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Distributed Leadership, Career Progression and Social Mobility in China's Underdeveloped Regions

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ABSTRACT

Despite the growing interest in the problems of leadership, career development and social mobility of knowledge workers, the mechanisms of the influence of distributed (collective) leadership on professional advancement in underdeveloped regions remain insufficiently studied. The aim of the study is to assess the impact of distributed leadership on the career development and social mobility of knowledge workers in underdeveloped regions of China, as well as to determine the mediating role of self-efficacy and a collaborative climate. The study used quantitative analysis methods and partial least squares structural equation modeling (PLS-SEM) using SmartPLS 4.0 software. The empirical basis was the data from a questionnaire survey of 150 knowledge workers employed in the fields of management, education, technology and healthcare in the provinces of Guangxi and Guizhou (China). According to the results of the study, distributed leadership is a significant factor in the career development and social mobility of knowledge workers in underdeveloped regions of China. It has been revealed that distributed leadership has a direct positive impact on the career development of knowledge workers ($\beta = 0.326$; $p < 0.001$), as well as an indirect impact through the mechanisms of self-efficacy and collaborative climate. The high value of the coefficient of determination ($R2 = 0.593$) indicates the significant explanatory power of the proposed model and confirms the importance of leadership and organizational factors for professional development in conditions of resource constraints. The results obtained emphasize the need to implement distributed leadership practices, support professional independence of employees, and foster a culture of collaboration.

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Қытайдың дамымаған аймақтарындағы ұжымдық көшбасшылық, мансаптық даму және әлеуметтік ұтқырлық

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ТҮЙІН

Көшбасшылық, мансаптық даму және білім қызметкерлерінің әлеуметтік ұтқырлығы мәселелеріне қызығушылықтың артуына қарамастан, дамуы төмен өңірлер жағдайында бөлінген (ұжымдық) көшбасшылықтың кәсіби ілгерілеуге ықпал ету тетіктері жеткілікті деңгейде зерттелмеген күйінде қалып отыр. Зерттеудің мақсаты — Қытайдың дамуы төмен өңірлеріндегі білім қызметкерлерінің мансаптық дамуы мен әлеуметтік ұтқырлығына бөлінген көшбасшылықтың ықпалын бағалау, сондай-ақ өзіндік тиімділік пен коллаборативтік ахуалдың делдалдық рөлін анықтау. Зерттеуде SmartPLS 4.0 бағдарламалық қамтамасыз етуін қолдана отырып, ішінара ең кіші квадраттар негізіндегі құрылымдық теңдеулерді модельдеу (PLS-SEM) және сандық талдау әдістері пайдаланылды. Эмпирикалық база ретінде Қытайдың Гуанси және Гуйчжоу провинцияларында басқару, білім беру, технологиялар және денсаулық сақтау салаларында жұмыс істейтін 150 білім қызметкерінің сауалнама нәтижелері қолданылды. Зерттеу нәтижелері бөлінген көшбасшылықтың Қытайдың дамуы төмен өңірлеріндегі білім қызметкерлерінің мансаптық дамуы мен әлеуметтік ұтқырлығының маңызды факторы екенін көрсетті. Бөлінген көшбасшылықтың білім қызметкерлерінің мансаптық дамуына тікелей оң әсер ететіні ($\beta = 0.326$; $p < 0.001$), сондай-ақ өзіндік тиімділік пен коллаборативтік ахуал тетіктері арқылы жанама ықпал жасайтыны анықталды. Детерминация коэффициентінің жоғары мәні ($R^2 = 0.593$) ұсынылған модельдің түсіндіру қабілетінің жоғары екенін көрсетіп, ресурстық шектеулер жағдайында кәсіби дамуға көшбасшылық және ұйымдастырушылық факторлардың маңызды әсерін растады. Алынған нәтижелер бөлінген көшбасшылық тәжірибелерін енгізу, қызметкерлердің кәсіби дербестігін қолдау және ынтымақтастық мәдениетін қалыптастыру қажеттілігін айқындайды.

