

# An Evolutionary Analysis of Enterprise Innovation Behavior Based on Organizational Routines

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## ABSTRACT

Routine innovation can help enterprises eliminate old routines that do not adapt to the environment, introduce new routines with high efficiency, and improve the adaptability of enterprises and the environment. Based on this, this paper constructs an evolutionary game model between enterprises and employees, explores the game relationship between enterprise innovation incentives and employee practice innovation, and uses simulation to analyze the influence of different parameters on the evolution path of both parties in the game. The results show that there are two kinds of evolutionary stability strategies, and the final result depends on the parameter values in the payoff matrix. The relationship between income and cost is the decisive factor affecting enterprises and employees' strategy choices. One effective measure to promote enterprise innovation is the third-party reward. Establishing reasonable revenue distribution mechanisms is conducive to improving employees' innovation initiatives. This paper contributes to the advancement of research in the field of routine innovation and broadens the use of organizational routines in corporate governance.

## KEYWORDS

Organizational routine; Enterprise incentive; Evolutionary game; Numerical simulation

## 1. INTRODUCTION

Multiple actors participate in repeated and identifiable organizational behavior patterns, known as organizational routines [1]. Scholars have traditionally studied organizational routines as organizational norms or an unconscious replication of behavior [2], which both maintain organizational stability and impede organizational innovation. Feldman and Pentland proposed the two-aspect view of organizational routines in response to the shortcomings of traditional routines research, dividing organizational routines into the ostensive aspect and the performative aspect. The ostensive aspect is a general generalization of organizational routines, while the performative aspect embodies specific behaviors by specific participants at specific times and places [1]. The ostensive aspect guides the concrete implementation of routines, and the performative aspect creates, maintains, and changes the ostensive aspect. This interaction makes it easier for routines and organizational innovations to grow [1, 2]. These two-aspect views of organizational routines are different from traditional research perspectives. They have helped the growth of organizational routines research by challenging the idea that routines are just rules that everyone follows. Instead, they stress that routines are a collective behavioral paradigm or a collective cognitive perspective [1].

In early studies, organizational routines, as normative guidelines developed by all members of an organization, maintained the organization's stability and continuity but were equally an impediment to the organization's inability to effectively respond to environmental changes [2]. Scholars have recognized the stability of organizational routines, yet they have overlooked the practitioners' subjective awareness of these routines, interpreting them as a barrier to organizational innovation [2].

Conversely, the two-aspect view of organizational routines posits that organizational routines serve as the foundation for organizational innovation [3-5]. Organizational routines maintain stability through the behavior, norms, and consensus within the organization [6]. Changes in the external environment of enterprises and changes in the cognition of internal members of organizations result in a continuous interaction between the ostensive aspect and the performative aspect. Routine innovation emerges during this process, resulting in transformative organizational routines. Organizational innovation is paradoxically affected by the dual properties of stability and change of routines [7]. Organizational routines will continue to absorb new knowledge and skills, generate new ideas and directions, and have a positive impact on enterprise innovation [8]. Despite the realization of the relationship between routine and innovation through relevant research on organizational routines, the research on routine innovation remains insufficient and has several shortcomings: The research that combines routine and enterprise governance is insufficient. Previous studies have examined organizational routines at various levels, primarily focusing on their norms and mechanisms. However, they have not successfully transformed routine innovation into management behavior or applied it to corporate governance, leaving a gap in the research on routine innovation. While some scholars have examined organizational routines through the lenses of learning behavior [9], transformational leadership behavior [10], entrepreneurial team diversity [11], and strategic human resource strategy [12], they have overlooked the connection between enterprise innovation incentive and routine innovation, leaving the impact of innovation incentive behavior on routine innovation unanalyzed. The dynamism and applicability of organizational routine research are insufficient. Current academic circles primarily study cases from a static configuration perspective and the QCA method, but they lack a dynamic perspective [6]. Studies on organizational routines also have the same problem. Management problems often involve the evolution of multiple factors, which are increasingly dynamic and complex. Traditional configuration theory research methods are unable to deeply study the dynamic evolution factors, making them unsuitable for addressing increasingly complex management problems. This paper's research focuses on the dynamic process of choosing an innovation incentive and routine strategy between enterprises and employees. Numerous irrational factors and incomplete information will impact both parties during the decision-making process. Enterprises and employees will choose the most beneficial strategy according to the logic of trial and error, learning, and growth. Therefore, the evolutionary game method can not only outline a stable strategy for enterprises and employees, but also dynamically depict the evolutionary path. Furthermore, current case studies on organizational routines often analyze a single case, and the conclusions drawn are not generalizable and applicable [13]. Evolutionary game analysis does not rely on specific enterprise cases, but it can apply to multiple enterprises in similar or similar situations.

