion about the meaning of environmental configuration", and Hilton (1992: 70) describes uncertainty as "the cognitive state that forms when there is a lack of information to adequately define or classify an event." Uncertainty can be defined as a feature in an organizational environment where a working system lacks predictability in inputs, processes, or outputs (Wall, Cordery, & Clegg, 2002). In the work environment, the uncertainty of the environment will affect the work attitude and behavior of members within the organization, such as work stress (Matta et al., 2017; Monat, Averill, & Lazarus, 1972), and self-efficacy (Janssen, Muller, & Greifeneder, 2011).

The turbulent changes in the external environment bring both opportunities and threats to the development of employees, and affect the various behaviors of individuals to cope with environmental changes. Thompson (1967) uses Stability/Dynamism to describe whether elements of the environment change abruptly or remain stable, while Child (1972) uses Variability to describe environmental factors. Thayer, Petruzzelli, and McClurg (2018) argue that organizations in innovative work such as research and development are faced with the uncertainty inherent in the core of the task and the task.

The enterprise environment is quite uncertain (Teece, Peteraf, & Leih, 2016). In a highly uncertain and volatile environment, the existing resources and abilities of employees may not be enough to enable them to grow better, and the competitive pressure increases sharply. At this time, the new knowledge and resources acquired through critical thinking and the old knowledge developed may have a very obvious impact on the self-efficacy of employees. Employees with strong critical thinking are conducive to motivating employees to utilize their analytical, reasoning, argumentative and other abilities to form skills to adapt to the dynamic environment (Qiang et al., 2018). Individuals with strong critical thinking have excellent critical thinking ability, rigorous and reliable logical reasoning, and can use a series of cognitive skills (such as elucidation, analysis, inference, evaluation, analysis, etc.) to make correct judgments about the work environment (Facione, 1990, 2011). Therefore, in order to cope with the dynamic changing environment, employees with strong critical thinking can face various problems at work with more confidence, which is conducive to improving self-efficacy.

Individuals with critical thinking often have an indomitable spirit of exploring truth (Facione, 1990), which is mainly manifested in daring to question, deny and surpass,

daring to face difficulties, daring to persist and challenge, and persevering in completing creative work, which gives individuals an unshakable sense of efficacy.^[5] Constantly strengthen the mental energy of individuals in the process of completing tasks. In a highly uncertain environment, employees with critical thinking can use a series of thinking skills to effectively analyze and solve problems, innovate working ideas and methods, and better cope with changes in the working environment (Deci et al., 1985), thus strengthening the belief and motivation of employees to complete work tasks. (Stajkovic et al., 1998; Gist et al, 1992; Sun Hongfei et al., 2016), thus promoting the improvement of employees' self-efficacy.

However, in a relatively stable environment, consumer demand changes slowly and technology updates slowly, while enterprises' desire to meet consumer demand through innovation decreases, and employees' willingness and motivation to innovate will also be inhibited. Employees face less pressure from competitors, and their motivation for self-learning is relatively weak. At this time, critical thinking can not promote the improvement of employees' self-efficacy.^[6]

Therefore, critical thinking is necessary for businesses to grow and develop in an uncertain environment. In a highly uncertain environment, it will promote employees to improve self-efficacy through critical thinking, and help enterprises better improve their own innovation ability in a constantly changing environment, so as to discover new opportunities and new resources. Therefore, the following hypothesis is proposed:

Hypothesis 5 (H5) : Environmental uncertainty has a moderating effect on critical thinking and self-efficacy.

2.5 Research hypothesis and model

Based on the literature discussion in the second chapter, the hypothesis of this research is deduced, and the theoretical model framework of this research is integrated and formed according to the creation theory and self-cognition theory. In other words, employees' critical thinking promotes the increase of self-efficacy, and thus improves employees' creativity. There is a corresponding logical relationship between the three variables. Transformational leadership can influence employees' creativity and expand their knowledge boundaries, thus regulating the relationship between critical thinking and self-efficacy. In highly uncertain environments, employees use critical thinking to enhance their self-efficacy and identify new opportunities.^[7] The research theoretical model is shown in Figure 1 below.