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Коллективное лидерство, карьерное развитие и социальная мобильность в слаборазвитых регионах Китая

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АННОТАЦИЯ

Несмотря на возрастающий интерес к проблемам лидерства, карьерного развития и социальной мобильности работников знаний, механизмы влияния распределенного (коллективного) лидерства на профессиональное продвижение в условиях слаборазвитых регионов остаются недостаточно изученными. Цель исследования — оценить влияние распределенного лидерства на карьерное развитие и социальную мобильность работников знаний в слаборазвитых регионах Китая, а также определить опосредующую роль самоэффективности и коллаборативного климата. В исследовании использованы количественные методы анализа и моделирование структурными уравнениями на основе частичных наименьших квадратов (PLS-SEM) с применением программного обеспечения SmartPLS 4.0. Эмпирической базой послужили данные анкетного опроса 150 работников знаний, занятых в сферах управления, образования, технологий и здравоохранения в провинциях Гуанси и Гуйчжоу (Китай). По результатам исследования установлено, что распределенное лидерство выступает значимым фактором карьерного развития и социальной мобильности работников знаний в слаборазвитых регионах Китая. Выявлено, что распределенное лидерство оказывает прямое положительное влияние на карьерное развитие работников знаний ($\beta = 0.326$; $p < 0.001$), а также косвенное воздействие через механизмы самоэффективности и коллаборативного климата. Высокое значение коэффициента детерминации ($R^2 = 0.593$) свидетельствует о существенной объясняющей способности предложенной модели и подтверждает важность лидерских и организационных факторов для профессионального развития в условиях ресурсных ограничений. Полученные результаты подчеркивают необходимость внедрения практик распределенного лидерства, поддержки профессиональной самостоятельности сотрудников и формирования культуры сотрудничества.

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1. Introduction

Under the background of global economic integration, the sustainable development of human capital has become the core driving force of regional development (Kovač et al., 2026). This trend is particularly critical in emerging economies such as China, where underdeveloped inland provinces face persistent brain drain and structural inequality. Knowledge workers in these areas often encounter a social and professional paradox: although they are crucial to the revitalization of the region they often struggle in the rigid hierarchical structure and the resource-limited ecosystem. These constraints embedded in the structure directly destroy the social mobility that is crucial to regional growth. The brain drain of knowledge workers and the stagnation of social mobility pose a serious threat to long-term social development.

In order to overcome the rigid hierarchy prevailing in these areas and determine the unstructured intervention measures that can go beyond these regional restrictions, this paper introduces the concept of distributed leadership and studies how leadership can be used as an institutional compensation mechanism to overcome these structural defects. Different from the traditional top-down leadership model, the decentralized and distributed leadership model gives individuals the ability to transcend the traditional top-down constraints, creating an environment in which knowledge workers can actively participate in decision-making and cooperate to solve problems (Liu et al., 2021).

The existing leadership research mainly investigates the resource-rich western environment, but it largely ignores how the leadership model works as a driving factor of social mobility under the background of structural inequality (Ly, 2020). In the environment of scarce resources in undeveloped regions, the internal mechanism of transforming distributed leadership into career progression has not been fully explored in theory.

To address this gap, this study hopes to reveal how distributed leadership, as an institutional compensation mechanism, can make up for structural disadvantages in underdeveloped regions with scarce resources, thus promoting the sustainable accumulation of regional human capital and improving social mobility. The innovation of this study lies in its integrated "psychological-situational" framework, which examines the chain intermediary role of self-efficacy and collaborative climate. This method illustrates how leadership can alleviate the social imbalance in underdeveloped regions by cultivating individual initiative and collective synergy. The discussion of these dynamic mechanisms contributes to the literature on the sustainability of human capital, and provides reference suggestions for promoting social mobility and regional development in developing countries such as China under the background of ongoing social transformation. The aim of the study is to assess the impact of distributed leadership on the career development and social mobility of knowledge workers in underdeveloped regions of China, as well as to determine the mediating role of self-efficacy and a collaborative climate.

2. Literature review

Leadership research has evolved considerably over time, moving from early individual-centered perspectives toward more collaborative and participatory approaches. Early leadership theories, including great man theory, trait theory, and behavioral theory, conceptualized leadership

as a function of individual characteristics, managerial qualities, or behavioral patterns of a single leader. However, subsequent theoretical developments increasingly emphasized teamwork, collective interaction, and shared responsibility, leading to a shift toward leadership models centered on distributed participation and collaborative decision-making (Leithwood et al., 2009; Harris et al., 2022; Somani, 2024). In this resource-limited ecosystem, leadership acts as a substitute for institutional gaps (Sharmelly, 2016) and compensates for weak external support systems through internal organizational mechanisms.

