



## OPEN ACCESS

## EDITED BY

Jianrong Wang,  
Shanxi University, China

## REVIEWED BY

Qiwei Wang,  
Zhengzhou University of Light Industry,  
China  
Jingtao Fu,  
Hainan University, China

## \*CORRESPONDENCE

Mengyun Wu,  
✉ [mewu@ujs.edu.cn](mailto:mewu@ujs.edu.cn)

RECEIVED 17 September 2023

ACCEPTED 17 October 2023

PUBLISHED 31 October 2023

## CITATION

Zhang L, Wu M, Li S, Liu R and Zhu Y (2023), Exploring the dynamics of role transition of employees in family businesses through the evolutionary game theory.

*Front. Phys.* 11:1295646.

doi: 10.3389/fphy.2023.1295646

## COPYRIGHT

© 2023 Zhang, Wu, Li, Liu and Zhu. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Exploring the dynamics of role transition of employees in family businesses through the evolutionary game theory

Linrong Zhang<sup>1,2</sup>, Mengyun Wu<sup>3\*</sup>, Shiyu Li<sup>1</sup>, Ruiwen Liu<sup>1</sup> and Yuqing Zhu<sup>1</sup>

<sup>1</sup>School of Finance and Economics, Jiangsu University, Zhenjiang, China, <sup>2</sup>School of Economics and Management, Tongji University, Shanghai, China, <sup>3</sup>School of Accounting, Shanghai Lixin University of Accounting and Finance, Shanghai, China

This investigation delves into the dynamic optimization of the progression from outsider to insider status within the context of family businesses. Utilizing a dynamic game model that incorporates three agents—leaders, insiders, and outsiders—it conducts a rigorous examination of the optimal pathway for the status transition of outsider employees in family businesses. The paramount objective of this study is to generate theoretical insights that may inform the optimization of human resources management and thereby bolster the overall performance of family businesses. The key findings of the research are as follows: 1) Outsider employees necessitate support from both leaders and insiders for a successful elevation in ranks. A collaborative relationship with insiders significantly enhances their performance. 2) The harmonious functioning of the workplace demands concerted efforts from all parties—leaders, insiders, and outsiders. The upward mobility of outsiders is contingent upon synergistic cooperation amongst all stakeholders. 3) A myriad of factors such as potential costs, benefits, and favoritism heavily influence the degree to which leaders endorse the upward mobility of outsiders. 4) Encouraging outsiders to move up in the ranks can instigate a sense of urgency among insiders, serving as a deterrent against complacency. This urgency can act as a catalyst for insiders to enhance their performance and mitigate the perceived threat to their own status.

## KEYWORDS

dynamic optimization, family businesses, differential leadership, evolutionary game, optimal pathway

## 1 Introduction

Family businesses, representing a prevalent organizational form, contribute significantly to China's economic development by virtue of their quantity and substantial contribution to the Gross Domestic Product (GDP). Leadership, an essential organizational context factor, exhibits variations across different social and organizational settings, largely attributable to their unique cultural nuances. In this landscape, Differential Leadership emerges as a leadership style deeply rooted in the Chinese cultural milieu and social structure, wielding considerable influence over the survival and long-term growth of family businesses. This approach entails leaders categorizing employees into two groups, “insiders” and “outsiders”, predicated on factors such as relational proximity, loyalty, and talent. This categorization often results in preferential treatment towards insiders in

management practices and resource allocation [1]. Research indicates that this insider-outsider dichotomy instigates an out-group favoritism among outsiders, fueling their desire to attain insider status [2]. Given the permeable boundaries between the two categories, outsiders are often motivated to strive for upward mobility, rendering the status transition a dynamic process. The transition from outsider to insider is a challenging journey, demanding consistent effort and a long-term commitment to surpass the established classification criteria. Outsiders typically employ an upward mobility strategy [3], exhibiting proactive attitudes in job performance and interpersonal interactions [4]. If sufficiently recognized and supported by leaders and insiders, their behavior can potentially enhance overall employee performance, mitigating conflicts and negative impacts [5]. Therefore, to facilitate the transition of outsiders to insider status, active collaboration between the two groups is encouraged. This dynamic optimization of upward mobility involves multiple agents and is a crucial aspect of maintaining equilibrium in the organizational structure.

