

INSTRUMENT VALIDATION FOR TRANSFORMATIONAL LEADERSHIP, ORGANIZATIONAL CULTURE AND INNOVATION CAPABILITY AMONG YOUNG LECTURERS IN CHINESE UNIVERSITIES

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Article history

Received date : 19-6-2026
Revised date : 20-6-2026
Accepted date : 25-7-2026
Published date : 1-8-2026

To cite this document:

Hua, Z., & Mohd Noor, M. A. (2026). Instrument validation for transformational leadership, organizational culture and innovation capability among young lecturers in Chinese universities. *International Journal of Accounting, Finance and Business (IJAFB)*, 11 (67), 13 - 33.

Abstract: Grounded in Bass's Transformational Leadership Theory(1994), Schein's model of organizational culture(1992), and Amabile's (1988) Componential Theory of Creativity, this pilot study aims to validate the reliability and validity of measurement instruments and preliminarily explore the structural relationships among transformational leadership, organizational culture, and innovation capability among young lecturers in Shandong universities, China. Employing a cross-sectional quantitative design, a stratified random sample of 130 young lecturers was surveyed via a structured questionnaire, with data analyzed using Exploratory Factor Analysis (EFA) and reliability tests. The EFA results yielded factor structures highly consistent with theoretical predictions: a 4-factor solution for Transformational Leadership, a 3-factor solution for Organizational Culture, and a 3-factor solution for Innovation Capability. All items demonstrated satisfactory factor loadings (>0.5) and corrected item-total correlations ($CITC > 0.3$). Furthermore, Cronbach's alpha coefficients for all sub-constructs exceeded 0.7, indicating good internal consistency and construct validity, thus no items were deleted during the purification process. By integrating seminal theories with empirical testing, this study confirms the cultural adaptability and structural validity of the scales within the specific context of Chinese higher education. The findings support the validity and reliability of the measurement instrument for assessing transformational leadership, organizational culture, and innovation capability among young lecturers in Chinese universities.

Keywords: Transformational Leadership; Innovation Capability; Organizational Culture; Young Lecturers; Higher Education;

Introduction

In the era of the global knowledge economy, technological innovation has emerged as the core driving force of national competitiveness (Etzkowitz, 2003; Gibbons et al., 1994). Universities, serving as the primary hubs for knowledge creation and talent cultivation, have been entrusted with an unprecedented mission of innovation. Particularly against the backdrop of China's "Double First-Class" initiative and its strategy for becoming a leading nation in science and technology, the innovative capability of young lecturers is directly linked to the construction of the national independent innovation system and the enhancement of higher education quality (Altbach, 2015; Marginson, 2013). Consequently, exploring how to effectively stimulate the innovative potential of young lecturers has become a critical issue requiring urgent resolution in the field of higher education management.

Although young lecturers are regarded as the fresh force in university research and innovation, they are currently facing severe survival challenges under the current evaluation system. With the widespread adoption of the "Pre-tenure and Tenure-track System" and rigorous quantitative assessment systems in domestic universities, young lecturers are subjected to immense pressure regarding resource competition, such as applications for the National Natural Science Foundation of China and publications in high-impact journals (Chen & Liu, 2018; Yang & Welch, 2012). Specifically, within the context of universities in Shandong Province, while institutions are undergoing a strategic transition "from large-scale to high-quality," young lecturers are often overwhelmed by heavy administrative duties and teaching loads. Under the pressure of stringent performance evaluations, they are prone to experiencing "survival anxiety" (Li & Zheng, 2021). This anxiety often drives them toward conservative research behaviors, favoring low-risk, easily publishable incremental research while avoiding high-risk, high-value original innovation explorations (Feng & Li, 2022). A sharp contradiction exists between this "strategic avoidance" behavior and the demand for breakthrough innovation in universities, highlighting the urgency of investigating the underlying mechanisms influencing the innovative behavior of young lecturers.

Existing literature indicates that individual innovative behavior is determined not only by personal traits but is also profoundly influenced by the organizational context (Amabile, 1988; Scott & Bruce, 1994). Transformational Leadership, characterized by visionary inspiration, intellectual stimulation, and individualized consideration, has been empirically validated to effectively enhance the creativity of young lecturers (Bass & Riggio, 2006; Wang et al., 2011). However, in the unique environment of Chinese universities, which features distinct administrative and interpersonal cultures, the specific mechanisms through which transformational leadership influences the innovative capability of young lecturers remain unclear (Ding & Lin, 2019). Organizational culture is considered a critical bridge connecting leadership behavior and the outcomes of young lecturers (Schein, 2010). A supportive organizational culture that tolerates failure encourages risk-taking, whereas a rigid, performance-only culture may stifle innovation (Martins & Terblanche, 2003). Whether leaders of grassroots academic organizations (e.g., Deans) act as shapers of organizational culture, and whether their leadership styles indirectly influence the innovative willingness and capability of young lecturers by fostering specific organizational cultural atmospheres, lacks sufficient empirical validation in the current literature (Tierney, 2008).

The implementation of this pilot test holds significant necessity and practical value. Given that the scales adopted in this study are primarily derived from Western management literature, although they possess mature measurement properties, their linguistic expression, dimensional adaptability, and measurement sensitivity require verification within the unique administrative and interpersonal cultural contexts of Chinese universities (Brislin, 1980). Through this small-scale pilot test, issues such as semantic ambiguity, cultural inadaptability, or logical redundancy in the items can be promptly identified and corrected. This reduces measurement error at the source and avoids invalid data or statistical bias caused by instrument defects in the formal survey (Presser et al., 2004).

Research Gap

Although academia has accumulated substantial research achievements in the fields of leadership and innovation capability, several limitations remain, constituting the problem sources for this study:

Limitations of Contextual Application. Existing research on transformational leadership and innovation capability has predominantly focused on corporate employees (Jung et al., 2003) or general K-12 school teachers (Leithwood et al., 2006). There is a relative scarcity of empirical studies targeting the specific group of Chinese university young lecturers, who are characterized by high educational attainment, high autonomy, and unique occupational stressors. Furthermore, few studies have focused on university samples from specific regions such as Shandong Province (Huang et al., 2019).