Unlike traditional vertical leadership, which concentrates power in a single executive, distributed leadership conceptualizes leadership as an extended social practice that spans multiple organizational members. This theoretical turn is consistent with the theory of human capital, which holds that economic development depends not only on material resources, but also on individual knowledge, skills and health (Abrha & Weldeyohans, 2025). However, the classical human capital theory assumes frictionless flows of talent, ignoring structural obstacles such as institutional constraints in underdeveloped areas that hinder career development (Bourguignon & Platteau, 2023). However, this alternative mechanism has not been explored sufficiently in existing distributed leadership research.

Distributed leadership is a leadership model in which the leadership function is not concentrated on a single leader but shared among multiple members of the organization and implemented in a decentralized manner (Woodier & Thuesen, 2024). This model emphasizes the interaction between individuals and the environment, and regards leadership as the collaborative result of multi-agent participation and collective action. Its core features are shared responsibility, collaborative decision-making, resource sharing, and mutual support among members (Zhao et al., 2025). Existing research has confirmed that distributed leadership positively impacts individual and organizational outcomes. At the individual level, distributed leadership can significantly improve employees' job satisfaction, organizational commitment and professional growth level (Liu et al., 2021); For knowledge workers, distributed leadership can also provide them with more sufficient independent decision-making space and career development opportunities, and then promote their career progress (Nguyen et al., 2025). At the organizational level, distributed leadership helps to stimulate organizational innovation, improve organizational performance and enhance organizational dynamic adaptability (Bektaş et al., 2020).

Contemporary literature provides a multi-theoretical perspective on the operating mechanism of distributed leadership. Harris et al. (2022) emphasize the interactive nature of leadership and argue that it is a process of co-construction among leaders, followers, and situations. In contrast, Braut et al. (2022) focus more on the core role of coordinated action and spontaneous cooperation in distributed leadership, from the perspective of activity theory. Despite the above theoretical differences, relevant empirical studies have consistently found that distributed leadership can effectively promote organizational adaptability and individual professional development. Western research generally confirms that distributed leadership can play an active role in education and in resource-rich enterprises, but its applicability in emerging economies with pronounced hierarchical characteristics remains to be tested (Leithwood et al., 2009; Tian et al., 2020). Some scholars have pointed out that decentralized decision-making may conflict with the cultural norms of high power distance, but some studies believe that in this kind of situation, distributed leadership can just become an effective mechanism to break through the rigidity of organizational structure (Or & Berkovich, 2023; Javed et al., 2025). This theoretical tension clearly

shows the need to conduct an in-depth study of distributed leadership in underdeveloped areas of China, as these areas are not only influenced by traditional hierarchical culture but also face the practical pressures of modernization.

Career progression refers to the process by which individuals achieve upward mobility in their careers, including promotions, salary increases, skill development, and enhanced professional reputation (Hirschi et al., 2020). The theory of human capital regards career progression as a function of individual skill accumulation and productivity improvement (Deming, 2022), while the theory of social cognition highlights individual subjective initiative and thinks that career progression depends on self-efficacy belief and active behavior (Yiming et al., 2024). Although both theories explain the driving mechanism of career progression, there are obvious differences in how to treat structural constraints: although the human capital perspective admits that the market is imperfect, it pays less attention to the regulatory role of organizational climate in individual career progress under the situation of scarce resources (Luwei & Huimin, 2024). Social cognitive theory emphasizes that self-efficacy is the key psychological mechanism for individuals to cope with unfavorable environment. For knowledge workers in underdeveloped regions, their career development is not only reflected in objective results such as job promotion and salary increase, but also in subjective experiences such as professional growth, work autonomy and job achievement. Moreover, objective career indicators are often closely related to individual psychological state and collective support at the organizational level, so it is necessary to integrate a comprehensive theoretical framework from the perspective of human capital and social cognition. Existing research indicates that the career development of knowledge workers is influenced by both personal and organizational factors. The personal level includes self-efficacy, professional skills and professional motivation (Darling-Hammond et al., 2017), while the organizational level includes leadership style, organizational culture and training support. Among them, distributed leadership, as a key organizational situational factor, can effectively promote the career progress of knowledge workers by providing resource support and development opportunities (Tian et al., 2020).