This research model is divided into five dimensions: critical thinking, self-efficacy, transformational leadership, environmental uncertainty, and creativity. Among them, critical thinking and self-efficacy precede dependent variables, creativity is the result variable of the theoretical framework, self-efficacy is the mediating effect of critical thinking and creativity, transformational leadership and environmental uncertainty are the moderating variables of critical thinking and self-efficacy.

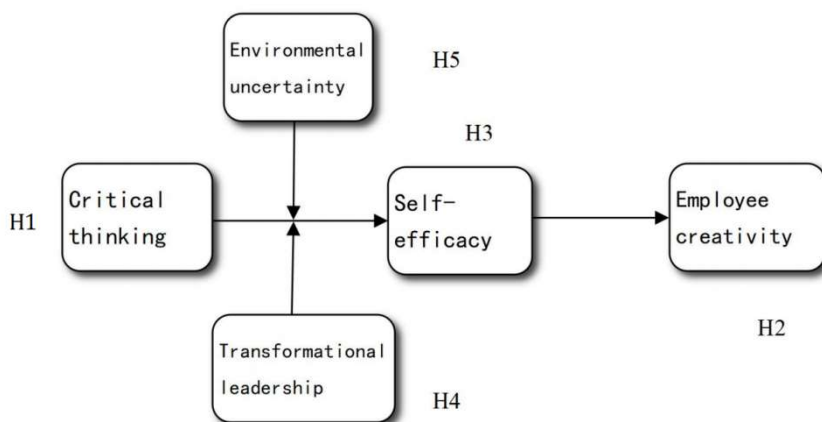


Fig. 1. Research theoretical model

3 Empirical analysis

This study is expected to adopt quantitative research and use SPSS (Statistical Package for the Social Science) for empirical analysis. The statistical methods used include item analysis and exploratory factor analysis. Multivariate normality test, confirmatory factor analysis and Structural Equations Modeling (SEM) were conducted with Mplus statistical software to further verify the relationship between employees' critical thinking ability and self-efficacy on creativity. The statistical methods used in the analysis are introduced, including narrative statistical analysis, reliability and validity analysis, and structural equation model analysis.^[8]

3.1 Project Analysis

SPSS statistical software was used for descriptive statistical detection, including mean, standard deviation correlation coefficient, factor load value and other indicators.

3.2 Descriptive Statistics

In this study, descriptive statistical analysis is adopted as the analysis method, which is helpful to describe and understand the characteristics of specific samples, and a large number of original data are sorted and summarized, and the information or statistics that are meaningful to the research results are presented in charts or words. Descriptive statistical analysis refers to the collation, categorization, analysis, and simplification of respondents' background variables, such as age, sex, education, occupation, and monthly disposable income, in order to understand the distribution information and data of each type of research variable to ensure that there is no instrumental bias. The representation of the data after processing includes frequency distribution table, chart analysis and various statistics.

When statistical analysis is carried out, the first step is data preparation. Therefore, in the work of descriptive statistics, the correctness of the data will be confirmed and the remedial measures for the lost value will be carried out. When there is an omission, the average value of the variable is used as the answer, so it is also called the direct mean replacement method. In this study, average values were used to replace missing values to ensure data integrity and usability.

By means of narrative statistical analysis method, this study detects the respondents' answers to each dimension and item in the questionnaire, and conducts narrative statistical analysis based on the results of each scale, and calculates statistical analysis of the mean, median, range and standard difference of each variable respectively to illustrate the distribution trend of concentration and dispersion of the scale. And describe the degree of interconnection between the data. The smaller the dispersion tendency, the greater the representation of the central tendency. If the dispersion trend is zero, it means that the data set is equal to each other and its value is equal to the central trend.

3.3 Exploratory factor analysis

According to the analysis results, the items with low factor load and unstable factor landing points in each dimension of the theoretical framework are eliminated, and then the analysis variables are determined. Secondly, we analyzed the dimensions to find out the potential characteristics of each factor, and further simplified the questions of each dimension. Cronbach's α reliability coefficient was used to measure the internal consistency of each item under the same construct.