The Black Box of Mediating Mechanisms. While existing research has confirmed the direct effects of transformational leadership on innovation, there is a lack of systematic and in-depth exploration regarding the transmission paths between the two, specifically concerning how organizational culture functions as a mediator (Avolio et al., 2004). The extent to which leader behaviors reshape organizational culture, thereby releasing or inhibiting the innovation of young lecturers, still requires further empirical support (Edmondson & McManus, 2007).

Disconnection from Management Practice. University administrators urgently require concrete managerial leverage. Currently, it remains unclear whether enhancing the transformational leadership of grassroots leaders can effectively optimize the organizational cultural ecology, thereby empowering young lecturers to achieve genuine innovation breakthroughs even within high-pressure assessment environments (Bolden et al., 2012).

Research Objectives

The primary objective of this study is to conduct rigorous psychometric testing on the measurement instruments to ensure the scientific rigor and validity of subsequent large-scale survey data (DeVellis, 2017). Specifically, this study will utilize the pilot test sample data (N=130) to systematically examine the reliability and validity of the Transformational Leadership Scale, the University Organizational Culture Scale, and the Innovative Capability Scale for young lecturers. Regarding reliability, the study will focus on assessing the internal consistency of each scale by calculating Cronbach's α coefficients to verify measurement stability within the specific context of "Shandong Universities" (Nunnally & Bernstein, 1994). Regarding validity, Exploratory Factor Analysis (EFA) will be employed to test the construct validity of the scales, examining whether items aggregate into corresponding factors as

theoretically predicted, and preliminarily testing the discriminant validity among core constructs (Kline, 2016). Based on the results of these analyses, this study will further purify and revise the initial questionnaire, identifying and deleting items that reduce reliability. Ultimately, a formal survey questionnaire with good reliability and validity, verified within the localized context, will be formed to lay a solid methodological foundation for subsequent Structural Equation Modeling (SEM) and hypothesis testing (Hair et al., 2019).

Theoretical Framework

This study constructs an integrated, multi-level theoretical model based on Transformational Leadership Theory, Schein's Organizational Culture Theory, and Amabile's Componential Theory of Creativity to systematically elucidate the transmission mechanism through which transformational leadership influences the innovative capability of young lecturers.

Transformational Leadership Theory (Bass & Avolio, 1994) constitutes the basis of the independent variable in this study. This theory posits that leaders can transcend mere transactional exchanges by inspiring followers' higher-order needs and self-transcendence motives through four dimensions: Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration (Burns, 1978). In the knowledge-intensive environment of higher education, where young lecturers are characterized by high autonomy and professional authority, leaders must rely more on visionary incentives rather than administrative power to exert influence (Bryman, 2007). Thus, this theory defines the specific behavioral characteristics of transformational leadership in the university context and establishes its legitimacy as a driving force for innovation.

Second, Schein's (1992) Organizational Culture Theory provides a critical explanatory framework for the mediating mechanism. This theory deconstructs organizational culture into three levels (Artifacts, Espoused Values, and Basic Underlying Assumptions) profoundly revealing how shared values and behavioral norms subtly shape individual behavior. In this study, organizational culture is viewed as the "conducting medium" for transformational leadership: the leader's vision and philosophy precipitate into the organization's deep assumptions through institutionalization, thereby regulating daily behavioral patterns in the academic environment (Trice & Beyer, 1993). This theory not only defines the operational connotation of the mediating variable (organizational culture) but also provides an authoritative theoretical lens for parsing the "black box" process of "how leadership behavior influences individuals through cultural penetration" (Martin, 2002).

Finally, Amabile's (1983, 1988, 1996) Componential Theory of Creativity and its subsequent contextual models provide a multi-dimensional measurement framework for defining the dependent variable (innovative capability) and accomplish the theoretical linkage between micro-individuals and macro-organizations. This theory states that individual creativity is a function of Domain-relevant Skills, Creativity-relevant Processes, Intrinsic Task Motivation, and Social Environmental Support (Amabile, 1996). Notably, this model exhibits a high degree of logical congruence with Transformational Leadership Theory: transformational leadership enhances young lecturers' creativity-relevant skills through "Intellectual Stimulation," strengthens their intrinsic motivation through "Individualized Consideration," and facilitates the integration of professional knowledge through "Idealized Influence" (Zhang & Bartol,

2010). This theoretical chain perfectly explains how leadership behaviors specifically act upon the constituent elements of innovative capability.

In summary, in the theoretical framework constructed in this study (as shown in Figure 1), transformational leadership acts as the antecedent, reshaping Schein's deep-level organizational culture (mediating variable), thereby optimizing the supportive social environment emphasized by Amabile, and ultimately stimulating the innovative behavior of young lecturers driven by domain skills and intrinsic motivation. This integrated framework not only compensates for the limitations of single-theory perspectives but also provides a systematic analytical path for understanding innovation management in the context of Chinese universities (Tsui, 2007).