Self-efficacy originates from Bandura's social cognitive theory and refers to an individual's belief in their ability to successfully organize and execute the actions necessary to accomplish specific goals and tasks (Bandura, 1997). Within social cognitive theory, self-efficacy is regarded as a key psychological mechanism shaping motivation, behavioral persistence, and individual responses to challenges. Empirical research consistently demonstrates that self-efficacy is an important determinant of career-related behaviors and professional development. Studies show that higher self-efficacy promotes individuals' willingness to pursue challenging tasks, cope with difficulties, engage in skill development, and sustain career-related motivation (Scott & Cervone, 2024). In organizational settings, self-efficacy has been linked to career advancement, work engagement, professional growth, and adaptability to changing work environments (Darling-Hammond et al., 2017). Consequently, self-efficacy may play an important role in facilitating career progression among knowledge workers.

In the field of leadership research, self-efficacy often serves as a mechanism that translates structural opportunities at the organizational level into behavioral motivation at the individual level (van Veen et al., 2020). However, most previous studies regard self-efficacy as an isolated variable, ignoring its linkage effect on collective organizational attributes. From the perspective of social cognitive theory, distributed leadership may enhance self-efficacy through several

mechanisms. First, participatory decision-making enables employees to contribute to organizational planning and implementation processes, strengthening perceptions of control and competence (Fan & Chu, 2025). Second, distributed leadership encourages mutual support, constructive feedback, and emotional reassurance among organizational members, thereby reducing uncertainty and increasing confidence in professional capabilities (Lin, 2022). Third, distributed leadership may expand access to professional development opportunities, skills training, and workplace learning, which further reinforces self-efficacy beliefs (van Veen et al., 2020).

Collaborative climate refers to the organizational atmosphere characterized by mutual trust, resource sharing, cooperative problem-solving, and mutual support among members (Wang et al., 2025), and it derives from social exchange and social capital theories. If self-efficacy reflects the psychological capital at the individual level, then the cooperative atmosphere represents the relational capital embedded in the organizational network, which together constitute an important situational foundation for individual development. Early research paid more attention to the influence of individual ability on professional development, while recent academic views emphasized that a positive cooperative atmosphere is not a subsidiary product of professional development, but a structural pre-factor to promote professional growth, which plays a key supporting role in knowledge exchange and sharing among members (Liu & Sun, 2025). A positive collaborative climate can promote knowledge exchange and sharing among members, improve work efficiency and innovation capabilities, and enhance organizational cohesion and stability (Cao et al., 2025). At the same time, a collaborative atmosphere can provide knowledge workers with more opportunities for teamwork and project participation, thereby enhancing their professional reputation and career development opportunities (Zhao et al., 2025).

Based on the results of the theoretical analysis, it has been established that distributed (collective) leadership is an important organizational mechanism that promotes the career development and social mobility of knowledge workers in conditions of institutional constraints and resource scarcity. It is shown that the evolution of leadership theories has shifted from individually oriented models to collective and distributed forms of interaction based on joint decision-making, responsibility sharing, and organizational cooperation. Existing research mainly focuses on organizations with sufficient resources, while the mechanisms of distributed leadership in underdeveloped regions and the institutional constraints involved have not been sufficiently studied. This confirms the need for further analysis of the role of distributed leadership as a tool for strengthening human capital, professional development, and reducing structural barriers to social mobility in underdeveloped regions of China.

3. Research methods

This study adopts a quantitative research method. A questionnaire was designed to collect raw data. In the questionnaire, all items are scored on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The research was conducted in the Chinese mainland, with special attention to Guangxi and Guizhou provinces, which were selected as the empirical representative cases of underdeveloped regions. The classification of these regions as “underdeveloped” is grounded in a multi-dimensional rationale. First, from the perspective of economic development gradient, according to the relevant statistical caliber of China Statistical Yearbook (2025), the per capita GDP of the two places has been in the lower position of 31 provincial administrative regions in China for

a long time, which can be regarded as the "low growth pole" in the regional economic structure of China (China Statistical Yearbook, 2025). Secondly, from the perspective of policy and systems, both places fall within the key coverage areas of the "western development strategy", and there are more pronounced resource constraints and institutional gaps in the industrial base, public service supply, and availability of organizational resources than in the eastern coastal areas. Third, judging from the consequences of social development, the superposition of the aforementioned structural conditions makes the two places face more pronounced risks of brain drain, and the lack of industrial agglomeration and professional infrastructure has further slowed the pace of knowledge workers' professional development. Based on this, this study focuses on knowledge workers in the two places, including technical personnel, managers, and professionals in fields such as education, healthcare, and technology, to ensure that the sample can fully reflect the socio-economic pressure borne by professional groups in underdeveloped areas, thus improving the situational validity of the analysis of career development and social mobility mechanisms.