Reliability and validity are very important in marketing research and involve the accuracy of measurement. Chen Shunyu (2005) pointed out that in addition to moderate difficulty and high identification, a good questionnaire should have reliability and validity, which is an important issue in all measurements. Random interference variables such as the mood, state of the respondents, or bad weather will affect the random error of the respondents when filling in the answers, which will lead to the problem of reliability and affect whether the measurement results are reliable. The validity is a variable that reflects the inconsistency or irrelevance between the design of the questionnaire items and the measurement purpose, and the systematic error generated is not random and cannot be controlled and estimated by statistical methods. Therefore, the validity of the questionnaire is more important than the reliability. Through the analysis of reliability and validity, we can also determine the quality of sample recovery data. If there is considerable confidence.^[9]

3.3.1 Reliability analysis.

reliability analysis is mainly used to predict the size of the measurement error, whether the test results have stability or consistency through multiple duplicate test investigations. Good reliability can get consistent or stable results after repeated manipulation for many times. Different test time and question items will also affect the reliability of the questionnaire. When the error ratio is low and the true score is high, the reliability is higher. According to Nunnally (1978), Cronbach's α statistical method

can be used to perform this reliability analysis. $\alpha < 0.3$ represents low reliability, $0.3 \leq \alpha < 0.7$ represents confidence, and $\alpha \geq 0.7$ represents high reliability.

In the reliability test of potential variables, Component reliability (CR) is used, also known as Construct reliability or Composite reliability. The CR value is a ratio between 0 and 1, and the higher the value is, the higher the proportion of true variation to total variation is, the higher the internal consistency is. Fornell and Larcker (1981) suggested that the CR value of potential variable should be greater than 0.60, indicating a considerable degree of internal consistency. The value of CR can be calculated by the following formula:

$$R = (\lambda_{x11} + \lambda_{x21} + \lambda_{x31})^2 / [(\lambda_{x11} + \lambda_{x21} + \lambda_{x31})^2 + (\delta_1 + \delta_2 + \delta_3)^2]$$

3.3.2 Validity analysis.

validity, also known as correctness, refers to the compatibility between the conceptual definition and the operational definition. An effective measurement tool (questionnaire) involves whether the characteristics desired by the researcher can be correctly measured and the purpose of measurement can be achieved, as well as the extent to which the test results can effectively measure the desired psychological characteristics. The higher the validity, the more the measurement results can show the real condition of the measured object. The same index may have different validity under different research purposes. Because constructs are abstract and indicators are concrete observations, the validity of the measurement is harder to achieve than the reliability. Researchers cannot be absolutely confident in determining whether one measure is valid, but can measure whether another measure is more valid. The following three types of measurement validity were used in this study:

3.3.2.1 construct validity.

measure validity, or measure validity, refers to the measurement of multiple indicators, the extent to which the concept, structure, or quality of a theory can be measured. Chen Shunyu (2005) pointed out that most social science concepts cannot be clearly defined and content validity cannot be expressed. Therefore, constructional validity must be used in order to find appropriate criteria. Combining two or more groups of question types in the results obtained after measurement, if there is some expected correlation, it means that this measurement tool has a certain degree of construction validity. According to Fornell and Larcker's (1981) criteria for evaluating convergence validity, all standardized factor load (λ) estimates of study results must be greater than 0.5, and T-values must meet the significance level.

3.3.2.2 convergent validity (convergent validity)

When multiple measurement tools are used to measure the same construct, the degree to which the measured results are related to each other. The test methods include Factor Loading, Average Variance Extracted (AVE), and Composite Reliability (CR). If the factor load is greater than 0.5, it means that the question has good validity, and the CR value is recommended to be greater than 0.7. If the CR value of the potential variable is higher, the potential variable can be measured better. The standard value of

AVE is recommended to be greater than 0.5, and the higher the value, the higher the convergence validity of the potential variable.