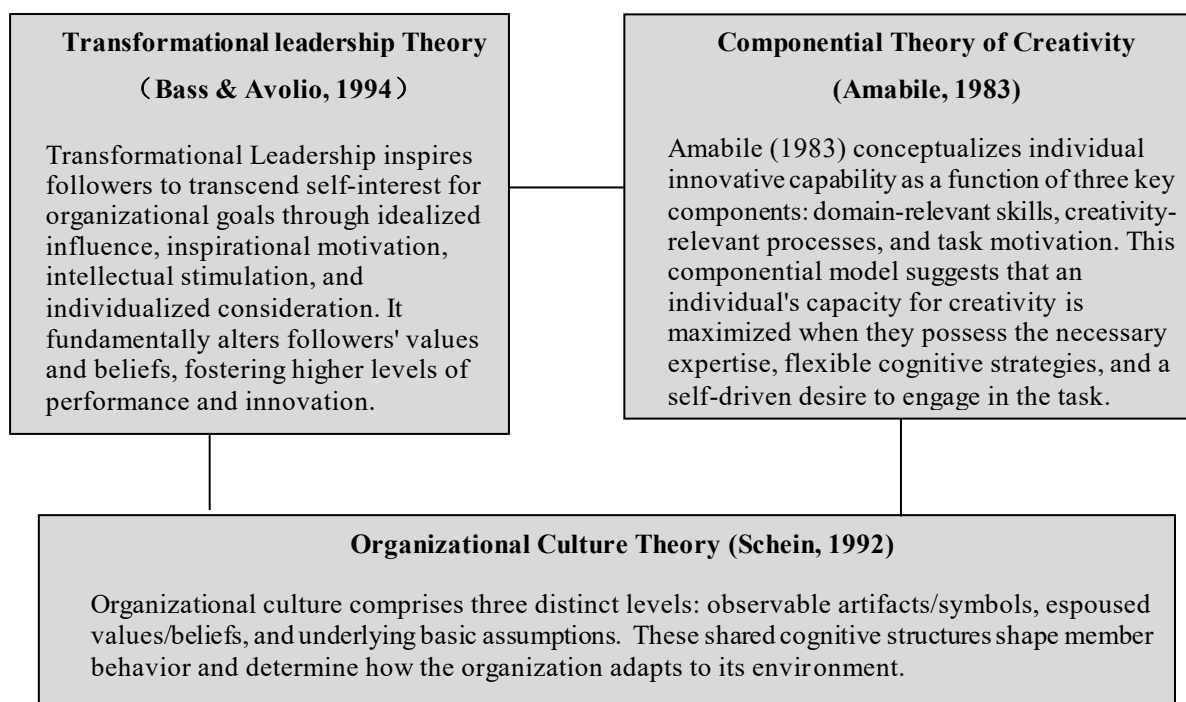


Figure 1: Theoretical Framework

Methodology

This study strictly adheres to the positivist paradigm, adopting objectivism as the foundational stance for ontology and epistemology. The core rationale for selecting positivism lies in the study's aim to investigate the causal relationship between transformational leadership and the innovative capability of young lecturers through quantitative means, and to systematically test the hypotheses within the established theoretical model rather than constructing new theories.

Specifically, this study employs a deductive approach. The process begins with a review of Transformational Leadership Theory, Organizational Culture Theory, and the Componential Theory of Creativity, based on which a theoretical model of "Transformational Leadership—Organizational Culture—Innovative Capability" is constructed, and a series of falsifiable hypotheses are proposed. Subsequently, quantitative data are collected via structured questionnaires, and statistical methods are utilized to verify the proposed hypotheses. As Easterby-Smith, Thorpe, and Jackson (2008) noted, research designs based on quantitative

analysis and hypothesis testing are typical characteristics of the positivist paradigm. Therefore, this study attempts to establish causal links between variables through empirical testing of mature existing theories, thereby achieving a certain degree of generalization and extrapolation of the research results.

Research Design

Based on the aforementioned positivist stance, this study adopts a quantitative research strategy, specifically manifested as a non-experimental cross-sectional survey design. The primary reasons for choosing a quantitative strategy include measurement precision and objectivity assurance. The core variables involved in this study (e.g., transformational leadership, organizational culture, innovative capability) are abstract constructs that require quantitative measurement via mature scales to facilitate precise statistical analysis of the strength of relationships between variables. Standardized questionnaire distribution and collection procedures, along with anonymous responses, minimize subjective bias and ensure the objectivity and scientific rigor of the data sources.

Sample Size

This study conducted a pilot test targeting young lecturers in Shandong universities, aiming to identify potential issues regarding wording ambiguity, comprehension barriers, and completion duration. Since the demographic characteristics of the pilot test participants were entirely consistent with the actual target population, the data obtained were used to preliminarily examine the reliability and validity of the measurement instruments.

Regarding sample size determination, this study balanced statistical efficacy with methodological characteristics. Although general rules of thumb suggest that a pilot test sample size should be 10% of the formal study (Hertzog, 2008), and Johanson and Brooks (2010) indicated that at least 30 representative participants are needed to construct a new scale, this study required higher statistical stability due to its reliance on Exploratory Factor Analysis (EFA) for item purification and dimension exploration. Adhering to Hair et al.(2010) recommendations regarding EFA and the principle of the "sample size-to-item ratio," this study ultimately determined an effective sample size of 130. This sample size satisfies the basic statistical power requirements of the EFA algorithm while aligning with the "small sample, diagnostic-focused" methodological positioning of the pilot phase.

Data Collection

Data collection was conducted from February to April 2026, utilizing the domestic mainstream online survey platform(Questionnaire Star), for electronic distribution. Given that this study aims to investigate the overall landscape of universities in Shandong Province, a stratified random sampling strategy was adopted to ensure sample representativeness and the scientific rigor of statistical inference. To ensure data quality, responses were limited to one submission per IP address or device. A total of 130 valid responses were obtained.

Throughout the data collection process, strict adherence to ethical protocols was maintained. Participants were assured of data confidentiality and anonymity, with explicit notification of their right to withdraw from the study unconditionally at any time. During the preliminary screening phase, the completeness and quality of responses were rigorously reviewed. Invalid samples characterized by substantial missing data, abnormally short completion times, or

obvious patterned responses were excluded based on predetermined criteria. This screening process ensured that the final dataset retained for analysis possessed a high degree of integrity and authenticity.

Research Instruments

This study utilized a structured self-administered questionnaire as the core measurement tool (see Table 1), designed to balance data standardization with the efficiency of large-scale collection. The questionnaire design strictly followed the principles of Oppenheim (2000), employing a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) to measure all core variables. The selection of a five-point scale over a seven-point scale was based on the recommendations of Malhotra et al. (2009), aiming to reduce respondent cognitive load and fatigue while effectively distinguishing item differences without sacrificing reliability.

The questionnaire comprised five sections: an introductory letter clarifying the research background and confidentiality commitments; the main body measuring transformational leadership (based on Bass & Avolio, 1994), organizational culture (based on Schein, 1992), and innovative capability (based on Amabile, 1988); subsequent demographic information for subgroup analysis; an optional open-ended question at the end to assist in triangulation; and an informed consent form adhering to ethical norms.