The data collection was carried out with a scheduled process. The researchers contacted relevant organizations and institutions in underdeveloped regions to obtain their support and cooperation. The questionnaires were distributed to knowledge workers through online platforms. Before the participants filled out the questionnaires, the researchers explained the purpose and significance of the study and assured them that the survey data would be used only for academic research and kept confidential. The participants filled out the questionnaires voluntarily. After the data collection, the researchers finally obtained 150 valid questionnaires. The sample size significantly exceeds the requirements of both the 10-times rule at 33 samples and the G*Power analysis at 77 samples. Thus, the actual sample of 150 provides high statistical power and ensures the stability of the PLS-SEM results.

The empirical model of this study is shown in Figure 1.

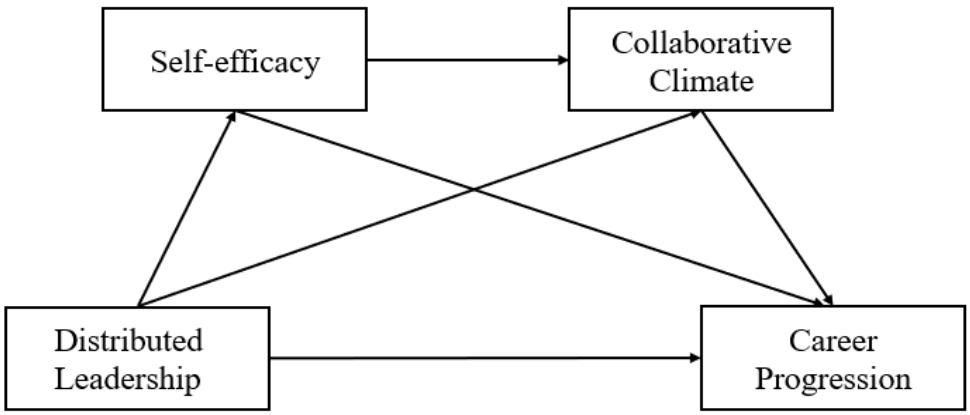


Figure 1. Conceptual model of distributed leadership and career progression.

The exogenous latent variable is distributed leadership; the endogenous latent variable is career progression; self-efficacy and collaborative climate are used as mediating variables in sequence. The model includes four direct paths and three mediation paths, which are used to test direct effects, independent mediation effects, and serial mediation effects.

This study proposes the following hypotheses:

H1: Distributed leadership has a significant positive effect on the career progression of knowledge workers in underdeveloped regions.

H2: Self-efficacy mediates the relationship between distributed leadership and career progression.

H3: Collaborative climate mediates the relationship between distributed leadership and career progression.

H4: Self-efficacy and collaborative climate play a serial mediating role between distributed leadership and career progression.

Partial least squares structural equation modeling (PLS-SEM) was adopted to evaluate the measurement model. The measurement model mainly evaluates indicator loadings, composite reliability (CR), average variance extracted (AVE), Fornell-Larcker criterion, and HTMT. The structural model mainly evaluates path coefficients, the coefficient of determination (R^2), predictive relevance (Q^2), effect size (f^2), and mediation effects based on 5000 bootstrap samples.

4. Results

In terms of gender, females accounted for 60.0% (n = 90) and males 40.0% (n = 60), reflecting the gender composition characteristics of knowledge workers in underdeveloped regions. For age distribution, the majority of respondents were concentrated in the 31–40 (38.7%, n = 58) and 41–50 (38.0%, n = 57) age groups, while those aged 21–30 accounted for 8.0% (n = 12) and 51–60 for 15.3% (n = 23), indicating a middle-aged-dominated workforce with rich practical experience. Regarding working experience, 40.7% (n = 61) had 16–20 years of experience, 26.0% (n = 39) had 11–15 years, 17.3% (n = 26) had ≥21 years, 9.3% (n = 14) had 6–10 years, and only 6.7% (n = 10) had 1–5 years. In general, this demographic composition, characterized by an experienced workforce primarily in the middle of their careers, ensures that respondents have sufficient organizational contacts to provide a meaningful assessment of leadership dynamics, collaborative climate, self-efficacy, and career progression within the specific socio-economic context of Guangxi and Guizhou provinces.

To establish the representativeness of the sample, the demographic characteristics of the 150 valid respondents are summarized in Table 1.