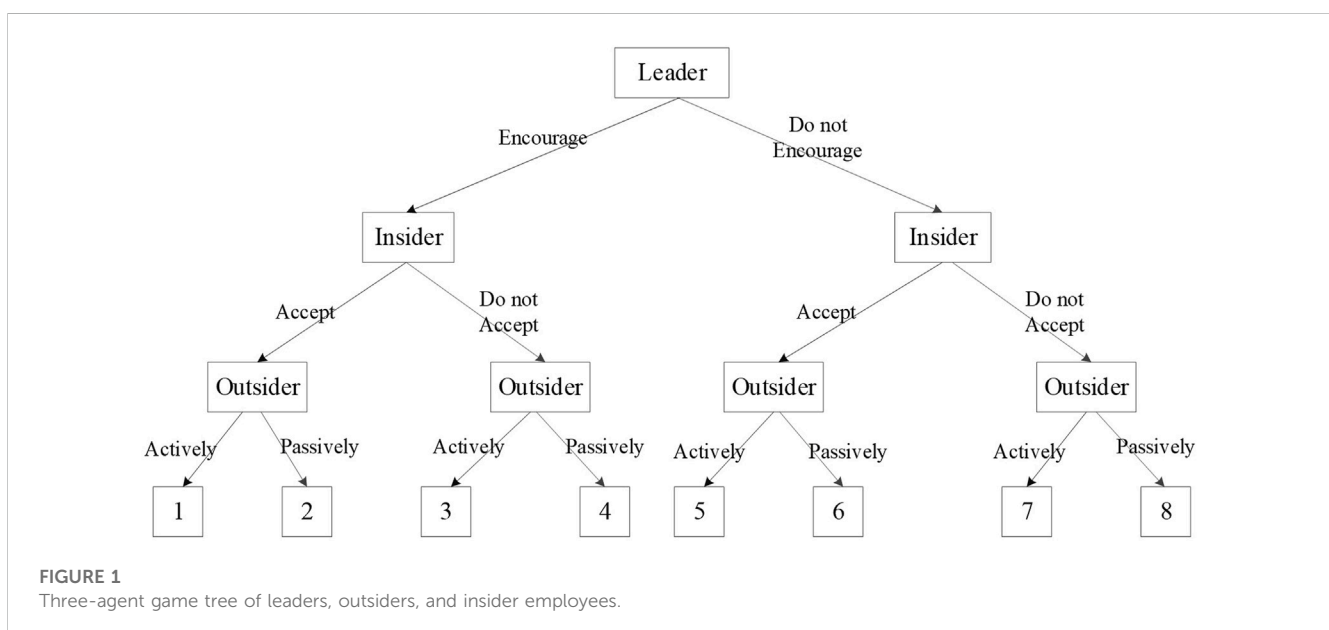
The transition from outsider to insider status within an organization constitutes a multi-agent game, necessitating the reconciliation of divergent interests to achieve equilibrium. In this context, differential leadership assumes the pivotal role of decision-making and strategizing, acting as the organization’s representative. Insiders, functioning as *de facto* leaders within their teams, establish substantial leadership relationships with outsiders [6,7]. The upward mobility of outsider employees to insider status mandates the collaborative involvement of leaders, insiders, and outsiders, thus establishing a dynamic interplay among them. To investigate this phenomenon, this study adopts dynamic game theory and identifies leaders, insider employees, and outsider employees as the three game agents. A tripartite dynamic game model is constructed to scrutinize the game relationships and strategic choices among these agents. The ultimate aim of this exploration is to elucidate the path optimization of outsider employees’ transition to insider status. It was found that the mobility of external employees’ status not only does not reduce

employee performance, but also can further improve employee performance based on the existing level, due to the efforts and input made by external employees, as well as the cooperation and interaction between them and internal employees. The insights gleaned from this study hold significant implications for the enhancement of human resources management strategies and the overall performance of family businesses.

## 2 The methods

In the context of this study, leaders, insider employees, and outsider employees are considered as participants in the transition from outsider to insider status. Each participant has a set of strategies: leaders can either encourage the status transition of outsiders ( $D_1$ ) or refrain from doing so ( $D_2$ ), with respective probabilities of  $x$  and  $1-x$ . Insider employees can accept the status transition of outsiders ( $E_1$ ) or resist it ( $E_2$ ), with respective probabilities of  $y$  and  $1-y$ . Outsider employees can actively engage in status transition ( $F_1$ ) or participate passively ( $F_2$ ), with respective probabilities of  $z$  and  $1-z$ . Here,  $0 \leq x, y, z \leq 1$ . The study presumes that the three agents are rational, each seeking to maximize their individual interests during the status transition process. Leaders aim to amplify team performance through member collaboration, enhancing leadership efficiency and personal benefits. Insider employees are primarily interested in improving their own performance, reaping benefits, and preserving their insider status. Outsider employees seek to boost their performance, gain benefits, and achieve upward mobility to become insiders.