To ensure the accuracy and cross-cultural equivalence of the measurement tool, this study implemented a rigorous validity testing and translation procedure. First, six experts in the field of educational administration were invited to evaluate the content validity of the items, and the questionnaire was optimized based on the results of a small-scale pilot test. Second, regarding the Chinese-English bilingual versions, the back-translation procedure (Brislin, 1970) was strictly followed. Multiple bilingual experts conducted independent translations and back-translations, ensuring a high degree of semantic and conceptual equivalence between the Chinese and English versions, thereby maintaining the psychometric properties of the original measurement instrument.

Table 1: Initial Measurement Items for Each Construct and Sources

Construct	Dimension	No. of Items	Sources
Transformational Leadership	Idealized Influence	5	Adapted from Bass and Avolio (1994)
	Inspirational Motivation	5	Adapted from Bass and Avolio (1994)
	Intellectual Stimulation	5	Adapted from Bass and Avolio (1994)
	Individualized Consideration	5	Adapted from Bass and Avolio (1994)
Organizational Culture	Artifacts	5	Adapted from Bonavia (2006)
	Espoused Values	5	Adapted from O'Reilly et al. (1991)
	Basic Underlying Assumptions	5	Adapted from Atuhaire et al. (2025)
Innovation Capability	Domain-Relevant Skills	5	Adapted from Spreitzer (1995)
	Creativity-Relevant Processes	5	Adapted from Zhou and George (2001)
	Motivational Factors	5	Adapted from Amabile (1994)

Data Analysis

This section aims to conduct a SPSS statistical analysis of the 130 valid samples collected from the pilot test to examine the psychometric properties of the measurement instruments. The specific analysis includes three core aspects: first, descriptive statistics of the sample's demographic characteristics to confirm the alignment between the sample structure and the target group; second, assessing the internal consistency reliability of each scale by calculating Cronbach's α coefficients; and finally, employing Exploratory Factor Analysis (EFA) to test the construct validity of the scales, thereby verifying the applicability and stability of the questionnaire in the context of Shandong universities.

Respondents' Demographic Characteristics

A total of 130 valid questionnaires were collected in the pilot test phase. The demographic characteristics of the sample are summarized below. The gender distribution was relatively balanced, with males accounting for 49.2% and females for 50.8%. The age of respondents was mainly concentrated between 29–35 years old, with the highest proportion in the 29–32 age group (41.5%), followed by the 33–35 age group (32.3%). Regarding institutional type, the ratio of faculty from public and private universities was nearly equal (49.2% and 50.8%, respectively). Educational attainment was generally high, with 56.9% holding a doctoral degree and 34.6% holding a master's degree; the combined proportion of Master's and Doctoral holders reached 91.5%, meeting the entry thresholds for university positions. The disciplinary background was predominantly STEM (Science, Technology, Engineering, and Mathematics) (56.2%), with Humanities and Social Sciences accounting for 43.8%. Regarding professional experience, 58.5% of the faculty had less than 5 years of teaching experience, while 61.5% had more than 5 years of academic work experience, indicating that although most respondents were relatively new to teaching, they had accumulated considerable experience in academic research. In terms of data quality, no missing values were detected after screening; thus, all 130 samples were included in the subsequent EFA and reliability tests. Detailed information on the respondents can be found in the Appendix. The skewness and kurtosis values for all items were within the acceptable range of ± 2 , indicating that the data were approximately normally distributed (George & Mallery, 2020).

Measurement Model Assessment

Validity

Pilot Study with experts/Expert Review

To ensure the content validity of the measurement instrument, this study established a panel of six experts to conduct a systematic evaluation of the questionnaire. The composition of the expert panel was strategically designed to encompass senior university administrators, scholars specializing in educational leadership and management, and human resource management experts. All members possessed extensive professional experience (ranging from 12 to 22 years) and outstanding academic credentials, enabling them to scrutinize the measurement items from both theoretical and practical perspectives.

Following the recommendations of Sekaran and Bougie (2016), the experts utilized a 4-point scale to assess the items across five dimensions: clarity of wording, relevance to the construct, representativeness, appropriateness for the target population, and leading language. Based on

the expert feedback, the study first conducted wording revisions and logical optimizations for several ambiguous items. The expert evaluation results are summarized in Table 2. This round of review effectively ensured the operational precision and content validity of the measurement tool, laying a solid foundation for subsequent data collection.

Table 2: Questionnaire Redesign Based on Experts' Feedback

Comments	Decision
Expert 1	
II3: The referent "our" is ambiguous.	It is a verified item in the established scale-retain the item.
II5: "Power" is susceptible to negative connotations (e.g., power struggles) in an academic context; it is recommended to replace it with "My Dean displays a sense of strength and self-confidence."	Replaced: My Dean displays a sense of strength and self-confidence.
IM4: The use of "his" is gender-specific.	Replaced: My Dean expresses his/her confidence that that goals will be achieved.
EV4: "People" is overly broad.	Replaced: Being considerate of young lecturers are emphasized.
Expert 2	
II1: The collocation "values of pride" is inappropriate; it is recommended to emphasize collective pride.	It is a verified item in the established scale-retain the item.
EV1: "Teachers'" should be specified as "young lecturers'."	Replaced: Young lecturers' academic exploration or management innovation are encouraged
Expert 3	
BA2: "Faculty" refers to the college, but "different parts" should be clarified as "departments."	Replaced: Coordination across different departments within the faculty works well.
Expert 4	
No comment at all	
Expert 5	
IS2: "Makes me look" carries a coercive connotation, which is inconsistent with the supportive nature of transformational leadership. It is recommended to replace it with "encourages me to."	My Dean encourages me to examine problems from different aspects.
Expert 6	
DRS2: "Technical" is inaccurate for scholars. It is recommended to replace it with "scholarly skills."	Replaced: I possess the necessary scholarly skills to perform my job well.

Pilot Study with Respondents

This study conducted a pilot study targeting young lecturers to identify potential issues regarding wording ambiguity, comprehension barriers, and completion duration. Since the demographic characteristics of the pilot test participants were entirely consistent with the actual target population, the data obtained were used to preliminarily examine the validity and reliability of the measurement instruments.

