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RESEARCH ARTICLE

Impact of transformational leadership and organizational learning on Non-R&D innovation in micro and small enterprises: An empirical study of China's software and IT servicesindustry

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ABSTRACT

This study focuses on 458 small and micro enterprises in China's software and infor-mation technology services sector. Using purposive sampling, data analysis was con-ducted through regression analysis and structural equation modeling (SEM) to explore the impact mechanisms of transformational leadership and organizational learning on non-R&D innovation, as well as the moderating role of innovation policies. The empir-ical results reveal that transformational leadership including establishing a vision, employee motivation, and individualized consideration significantly drives non-R&D innovation in technology application, process optimization, and market innovation of micro and small enterprises. This driving effect is realized through organizational learning as a key mediating mechanism. Innovation policies amplify the impact of transformational leadership on non-R&D innovation, but have a limited moderating effect on its interaction with organizational learning. This suggests policy tools more likely alleviate resource constraints over directly intervene internal learning process.

This study has developed a model of "leadership—learning—innovation," to clarify the role of leadership in shaping organizational atmosphere and learning processes. These elements are the key in stimulating innovation when resource constraints could be the barrier for business development, which physically and psychologically support the business in organizational innovation and develop a theoretical guide for enterprises towards innovation. Furthermore, the findings would be useful for enterprises to en-hance innovation through leadership transformation and learning organizations, and for policymakers to improve policies for businesses in innovation corporation.

Keywords: transformation leadership; organizational learning; non-R&D innovation; micro and small enterprises; innovation policy

1. Introduction

Micro and small enterprises (MSEs) serve as core units in the global economic ecosystem and drive economic growth, job creation, and social stability [1, 2]. In China, MSEs accounted for 91.68% of all market entities by the end of 2022, contributing over 60% of gross domestic product, 50% of tax revenue, and 80%

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of urban employment [3, 4]. However, these enterprises face structural challenges: their operations are predomi-nantly concentrated in low-technology, labor-intensive sectors, with limited risk resil-ience. During the Covid-19 pandemic, the annual growth of MSEs on business profit was significantly behind those large enterprises showing apparent vulnerability[5] . Then, how to lift up constraints on MSE business development and seek sustainable development are critical tasks for academics and entrepreneurs alike [3]

Traditional innovation theory has long centered on research and development (R&D) investment, emphasizing technological breakthroughs as decisive factors for competitiveness [6]

However, this perspective fails to explain innovation practices in re-source-constrained MSEs. Studies indicate that over 70% of innovative European firms do not engage in formal R&D activities[7], while non-technological innovations in German and U.S. firms surpass breakthrough technological innovations [8, 9]. Non-R&D innovation, characterized by technology adoption, incremental improvements, and market model reconfiguration, has emerged as a key low-resource-dependent strategy for MSEs to address the "innovation paradox" [10, 11]. For example, Santamaría et al. [12] found that low-tech firms achieve performance leaps through external knowledge in-tegration and process optimization without R&D investment. Liu [13] further identified six non-R&D innovation modes (e.g., technology adoption, imitation innovation, and organizational restructuring) in the Chinese context, offering differentiated capabil-ity-building pathways for MSEs. Transformational leadership (TL) provides a psycho-logical mechanism for employees and teams to rely on, and to meet three psychologi-cal needs – autonomy, competence, and belonging, TL serves the organization to mo-tivate individuals to innovate [14]. Organizational learning (OL), on the other hand, alters behavioral patterns through cognitive reconstruction and expe-riential coding, jointly constituting the micro-psychological foundation of non-R&D innovation [15]. Nonetheless, critical research gaps persist regarding drivers and policy adaptability of non-R&D innovations. First, leadership mechanisms remain ambiguous. While transformational leadership (TL) is widely acknowledged as a pre-cursor to organizational innovation [16, 17], existing research predominantly focuses on its direct effects on R&D-intensive innovation, thereby neglecting differentiated path-ways in non-technical domains [18]. This oversight limits the theoretical guidance available for practical applications, and unable to demonstrate the mechanism of that TL drives adaptive innovation in non-tech fields to form key psychosocial environ-ments [19]. For example, TL's individualized consideration may more effectively foster incremental innovations, such as service process optimization, while intellectual stimulation could facilitate market model reconfiguration [20]. The current lack of dimensional specificity in TL research hinders a nuanced understand-ing of its impact across diverse innovation types. Furthermore, the mediating role of organizational learning (OL) in MSE contexts remains inadequately explored. MSEs' learning processes are often deeply embedded in practice, relying heavily on customer interactions and iterative trial-and-error experiences [21],, and most studies have been done based on manufacturing or high-tech samples, lacking empirical tests on behav-ioral adaptation in the chain leadership - learning – innovation[22]. However, prior re-search, largely based on manufacturing or high-tech samples, lacks a systematic ex-amination of the "leadership-learning-innovation" chain within MSEs[23]. Third, theo-retical debates persist regarding the moderating effects of innovation policies. Alt-hough such policies are frequently perceived as mechanisms for alleviating resource constraints[23], their specific pathways to influence innovation remain contested. Some scholars emphasize direct innovation promotion through financial support [24], while others contend that policy efficacy is contingent upon alignment with internal organi-zational capabilities [25]. In the context of non-R&D innovation, policy design may ne-cessitate a shift from a "technology supply orientation" to a "capability activation orientation" [26]); however, the theoretical foundations for this transition require fur-ther development

To address these gaps, this study poses three core questions: How can transforma-tional leadership influence the adaptive behaviors of employees and teams by shaping social and psychological environmental factors, driving non-R&D innovation? Does organizational learning serve as an intermediary for cognitive-behavioral transfor-mation, connecting TL with non-R&D innovation? Under what conditions does innovation policy regulate the relationship between leadership and innovation? Further-more, based on Self-Determination Theory[27], Using a mixed-methods analysis of 458 MSEs in the Zhejiang Province's software and information technology sector, we developed a new model of "leadership - learning - policy" to demonstrate the synergistic effects between the three. The model posits that, in the context of resource constraints, through creat-ing a supportive psychosocial environment and policy response capabilities, TL is able to activate a capability substitution pathway for non-R&D innovation, centering on behavioral adaptation and organizational resilience. These results provide new thoughts to aca-demic debates on mediation mechanisms and policy boundary conditions [28], and offer fresh ideas into innovation theory under resource constraints and practical suggestions for MSEs in TL development and governments in policy making.

2. Literature review

2.1. Theoretical foundation

This study takes the self-determination theory as the overarching framework, which reveals that the essence of human innovative behavior is rooted in the fulfil-ment of the three basic psychological needs: autonomy, competence and belonging[27]. This theory provides a core lens for deconstructing non-R&D innovation in small and micro enterprises. Unlike technology-intensive innovation, non-R&D innovation is an essentially adaptive behavior driven by employee intrinsic motivation under resource constraints, and its effects highly associated with the level of psychological needs satisfaction. Transformational leadership serves as the core trigger mechanism, responding to these demands through four dimensions of behavior: idealized influence provides a sense of meaning to the work, enhancing employees' autonomous commitment to innovation goals; inspirational motivation increases task control beliefs, strengthening employees' competence confidence in incremental im-provements; intellectual stimulation drives the updating of cognitive frameworks, stimulating the desire to explore cross-boundary solutions; individualized considera-tion builds trust bonds, catalyzing the sense of belonging necessary for collaborative innovation [29] Such leadership practices transform external pressures into intrinsic drivers, shifting employees from passive adaptation to active creation, fundamentally breaking through resource bottlenecks.

Organizational learning is restructured in this framework as a cognitive interme-diary for employees' motivation internalization. When transformational leaders meet their psychological needs, employees experience cognitive process through four stages: knowledge acquisition, information distribution, information interpretation, and or-ganizational storage, transforming their motivational states into sustainable innova-tion capabilities [30]. Individualized care can stimulate the sense of belonging that can encourage the experienced employee to pass their knowledge to new comers, minimizing the concealment of knowledge[31]. And, autonomous demand-driven intellectual stimulation can prompt employees to address problems and accelerate marketing innovation[32]. Ultimately, the internalized motivation manifest in innovative behaviors like the adoption of de-mand-oriented technologies to achieve precise matching of external solutions, marketing innovation driven by autonomous demands with low-resource channels, and organizational transformation to reshape collaborative processes based on the aggre-gation of demands.

Based on the Self-determination Theory (SDT), this study aims to explore the cor-relation mechanism between transformational leadership, organizational learning and non-R&D innovation. Explicating these mechanisms, this study breaks through the traditional theoretical discussion of isolated variables and reach a model of combining transformational leadership, organizational learning and non-R&D innovation at the psychological level, establishing a new framework for research into micro and small enterprises innovation.