3.3.2.3 *discriminant validity.*

It is also known as divergent validity, which is different from convergence validity. When multiple measurement tools are used to measure the same construct, the measured results should also have a negative correlation with the measurement indicators of the opposite construct if they are correlated or echoed with each other. According to the suggestion put forward by Fornell & Larcker (1981), comparing the correlation coefficient with the average variation extraction value (AVE) of the research construct, if the average variation extraction value of the construct itself is lower than the phase relation value of the two constructs, it indicates that it has differential validity. It means that the two constructs are different from each other and can be distinguished from each other.^[10]

3.4 Structural equation model analysis

Structural Equation Modeling (SEM) is a methodology based on statistical analysis technology. It is classified as advanced statistics and belongs to multivariate statistics technology. It can analyze and process complex multivariate data and integrate statistical techniques of "factor analysis" and "path analysis". Is a combination of linear equations that define phenomena in terms of hypothesized cause and effect variables, allowing variables that cannot be measured directly to measure causality between potential variables and observed variables using standard coefficients and significance values.

Therefore, this study uses structural equation as an analysis method to detect the characteristics of online travel platform, and analyzes how consumers' views on the convenience of services provided by online travel platform affect their purchase intention on the platform. Personal differences of consumers (online shopping experience, time pressure, shopping pleasure) are regarded as moderating variables, and the significance of data is analyzed by using SEM model to verify the influence of service convenience, customer satisfaction, positive word-of-mouth and perceived value on the relationship between purchase intention.^[11]

The structural equation model consists of two basic models, which are divided into hypothesis model and measurement model. The hypothesis model is to explain the linear relationship between each potential variable, while the measurement model is to understand the relationship between the observed variable and the potential variable. In the structural equation model, the observed variables of the hypothesis model are represented by rectangles, while the potential variables, also known as "unobservable variables", are distinguished from the observed variables by circles.

3.4.1 Develop theoretical models and construct causal path maps.

The conceptual framework constructed in this research is based on the service convenience theory proposed by Berry et al.(2002), which has subsequently received em-

pirical research and support from many scholars. Therefore, the establishment of various causal associations in the conceptual framework is a theoretical foundation and reasonable.

Secondly, an analytical model of hypothetical correlation and causality between the variables to be tested or measured is established. In the path diagram, if the graph represents the potential variables, the rectangular type represents the observed variables, and the arrow represents the causal relationship between them. According to the path diagram, it is converted into measurement model and structural equation, and the parameters to be estimated are listed.

3.4.2 Relevant indexes of SEM fit test.

3.4.2.1 chi-square Test (Chi-square, 2).

Chi-square value is the most basic measure of overall fit, and it is the only measure based on statistics to measure fit index in structural equation model (Joreskog & Sorbom, 1993). Values with greater relative degrees of freedom indicate differences between the observed and estimated matrices, and statistical significance levels indicate the probability that these differences are due to the amount of variation in the sample. A significant level of Chi-square value below 0.05 or 0.01 indicates that there is indeed a significant difference between the matrix of the observed sample and the theoretical construction, so the null hypothesis must be rejected.^[12]

The Chi-square value is often affected by the difference in sample size (Long 1983), especially when the number of samples exceeds 200, the measurement results will be more oriented to indicate the degree of significant difference of the equivalent models, and the null hypothesis needs to be rejected. On the contrary, if the number of samples is small, the test results will have a non-significant degree of significant difference, no obvious difference, and the null hypothesis will not be rejected. Therefore, scholars rarely use it, and in order to make up for this lack, different matching measurements will be used to set up Chi-square degrees of freedom.

3.4.2.2 Chi-square freedom ratio (2/df).

The Chi-square DOF ratio represents the degree of difference between the derived matrix and the observed matrix of the structural equation model. In order to reduce the influence of the number of samples, the Chi-square DOF ratio is derived from the Chi-square difference value (CMIN) divided by the number of degrees of freedom (df), and is adjusted by the number of degrees of freedom (Joreskog 1970). The smaller the Chi-square DOF, the better, indicating the better fit. Generally, the ideal value is less than 3, but less than 5 is an acceptable range.