Regarding

data collection methods, this study employed a self-administered questionnaire distributed electronically via the domestic mainstream online survey platform, questionnaire star. This mode ensured that respondents relied solely on the clarity of the written text to answer, avoiding biases introduced by interviewer effects (Hair et al., 2010), and facilitating an objective assessment of questionnaire length, item clarity, and completion time. A total of 130 revised questionnaires were distributed to young lecturers, and 130 valid samples were recovered (effective rate: 100%). The results indicated that the average completion time was less than 10 minutes, suggesting that the burden of the measurement tool was moderate. Based on participant feedback regarding the user interface and item comprehension, the research team made minor adjustments to the layout and formatting of the questionnaire to further enhance readability and response convenience, laying a solid foundation for the formal survey. A summary of participant comments and responses is presented in Table 3.

Table 3: Questionnaire Redesign Based on Respondents' Feedback

Comments	Decision
Part I: Invitation Reading through the lengthy introduction and consent form before accessing survey items resulted in unnecessary time expenditure.	Page 1 (Start): A condensed invitation (stating core purpose, voluntary, anonymity, and estimated time) followed directly by measurement scales. Last Page (End): The detailed Informed Consent Form was relocated to the terminal section.
Demographic Q2: Why list every single age from 25 to 35? It takes too long to scroll and tick.	Revised to a grouped format: ☐ 25-28, ☐ 29-32, ☐ 33-35.
Demographic Q4: Regional division Municipality directly under the Central Government/Provincial Capital City, Prefecture-level City, county-level City. Confusing	Remove the orientation tags and modify them to: east, west, south, north, center.
Part V: Open-ended I don't want to type a long story. Can I just give a short example?	Clarified the instruction to emphasize its optional nature and encourage brevity.

Exploratory Factor Analysis (EFA)

Based on the revisions from the pilot test results, this study conducted an empirical test on the construct validity of the measurement instrument, focusing on examining the unidimensionality and internal structural purity of each construct.

First, Exploratory Factor Analysis (EFA) was employed to test the structural validity of the data from the pilot sample ($n=130$). Prior to conducting the factor analysis, the suitability of the data was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity, following the recommendations of Kaiser (1974) and Bartlett (1954). The criteria were set at a KMO value higher than 0.60 and a significant level for Bartlett's test ($p < .001$). After confirming the data were suitable for factor analysis, the communalities of each item were checked, and items with communalities lower than 0.3 were deleted.

During the factor extraction process, Principal Component Analysis (PCA) combined with Varimax rotation was used. The number of factors was determined based on the Kaiser criterion (eigenvalue > 1), the scree plot inflection point, and the cumulative explained variance ($> 60\%$). According to the standards of Hair et al. (2010), items with communalities lower than 0.3, factor loadings lower than 0.5, or significant cross-loadings were removed.

Before initiating the EFA, prerequisite assumptions of the data were tested. The results showed that the skewness and kurtosis values of all observed variables fell within the range of ± 2 (Garson, 2012), and no extreme outliers with an absolute value greater than 4 were found (Hair et al., 2010), indicating that the data approximated multivariate normal distribution and fully satisfied the minimum statistical requirements for subsequent factor analysis.

The results of the EFA for the 20 measurement items under the construct of Transformational Leadership (Table 5) indicate that the data possess excellent suitability for factor analysis. The KMO value was 0.832, and Bartlett's Test of Sphericity reached statistical significance (Chi-Square=1448.90, $df=190$, $p < 0.001$). According to Huck (2012) and Tabachnick and Fidell (2007), the KMO value is far above the recommended threshold of 0.6, suggesting a strong common factor structure among the variables and confirming the suitability for factor analysis.

During the factor extraction process, the minimum value in the Communalities of all the items is 0.662., indicating that the extracted factor structure could effectively explain the variance of each item. Based on the Kaiser criterion (eigenvalue > 1), EFA extracted four factors, with a cumulative explained variance of 70.244%. This result was further supported by the Scree Plot (Figure 2), where the eigenvalues leveled off after the fourth factor, confirming that extracting four factors retained most of the information.

The factor loading results show that the items loaded onto their corresponding dimensions as theoretically expected: Factor 1 (Idealized Influence) contained items a1 to a5; Factor 2 (Inspirational Motivation) contained items a6 to a10; Factor 3 (Intellectual Stimulation) contained items a11 to a15; and Factor 4 (Individualized Consideration) contained items a16 to a20. The standardized factor loadings of all items exceeded the threshold of 0.5 (Hair et al., 2010), verifying the stability of the four-dimensional structure of transformational leadership and its good construct validity.

Table 4: Exploratory Factor Analysis (EFA) for Transformational Leadership

Item s	KMO (Bartlett's Test)	Cumulativ e % of variance	loading				Communalitie s	Anti- image correlatio n
			Factor 1	Factor 2	Factor 3	Factor 4		
a1			0.856				0.741	0.795
a2			0.808				0.668	0.811
a3			0.777				0.676	0.824
a4			0.847				0.728	0.844
a5			0.830				0.704	0.834
a6				0.823			0.698	0.854
a7				0.814			0.675	0.855
a8				0.843			0.715	0.815
a9				0.873			0.770	0.797
a10	0.832			0.802			0.671	0.888
a11	(p< 0.001)	70.244			0.811		0.662	0.879
a12					0.833		0.698	0.844
a13					0.844		0.717	0.796
a14					0.835		0.713	0.814
a15					0.798		0.665	0.806
a16						0.815	0.673	0.872
a17						0.866	0.763	0.836
a18						0.830	0.734	0.866
a19						0.818	0.671	0.803
a20						0.826	0.705	0.830