2.2. TL, Non-R&D innovation, OL, innovation policy, and their influencing factors

Burns [33] first systematically proposed the TL theory, positing that TL involves leaders transcending followers' self-interests to enhance their work capabilities and moral standards. Subsequent scholars, including Bass[16], Leithwood [34], Yukl [35, 36] and Pillai [37], further developed the conceptualization of TL. Bass [16] categorized TL into three components: charismatic leadership, individualized consideration, and intellec-tual stimulation. Bass and Avolio [38] then refined "charismatic leadership" into ideal-ized influence and inspirational motivation, forming the four dimensions of TL—idealized influence, inspirational motivation, intellectual stimulation, and indi-vidualized consideration—and developed the widely used multifactor leadership questionnaire.

Since Schumpeter [39] introduced the concept of innovation, it has evolved into several branches. Innovation is not merely the outcome of R&D activities but encom-passes a complex process from idea generation to commercialization. Non-R&D inno-vation, although frequently mentioned in literature [40], lacks a unified definition. Early studies identified non-R&D activities such as design, patent applications, and licensing [12, 41]. Arundel et al.[7] systematically categorized non-R&D innovations into incremen-tal product/process adjustments, imitation, reverse engineering, and innovative appli-cations of existing knowledge. Subsequent scholars expanded this framework: Gar-cía-Manjón [42] identified four modes (technology adoption, incremental improvement, reverse imitation, and knowledge recombination), while Hervas-Oliver et al. [21]and Chen et al. [43] extended it to include marketing and organizational innovation. In the Chinese context, Liu [13] empirically validated a six-dimensional framework comprising technology adoption, reverse engineering, incremental improvement, knowledge ap-plication, market innovation, and organizational innovation.

The OL theory originated with March and Simon [44], with Argyris and Schön [45] defining it as error detection and correction by aligning organizational practices with external environments. Fiol [46] emphasized its role in enhancing organizational com-petencies, whereas Huber [47] systematized them into four stages: knowledge acquisi-tion, information distribution, interpretation, and organizational memory. These frameworks highlight OL as a strategic driver of competitive advantage [48].

The OECD [49] pioneered the innovation policy conceptualization as encompassing energy, human, material, and financial resource strategies. Edquist defined innovation as a public action that influences technological and other forms of innovation. Innova-tion policy integrates science, talent, industry, and economic measures to incentivize innovation [50, 51]. Rothwell and Zegveld [23] classified innovation policies into sup-ply-side, environmental, and demand-side categories, a taxonomy that remains fun-damental. Effective innovation policies must align with macroeconomic strategies while providing institutional support for innovation activities [52]

2.3. Hypothesis development

2.3.1. TL and Non-R&D innovation

TL fosters organizational innovation, enhances innovation performance, and improves competitiveness [53, 54, 55]. The influence of TL on innovation has been extensively studied over the past two decades [56], with TL described as a facilitator of internal innovation [20, 57]. Bass [16] posited that the TL exhibits creative behavior and serves as a role model for innovation. The four dimensions of TL—idealized influence, inspirational motiva-tion, intellectual stimulation, and individualized consideration—act as catalysts for employees to achieve peak performance. Leaders with TL traits encourage critical thinking and novel ideas and foster creativity and innovative products and services [58, 59]. TL is a key driver of knowledge-sharing processes and innovation outcomes, signif-icantly affecting process and product innovation performance [57, 60, 61]. Based on this, we propose the following hypothesis:

H1: TL significantly affects non-R&D innovation, which is further divided into four sub-hypotheses.

H1a: Idealized influence positively influences non-R&D innovation.

H1b: Inspirational motivation positively influences non-R&D innovation.

H1c: Intellectual stimulation positively influences non-R&D innovation.

H1d: Individualized consideration positively influences non-R&D innovation.

2.3.2. TL and OL

TL, characterized by charismatic communication, motivation, and intellectual stimulation, inspires employees to prioritize organizational stakeholders [62]. TL fosters the creation, utilization, renewal, and application of knowledge, building critical ca-pabilities for OL [63]. Berson et al.[64] highlighted the role of leadership in promoting OL, which ultimately enhances performance. Transformational leaders cultivate teams, provide direction, and drive change through learning processes [65]. Empirical studies have confirmed the positive relationship between TL and OL [66, 67, 68]. Thus, we propose:

H2: TL significantly affects OL, which is divided into the following four sub-hypotheses based on the division of TL dimensions:

H2a: TL idealization influence positively affects OL.

H2b: TL inspirational motivation positively impacts OL.

H2c: TL intellectual stimulation positively impacts OL.

H2d: TL and personalized care positively impact O

2.3.3. OL and Non-R&D innovation

OL involves creating, transferring, and integrating knowledge to drive continuous im-provement [69]. OL is a precursor to innovation, with studies linking it to enhanced in-novation capabilities [70, 71]. Jiménez and Sanz [72] emphasized the interconnectedness of OL, innovation, and performance. Innovation relies on knowledge acquisition and sharing [73] and directly enhances innovation performance [74, 75]. Accordingly, we pro-pose the following hypothesis:

H3: OL has a significantly positive impact on non-R&D innovation

2.3.4. OL and Non-R&D innovation

While prior studies have confirmed a direct link between TL and innovation [17, 22], the mediating role of OL in MSE contexts remains unexplored. Garvin [76] argued that TL fosters OL, which in turn drives innovation. Berson et al. [77] demonstrated that TL enhances innovation through OL, whereas Cohen and Levinthal [78] emphasized OL's role in leveraging resources for innovation. Thus, we propose the following hypothesis:

H4: OL mediates the relationship between TL and non-R&D innovation, which is divided into four sub-hypotheses

H4a: OL mediates the relationship between idealized influence and non-R&D innovation.

H4b: OL mediates the relationship between inspirational motivation and non-R&D innovation.

H4c: OL mediates the relationship between intellectual stimulation and non-R&D innovation.

H4d: OL mediates the relationship between individualized consideration and non-R&D in-novation.

2.3.5. Moderating role of innovation policy

The relationship between TL and innovation depends on moderating factors such as resource availability [28]. Innovation policies enhance OL and innovation through funding, tax incentives, and knowledge-sharing platforms [24, 25]. However, policy effec-tiveness depends on its alignment with internal capabilities [26]. Thus, we propose

H5: Innovation policy moderates the relationship between TL and non-R&D in-novation.

H6: Innovation policy moderates the relationship between OL and non-R&D in-novation.

Figure 1 shows the theoretical framework.

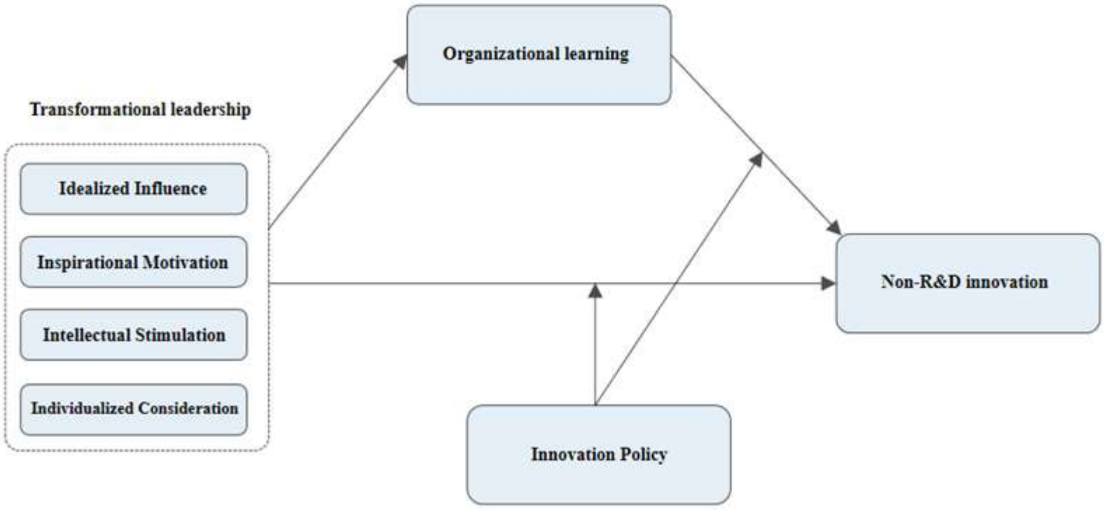

Figure 1. Conceptual framework

Source: *Own elaboration*

3. Materials and methods

3.1. Sample selection and data collection

The study sample comprised MSEs in Zhejiang Province's software and information technology services sector registered between January 1, 2012, and December 31, 2022 (sourced from the Tianyancha platform). Zhejiang Province was selected because of its large MSE population and rapid growth rate, which exceeds the national average by 24.2 percentage points, ensuring representativeness in both quantity and quality. Meanwhile, as the birthplace of China's private enterprise, Zhejiang Province's histor-ical and cultural heritage, along with the local government's introduction of policies such as the "No. 1 Project" for the digital economy, give small and micro enterprises unique advantage for healthy development.