Given the inherent incompleteness of information in practical game scenarios, the study assumes that despite having worked together for an extended period, leaders, insider employees, and outsider employees possess incomplete information about each other. As the *de facto* organizational representative, differential leadership assumes the role of decision-making. Insiders function as “colleague leaders,” establishing factual leadership relations with



**TABLE 1** Payoff matrix for different strategy profile of leader, insider and outsider.

Strategy profile	Leader	Insider	Outsider
(Encourage, accept, actively)	$\Delta_{11} = \eta(V + \pi_1) - G$	$\Delta_{12} = S + \theta A_1 + G - B$	$\Delta_{13} = R + \zeta Q_1 - \lambda C_0$
(Encourage, accept, passively)	$\Delta_{21} = \eta V - G$	$\Delta_{22} = S + G$	$\Delta_{23} = R$
(Encourage, do not accept, actively)	$\Delta_{31} = \eta(V + \pi_1)$	$\Delta_{32} = S + \theta A_2$	$\Delta_{33} = R + \zeta Q_2 - \lambda D_0$
(Encourage, do not accept, passively)	$\Delta_{41} = \eta V$	$\Delta_{42} = S$	$\Delta_{43} = R$
(Do not encourage, accept, actively)	$\Delta_{51} = \eta(V + \pi_2)$	$\Delta_{52} = S + \theta A_1 - B$	$\Delta_{53} = R + \zeta Q_1 - \lambda C_0$
(Do not encourage, accept, passively)	$\Delta_{61} = \eta V$	$\Delta_{62} = S$	$\Delta_{63} = R$
(Do not encourage, do not accept, actively)	$\Delta_{71} = \eta(V + \pi_2)$	$\Delta_{72} = S + \theta A_2$	$\Delta_{73} = R + \zeta Q_2 - \lambda D_0$
(Do not encourage, do not accept, passively)	$\Delta_{81} = \eta V$	$\Delta_{82} = S$	$\Delta_{83} = R$

outsiders [6,7]. The study further presumes that the actions of the three parties occur sequentially rather than simultaneously. Subsequent actors can observe the actions of the preceding actors and infer the probabilities based on those actions. Thus, the study constructs a dynamic game model involving three parties with incomplete information. The game tree is illustrated in Figure 1, and the corresponding payoff parameters for the participants are delineated as follows:

(1) Leaders

In this study,  $V_1$  denotes the leaders' payoff when they encourage outsider employees to transition, even though these outsiders choose not to participate in the transition but contribute to team performance. The conversion rate of team performance to personal benefits for leaders is represented by  $\eta$ , hence the leaders' payoff is  $\eta V_1$ . Similarly,  $V_2$  signifies the leaders' payoff when they do not encourage the outsiders' transition, and these employees still decide not to participate in the transition while contributing to team performance. Therefore, the payoff for leaders in this scenario is  $\eta V_2$ . In both situations, we can assert that  $V_1 = V_2 = V$ . On the other hand,  $\pi_1$  embodies the leaders' payoff when they encourage the transition of outsiders who actively participate in the process, thereby enhancing team performance. This additional performance improvement translates into supplementary benefits for leaders, denoted by  $\eta\pi_1$ .  $\pi_2$  represents the leaders' payoff when they refrain from encouraging the transition of outsiders who, nonetheless, actively participate and contribute to the team's improved performance. In this case, the additional performance improvement converts into extra benefits for leaders, expressed as  $\eta\pi_2$ . Notably,  $\pi_1 > \pi_2$ . The term  $G$  denotes the additional cost incurred by leaders to persuade insider employees to support and collaborate with the policy of encouraging the outsiders' transition. This cost encompasses subsidies or appeasements directed towards insider employees, which consequently enhance their authorization level and psychological empowerment [8,9].

(2) Insider Employees

$S_1$  denotes the payoff for insider employees when they accept the status transition of outsider employees who choose not to participate in the transition. In this scenario, insiders receive their standard benefits. Similarly,  $S_2$  signifies the payoff for insiders when they resist the status

transition of outsiders who also opt not to participate in the transition. In this instance, insiders also receive their typical benefits. In both situations,  $S_1$  and  $S_2$  can be equated as  $S_1 = S_2 = S$ .  $A_1$  represents the payoff for insiders when they accept the transition of outsiders and cooperate with them by sharing resources. The active participation of outsiders in the transition results in an improvement in insiders' performance. This performance enhancement is converted into additional benefits for insiders at a rate of  $\theta$ , thus yielding additional benefits of  $\theta A_1$ . In contrast,  $A_2$  corresponds to the payoff for insiders when they do not accept the transition of outsiders, yet the outsiders actively participate in the transition and collaborate with insiders, thereby leading to enhanced performance. The additional benefits for insiders are  $\theta A_2$ , with the assumption that  $A_1 > A_2$ . Lastly,  $B$  encapsulates the potential cost incurred by insiders when they accept the outsiders' transition and cooperate with them. This cost may include resource sharing with outsiders, the investment of time and effort in collaboration, and the potential threat to insiders' status.