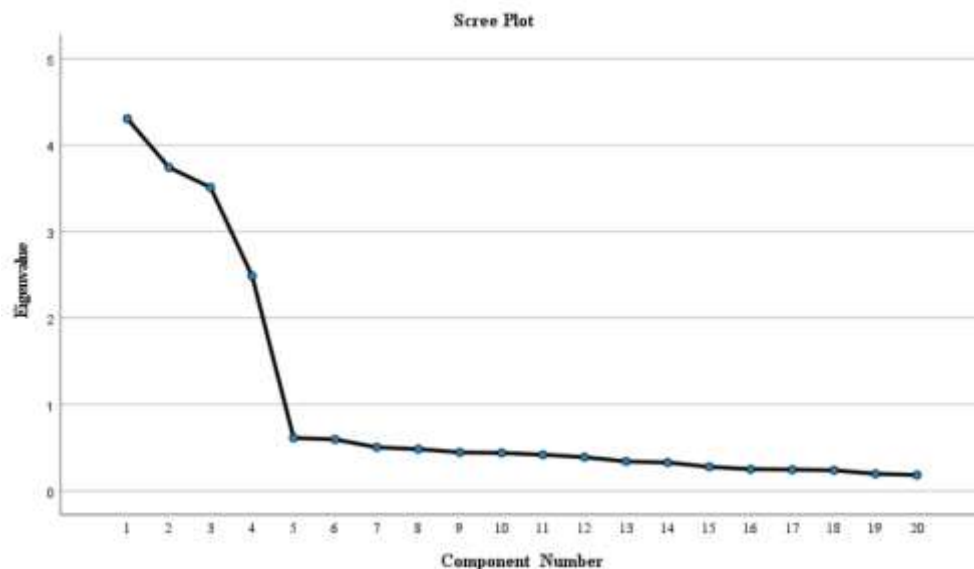


Figure 2: Scree Plot of Transformational Leadership

The results of the Exploratory Factor Analysis for the 15 measurement items under the construct of Organizational Culture (Table 6) indicate that the data also exhibit excellent suitability for factor analysis. The Kaiser-Meyer-Olkin (KMO) value was 0.839, and Bartlett's Test of Sphericity reached statistical significance (Approx. Chi-Square=1053.301, df=105, $p < 0.001$). According to Huck (2012) and Tabachnick and Fidell (2007), the KMO value is far above the recommended threshold of 0.6, suggesting a strong common factor structure among the variables and confirming that the data are highly suitable for factor analysis.

During the factor extraction process, the minimum value of Communalities for all items is 0.548, indicating that the extracted factor structure could effectively explain the variance of each item. Based on the Kaiser criterion (eigenvalue > 1), EFA extracted three factors, with a cumulative explained variance of 69.41%. This result was further supported by the Scree Plot (Figure 3), where the eigenvalues leveled off after the third factor, confirming that extracting three factors retained most of the information.

The factor loading results show that the items loaded onto their corresponding dimensions as theoretically expected: Factor 1 (Artifacts) contained items a21 to a25; Factor 2 (Espoused Values) contained items a26 to a30; and Factor 3 (Basic Underlying Assumptions) contained items a31 to a35. The standardized factor loadings of all items exceeded the threshold of 0.5, verifying the stability of the three-dimensional structure of organizational culture and its good construct validity.

Table 5: Exploratory Factor Analysis (EFA) for Organizational Culture

Items	KMO (Bartlett's Test)	Cumulative % of variance	loading			Communalities	Anti-image correlation
			Factor1	Factor2	Factor3		
a21	0.839 (p<0.001)	69.41	0.805			0.673	0.808
a22			0.859			0.739	0.844
a23			0.873			0.763	0.841
a24			0.795			0.678	0.845
a25			0.792			0.632	0.874
a26				0.844		0.713	0.828
a27				0.817		0.679	0.853
a28				0.868		0.757	0.826
a29				0.851		0.731	0.840
a30				0.829		0.696	0.826
a31					0.815	0.666	0.869
a32					0.730	0.548	0.860
a33					0.854	0.745	0.829
a34					0.831	0.696	0.830
a35					0.823	0.696	0.832

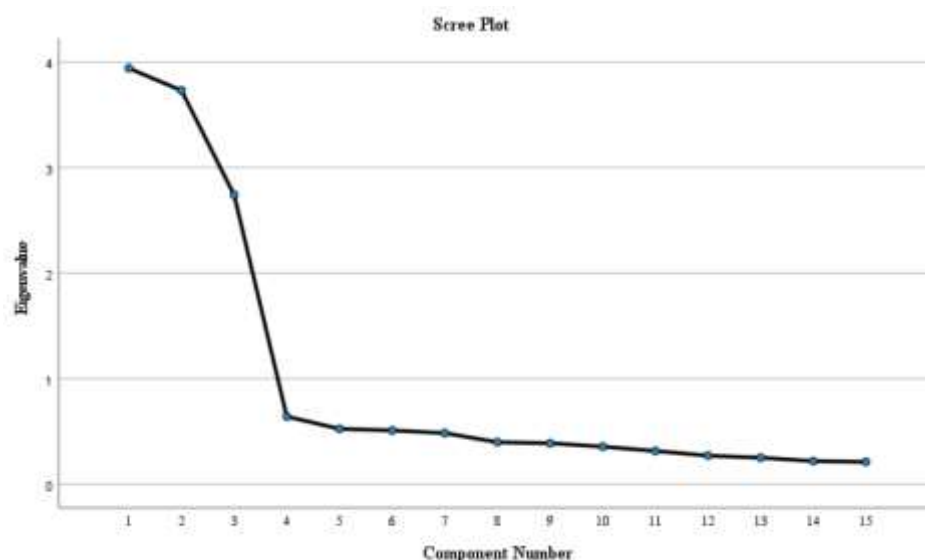


Figure 3: Scree Plot of Organizational Culture

The results of the Exploratory Factor Analysis for the 15 measurement items under the construct of Innovative Capability (Table 7) indicate that the data demonstrate extremely high suitability for factor analysis. The Kaiser-Meyer-Olkin (KMO) value was 0.851, and Bartlett's Test of Sphericity reached statistical significance (Approx. Chi-Square=964.831, df=105, $p < 0.001$). According to Huck (2012) and Tabachnick and Fidell (2007), the KMO value is far above the recommended threshold of 0.6, suggesting a very strong common factor structure among the variables and confirming that the data are highly suitable for factor analysis.