This study employed a stratified random sampling method and a questionnaire survey as research tools. To minimize variance, Cochran's [79] formula was used with a 95% confidence level. The sample size was calculated as n = 385, where $n = Z^2 * \sigma^2 / d^2$. The total population was 59,368 with an acceptable margin of error of 5% and an ex-pected response rate of 40%. The calculated result was 382 + (382 × 0.4) = 535 [80]. A proportional random sample was then selected from the MSEs in the software and in-formation technology services industry.

The unit of analysis was the organizational level. Managers or technical leaders completed the questionnaires. After the expert Item Objective Congruence (IOC) evaluation, the questionnaire was developed, and the survey work was carried out. This study was conducted through an electronic questionnaire survey, with the ques-tionnaire created on the Chinese platform Wenjuanxing (ID: 276344198). The data col-lection period lasted from August 2, 2024, to November 1, 2024. All participants vol-untarily provided responses and were assured that their answers would remain anonymous and confidential. According to the established research ethics of the uni-versity, respondents are deemed to have agreed to participate when having voluntari-ly submitted completed questionnaires. The survey was conducted in two phases. The first phase was a pilot survey, aimed at ensuring the quality of the questionnaire. Prior to the official survey, a pretest was carried out, focusing on aspects such as the ques-tion framework, wording, sequence, and understanding of the questions, resulting in the final version of the questionnaire. The second phase was the official survey. A total of 535 questionnaires were distributed in this survey. Among the 483 returned ques-tionnaires (response rate: 90.28%), 25 invalid responses were excluded, resulting in 458 valid responses (validity rate: 85.61 %). Table 1 presents the demographic details of the respondents. This study measures variables that may affect non-R&D innovation, such as personal information including gender, age and position, etc. and the basic infor-mation of enterprises including nature, scale, etc.

Table 1. Frequency analysis of basic information (n=458)

Variable	Option	Subtotal	Percentage
Sex	Male	285	62.23%
	Female	173	37.77%
Age	30 years and below	54	11.79%
	31–40 years	47	10.26%
	41–50 years	240	52.40%
	Above 51 years	117	25.55%
Years of Service	3 years and below	43	9.3%
	4–6 years	47	10.18%
	7–9 years	137	29.99%
	10 years and above	231	50.53%
Position	Entrepreneur or Executive	47	10.26%
	Middle Manager	92	20.08%
	Technical Staff, Engineer	275	60.05%
	Other	44	9.61%

3.2. Variable measurement

The questionnaire employed a 5-point Likert scale with the variables operational-ized as follows: TL was measured using scales from Bass and Avolio [38], Mozhdeh Mokhber [81], and Bass [82] comprising four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, with 20 items. OL was drawn from Huber [47] and Jimenez [47] and covered knowledge acquisi-tion, information distribution, information interpretation, and organizational memory across 19 items. The non-R&D innovation integrated scales by Arundel et al. [7], Liu [13], and the OECD [13] encompass six dimensions: technology adoption, imitation innovation, gradual improvement, knowledge innovation and application, market in-novation, and organizational innovation (19 items). The innovation policy was adapted from Rothwell and Zegveld [13] and China's Action Plan for Improving Tech-nological Innovation Capability (2022–2023), with 12 items across supply, environmental, and demand policies, as listed in Table 2.

Table 2. Variable measurement and source

Variables	Measurement Dimensions	Number of Questions	References
TL	Idealized Influence	5	[38], [81], [82]
	Inspirational Motivation	5	
	Intellectual Stimulation	5	
	Individualized Consideration	5	
OL	Knowledge Acquisition	5	[47],[72]
	Information Distribution	5	
	Information Interpretation	5	
	Organizational Memory	4	
Non-R&D innovation	Technology Adoption	3	[7, 13, 83]
	Imitation Innovation	3	
	Gradual Improvement	3	
	Knowledge Innovation and Application	3	
	Market Innovation	3	
	Organizational Innovation	4	
Innovation Policy	Supply Policies	4	[23]
	Environmental Policies	4	
	Demand Policies	4	

3.3. Reliability of the scales

Based on the analysis of the questionnaire data, the TL scale comprises four measurement dimensions: idealized influence (Cronbach's α=0.836), inspirational motivation (Cronbach's α=0.857), intellectual stimulation (Cronbach's α=0.900), and individualized consideration (Cronbach's α=0.850). The overall Cronbach's alpha coefficient for the TL scale was 0.929.

The Cronbach's alpha coefficient for the OL scale was 0.923. The OL scale includes four measurement dimensions: knowledge acquisition (Cronbach's α = 0.865), information distribution (Cronbach's α = 0.841), information interpretation (Cronbach's α = 0.849), and organizational memory (Cronbach's α = 0.851). The Cronbach's alpha coefficient for the Non-R&D innovation scale was 0.922, comprising six measurement dimensions: technology adoption (Cronbach's α = 0.806), imitation innovation (Cronbach's α = 0.828), gradual improvement (Cronbach's α = 0.887), knowledge innovation and application (Cronbach's α = 0.797), market innovation (Cronbach's α = 0.882), and organizational innovation (Cronbach's α = 0.886). Cronbach's alpha coefficient for the innovation policy scale was 0.946. All scales and their respective dimensions had Cronbach's alpha coefficients greater than 0.7, indicating good reliability.

4. Results

4.1 Model measurement

Exploratory Factor Analysis (EFA) and confirmatory factor analysis (CFA) were conducted using SPSS and AMOS. For the TL scale, the Kaiser-Meyer-Olkin (KMO) value was 0.944 ($p < 0.001$), and the CFA results showed minimum discrepancy per degree of freedom(CMIN/DF) = 1.606, root mean square residual (RMR) = 0.017, goodness of fit index (GFI) = 0.957, adjusted goodness of fit index (AGFI) = 0.944, incremental fit index (IFI) = 0.983, Tucker-Lewis index (TLI) = 0.98, comparative fit index (CFI) = 0.983, and root mean square error of approximation (RMSEA) = 0.033. For the OL scale, the KMO value was 0.931 ($p < 0.001$), and the CFA results showed that CMIN/DF = 2.66, RMR = 0.019, GFI = 0.929, AGFI = 0.907, IFI = 0.954, TLI = 0.946, CFI = 0.954, and RMSEA = 0.054. For the non-R&D innovation scale, the KMO value was 0.908 ($p < 0.001$), and the CFA results showed CMIN/DF = 2.341, RMR = 0.017, GFI = 0.944, AGFI = 0.922, IFI = 0.970, TLI = 0.963, CFI = 0.970, and RMSEA = 0.049. Therefore, all the structures met the standards of the measurement model.

4.2. Convergent and discriminant validity analysis

Convergent validity was assessed using CFA, focusing on composite reliability (CR) and average variance extracted (AVE) indicators. CR, similar to Cronbach's alpha, was used to test the internal consistency of the constructs. The higher the CR, the greater the internal consistency and convergence of the construct, with a commonly accepted threshold value of >0.7. The AVE reflects the average explanatory power of the latent variable over the observed variables. The higher the AVE, the greater the convergent validity, with a typical threshold of AVE > 0.5. The analysis shows that CR values for the CFA of the scales ranged from 0.809 to 0.900, exceeding the standard value of 0.7, whereas the AVE values ranged from 0.507 to 0.725, exceeding the standard value of 0.5. The discriminant validity was tested by comparing the AVE values from the CFA with the correlation analysis results. Discriminant validity was primarily evaluated by comparing the correlations within and between dimensions. Discriminant validity is established if the internal correlation within a dimension is greater than its correlation with other dimensions. The TL, OL, and non-R&D innovation scales all have sub-dimensions, and there is clear discriminant validity between the sub-dimensions of each scale.

4.3. Descriptive and correlation analysis

Correlation analysis was conducted using Pearson's correlation coefficient to measure the degree of association between variables. After calculating the mean scores for each dimension, correlation analysis was performed. The results show that the mean score for TL is 4.271, for OL is 4.288, and for non-R&D innovation is 4.210. As shown in Table 3, there are significant positive correlations between TL and its four sub-dimensions with OL and non-R&D innovation. Specifically, TL and OL ($r = 0.773$, $p = 0.01$); TL and non-R&D innovation ($r = 0.834$, $p = 0.01$); and OL and non-R&D innovation ($r = 0.750$, $p = 0.01$).

Table 3. Correlation coefficient for each dimension in the variable

	Correlations								
	M	**S.D**	**TL**	**II**	**IM**	**IS**	**IC**	**OL**	**NRD**
TL	4.271	0.546	1						
II	4.308	0.618	.795**	1					
IM	4.305	0.631	.843**	.598**	1				
IS	4.271	0.708	.806**	.516**	.578**	1			

IC	4.201	0.723	.818**	.523**	.601**	.514**	1		
OL	4.288	0.494	.773**	.599**	.679**	.637**	.610**	1	
NRD	4.210	0.518	.834**	.661**	.724**	.655**	.684**	.750**	1

Table 2. (*Continued*)

*** Correlation is significant at the 0.01 level (2-tailed).*

4.4. Common method bias

To avoid common method bias (CMB), this study employed Harman's single-factor test and conducted an EFA on all factor items. The results showed that the variance explained by the first unrotated principal component was 32.113%, which did not reach the critical threshold of 40%. Thus, common method variance was not the primary cause of covariation between the variables in this study, allowing for further data analysis.