Table 1. Demographic profile of respondents.

Variable	Category	Frequency	Percentage
Gender	Male	60	40.0
	Female	90	60.0
Age	21-30	12	8.0
	31-40	58	38.7
	41-50	57	38
	51-60	23	15.3
Working experience	1-5 years	10	6.7
	6-10 years	14	9.3
	11-15 years	39	26.0
	16-20 years	61	40.7
	≥21 years	26	17.3

Note: compiled by the authors.

After analyzing the demographic characteristics of the sample, the quality of the measurement model was assessed. For this purpose, the factor loadings of the indicators, indicators of internal consistency, as well as the average extracted variance (AVE) were analyzed. The factor loadings, internal consistency coefficients, and convergent validity indicators are presented in Table 2.

Table 2. Measurement Model: Loadings, Cronbach's α, CR, and AVE.

Construct	Items	Factor Loading	Cronbach's α	CR	AVE
Distributed Leadership (DL)	DL1	0.841	0.892	0.914	0.621
	DL2	0.855	-	-	-
	DL3	0.822	-	-	-
	DL4	0.798	-	-	-
	DL5	0.816	-	-	-
Self-Efficacy (SE)	SE1	0.863	0.905	0.927	0.657
	SE2	0.877	-	-	-
	SE3	0.849	-	-	-
	SE4	0.824	-	-	-
	SE5	0.831	-	-	-
Collaborative Climate (CC)	CC1	0.852	0.899	0.921	0.638
	CC2	0.868	-	-	-
	CC3	0.835	-	-	-
	CC4	0.819	-	-	-
	CC5	0.827	-	-	-
Career Progression (CP)	CP1	0.836	0.887	0.910	0.609
	CP2	0.844	-	-	-
	CP3	0.818	-	-	-
	CP4	0.805	-	-	-
	CP5	0.823	-	-	-

Note: compiled by the authors.

As shown in Table 2, all standardized factor loadings of the measurement items ranged from 0.798 to 0.877, exceeding the recommended threshold of 0.700, indicating satisfactory indicator reliability. For internal consistency reliability, Cronbach's α values for all constructs (distributed leadership: 0.892; self-efficacy: 0.905; collaborative climate: 0.899; career progression: 0.887) were greater than 0.700, and composite reliability (CR) values ranged from 0.910 to 0.927, all above 0.800, confirming high internal consistency. Convergent validity was supported, as the average variance extracted (AVE) values for all constructs ranged from 0.609 to 0.657, meeting the criterion of AVE ≥ 0.500. Overall, these results confirm that the measurement instrument demonstrates powerful psychometric properties and provides a reliable basis for subsequent structural model analysis.

To further establish discriminant validity and confirm that each construct captures a distinct theoretical concept, two complementary assessment methods were applied. The results of the Fornell–Larcker criterion are presented in Table 3.

Table 3. Discriminant Validity (Fornell-Larcker Criterion).

Construct	DL	SE	CC	CP
Distributed Leadership	0.788			
Self-Efficacy	0.652	0.810		
Collaborative Climate	0.628	0.635	0.799	
Career Progression	0.684	0.702	0.693	0.780

Note: compiled by the authors.

As presented in Table 3, the square root of the AVE for each construct was greater than its inter-construct correlation coefficients, satisfying the Fornell-Larcker criterion. The results show that all the studied indicators differ well from each other and measure different aspects of the model. According to the Fornell–Larcker criterion, the values along the diagonal (0.788, 0.810, 0.799, 0.780) turned out to be higher than the relationships between the constructions, which confirms sufficient discriminant validity. Further, Table 4 shows that all HTMT values were below the conservative threshold of 0.850, ranging from 0.689 to 0.751, providing robust evidence of discriminant validity.

Table 4. Discriminant Validity (HTMT Values).

Construct Pair	HTMT Value
DL – SE	0.712
DL – CC	0.689
DL – CP	0.734
SE – CC	0.697
SE – CP	0.751

Note: compiled by the authors.

The values obtained range from 0.689 to 0.751, which is lower than the recommended threshold. The highest value is observed between self-efficacy and career advancement (0.751), and the lowest is between distributed leadership and a collaborative climate (0.689).

When the reliability and validity of the measurement model are established, the structural model is tested to evaluate the hypothetical relationship. Table 5 reports the path coefficient, t value and significance level of all direct and indirect effects.

Table 5. Structural model path coefficients hypothesis testing.