(3) Outsider Employees

In this framework,  $R$  designates the payoff for outsider employees when they abstain from participating in the status transition, thereby receiving their usual benefits.  $Q_1$  signifies the payoff for outsider employees when insider employees accept the outsiders' status transition, and these outsiders actively engage in the transition, investing added time and effort to enhance performance. This additional performance improvement is converted into extra benefits for outsiders at a rate of  $\zeta$ , culminating in benefits of  $\zeta Q_1$ . The performance improvement is positively correlated with the investment cost by outsider employees, which aligns with empirical research findings suggesting a positive association between work engagement and employee performance [10,11]. Thus,  $Q_1 = f(C_1) = f(\lambda C_0)$ .  $Q_2$  represents the payoff for outsider employees when insider employees resist the status transition of outsiders, who still actively participate in the transition, thereby leading to performance enhancement. The additional benefits for outsiders are  $\zeta Q_2$ , and it is assumed that  $Q_1 > Q_2$  and  $Q_1 = Q_2 + Q_0$ . Here,  $Q_2 = f(C_2) = f(\lambda D_0)$ .  $C_i$  encapsulates the cost and effort that outsider employees are willing to invest to actively participate in the status transition. Specifically,  $C_1 = \lambda C_0$  and  $C_2 = \lambda D_0$ . The parameter  $\lambda \in [0, 1]$  reflects the degree of outsider employees' out-group favoritism, varying from 0 to 1. The greater the degree of out-group favoritism,

the higher the cost that outsiders are willing to bear for achieving status mobility to insiders [12,13].  $C_0$  denotes the maximum cost that outsiders are willing to bear to participate in the transition when insiders accept the transition. Meanwhile,  $D_0$  signifies the maximum cost that outsiders are willing to bear to participate in the transition when insiders do not accept the transition, with  $C_0 \leq D_0$ .

Table 1 presents the payoff matrices for the eight strategic options corresponding to the game tree illustrated in Figure 1.

### 3 Results

#### 3.1 Model analysis and solution

Based on the game analysis described above, we can obtain the total expected payoff functions for the three major game agents: leaders, insider employees and outsider employees.

(1) The expected payoff for leaders is:

$$\begin{aligned} \sum_L = &xyz\Delta_{11} + xy(1-z)\Delta_{21} + x(1-y)z\Delta_{31} + x(1-y)(1-z)\Delta_{41} \\ &+ (1-x)yz\Delta_{51} + (1-x)y(1-z)\Delta_{61} + (1-x)(1-y)z\Delta_{71} \\ &+ (1-x)(1-y)(1-z)\Delta_{81} \end{aligned} \tag{1}$$

(2) The expected payoff for insider employees is:

$$\begin{aligned} \sum_Z = &xyz\Delta_{12} + xy(1-z)\Delta_{22} + x(1-y)z\Delta_{32} + x(1-y)(1-z)\Delta_{42} \\ &+ (1-x)yz\Delta_{52} + (1-x)y(1-z)\Delta_{62} + (1-x)(1-y)z\Delta_{72} \\ &+ (1-x)(1-y)(1-z)\Delta_{82} \end{aligned} \tag{2}$$

(3) The expected payoff for outsider employees is:

$$\begin{aligned} \sum_W = &xyz\Delta_{13} + xy(1-z)\Delta_{23} + x(1-y)z\Delta_{33} + x(1-y)(1-z)\Delta_{43} \\ &+ (1-x)yz\Delta_{53} + (1-x)y(1-z)\Delta_{63} + (1-x)(1-y)z\Delta_{73} \\ &+ (1-x)(1-y)(1-z)\Delta_{83} \end{aligned} \tag{3}$$

Since dynamic games are sequential, backward induction is the fundamental method for solving equilibrium solutions in dynamic game models. Based on the previous assumptions, the sequence of the dynamic game is leaders, insider employees and outsider employees. Therefore, we first solve for the maximum expected payoff value of outsider employees, then substitute it into the expected payoff function of insider employees to obtain their maximum expected payoff value. Finally, we derive the maximum expected payoff value for leaders.