4.5. Structural model

The overall hypothesized model was tested for goodness-of-fit using AMOS software (Figure 3). The results indicate CMIN/DF = 1.811, GFI = 0.925, RMR = 0.018, RMSEA = 0.038, AGFI = 0.911, and CFI = 0.965. All model fit indices met the standard values. The next step was to test the path coefficients of the model based on the factor fit indices.

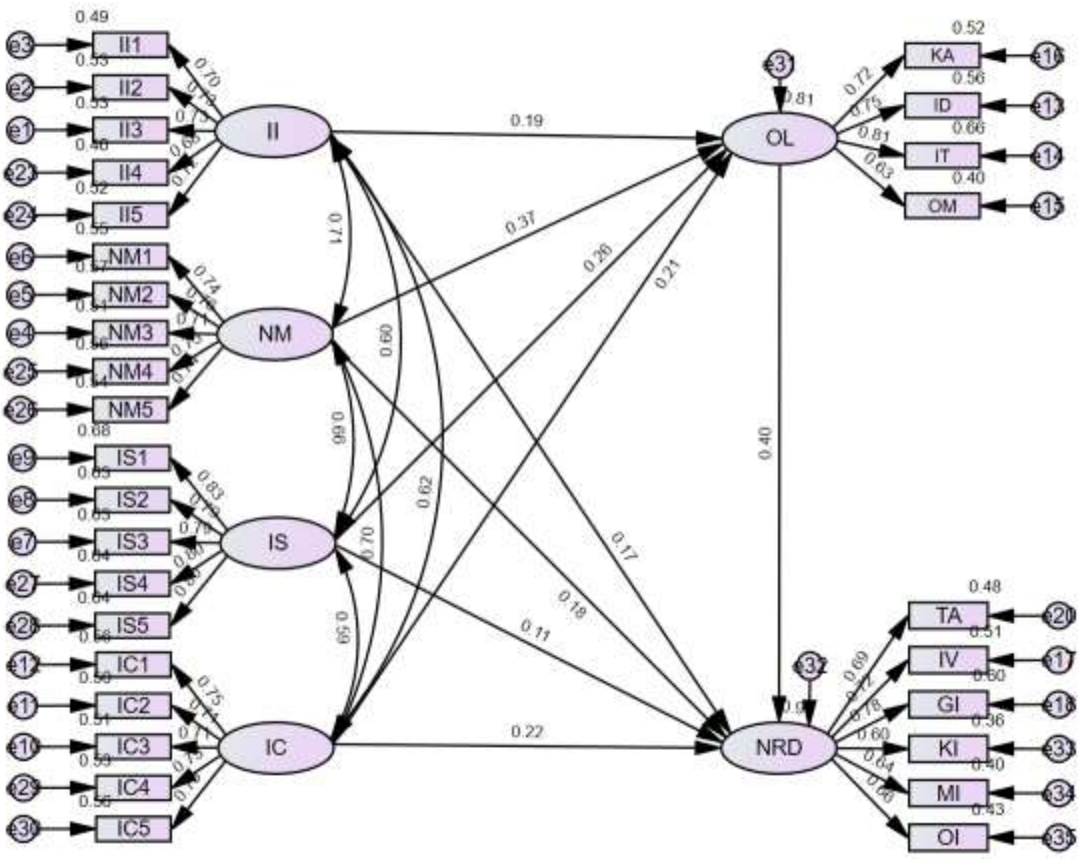

Figure 2. Structural equation model of the relationship between TL, OL, and non-R&D innovation

4.6. Hypothesis testing

Main Effect Testing. Table 4 suggests that the results indicate a significant positive effect of idealized influence on non-R&D innovation (β = 0.17, $p < 0.001$), supporting H1a. Inspirational motivation also has a significant positive effect on non-R&D innovation (β = 0.18, $p < 0.001$), supporting H1b. Intellectual stimulation has a significant positive effect on non-R&D innovation (β = 0.106, $p < 0.001$), supporting H1c. Individualized consideration has a significant positive effect on non-R&D innovation (β = 0.223, $p < 0.001$), supporting H1d.

Idealized influence has a significant positive effect on OL (β = 0.19, $p < 0.001$), supporting H2a. Inspirational motivation has a significant positive effect on OL (β = 0.373, $p < 0.001$), supporting H2b. Intellectual stimulation has a significant positive effect on OL (β = 0.261, $p < 0.001$), supporting H2c. Individualized consideration has a significant positive effect on OL (β = 0.213, $p < 0.001$), supporting H2d.

OL has a significant positive effect on non-R&D innovation (β = 0.397, $p < 0.001$), supporting H3.

Table 4. Path coefficient of the structural equation model

Hypothesis & Paths	Estimate	S.E.	C.R.	P
H1a: Non-R&D innovation <---Idealized Influence	0.17	0.041	3.595	***
H1b: Non-R&D innovation<---Inspirational Motivation	0.18	0.057	2.905	0.004
H1c: Non-R&D innovation<---Intellectual Stimulation	0.106	0.034	2.44	0.015
H1d: Non-R&D innovation <---Individualized Consideration	0.223	0.038	4.662	***
H2a: OL<---Idealized Influence	0.19	0.041	3.649	***
H2b: OL<---Inspirational Motivation	0.373	0.053	5.915	***
H2c: OL<---Intellectual Stimulation	0.261	0.032	5.715	***
H2d: OL<---Individualized Consideration	0.213	0.037	4.152	***
H3: Non-R&D innovation <---OL	0.397	0.095	4.635	***

*Note: ***=p < 0.001, **=p < 0.01, *=p < 0.05*

Mediation Effect Testing. The bootstrap method was used with 5000 resampling iterations to test the mediation effect of OL between the four independent variables (idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration) and the dependent variable (non-R&D innovation). A 95% confidence interval (CI) was set; if the lower and upper bounds did not include zero, the mediation effect was considered statistically significant.

Table 5. Bootstrap method Results of the mediation effect test

Parameter	Estimate	SE	95% CI	
			Lower	Upper
H4a: Idealized Influence--OL--Non-R&D innovation	0.066	0.04	0.011	0.161
H4b: Inspirational Motivation--OL--Non-R&D innovation	0.137	0.063	0.049	0.304
H4c: Intellectual Stimulation--OL--Non-R&D innovation	0.08	0.036	0.032	0.171
H4d: Individualized Consideration--OL--Non-R&D innovation	0.067	0.033	0.019	0.154

According to Table 5, H4a: "Idealized Influence → OL → Non-R&D Innovation," the mediation effect value is 0.066, with a 95% confidence interval (CI) of (0.011, 0.161), indicating that OL significantly mediates the relationship between idealized influence and non-R&D innovation, supporting H4a.

H4b: "Inspirational Motivation → OL → Non-R&D Innovation," the mediation effect value is 0.137, with a 95% CI of (0.049, 0.304), indicating that OL significantly mediates the relationship between inspirational motivation and non-R&D innovation, supporting H4b.

H4c: "Intellectual Stimulation → OL → Non-R&D Innovation," the mediation effect value is 0.08, with a 95% CI of (0.032, 0.171), indicating that OL significantly mediates the relationship between intellectual stimulation and non-R&D innovation, supporting H4c.

H4d: "Individualized Consideration → OL → Non-R&D Innovation," the mediation effect value is 0.067, with a 95% CI of (0.019, 0.154), indicating that OL significantly mediates the relationship between individualized consideration and non-R&D innovation, supporting H4d.

Moderating Effect Testing. The moderating effect of innovation policy was tested using a process macro as the analysis tool. The moderating effect of innovation policy was examined after controlling for variables such as sex, age, and work experience.

The study used Process Model 15 for testing, with bootstrapping set to 5000 resampling iterations. Innovation policy was tested as a moderator on the path between the independent variable, TL, and the dependent variable, non-R&D innovation, as well as on the path between the mediator, OL, and non-R&D innovation. Table 6 summarizes the results.

Table 6. Moderating effects

Implicit variable	**Non-R&D innovation**				
	B	Se	T	LLCI	ULCI
Constant	4.134	0.069	59.916	3.998	4.269
Distinguishing between the sexes	-0.001	0.022	-0.062	-0.045	0.042
Age	-0.003	0.012	-0.293	-0.027	0.02
Length of service	0.000	0.011	0.033	-0.022	0.022
Duties	0.026	0.014	1.874	-0.001	0.053
TL	0.545***	0.032	16.99	0.482	0.608
OL	0.248***	0.035	7.001	0.179	0.318
Innovation Policy	0.172***	0.021	8.211	0.131	0.214
TL *Innovation Policy	0.145***	0.045	3.256	0.058	0.233
OL *Innovation Policy	-0.021	0.051	-0.406	-0.12	0.079
F	196.215***				
R-square	0.759				

Note: ****=p < 0.001, **=p < 0.01, *=p < 0.05*

The moderating effect of innovation policy on "TL → Non-R&D Innovation" was 0.145, with a 95% CI of (0.058, 0.233), which does not include zero, thus supporting H5.