3.4.2.3 Comparative fit index (CFI).

The comparative fit Index (CFI) reflects the degree of difference between a hypothetical model and a null model, or an independent model without any covariant relationship, while also taking into account the discretization of the tested or measured model and the central Chi-square assignment. Since the null hypothesis or independent model is the least ideal model, any proposed hypothesis will be more suitable than the

null hypothesis, so the closer the CFI value is to 1, the more ideal it is, indicating the degree to which centrality can be effectively improved. $CFI > 0.9$ is usually used.

3.4.2.4 non-normed fit index (NNFI).

The non-standard fit Index, or TLI (Tuck-Lewis Index), is a fit index often cited by SEM. It is derived from the calculation program of chi-square value and the index adjusted by NNFI to consider the complexity of the model. Combined with a simplified method, it is a comparable indicator between a hypothetical model and an independent model without any covariant assumptions, with values ranging from 0 to 1, where closer to 1 indicates a good fit, and generally greater than 0.9 is the recommended standard. The NNFI indicator is almost unaffected by the sample size, but the possibility that the indicator value may be outside the range of 0 to 1 indicates high volatility.

3.4.2.5 standardized root mean square residual (SRMR) Standardized root mean square residual (SRMR).

The standardized root-mean-square residual value (SRMR) is used to evaluate the merits of the model, and the value is between 0 and 1. When the SRMR is less than 0.05, it can be regarded as a good fit. The smaller the value is, the better the fit of the model is.

3.4.2.6 root mean square error of approximation (RMSEA) Root mean Square Error of Approximation (RMSEA).

Approximate root mean square error (RMSEA) is an indicator of lack of moderation, comparing the degree of difference between the theoretical model and the perfectly fitted saturated model. The smaller the value, the better the fit of the hypothesized model; conversely, the larger the value, the less the fit of the hypothesized model and the data. The RMSEA value is less than 0.05, indicating a good fit of the theoretical model. It is generally recommended that the value equal to or less than 0.05 is better, and less than 0.08 is a good fit and acceptable range, which is a commonly used adaptation indicator in recent years. RMSEA is less affected by sample size, but if the sample size is too small, RMSEA is easily overestimated.

3.5 Common method variation analysis

Because this study focuses on the level of middle and senior managers, the variables are mainly based on the subjective feelings of middle and senior managers of journalists, and they are worried about the variation of common methods. Therefore, in addition to designing reverse questions in scale design, this study also proposed detection procedures with Podsakoff & Organ (1986). Harman single factor test was used to detect common method variation, and all items were tested by unrotated principal component factor analysis.

4 Pre-test analysis

Descriptive statistical analysis was used to examine age, sex, education, income, occupation, industry, scale, etc., to understand the characteristics of the pre-test questionnaire respondents. Fifty pre-test questionnaires were sent out, 42 were recovered, the recovery rate was 84%, and 39 were valid.

The pre-test analysis results are shown in Table 1. Cronbach's α value of all variables in the questionnaire is greater than 0.7, and intraclass correlation coefficient (ICC) of all items is greater than 0.5, indicating that the total variation is all due to the differences of the subjects themselves. Moreover, it indicates that the interdependent items of repeated measurement can be interdependent, which means that the questionnaire has the reliability and validity required for analysis. The results show that most of the dimension items meet the requirements of reliability and validity. For items that do not meet the requirements, this study will revise and verify them in the subsequent work.

Table 1. Pre-test analysis table

Research construct	Mean value	Standard deviation	Intra-group correlation coefficient	Cronbach's α
1. Employee creativity	6.14	0.88	0.89	0.89
2. Critical thinking	6.05	0.76	0.92	0.81
3. Self-efficacy	6.12	0.85	0.91	0.85
4. Transformational leadership	5.95	0.77	0.77	0.73
5. Environmental uncertainty	5.67	0.72	0.81	0.71

5 Conclusion

Employee creativity plays an important role in promoting the competitiveness and better development of enterprises, and is one of the core competitiveness of enterprises. In the context of China, this study conducted theoretical construction and empirical investigation and verification research on the impact of employees' critical thinking ability and self-efficacy on creativity, hoping to make the following four theoretical contributions:

First, based on self-determination theory, this paper discusses the predictive effect of critical thinking on job performance, which is helpful to further enrich the existing research results on critical thinking and creativity.