To determine the equilibrium solution for the maximum expected payoff of outsider employees, we first set the first derivative of Eq. 1 equal to zero:

$$\begin{aligned} \frac{d\sum_W}{dz} = &xy\Delta_{13} - xy\Delta_{23} + x(1-y)\Delta_{33} - x(1-y)\Delta_{43} + (1-x)y\Delta_{53} \\ &- (1-x)y\Delta_{63} + (1-x)(1-y)\Delta_{73} - (1-x)(1-y)\Delta_{83} = 0 \\ = &xy(\Delta_{13} - \Delta_{23}) + x(1-y)(\Delta_{33} - \Delta_{43}) + (1-x)y(\Delta_{53} - \Delta_{63}) \\ &+ (1-x)(1-y)(\Delta_{73} - \Delta_{83}) = 0 \end{aligned} \tag{4}$$

$$y = \frac{\lambda D_0 - \zeta(Q_1 - Q_0)}{\lambda(D_0 - C_0) + \zeta Q_0} \tag{5}$$

Equation 5 represents the probability of insider employees accepting the strategy of outsider employees' status movement to insiders, where their expected payoff is maximized.

To find the equilibrium solution for the maximum expected payoff of insider employees, we set the first derivative of Eq. 2 equal to zero:

$$\begin{aligned} \frac{d\sum_Z}{dy} = &xz\Delta_{12} + x(1-z)\Delta_{22} - xz\Delta_{32} - x(1-z)\Delta_{42} + (1-x)z\Delta_{52} \\ &+ (1-x)(1-z)\Delta_{62} - (1-x)z\Delta_{72} - (1-x)(1-z)\Delta_{82} = 0 \\ = &xz(\Delta_{12} - \Delta_{32}) + x(1-z)(\Delta_{22} - \Delta_{42}) + (1-x)z(\Delta_{52} - \Delta_{72}) \\ &+ (1-x)(1-z)(\Delta_{62} - \Delta_{82}) = 0 \end{aligned} \tag{6}$$

$$x = \frac{[B - \theta(A_1 - A_2)]z}{G} \tag{7}$$

Equation 7 represents the probability of leaders encouraging outsider employees' status movement to insiders, where their expected payoff is maximized.

To find the equilibrium solution for the maximum expected payoff of leaders, we set the first derivative of Eq. 1 equal to zero:

$$\begin{aligned} \frac{d\sum_L}{dx} = &yz\Delta_{11} + y(1-z)\Delta_{21} + (1-y)z\Delta_{31} + (1-y)(1-z)\Delta_{41} \\ &- yz\Delta_{51} - y(1-z)\Delta_{61} - (1-y)z\Delta_{71} - (1-y)(1-z)\Delta_{81} = 0 \\ = &yz(\Delta_{11} - \Delta_{51}) + y(1-z)(\Delta_{21} - \Delta_{61}) + (1-y)z(\Delta_{31} - \Delta_{71}) \\ &+ (1-y)(1-z)(\Delta_{41} - \Delta_{81}) = 0 \end{aligned} \tag{8}$$

$$z = \frac{Gy}{\eta(\pi_1 - \pi_2)} \tag{9}$$

Equation 9 represents the probability of outsider employees actively and diligently participating in status movement, where their expected payoff is maximized.

By substituting Eq. 5 into Eq. 9, we obtain the probability of outsider employees actively participating in status movement under the condition of maximizing their payoff:

$$z = \frac{G[\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} \tag{10}$$

By substituting Eq. 10 into Eq. 7, we obtain the probability of leaders encouraging outsider employees' status movement under the condition of maximizing their payoff:

$$x = \frac{[B - \theta(A_1 - A_2)][\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} \tag{11}$$

Considering Eqs 7, 10 and 11, the equilibrium solution for the dynamic game is:

$$(x^*, y^*, z^*) = \left\{ \begin{aligned} &\frac{[B - \theta(A_1 - A_2)][\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]}, \\ &\frac{\lambda D_0 - \zeta(Q_1 - Q_0)}{\lambda(D_0 - C_0) + \zeta Q_0}, \frac{G[\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} \end{aligned} \right\} \tag{12}$$

### 3.2 Game equilibrium solution analysis

Under the equilibrium of the three-agent dynamic game, the probability of outsider employees actively participating in status movement to insiders is:

$$z^* = \frac{G[\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} \tag{13}$$