To clearly present the moderating effect of innovation policy on the relationship between TL and non-R&D innovation, the sample with scores one standard deviation above the mean of innovation policy was classified as the high group, and the sample with scores one standard deviation below the mean was classified as the low group. This study used the pick-a-point method to test the effect, plotting the influence of TL on non-R&D innovation at high and low levels of innovation policy. Figure 3 shows the results. For the high innovation policy group, the positive effect of TL on non-R&D innovation was more pronounced, whereas for the low innovation policy group, it was slightly weaker. This finding is consistent with expectations. Thus, innovation policy plays a significantly positive moderating role in the relationship between TL and non-R&D innovation.

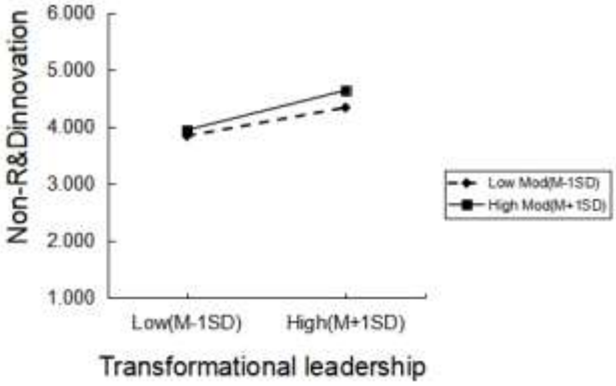

Figure 3. Moderating effect of innovation policy on "TL → Non-R&D Innovation"

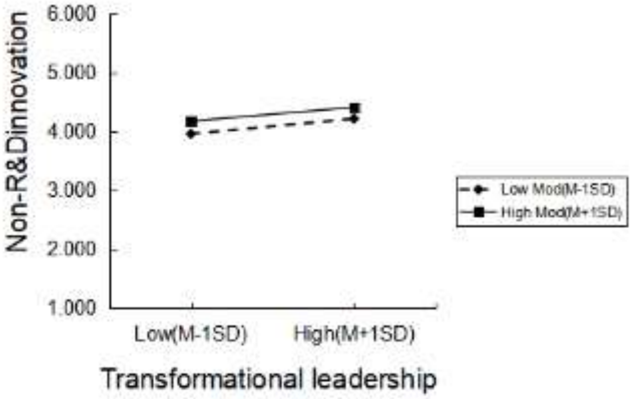

Figure 4. Moderating effect of innovation policy on "OL → Non-R&D Innovation"

As shown in Figure 4, the moderating effect of innovation policy on "OL → Non-R&D Innovation" is -0.021, with a 95% CI of (-0.12, 0.079), including zero. Therefore, H6 was not supported. Using the same method, a simple slope graph was plotted for the moderating effect of innovation policy on the relationship between OL and non-R&D innovation. The graph shows that the slopes of the two lines are considerably close, exhibiting a nearly parallel behavior. This does not align with the previously expected hypothesis. Thus, innovation policy does not moderate the relationship between OL and non-R&D innovation.The results of the hypothesis test are shown in Table 7.

Table 7. Summary table of the results of the hypothesis testing

Hypothesis	Testing result
H1: Transformational leadership has a significant positive impact on non-R&D innovation	Accepted
H1a: Transformational Leadership Idealization Influence Positively Affects Non-R&D Innovation	Accepted
H1b:Transformational leadership inspirational motivation has a positive impact on non-R&D innovation	Accepted

Hypothesis	Testing result
H1c:Transformational Leadership Intellectual Stimulation has a Positive Impact on Non-R&D Innovation	Accepted
H1d:Transformational leadership and personalized care have a positive impact on non-R&D innovation	Accepted
H2: Transformational leadership has a significant positive effect on organizational learning	Accepted
H2a: Transformational Leadership Idealization Influence Positively Affects Organizational Learning	Accepted
H2b:Transformational Leadership Inspirational Motivation Has a Positive Impact on Organizational Learning	Accepted
H2c: Transformational Leadership Intellectual Stimulation Has a Positive Impact on Organizational Learning	Accepted
H2d:Transformational leadership and personalized care have a positive impact on organizational learning	Accepted
H3: Organizational learning has a significant positive impact on non-R&D innovation	Accepted
H4: Organizational learning mediates between transformational leadership and non-R&D innovation	Accepted
H4a: Organizational Learning Positively Mediates the Impact of Transformational Leadership Idealization on Non-R&D Innovation	Accepted
H4b: Organizational learning positively mediates the relationship between transformational leadership inspirational motivation and non-R&D innovation	Accepted
H4c: Organizational learning positively mediates the relationship between transformational leadership intellectual stimulation on non-R&D innovation	Accepted
H4d:Organizational learning positively mediates the relationship between transformational leadership and personalized care on non-R&D innovation	Accepted
H5: Innovation policy moderates between transformational leadership and non-R&D innovation.	Accepted
H6: Innovation policy moderates between organizational learning and non-R&D innovation.	Rejected

Table 7. (*Continued*)

5. Discussion

This study focuses on non-R&D innovation in MSEs , with TL, OL, and innovation policy as the core variables, using structural equation modeling, linear regression analysis, and the bootstrap method, this study tested research hypotheses and drew following conclusions:

Regarding H1, the study found that TL positively affects non-R&D innovation (β=0.834, p<0.001), with its four dimensions (idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration) driving non-R&D innovation through different mechanisms. This finding aligns with previous findings. Leaders with idealized influence drive "personalized service" innovation by regularly discussing customer needs with employees, thereby significantly enhancing customer satisfaction [84]. TL, through inspirational motivation, can stimulate employees' intrinsic motivation and promote innovation in non-technical areas, thereby improving overall organizational efficiency [85, 86]. Additionally, leaders enhance employees' creativity through intellectual stimulation, increasing non-R&D innovation output [87]. Furthermore, when employees feel supported by their leaders (individualized consideration), they are more willing to experiment with service innovation, process improvements, and other aspects [81]. In other words, transformational leadership, empowering employees by individualized cares, support employees through fulfilling core needs: job autonomy, ability recognition, and team belonging. That would lead employees to regard external challenges as manageable development opportunities and thus be more proactive in engaging in adaptive innovation activities.

Regarding H2, the results indicate that TL positively affects OL (β = 0.773, p < 0.001), with all four dimensions of TL influencing OL. This finding aligns with that of several empirical studies. TL promotes exploratory learning by fostering psychological safety, encouraging experimentation, and embracing failure

[19]. Through idealized influence, transformational leaders align organizational goals with personal development, motivating members to actively learn strategy-related skills [88].

Through inspirational motivation, TL shapes employees' visions, creates an innovative organizational atmosphere, and fosters OL [22]. Through intellectual stimulation, TL helps the organization balance exploratory and exploitative learning [89]. Additionally, through individualized consideration, TL enhances employees' organizational commitment, thereby promoting OL [90]. When leaders create a highly trustable workplace that makes employees concern less about sharing experiences and knowledge within the organization, employees would be more likely to invest their efforts in the organization and make more commitments to organizational learning. That propels the organization to update knowledge and skills as a whole which the business development truly needs.

Regarding H3, the research results indicate that OL has a positive impact on non-R&D innovation (β=0.750, $p<0.001$). Our findings align with those of previous studies. Cohen and Levinthal [78] argued that OL facilitates innovation activities in non-R&D areas such as process, management, and marketing innovation. Non-technical innovation relies on knowledge management, practice improvement, and external knowledge absorption within OL [91]. Learning organizations perform better in process optimization, customer relationship management, and service innovation [71, 72]. Organizational learning is essentially a collective process of knowledge transformation and experience reconstruction. Successful organizational learning practices, such as effectively interpreting external customer feedback and rendering it into specific improvement plans, help employees to enhance their recognition of their abilities on problem-solving. This positive self-awareness and collective belief are the key drive that motivates employees to continuously engage in non-R&D innovation.