Path	β	t-value	p-value
Direct Effect: DL → CP	0.326	6.89	< 0.001
Indirect Effect 1: DL → SE → CP	0.251	5.67	< 0.001
Indirect Effect 2: DL → CC → CP	0.227	5.12	< 0.001
Serial Indirect Effect: DL → SE → CC → CP	0.149	4.36	< 0.001

Note: compiled by the authors.

The direct effect of distributed leadership on career progression was significantly positive (β = 0.326, t = 6.89, p < 0.001), which supports hypothesis 1. This shows that even in the resource-constrained environment of underdeveloped regions in China, distributed leadership has a substantial and direct impact on the career trajectory of knowledge workers. For the indirect path, the mediating effect of self-efficacy (DL → SE → CP) is significant (β = 0.251, t = 5.67, p < 0.001), which supports hypothesis 2. This discovery shows that psychological empowerment through enhancing self-confidence is the main channel for leadership to transform into career progression. The mediating effect of collaborative climate (DL → CC → CP) is also significant (β = 0.227, t = 5.12, p < 0.001), which supports hypothesis 3. This proves that organizational climate is a key situational path, and leadership-driven trust and cooperation promote professional growth. Notably, the serial indirect effect (DL → SE → CC → CP) was also statistically significant (β = 0.149, t = 4.36, p < 0.001), supporting the hypothesized dual-mediating mechanism. This series of intermediary paths verify the proposed "psychological-situational" framework, indicating that distributed leaders first

activate individual psychological capital (self-efficacy), then cultivate collective organizational capital (collaborative climate), and finally reach the peak in career progression.

In order to evaluate the overall explanatory power and prediction ability of the structural model, the determining coefficient (R) and the Q value of Stone-Geisser are calculated. These results are listed in Table 6.

Table 6. Explanatory power and predictive relevance.

Endogenous variable	R^2	Adjusted R^2	Q^2
Self-Efficacy	0.425	0.419	0.346
Collaborative Climate	0.561	0.554	0.428
Career Progression	0.593	0.578	0.452

Note: compiled by the authors.

As illustrated in Table 6, the coefficient of determination (R^2) values were 0.425 for self-efficacy, 0.561 for collaborative climate, and 0.593 for career progression, indicating that the model explains 42.5%, 56.1%, and 59.3% of the variance in the respective endogenous variables. All adjusted R^2 values were close to the unadjusted values, confirming model stability. The Stone-Geisser Q^2 values, obtained via blindfolding procedures, were 0.346 (self-efficacy), 0.428 (collaborative climate), and 0.452 (career progression), all greater than zero, demonstrating the model's strong predictive relevance for all endogenous constructs. An high explanatory power R^2 value of 0.593 further emphasizes the explanatory depth of the model, and reveals that most of the differences in career trajectories are explained by the synergy of distributed leadership, individual psychological institutions and collectives. This empirical robustness proves that the institutional compensation framework is a powerful theoretical lens, and that it has the ability to capture complex organizational mechanisms, which are conducive to achieving career progress in the social ecosystem of China's backward areas with limited resources.

The results of this study show that distributed leadership can directly and positively predict the career progression of knowledge workers in underdeveloped regions, which means that strengthening distributed leadership practice can effectively promote the career growth of knowledge workers. Distributed leadership improves employees' sense of participation, autonomy, and support by flattening management, sharing decision making power, and encouraging collaborative participation, thereby creating favorable conditions for career progression.

Self-efficacy plays a significant independent mediating role. Distributed leadership enhances employees' confidence in their professional abilities by providing practical opportunities, positive feedback, and growth space. High self efficacy enables individuals to actively pursue career goals, meet challenges, and continuously improve their abilities, thus promoting career progression.

Collaborative climate also plays a significant independent mediating role. Distributed leadership helps shape an organizational atmosphere of mutual trust, open communication, and resource sharing. In a good collaborative climate, knowledge workers can more smoothly carry out knowledge exchange, peer learning, and cooperative innovation, which helps improve professional ability and career development space.

More importantly, self efficacy and collaborative climate form a significant serial mediation mechanism. Distributed leadership first enhances individual self efficacy, and high self efficacy further promotes the formation of a collaborative climate, which ultimately promotes career progression. This means that the individual psychological path and the organizational situational

path are interconnected and successive, rather than independent of each other. The improvement of individual psychological capital helps to better activate the positive role of the organizational situation.