During the factor extraction process, the minimum value of Communalities for all items is 0.569, indicating that the extracted factor structure could explain the variance of each item extremely effectively. Based on the Kaiser criterion (eigenvalue > 1), EFA extracted three factors, with a cumulative explained variance as high as 67.384%. This result was further supported by the Scree Plot (Figure 4), where the eigenvalues leveled off after the third factor, confirming that extracting three factors retained the vast majority of the information.

The factor loading results show that the items loaded onto their corresponding dimensions as theoretically expected: Factor 1 (Domain-relevant Skills) contained items a36 to a40; Factor 2 (Creativity-relevant Processes) contained items a41 to a45; and Factor 3 (Task Motivation) contained items a46 to a50. The standardized factor loadings of all items exceeded the threshold of 0.5, verifying the stability of the three-dimensional structure of innovative capability and its excellent construct validity.

Table 6: Exploratory Factor Analysis (EFA) for Innovation Capability

Items	KMO (Bartlett's Test)	Cumulative % of variance	loading			Communalities	Anti-image correlation
			Factor1	Factor2	Factor3		
a36	0.851 ($p < 0.001$)	67.384	0.803			0.650	0.866
a37			0.792			0.630	0.860
a38			0.817			0.669	0.871
a39			0.876			0.771	0.830
a40			0.874			0.773	0.832
a41				0.801		0.660	0.831
a42				0.754		0.611	0.887
a43				0.808		0.682	0.874
a44				0.823		0.704	0.862
a45				0.837		0.708	0.855
a46					0.806	0.675	0.880
a47					0.848	0.720	0.815
a48					0.740	0.569	0.859
a49					0.788	0.628	0.822
a50					0.802	0.657	0.830

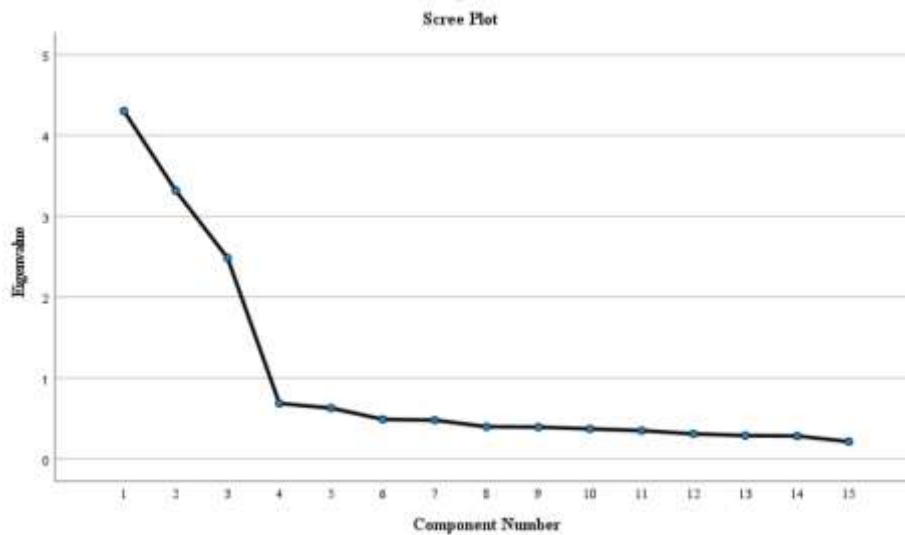


Figure 4: Scree Plot of Innovation Capability

To further examine the convergent and discriminant validity of the scales, this study conducted an overall Exploratory Factor Analysis on all 50 items simultaneously (Table 7). The results showed that the KMO value was 0.711, Bartlett's Test of Sphericity was significant ($p < 0.001$), and the MSA values for all items exceeded 0.5, indicating that the data were highly suitable for factor analysis.

Based on the Kaiser criterion (eigenvalue > 1), EFA extracted 10 factors, with a cumulative explained variance of 71.332%. The communalities of all items were higher than 0.3, and the factor loadings on their respective corresponding factors exceeded the threshold of 0.5, with no significant cross-loading phenomena observed. These results strongly confirm that the items possess good convergent and discriminant validity for the constructs they represent.

In conclusion, the EFA results fully support the preset factor structure of this study. All items were accurately categorized as theoretically expected, verifying the dimensional stability and construct validity of the measurement model.

Table 7: Exploratory Factor Analysis (EFA) for all Construct Simultaneously

Kaiser-Meyer-Olkin (KMO) value 0.711
Bartlett's Test of Sphericity value 0.001
Cumulative % variance 71.332

Item	Factor 1	Factor 2	Factor3	Factor 4	Factor 5	Factor6	Factor 7	Factor 8	Factor9	Factor 10	Communi- ties	Anti-image correlation
a1	0.843										0.758	0.686
a2	0.799										0.689	0.755
a3	0.775										0.700	0.757
a4	0.833										0.750	0.792
a5	0.817										0.708	0.711
a6		0.834									0.736	0.731
a7		0.794									0.682	0.791
a8		0.838									0.750	0.769
a9		0.869									0.767	0.698
a10		0.786									0.695	0.671
a11			0.806								0.692	0.696
a12			0.826								0.700	0.653
a13			0.817								0.706	0.652
a14			0.831								0.720	0.740
a15			0.797								0.693	0.674
a16				0.811							0.720	0.695
a17				0.862							0.776	0.725
a18				0.827							0.765	0.723
a19				0.803							0.693	0.784
a20				0.815							0.715	0.695
a21					0.806						0.705	0.699
a22					0.836						0.742	0.750
a23					0.859						0.778	0.645
a24					0.789						0.689	0.747
a25					0.787						0.681	0.744
a26						0.829					0.719	0.785
a27						0.801					0.673	0.709
a28						0.863					0.777	0.769
a29						0.847					0.741	0.724
a30						0.819					0.736	0.687
a31							0.820				0.679	0.711
a32							0.752				0.602	0.715
a33							0.851				0.749	0.632
a34							0.805				0.709	0.629
a35							0.803				0.714	0.743
a36								0.812			0.701	0.676
a37								0.788			0.679	0.689
a38								0.817			0.697	0.698
a39								0.864			0.789	0.690
a40								0.850			0.800	0.781
a41									0.775		0.655	0.650
a42									0.760		0.648	0.693
a43									0.789		0.703	0.765
a44									0.828		0.740	0.705
a45									0.829		0.723	0.655
a46										0.789	0.713	0.802
a47										0.857	0.753	0.647
a48										0.724	0.641	0.772
a49										0.781	0.640	0.611
a50										0.777	0.676	0.693

Reliability

This study conducted a reliability test on all constructs and their measurement items, focusing on evaluating the internal consistency of the scales. Following the recommendations of Sekaran and Bougie (2009) and Malhotra (2009), this study systematically assessed the internal consistency of the measurement model using Cronbach's α coefficients and Corrected Item-Total Correlations (CITC). Referring to the criteria of Hair et al. (2010), Cronbach's $\alpha \geq 0.7$ was set as the minimum acceptable threshold for the scale; meanwhile, following Coakes and Steed (2003), CITC ≥ 0.3 was adopted as the critical standard for item retention to purify low-quality items.