Regarding H4, we found that OL partially mediated the relationship between TL and non-R&D innovation (idealized influence=0.066 (95% CI); inspirational motivation=0.137 (95% CI); intellectual stimulation=0.08 (95% CI); individualized consideration=0.067 (95% CI)). Previous research suggests that TL significantly enhances a firm's innovation performance, including non-R&D innovation, by improving OL capabilities [22]. TL shapes a learning culture through OL, encouraging employees to continuously experiment and improve, thereby enhancing their innovation and problem-solving abilities [36, 88]. For non-R&D-oriented enterprises, the mediating effect of OL may be more pronounced as these industries rely more on process optimization and market innovation [21, 41]). Particularly in MSEs, the effect of TL in driving non-R&D innovation through OL may be stronger because these enterprises depend more on flexibility and adaptability [22]. Moreover, the mediating role of OL is particularly important in dynamic environments where TL helps organizations adapt quickly to change and achieve innovation [92]. This reveals the core mechanism of the "leadership - learning - innovation" chain. Transformational leaders first meet the key needs of employees and create a supportive context at workplace. With such environment, employees would be more actively involve in knowledge sharing and in-depth reflection, which strengthens confidence in employees in innovation and teamwork. And this positive state can eventually turn to specific innovation activities in resource-constrained non-R&D innovations. Organizational learning serves as a bridge in this process, helping leadership to lead employees towards innovative actions in favorite environment.

Regarding H5, this study showed that innovation policy has a significant positive moderating effect between TL and non-R&D innovation (β=0.145, $p<0.001$). Thus, innovation policy support provided at the government or industry levels can strengthen the effect of TL on promoting non-R&D innovation. Specifically, when the external policy environment in which a firm operates supports innovation activities, such as tax incentives, financial subsidies, or technical training, transformational leaders' ability to stimulate employee innovation through behaviors such as idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration is significantly enhanced. This finding aligns with that of Bass and Riggio [93], who state that the availability of external resources can boost the impact of leadership on innovation. Policy support helps alleviate resource constraints for MSEs, making leadership motivational behaviors more feasible. However, this study also found that the moderating effect of policy support has boundary conditions. When policy tools are overly focused on R&D (such as subsidies for patent applications), their moderating effect on non-R&D innovation may weaken. Therefore, policy design should focus on balance; for example, using diversified tools such as market innovation rewards or special funds for organizational innovation to more precisely match the needs of non-R&D innovation [23].

Regarding H6, the results indicate that the moderating effect of innovation policy between OL and non-R&D innovation did not pass the significance test (β = -0.021, $p > 0.05$). This differs from the prior expectation, and a possible explanation is that, although OL itself has a significant positive effect on non-R&D innovation (β = 0.397, $p < 0.001$), external policy support did not significantly enhance the impact of this pathway. As an internal capability, the effectiveness of OL largely depends on a firm's knowledge-management mechanisms rather than on external policy interventions. For instance, learning processes such as knowledge acquisition and information distribution require firms to establish stable internal communication networks and a culture of knowledge sharing in which policy tools (such as tax incentives) cannot directly influence the micromanagement level [94]. Further analysis suggests that the moderating effect of innovation policy on OL may exhibit a "lag effect." For example, while government training subsidies may enhance employee skills in the short term, learning effects are unlikely to be sustained if a firm lacks a system to convert training outcomes into organizational memory [47]. Furthermore, the design of policy tools may not fully meet the learning needs of non-R&D innovation, while neglecting the support for market information sharing platforms or cross-industry experience exchanges, resulting in less effective organizational learning in non-technical fields (Santamaria et al., 2009)[10]. Therefore, the key to bridging the gap between macro policies and micro behaviors lies in rendering policy design at a broad scale of resource allocation into empowering enterprises at a specific business operation. It's important to facilitating enterprises to make knowledge currency flow at workplace among employees and activate teamwork learning. This method can be the core role of organizational learning as intermediary to effectively lever up employees in non-R&D innovation performance.

6. Conclusion

This study conducts an empirical analysis into 458 small and micro enterprises in the industry of software and information technology services in Zhejiang Province. The research finds that transformational leadership drives non-R&D innovation through four behavioral dimensions (idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration) with segmented manners. Specifically, idealized influence promotes service innovation by enhancing employees' sense of psychological safety, and intellectual stimulation helps to reconstruct problem-solving framework by improving technology adoption, and individualized consideration strengthens the sustainability of organizational innovation. Organizational learning plays a mediating role between the two, but organizational storage, due to path dependence, may obstacle any breakthrough innovation so that the business can undergo a bottleneck in the knowledge transformation. The moderation effect of innovation policies shows heterogeneity when functions, for example, demand-oriented policies such as government procurement amplify the role of leadership in marketing innovation by enhancing the credibility of the vision, but have no significant moderation effect on organizational learning. That indicates policies need to align with knowledge management needs. By segmenting non-R&D innovation types (such as technology adoption, marketing innovation, etc., in six categories) and verifying their compatibility with leadership dimensions, this study not only reveals the multi-dimensional paths of non-R&D innovation in applying the new theory in non-technical innovation, and provides theoretical and practical ideas for small and micro enterprises to overcome resource constraints achieving sustainable innovation.

6.1. Theoretical contributions

This study has several theoretical significances. First, we construct a multidimensional causal model of non-R&D innovations. Using the Chinese context, this study integrates six dimensions, including technology adoption, market innovation, and organizational innovation, to validate the pathway through which TL influences non-R&D innovation via OL. This model responds to Rosing et al.'s [28] call for "mediating mechanisms to explain the relationship between leadership and innovation" and provides empirical support for classifying non-R&D innovation. For example, the study found that individualized consideration has a stronger effect on organizational innovation than technology adoption; thus, leadership effects may vary by innovation type. This finding deepens the theoretical discussion on the "leadership style and innovation fit" by Jaskyte[18]. Second, this study revealed the boundary effects of innovation policies. The existing literature commonly emphasized the direct driving effect of policies on innovation [25]. However, our study found that policy support primarily promotes non-R&D innovation indirectly by enhancing leadership effectiveness rather than directly affecting OL. This conclusion challenges the "policy-learning-innovation" chain hypothesis by Czarnitzki and Hottenrott [24] and suggests that future research should focus on the context-specific application of policy tools. Third, this study extends innovation theory to MSEs. Innovation research in MSEs has long been dominated by the "resource-based view," emphasizing the core role of external resource acquisition [95]. This study shows that TL can partially offset resource disadvantages by activating internal learning and innovation cultures, echoing Hervas-Oliver et al.'s [21] discussion on the "capability basis of non-R&D innovation" and providing a new perspective on research in MSE innovation.

6.2. Practical implications

This study provides the following managerial implications for non-R&D innovation in MSEs:

First is strengthening the cultivation and application of TL. Managers of MSEs should systematically enhance four leadership capabilities: (1) enhance employees' recognition of non-technical innovation by setting moral examples and sharing vision (idealized influence); (2) use inspirational motivation to link organizational goals with personal growth, such as setting up a "Process Optimization Star" award to encourage employees' participation in incremental improvements; (3) stimulate cross-disciplinary thinking through intellectual stimulation and guide employees to reconstruct customer experience issues from a non-technical perspective; (4) implement individualized consideration by designing differentiated innovation support programs for employees in different positions. For example, provide customer data analysis training for marketing department employees, while focusing on equipment operation experience exchanges for production department employees.

Second concerns building a learning-driven non-R&D innovation system. Enterprises must establish a full-cycle learning mechanism of "knowledge acquisition—integration—application": (1) Acquire market trends and competitor information through external networks such as industry associations and customer communities; (2) use digital tools to facilitate cross-departmental information sharing, avoiding "information silos"; (3) promote tacit knowledge conversion through job rotation and cross-functional project teams and facilitate precise alignment between technology adoption and customer demand; (4) institutionalize innovation experiences, such as establishing an "innovation case library" to embed non-R&D innovation achievements into standardized processes.

Third concerns optimizing the adaptability and implementation effectiveness of the policy tools. At the government level, innovation policy design should be improved in three aspects: (1) Differentiate policy supply by developing special support plans for the six dimensions of non-R&D innovation. For example, establish "management model optimization subsidies" for organizational innovation and provide "channel expansion insurance" for market innovation; (2) create a policy-enterprise link using an "innovation diagnosis platform" to help enterprises identify key bottlenecks in non-R&D innovation and match policy resources; (3) make most use of a favorable social context to render policies into supporting tools for small and micro enterprises in growing in the local innovation networks, and promote community-based experience sharing and cross-enterprise learning to enhance their competence in interaction with customers in the social context. (4) strengthen the dynamic nature of policy evaluation by incorporating non-R&D innovation indicators as core measures of policy effectiveness, avoiding the "heavy R&D, light application" evaluation bias.

6.3. Limitations and future directions

Although this study employed various methods to enhance the reliability and validity of the sample and the research hypotheses were largely validated, some limitations remain.

First, the sample size was small. This study uses MSEs in the software and information technology service industry in Zhejiang Province as a sample. Although this industry is typical of non-R&D innovation, caution is required when generalizing the conclusions to manufacturing or traditional service industries. Additionally, the sample is dominated by enterprises with 10–50 employees, leading to some homogeneity in firm size and failing to fully capture the innovation characteristics of MSEs with more diverse sizes. Microenterprises may rely more on founders' personal traits owing to extreme resource scarcity (e.g., risk preference) than on systematic OL for non-R&D innovation [96].