The overall model has a high explanatory power, with R^2 reaching 0.593, indicating that the research model has strong explanatory power for career progression in the context of underdeveloped regions. All four hypotheses are supported.

5. Discussion

This study reveals how distributed leadership can function as a context-sensitive leadership mechanism in mainland China's underdeveloped Guangxi and Guizhou provinces by promoting knowledge workers' career progression through a psychological–situational transmission process. In addition to the internal achievements of the organization, the career progression in areas with limited resources also represents the micro-level foundation of human capital sustainability and upward social mobility, which is the core of long-term regional development under the condition of structural inequality.

First of all, the research results confirm the positive and direct influence of distributed leadership on career progression, and extend the empirical applicability of distributed leadership theory to the environment with scarce resources. Although the previous research mainly investigated the distributed leadership in the environment with relatively rich resources, our results show that distributed leadership may be particularly valuable in underdeveloped regions because it can partially compensate for limited development opportunities and limited organizational resources.

Second, this study clarifies the dual mediating paths of self-efficacy and collaborative climate. The results show that distributed leadership not only acts on individual career development through psychological empowerment but also provides situational support through shaping a collaborative climate. This helps to explain how leadership practices affect individual career results from the combination of internal and external factors.

Third, the serial mediation model reveals the continuous transmission mechanism from distributed leadership to self-efficacy to collaborative climate to career progression. This means that the improvement of individual self-efficacy is the premise of forming a collaborative climate, and the collaborative climate further promotes career development. This discovery shows that in underdeveloped regions, cooperation is not just an organizational giving; On the contrary, it is a sudden situational asset that may need to be cultivated through psychological activation and distributed influence. Conceptually, this provides evidence for understanding distributed leadership as an institutional compensation mechanism, which alleviates structural disadvantages by giving knowledge workers the right to speak, support and develop.

In terms of practical implications, organizations in underdeveloped regions should actively promote distributed leadership practices, including delegating decision-making power, encouraging employee participation, supporting professional autonomy, and strengthening collaborative communication to create more opportunities for competence demonstration and career-related learning. At the same time, Managers should also invest in strengthening employees' self-efficacy through structured development tasks, timely feedback and visible recognition mechanism. At the same time, organizations should deliberately create a collaborative atmosphere characterized by mutual trust and resource sharing, such as peer guidance, knowledge sharing

procedures and joint problem-solving mechanisms. In a word, these interventions may help to reduce the risk of brain drain and improve the stability of regional talents, thus supporting broader social development goals.

This study has certain limitations. First, it adopts a cross-sectional design, which cannot fully determine the causal relationship. Second, the sample is drawn from Guangxi and Guizhou which may limit the generalizability of the conclusions to other regions or different national contexts. Third, other potential variables such as institutional support and cultural values are not included. Future research can adopt a longitudinal design, expand the sample scope, and introduce moderating variables for further analysis.

6. Conclusions

This study constructs and verifies a PLS-SEM model of distributed leadership affecting career progression, with self-efficacy and collaborative climate as serial mediators. Based on a sample of 150 knowledge workers in underdeveloped provinces Guangxi and Guizhou, the results show that distributed leadership can directly promote career progression, and can also indirectly promote career progression through the independent mediation of self-efficacy and collaborative climate, as well as the serial mediation of the two. The model has high explanatory power and predictive ability.

Theoretically, this study expands the distributed leadership, and specifically illustrates a psychological-situational mechanism, through which leadership practice is transformed into career-related mobility under structural constraints. By doing so, it helps to better understand that leadership is an institutional compensation mechanism to support the sustainability of human capital and social mobility in underdeveloped regions. As a matter of fact, the research results show that organizations should institutionalize distributed leadership, strengthen employees' self-efficacy through developing and recognizing practices, and cultivate a collaborative climate that can realize knowledge sharing and mutual support. Such efforts may help to retain knowledge workers, relieve the pressure of brain drain and enhance the vitality of regional development.

Despite the results, the study has a number of limitations. Firstly, the analysis is based on data collected in selected underdeveloped regions of China, which may limit the possibility of extending the findings to other socio-economic conditions. Secondly, the study relies on a cross-sectional design, which does not allow us to fully trace the causal relationships between distributed leadership, self-efficacy, collaborative climate and career development. In the future, it seems promising to conduct comparative interregional studies, expand the sample, and include additional factors related to the institutional environment, organizational culture, and socio-economic development of the territories.

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