Firstly, to ensure  $z^* = \frac{G[\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} > 0$ , because  $\pi_1 > \pi_2$ ,  $\lambda(D_0 - C_0) + \zeta Q_0 > 0$ , so  $\lambda D_0 - \zeta(Q_1 - Q_0) > 0$ ,  $\lambda D_0 > \zeta(Q_1 - Q_0)$ ,  $\lambda D_0 > \zeta Q_2$ . This indicates that when insider employees do not accept the status movement of outsider employees, the cost  $\lambda D_0$  incurred by outsider employees to achieve status movement is greater than the benefits  $\zeta Q_2$  they receive. The benefits are derived from the performance improvement resulting from the cost invested by outsider employees to achieve status movement, and for those outsiders with a higher degree of out-group favoritism  $\lambda$ , they are willing to invest more to achieve status movement. This further demonstrates that under differential leadership, the status movement of outsider employees requires acceptance and cooperation from insider employees.

From Eq. 10, it is evident that the probability  $z$  of outsider employees actively participating in status transition is directly proportional to  $G$ . This relationship implies that an increase in  $G$  corresponds to an increase in  $z$ . In practice, this suggests that in order to foster insider employees' support and collaboration with the strategy of encouraging outsider employees' status transition, leaders should extend additional subsidies and appeasements to insider employees. This action confers greater psychological authority to the insiders. This is because, in the highly personalized leadership atmosphere of China, leaders control and allocate resources within the organization. Insiders play the role of 'colleague leaders' within the organization or team, and they have the responsibility to support and execute the decisions of the leaders. If leaders provide larger subsidies and appeasement costs to insiders and increase their level of authorization, thereby reducing the concerns of insiders, insiders will be more proactive in responding to the policies of the leaders, accepting the status mobility of outsiders, and cooperating with them. This, in turn, reduces the costs and obstacles that outsiders face when striving for status mobility, making them more willing to invest in the long-term process of achieving their status mobility to insiders.

By solving the first derivative of  $z$  with respect to  $\lambda$ , we obtain  $\frac{\partial z}{\partial \lambda} = \frac{\zeta G[D_0 Q_1 - C_0(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)(-\lambda C_0 + \lambda D_0 + \zeta Q_0)^2} > 0$ . It can be observed that the probability  $z$  of outsider employees actively participating in status movement is a monotonically increasing function of  $\lambda$ . This means that as the degree of out-group favoritism  $\lambda$  of outsider employees, the probability of outsider employees actively participating in status movement also increases. This is consistent with reality, as individual attitudes determine behaviors. Therefore, only when outsider employees have a greater degree of out-group favoritism, they are more motivated to participate in the status movement.

Furthermore, by solving the first derivative of  $z$  with respect to  $C_0$ , we get  $\frac{\partial z}{\partial C_0} = \frac{\lambda G[\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)(-\lambda C_0 + \lambda D_0 + \zeta Q_0)^2} > 0$ . The probability of outsider employees actively participating in status movement is a monotonically increasing function of  $C_0$ . This indicates that

when insider employees accept the status movement of outsider employees, and thus reduce the obstacles faced by outsider employees in the status movement process, it increases the enthusiasm of outsider employees to participate in status movement. However, on the other hand, the realization of status movement for outsider employees is not an instantaneous process and requires significant time and long-term investment. Therefore, the higher the subjective willingness of outsider employees to invest and make efforts for status movement, the greater their likelihood of participating in status movement. Since employee performance is positively correlated with their effort invested in their work, outsider employees' willingness to invest more effort and cost for status movement leads to higher employee performance.

In the three-agent dynamic game equilibrium, the probability  $y$  of insider employees accepting the status movement of outsider employees is:

$$y^* = \frac{\lambda D_0 - \zeta(Q_1 - Q_0)}{\lambda(D_0 - C_0) + \zeta Q_0} \tag{14}$$

Taking the derivative of  $y$  with respect to  $\lambda$ , we get:  $\frac{\partial y}{\partial \lambda} = \frac{\zeta[D_0 Q_0 + (Q_1 - Q_0)(D_0 - C_0)]}{(-\lambda C_0 + \lambda D_0 + \zeta Q_0)^2} > 0$ . This shows that the probability  $y$  of insider employees accepting the status movement of outsider employees is directly proportional to the degree of  $\lambda$ . In real life, when outsider employees have a stronger desire to become part of the insider employee group, the probability of the insider employees accepting the status movement of outsiders increases. This reflects the mutual influence between outsider employees, who are both the implementers of "colleague leader", and the decision-making of the "colleague leader".