Second is limitations to the data collection and design. Although a structural equation model was used to validate the relationships between the variables, the cross-sectional data failed to capture the dynamic evolution process. The mediating effect of OL may exhibit nonlinear characteristics in the long term [78]. Furthermore, this study used self-report scales to measure non-R&D innovation, which may be influenced by social desirability bias (e.g., companies tending to over-report innovation outcomes). Although CMB was excluded through Harman's single-factor test, the study did not incorporate objective data (e.g., financial performance and patent citations) for triangulation [97].

Third, the coverage of the theoretical model was insufficient. This study focused on the relationships among TL, OL, and non-R&D innovation; however, key contextual variables were not included, and the study did not differentiate between the non-R&D innovation characteristics of MSEs at different stages of development (e.g., startup, growth, and maturity). Different stages of firm development may moderate the relationship between leadership and innovation [98]. Not considering life cycle differences may have led to biased conclusions regarding the universality of leadership effects. Additionally, this study did not sufficiently segment the policy tools. The research simplified innovation policy into supply, demand, and environmental types [23] without further exploring the synergistic effects of tool combinations, such as the interaction between tax incentives and knowledge platform development.

Based on the abovementioned limitations, the following suggestions are proposed for future research:

First is to expand the research context and sample diversity. Future research could conduct cross-industry comparative studies comparing the non-R&D innovation pathways in MSEs across the manufacturing, service, and agricultural sectors to reveal how industry characteristics moderate the effect of leadership. Additionally, this study could be expanded to cross-country cultural comparisons to investigate how cultural dimensions and other factors affect the relationship between TL and non-R&D innovation. For example, in high power distance cultures, the effect of individualized consideration on employee innovation may be weakened[99].

Second is to deepen dynamic mechanism studies. Future research could explore longitudinal designs using panel data or case-tracking methods to capture the dynamic interactions between TL and innovation. For example, analyzing how the intensity of leadership style impacts firms at different stages of development (from survival to expansion) [98]. Alternatively, experimental and quasi-experimental research could be employed to compare non-R&D innovation performance before and after MSE managers receive TL training [100].

Third is to improve the theoretical model and variable system. Future studies could explore multilevel theoretical integration, such as incorporating individual-level (employee creativity), team-level (leadership style), and organizational-level (policy environment) variables into a cross-level model to examine how regional innovation policies moderate executive leadership behaviors to influence grassroots innovation practices [101]. Further investigations into the combined effects of policy tools should be conducted to test the synergistic effects of different policy combinations on non-R&D innovation.

Conflict of interest

The authors declare no conflict of interest

References

1. Alferaih A. Weight-and meta-analysis of empirical literature on entrepreneurship: Towards a conceptualization of entrepreneurial intention and behaviour. The International Journal of Entrepreneurship and Innovation. 2017;18:195-209.
2. Nursini N. Micro, small, and medium enterprises (MSMEs) and poverty reduction: empirical evidence from Indonesia. Development Studies Research. 2020;7:153-66.
3. Liu Y. The innovation dilemma and policy optimization path for small and Micro Enterprises in China. Econ Res J. 2022;57:45-60.
4. Zeng Y. The role and challenges of small and Micro Enterprises in China's national economy. Manag World. 2020;36:78-92.
5. Hu Y, Choi SL, Tan SK. The Influence of Organizational Resilience on SME Firm Performance: A Conceptual Model. Business Management and Strategy. 2024;15:205-14.
6. Cohen WM, Levinthal DA. Innovation and learning: the two faces of R & D. The economic journal. 1989;99:569-96.
7. Arundel A, Bordoy C, Kanerva M. Neglected innovators: How do innovative firms that do not perform R&D innovate. 2008:1-38.
8. Schmidt T. Non-R&D Innovators: How Do They Differ from R&D-Performing Firms? ZEW Discussion Papers. 2007:07–052.
9. Cohen E. Sensuality and venality in Bangkok: The dynamics of cross-cultural mapping of prostitution. Deviant Behavior. 1987;8:223-34.
10. Santamaría L, Nieto MJ, Barge-Gil A. Beyond formal R&D: Taking advantage of other sources of innovation in low-and medium-technology industries. Research Policy. 2009;38:507-17.
11. Sterlacchini A. Do innovative activities matter to small firms in non-R&D-intensive industries? An application to export performance. Research Policy. 1999;28:819-32.
12. Santamaría L, Nieto MJ, Rodríguez A. Non-R&D innovation in low-tech industries: The role of external knowledge. Res Policy. 2009;38:507-17.

13. Liu F. Research on the models and pathways of non-R&D innovation in small and micro enterprises. Sci Res Manag. 2013;34:112-20.
14. Ryan R, Deci E. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. The American psychologist. 2000;55:68-78.
15. Kolb DA. Experiential learning: Experience as the source of learning and development: Prentice-Hall; 1984.
16. Bass BM, Bass Bernard M. Leadership and performance beyond expectations: Free press New York; 1985.
17. Gumusluoglu L, Ilsev A. Transformational leadership, creativity, and organizational innovation. Journal of business research. 2009;62:461-73.
18. Jaskyte K. Transformational leadership, organizational culture, and innovativeness in nonprofit organizations. Nonprofit management and leadership. 2004;15:153-68.
19. Edmondson A. Psychological safety and learning behavior in work teams. Administrative science quarterly. 1999;44:350-83.
20. Eisenbeiß SA, Boerner S. A double-edged sword: Transformational leadership and individual creativity. British Journal of Management. 2013;24:54-68.
21. Hervas-Oliver J-L, Garrigos JA, Gil-Pechuan I. Making sense of innovation by R&D and non-R&D innovators in low technology contexts: A forgotten lesson for policymakers. Technovation. 2011;31:427-46.
22. García-Morales VJ, Jiménez-Barrionuevo MM, Gutiérrez-Gutiérrez L. Transformational leadership influence on organizational performance through organizational learning and innovation. Journal of business research. 2012;65:1040-50.
23. Rothwell R, Zegveld W. Industrial Innovation and Public Policy: Frances Pinter; 1981.
24. Czarnitzki D, Hottenrott H. R&D investment and financing constraints of small and medium-sized firms. Small business economics. 2011;36:65-83.
25. Fagerberg J, Fosaas M, Sapprasert K. Innovation: Exploring the knowledge base. Research policy. 2012;41:1132-53.
26. Edler J, Fagerberg J. Innovation policy: what, why, and how. Oxford Review of Economic Policy. 2017;33:2-23.
27. Deci EL, Ryan RM. Intrinsic motivation and self-determination in human behavior: Plenum Press; 1985.
28. Rosing K, Frese M, Bausch A. Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership. The leadership quarterly. 2011;22:956-74.
29. Gagné M, Deci EL. Self-determination theory and work motivation. Journal of Organizational behavior. 2005;26:331-62.
30. Ryan RM, Deci EL. Self-determination theory: Basic psychological needs in motivation, development, and wellness: The Guilford Press; 2017.
31. Connelly CE, Zweig D, Webster J, Trougakos JP. Knowledge hiding in organizations. Journal of organizational behavior. 2012;33:64-88.
32. Grant AM, Berry JW. The necessity of others is the mother of invention: Intrinsic and prosocial motivations, perspective taking, and creativity. Academy of management journal. 2011;54:73-96.
33. Burns JM, Leadership NY. Harper & row. New York1978.
34. Leithwood K. The move toward transformational leadership. Educ Leadersh. 1992;49:8-12.
35. Yukl G. Managerial leadership: A review of theory and research. Journal of management. 1989;15:251-89.
36. Portugal E, Yukl G. Perspectives on environmental leadership. The Leadership Quarterly. 1994;5:271-6.
37. Pillai P. The Malaysian state's response to migration. SOJOURN: Journal of Social Issues in Southeast Asia. 1999:178-97.
38. Bass BM, Avolio BJ. Improving organizational effectiveness through transformational leadership: sage; 1994.
39. Schumpeter JA. The Theory of Economic Development.(1934 Edition): Cambridge MA; 1912.
40. Santarelli E, Sterlacchini A. Innovation, formal vs. informal R&D, and firm size: Some evidence from Italian manufacturing firms. Small Business Economics. 1990;2:223-8.
41. Brouwer E, Kleinknecht A. Measuring the unmeasurable: a country's non-R&D expenditure on product and service innovation. Research policy. 1997;25:1235-42.
42. García-Manjón JV, Romero-Merino ME. Research, development, and firm growth. Empirical evidence from European top R&D spending firms. Research Policy. 2012;41:1084-92.
43. Chen Z, Huang S, Liu C, Min M, Zhou L. Fit between organizational culture and innovation strategy: Implications for innovation performance. Sustainability. 2018;10:3378.
44. March JG, Simon HA. Organizations: John wiley & sons; 1993.
45. Argyris C, Schön DA. A theory of action perspective: Addison-Wesley Publishing Company; 1978.
46. Fiol CM, Lyles MA. Organizational learning. Academy of management review. 1985;10:803-13.
47. Huber GP. Organizational learning: The contributing processes and the literatures. Organization science. 1991;2:88-115.
48. Montes FJL, Moreno AR, Morales VG. Influence of support leadership and teamwork cohesion on organizational learning, innovation and performance: an empirical examination. Technovation. 2005;25:1159-72.