The second is to explore the mediating role of self-efficacy between critical thinking and creativity from the path of "cognition-motivation-behavior", which is helpful to deepen the understanding of the mediating mechanism of self-efficacy.

Third, transformational leadership is added as a moderating variable, which makes an important expansion contribution to both transformational leadership and critical thinking theory.

Fourth, considering the influence factors of external environment, environmental uncertainty is added as a moderating variable, which makes an expanded contribution to the theory of critical thinking.

Reference:

1. Ashforth, B. E., Rogers, K. M., Pratt, M. G., & Pradies, C. (2014). Ambivalence in Organizations: A Multilevel Approach. *Organization Science*, 25(5), 1453-1478. doi:10.1287/orsc.2014.0909
2. Bachtiar, D., Sudibjo, N., & Bernarto, I. (2018). The Effects of Transformational Leadership, Perceived Organizational Support on Job and Life Satisfaction of Preschool Teachers. *International Information Institute (Tokyo). Information*, 21(4), 1301-1320.
3. Baer, M. (2010). The Strength-of-Weak-Ties Perspective on Creativity: A Comprehensive Examination and Extension. *Journal of Applied Psychology*, 95(3), 592-601. doi:10.1037/a0018761
4. Chaudhary, R., & Akhouri, A. (2019). CSR perceptions and employee creativity: examining serial mediation effects of meaningfulness and work engagement. *Social Responsibility Journal*, 15(1), 61-74. doi:10.1108/srj-01-2018-0018
5. Chen, G., Kirkman, B. L., Kanfer, R., Allen, D., & Rosen, B. (2007). A multilevel study of leadership, empowerment, and performance in teams. *Journal of Applied Psychology*, 92(2), 331-346. doi:10.1037/0021-9010.92.2.331
6. Chen, L. Y. (2017). Perceived Organizational Support, Affective Organizational Commitment and Teachers' Job Performance: the Moderating Effect of Family-to-Work Conflict. *Xuexiao Xingzheng Shuangyuekan = School Administrators* (107), 83-104. doi: http://dx.doi.org/10.3966/160683002017010107005
7. Chen, M.-H., Chang, Y.-Y., & Chang, Y.-C. (2015). Exploring individual-work context fit in affecting employee creativity in technology-based companies. *Technological Forecasting and Social Change*, 98, 1-12. doi: 10.1016/j.techfore.2015.05.002
8. WALTERS, K. S. (1992). Critical Thinking, Logicism, and the Eclipse of Imagining. *The Journal of Creative Behavior*, 26(2), 130-144. doi:10.1002/j.2162-6057.1992.tb01168.x
9. Meinel, M., Wagner, T. F., Baccarella, C. V., & Voigt, K.-I. (2018). Exploring the Effects of Creativity Training on Creative Performance and Creative Self-Efficacy: Evidence from a Longitudinal Study. *The Journal of Creative Behavior*. doi:10.1002/jocb.234
10. Puente-Diaz, R., & Cavazos-Arroyo, J. (2018). Creative Metacognitive Feelings as a Source of Information for Creative Self-efficacy, Creativity Potential, Intrapersonal Idea Selection, and Task Enjoyment. *The Journal of Creative Behavior*. doi:10.1002/jocb.384
11. Qiang, R. , Han, Q. , Guo, Y. , Bai, J. , & Karwowski, M. . (2018). Critical thinking disposition and scientific creativity: the mediating role of creative self-efficacy. *The Journal of creative behavior*. 2020, 54:90-99
12. UZUNTIRYAKI-KONDAKCI E, CAPA-AYDIN Y. Predicting Critical Thinking Skills of University Students through Metacognitive Self-Regulation Skills and Chemistry Self-Efficacy [J]. *Educational Sciences*, 2013; 13(1): 666-670.

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