Further, when we take the derivative of  $y$  with respect to  $C_0$ , we get:  $\frac{\partial y}{\partial C_0} = \frac{\lambda[\lambda D_0 - \zeta(Q_1 - Q_0)]}{(-\lambda C_0 + \lambda D_0 + \zeta Q_0)^2} > 0$ . It is evident that the probability  $y$  of insider employees accepting the status movement of outsider employees is a monotonically increasing function of  $C_0$ . This means that when insider employees accept the status movement of outsiders, the greater the cost and effort that outsider employees are willing to invest  $C_0$ , the higher the probability of insider employees accepting their movement. It because when insiders accept the status movement of outsiders, if outsider employees are willing to put in more effort and investment to their status movement, it not only improves their own performance but also demonstrates greater support for the organization, the team, the leader and especially their insider colleagues. It leads to more involvement in completing their work and actively assisting insider employees in overcoming work challenges. Such interactions between insider and outsider employees contribute to an increase in the performance of the insider employees, thereby increasing the likelihood of them accepting the status movement of outsider employees.

In order to ensure  $x^* = \frac{[B - \theta(A_1 - A_2)][\lambda D_0 - \zeta(Q_1 - Q_0)]}{\eta(\pi_1 - \pi_2)[\lambda(D_0 - C_0) + \zeta Q_0]} > 0$ , it follows that  $B - \theta(A_1 - A_2) > 0$ ,  $B > \theta(A_1 - A_2)$ . It implies that for insider employees, choosing to accept the status movement of outsider employees and cooperating with them may lead to an improvement in their performance level, but the net benefits derived from this improvement are not enough to compensate for the costs and threats they need to bear in accepting the status movement. Moreover,  $x$  is positively correlated with  $B$ , meaning that when insider employees have higher costs and face more threats in accepting the status

movement of outsider employees, they need stronger support from the leader to encourage the status movement. In this case, the leader needs to explicitly demonstrate their encouragement and support for the status movement of outsider employees, thereby exerting pressure on the insider employees. To encourage outsider employees' participation in status movement, the leader not only needs to apply pressure to the insiders to show their determination to encourage the movement of outsiders but also needs to provide them with subsidies and reassurance to alleviate their concerns and worries. Simultaneously, the leader's encouragement of outsider employees' status movement instills a sense of crisis and urgency to the insiders, keeping them vigilant throughout the long-term process of the status movement and maintaining and improving their performance.

From Eq. 11, we observe an inverse proportionality between  $x$  and  $A_1$ . This suggests that as insider employees accept the status transition of outsider employees and experience a substantial performance enhancement, the necessity for the leader to facilitate the status transition of outsider employees decreases. The rationale behind this is that the leader's facilitation of outsider employees' status transition, coupled with significant performance improvement and benefit increases for insider employees, results in minimal resistance to policy implementation from insiders. Consider that the status transition of outsider employees constitutes a long-term process. The sustained improvement in insider employees' performance not only yields additional benefits but also solidifies their status. This consolidation of status reduces insiders' perception of threat, thereby alleviating their concerns.

In this context, the derivative of  $x$  with respect to  $\lambda$  is  $\frac{\partial x}{\partial \lambda} = \frac{\zeta[B_1 - \theta(A_1 - A_2)](Q_0 D_0 + (Q_1 - Q_0)(D_0 - C_0))}{\eta(\pi_1 - \pi_2)(-\lambda C_0 + \lambda D_0 + \zeta Q_0)^2} > 0$ , indicating that the probability  $x$  of the leader encouraging outsider employees' status movement is directly proportional to the degree of  $\lambda$ . In real-life, if outsider employees do not have out-group favoritism, the leader would be even less likely to provide opportunities for status movement. If outsider employees have a strong motivation to become insiders and if the leader perceives their desire, the probability of the leader encouraging outsider employees' status movement will increase.

## 4 Discussion

### 4.1 Conclusions

This study utilized a dynamic game methodology to establish an equilibrium among leaders, insider employees, and outsider employees. Findings underscore the positive impacts of effective status transition for outsider employees on the overall performance of the workforce. The research also highlighted the importance of synergy and alignment between leaders and employees for the successful status transition of outsiders. Variables such as the degree of outgroup favoritism, costs borne by employees, and leadership endorsement significantly affected the facilitation of status transition. The study offers valuable insights for future longitudinal inquiries and establishes a foundation for subsequent empirical research. Based on the dynamic game model

encompassing leaders, insider employees, and outsider employees, the study yielded key findings:

- 1) Effective status transition of outsider employees is contingent on the support from both leaders and insider employees. This is attributed to the cooperative efforts between outsider and insider employees during the status transition process, which can subsequently enhance the performance of both employee groups.
- 2) To achieve equilibrium among leaders, insider employees, and outsider employees, effective collaboration is essential. The status transition of outsider employees can only be facilitated when all stakeholders work in a synergistic manner.
- 3) The facilitation of status transition for outsider employees by leaders is influenced by several factors. These include potential costs and threats that insider employees may face when accepting the transition, net benefits gained by insiders from endorsing and cooperating with outsiders, and the degree of favoritism that outsiders have towards the insider group.
- 4) The role of crisis and urgency is crucial in this context. Leaders' facilitation of outsider employees' status transition creates a sense of crisis and urgency among insider employees, deterring complacency or opportunistic behavior. This sense of urgency motivates insider employees to enhance their performance and mitigate the perceived threat to their own status.