49. Grubb D, Jackman R, Layard R. Wage rigidity and unemployment in OECD countries: Centre for Labour Economics, London School of Economics; 1982.
50. Yu S. How do accelerators impact the performance of high-technology ventures? Management Science. 2020;66:530-52.
51. Tian G. Deceleration of China's Economic Growth: Causes and Countermeasures. Frontiers of Economics in China-Selected Publications from Chinese Universities. 2019;14:3-25.
52. Freitas IMB, Von Tunzelmann N. Mapping public support for innovation: A comparison of policy alignment in the UK and France. Research Policy. 2008;37:1446-64.
53. Edelbroek R, Peters P, Blomme RJ. Engaging in open innovation: The mediating role of work engagement in the relationship between transformational and transactional leadership and the quality of the open innovation process as perceived by employees. Journal of General Management. 2019;45:5-17.
54. Alharbi BF, Al-Ashaab A. The influential factors of business development among SMEs in the Food Industry of the GCC Region. Journal of Business and Retail Management Research. 2020;14:96-113.
55. Gong H, Hassink R. Co-evolution in contemporary economic geography: Towards a theoretical framework. Regional Studies. 2019;53:1344-55.
56. Howell JM, Avolio BJ. Transformational leadership, transactional leadership, locus of control, and support for innovation: key predictors of consolidated-business-unit performance. Journal of Applied Psychology. 1993;78:891-902.
57. Li J, Strange R, Ning L, Sutherland D. Outward foreign direct investment and domestic innovation performance: Evidence from China. International Business Review. 2016;25:1010-9.
58. Waldman DA, Bass BM. Transformational leadership at different phases of the innovation process. The Journal of High Technology Management Research. 1991;2:169-80.
59. Mittal S, Dhar RL. Transformational leadership and employee creativity: Mediating role of creative self-efficacy and moderating role of knowledge sharing. Management decision. 2015;53:894-910.
60. Gong Y. Creating a greener future: the crucial role of green innovation and supply chain management in corporate sustainability. Environmental Science and Pollution Research. 2023;30:118523-34.
61. Otair M, Abualoush S, Obeidat A, Bataineh K. Improving firm's innovation performance through transformation leadership and knowledge sharing: the moderating role of absorptive capacity. Case Study Jordan. 2022;11:1693-709.
62. Noruzy A, Dalfard VM, Azhdari B, Nazari-Shirkouhi S, Rezazadeh A. Relations between transformational leadership, organizational learning, knowledge management, organizational innovation, and organizational performance: an empirical investigation of manufacturing firms. The International Journal of Advanced Manufacturing Technology. 2013;64:1073-85.
63. Aragón JAB. Organizational learning and transformational leadership in the SME context. Pers Rev. 2007;36:714-31.
64. Berson Y, Nemanich LA, Waldman DA, Galvin BM, Keller RT. Leadership and organizational learning: A multiple levels perspective. The leadership quarterly. 2006;17:577-94.
65. Seidman G, Pascal L, McDonough J. What benefits do healthcare organisations receive from leadership and management development programmes? A systematic review of the evidence. BMJ Leader. 2020;4:21-36.
66. Amitay M, Popper M, Lipshitz R. Leadership styles and organizational learning in community clinics. The Learning Organization. 2005;12:57-70.
67. Slater SF, Narver JC. Market orientation and the learning organization. Journal of marketing. 1995;59:63-74.
68. SNELL RS. Developing as a learning organization: a Hong Kong case of sensegiving and career contracts. Journal of management. 2001;27:1-41.
69. Tohidi H, Mohsen Seyedaliakbar S, Mandegari M. Organizational learning measurement and the effect on firm innovation. Journal of Enterprise Information Management. 2012;25:219-45.
70. Calantone RJ, Cavusgil ST, Zhao Y. Learning orientation, firm innovation capability, and firm performance. Industrial marketing management. 2002;31:515-24.
71. Alegre J, Chiva R. Assessing the impact of organizational learning capability on product innovation performance: An empirical test. Technovation. 2008;28:315-26.
72. Jiménez-Jiménez D, Sanz-Valle R. Innovation, organizational learning, and performance. Journal of business research. 2011;64:408-17.
73. Dodgson M. Organizational learning: a review of some literatures. Organization studies. 1993;14:375-94.
74. Alegre J, Chiva R. Linking entrepreneurial orientation and firm performance: The role of organizational learning capability and innovation performance. Journal of small business management. 2013;51:491-507.
75. Hsu Y-H, Fang W. Intellectual capital and new product development performance: The mediating role of organizational learning capability. Technological Forecasting and Social Change. 2009;76:664-77.
76. Garvin DA. Manufacturing strategic planning. California Management Review. 1993;35:85-106.

77. Berson Y, Avolio BJ. Transformational leadership and the dissemination of organizational goals: A case study of a telecommunication firm. The leadership quarterly. 2004;15:625-46.
78. Cohen WM, Levinthal DA. Absorptive capacity: A new perspective on learning and innovation. Administrative science quarterly. 1990;35:128-52.
79. Cochran WG. Matching in analytical studies. American Journal of Public Health and the Nations Health. 1953;43:684-91.
80. Vanichbuncha K. Statistics for research. Bangkok: Faculty of Commerce and Accountancy Chulalongorn University. 2006.
81. Mokhber M, Bin Wan Ismail WK, Vakilbashi A. Effect of transformational leadership and its components on organizational innovation. Iranian Journal of Management Studies. 2015;8:221-41.
82. Bass BM, Stogdill RM. Bass & Stogdill's handbook of leadership: Theory, research, and managerial applications: Simon and Schuster; 1990.
83. OECD. Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd ed.: OECD Publishing; 2005.
84. Eisenbeiss SA, Van Knippenberg D, Boerner S. Transformational leadership and team innovation: integrating team climate principles. Journal of applied psychology. 2008;93:1438.
85. Deci EL, Ryan RM. The general causality orientations scale: Self-determination in personality. Journal of research in personality. 1985;19:109-34.
86. Wang H, Tsui AS, Xin KR. CEO leadership behaviors, organizational performance, and employees' attitudes. The leadership quarterly. 2011;22:92-105.
87. Tierney P, Farmer SM. Creative self-efficacy: Its potential antecedents and relationship to creative performance. Academy of Management journal. 2002;45:1137-48.
88. Bass BM, Riggio RE. Transformational leadership: Psychology press; 2006.
89. Vera D, Crossan M. Strategic leadership and organizational learning. Academy of management review. 2004;29:222-40.
90. Avolio BJ, Gardner WL, Walumbwa FO, Luthans F, May DR. Unlocking the mask: A look at the process by which authentic leaders impact follower attitudes and behaviors. The leadership quarterly. 2004;15:801-23.
91. Tidd J, Bessant JP. Keith. Managing Innovation: integranting technological, managerial organizacional change 2005.
92. Zahra SA, Sapienza HJ, Davidsson P. Entrepreneurship and dynamic capabilities: A review, model and research agenda. Journal of Management studies. 2006;43:917-55.
93. Bass BM, Riggio RE. Transformational Leadership, 2nd ed.: Psychology Press; 2012.
94. Argote L, Miron-Spektor E. Organizational learning: From experience to knowledge. Organization science. 2011;22:1123-37.
95. Barney J. Firm resources and sustained competitive advantage. Journal of management. 1991;17:99-120.
96. Nooteboom B. Innovation and diffusion in small firms: theory and evidence. Small business economics. 1994;6:327-47.
97. Podsakoff PM, MacKenzie SB, Podsakoff NP, Lee JY. The mismeasure of man (agement) and its implications for leadership research. The leadership quarterly. 2003;14:615-56.
98. Ling Y, Simsek Z, Lubatkin MH, Veiga JF. Transformational leadership's role in promoting corporate entrepreneurship: Examining the CEO-TMT interface. Academy of Management journal. 2008;51:557-76.
99. Hofstede G, Hofstede GJ, Minkov M. Cultures and Organizations: Software of the Mind, 3rd ed.: McGraw-Hill; 2010.
100. Antonakis J, Banks G, Bastardoz N, Cole M, Day D, Eagly A, Epitropaki O, Foti R, Gardner W, Haslam A. The leadership quarterly: State of the journal. The Leadership Quarterly. 2019;30:1-9.
101. Crossan MM, Lane HW, White RE. An organizational learning framework: From intuition to institution. Academy of management review. 1999;24:522-37.