After analyzing the data using SPSS, it was found that the Cronbach's α coefficients of each construct in this study were all higher than the recommended standard of 0.70 (Hair et al., 2003), indicating that the scale had good internal consistency. Specifically, the Cronbach's α coefficient of Transformational Leadership is 0.787, and that of Organizational Culture is also 0.787. The Cronbach's α coefficient of Innovation Capability is 0.819.

Furthermore, as shown in Table 8, the Cronbach's α coefficients of each dimension all exceeded the recommended threshold of 0.70 (Hair et al., 2003), further confirming the good internal consistency of each dimension. Meanwhile, the CITC values of all items were higher than the recommended standard of 0.30 (Garson, 2013), indicating a good correlation between each item and its corresponding construct. Therefore, there is no need to delete any measurement items, which further proves that the measurement tools in this study have good reliability.

Table 8: Reliability Analysis of pilot study

Item	Corrected Item- Total Correlation	Cronbach's alpha if Item Deleted	Cronbach's alpha	No. of Items
Idealized Influence				
a1	0.764	0.856	0.888	5
a2	0.702	0.871		
a3	0.701	0.870		
a4	0.749	0.860		
a5	0.733	0.863		
Inspirational Motivation				
a6	0.736	0.871	0.894	5
a7	0.715	0.876		
a8	0.742	0.870		
a9	0.792	0.859		
a10	0.717	0.875		
Intellectual Stimulation				
a11	0.703	0.862	0.883	5
a12	0.726	0.856		
a13	0.735	0.854		
a14	0.737	0.854		
a15	0.695	0.863		
Individualized Consideration				
a16	0.714	0.871	0.890	5
a17	0.759	0.861		
a18	0.751	0.862		
a19	0.706	0.873		
a20	0.734	0.866		

Item	Corrected Item-Total Correlation	Cronbach 's alpha if Item Deleted	Cronbach 's alpha	No. of Items
Artifacts				
a21	0.703	0.866		
a22	0.761	0.852		
a23	0.782	0.848	0.886	5
a24	0.697	0.867		
a25	0.678	0.872		
Espoused Values				
a26	0.744	0.877		
a27	0.720	0.882		
a28	0.781	0.869	0.898	5
a29	0.767	0.872		
a30	0.733	0.880		
Basic Underlying Assumptions				
a31	0.700	0.846		
a32	0.607	0.867		
a33	0.763	0.830	0.873	5
a34	0.709	0.843		
a35	0.725	0.840		
Domain-relevant Skills				
a36	0.701	0.875		
a37	0.674	0.880		
a38	0.714	0.871	0.891	5
a39	0.787	0.854		
a40	0.795	0.853		
Creativity-relevant Processes				
a41	0.694	0.845		
a42	0.652	0.855		
a43	0.714	0.840	0.871	5
a44	0.730	0.836		
a45	0.698	0.844		
Motivation Factors				
a46	0.704	0.828		
a47	0.733	0.821		
a48	0.623	0.848	0.863	5
a49	0.662	0.839		
a50	0.689	0.832		

Discussion

The results of the EFA in this study fully support the preset multi-factor model, which is highly consistent with the classical theories of Bass (1994), Schein (1992), and Amabile (1988). The four-dimensional structure of Transformational Leadership, the three-dimensional structure of Organizational Culture, and the componential model of Innovative Capability were all validated within the local sample, indicating that these Western theories retain robust explanatory power in the context of Chinese universities.

Furthermore, the Cronbach's α coefficients for all scales were far above the standard of 0.7, and the cumulative explained variance of the EFA exceeded 70% for each construct, demonstrating excellent internal consistency and structural stability of the measurement instrument. This implies that the questionnaire developed in this study can accurately and reliably capture subtle changes within the causal chain of providing a solid methodological foundation for subsequent formal hypothesis testing.

Acknowledgement

The researcher wishes to express sincere gratitude to the Faculty of Management and Economics, Sultan Idris Education University, for their invaluable support and guidance throughout the completion of this research. The provision of resources, expertise, and encouragement has greatly contributed to the success of this study. Appreciation is also extended to all individuals and organizations who have directly or indirectly supported this work.

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APPENDIX

Respondents' Profile and Descriptive Statistics (Pilot Study)

Respondents' Profile

		Frequency	Percentage	Mean(SD)
Gender	Male	64	49.2	1.51(0.50)
	Female	66	49.2	
Age	25 to 28 years old	34	26.2	2.06(0.77)
	29 to 32 years old	54	41.5	
	33 to 35 years old	42	32.3	
Type of University	Public university	69	53.1	1.47(0.50)
	Private university	61	46.9	
Religion	Provincial Capitals	58	44.6	1.80(0.81)
	Prefecture-level Cities	40	30.8	
	County-level Areas	32	24.6	
Discipline	Science and Engineering	73	56.2	1.44(0.50)
	Humanities and Social Sciences	57	43.8	
Education Qualification	Doctor Degree	74	56.9	1.52(0.65)
	Master Degree	45	34.6	
	Other	11	8.5	
Teaching experiences	Less than 5 Years	76	58.5	1.42(0.50)
	More than 5 Years	54	41.5	
Academic experiences	Less than 5 Years	50	38.5	1.62(0.49)
	More than 5 Years	80	61.5	