### 4.2 Practical significance

- 1) Maintain dynamic employee categorization. Leaders should maintain a dynamic employee categorization system and cultivate a fair and dynamic corporate culture. Emphasizing the advantages of differential leadership over time can have a long-term impact on improving employee performance. This approach can encourage outsider employees to accept differential treatment and find suitable justifications for this treatment. However, it is essential to ensure that accepting such treatment serves as a source of motivation for outsider employees.
- 2) Address the sense of crisis and urgency. Leaders should encourage outsider employees' status movement to instill a sense of crisis and urgency among insider employees. This will prevent insider employees from becoming complacent due to perceived preferential treatment from leaders. The encouragement of outsider employees' status movement, coupled with the motivation of outsider employees to improve their status, can further enhance employee performance and contribute to the sustainable development of the organization.
- 3) Promote synergy among leaders and employees. Leaders should maintain the dynamic categorization of insider and outsider employees, particularly in encouraging outsider employees' status movement. This can motivate outsider employees and also create a sense of crisis and urgency among insider employees. The long-term efforts and cooperation between outsider and insider employees during the status movement process can lead to mutual improvement in employee performance, thereby further enhancing overall employee performance.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

## Author contributions

LZ: Conceptualization, Methodology, Writing–original draft, Writing–review and editing. MW: Conceptualization, Methodology, Writing–original draft, Writing–review and editing. SL: Investigation. RL: Writing–review and editing. YZ: Writing–review and editing.

## Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This research is supported by the National Social Science Foundation of China

## References

- Jiang D, Zhang W. Chinese differential leadership and subordinate effectiveness. *Indigenous Psychol Res Chin Societies* (2010) 33:109–77.
- Zhang L. *The influence of family business differential leadership on employee performance and its mechanism*. China: Jiangsu University (2019).
- Wu M, Zhang L, Imran M, Xu J, Yu R. Impact of differential leadership on innovative behavior of employees: a double-edged sword. *Soc Behav Personal* (2021) 49: 1–12. doi:10.2224/sbp.9746
- Liu Y, Zhang Z, Zhao H, Liu L. The double-edged sword effects of differential leadership on deviant behavior. *Curr Psychol* (2022) 42:27888–900. doi:10.1007/s12144-022-03845-x
- Liu N, Zhang H, Zhou J. Unraveling the effect of differential leadership on employee performance: evidence from China. *Front Psychol* (2023) 14:1081073. doi:10.3389/fpsyg.2023.1081073
- Tao Y, Zhang J, Li L. Study on the influence of differential leadership on employees' prosocial organizational behavior. *China Ind Econ* (2016) 336:116–31.
- Wang L. *Theoretical and empirical study on the effectiveness of differential leadership*. China: Northeast University of Finance and Economics (2013).
- Mubarak F, Noor A. Effect of authentic leadership on employee creativity in project-based organizations with the mediating roles of work engagement and psychological empowerment. *Cogent Business Manag* (2018) 5:1. doi:10.1080/23311975.2018.1429348
- Meyerson SL, Kline TJ. Psychological and environmental empowerment: antecedents and consequences. *Leadersh Organ Dev J* (2008) 29:444–60. doi:10.1108/01437730810887049
- Kahn WA. Psychological conditions of personal engagement and disengagement at work. *Acad Manag J* (1990) 33:692–724. doi:10.5465/256287
- Wang YF, Jin YX. The impact of proactive coping and work engagement on employee performance: the moderating effect of skills. *Sci Stud Sci Manag* (2016) 37: 158–71.
- Donnenwerth GV, Foa UG. Effect of resource class on retaliation to injustice in interpersonal exchange. *J Personal Soc Psychol* (1974) 29:785–93. doi:10.1037/h0036201
- Martin J, Harder JW. Bread and roses: justice and the distribution of financial and socioemotional rewards in organizations. *Soc Justice Res* (1994) 7:241–64. doi:10.1007/bf02334833

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.