Based on the aforementioned shortcomings, the research questions in this paper center around the creation of an evolutionary game model that combines enterprise innovation incentive with employee routine innovation. Enterprise incentives have the potential to ignite employees' enthusiasm and creativity, while also altering their existing cognitive processes, making them an effective tool for routine innovation [14]. The strategy choice between enterprise innovation incentive and employee routine innovation is a dynamic process under the condition of finite rationality and incomplete information. Therefore, we can utilize an evolutionary game to illustrate the progression of the enterprise-employee strategy and the ultimate stable strategy in the context of finite rationality and incomplete information. We examine the connection between the incentive for enterprise innovation and the routine innovation of employees. Routine innovation occurs when the ostensive and performative aspects interact. Innovation incentives have the potential to influence employees' existing cognitive processes, leading to differentiated execution results during routine implementation. This, in turn, influences the ostensive aspect of organizational routines, with the new ostensive aspect guiding the subsequent round of performative aspects [1]. Therefore, analyzing the game relationship between enterprise innovation incentive and employee routine innovation is helpful to identify the evolutionary logic. The relationship between innovation incentives and routine innovation shapes management behavior. Routine innovation can continuously foster a match

between an enterprise's internal capabilities and resources and the external environment, thereby creating an open innovation atmosphere and promoting enterprise innovation [15]. When an enterprise adopts an innovation incentive behavior, it fosters innovation in organizational routines and positively influences enterprise innovation. Therefore, this paper attempts to form management behaviors that guide corporate governance based on the relationship between the two.

The rest of the paper follows the above analysis's structure: Section 2 is the literature review, sorting out the domestic and foreign research on organizational routines. In Section 3, we construct an evolutionary game model of enterprises and employees, aiming to determine their evolutionary stable strategies. In Section 4, we conduct a simulation analysis to pinpoint the factors that influence the selection of enterprise and employee strategies, as well as to uncover the evolution law and characteristics of the game subjects. Section 5 is the discussion. Based on the above analysis, the research results are obtained, and the corresponding implications are put forward. Section 6 is the conclusion, which summarizes the paper and puts forward the limitations.

## **2. LITERATURE REVIEW**

### **2.1. Organizational Routine**

When introduced at the organizational level, routines represent a rule, a procedure, a paradigm of collective behavior, or a tendency of organizational behavior or thought [14]. The study of organizational routines has gone through a process of moving from explicit to implicit dimensions. Early research stagnated at the explicit cognition stage, viewing organizational routines as an explicit set of rules, processes, procedures, and norms, or as an unconscious replication of behaviors [2]. People perceive organizational routines as both the source of organizational stability and the root of organizational rigidity. Therefore, research on organizational routines based on the explicit dimension emphasizes the stability of organizational routines, which hinders organizational innovation and stands in contrast to organizational routines [14].

There are two main views of organizational routines: the traditional view of routines and the two-aspect view of organizational routines. Since Nelson and Winter [3], the understanding and study of organizational routines has moved to the implicit level [14]. They defined organizational routines as the general term for all of an organization's rules and predictable behavior patterns [16]. Feldman and Pentland's two-aspect view of organizational routines is the most popular, emphasizing the fact that organizational routines are repetitive and identifiable collective behavioral paradigms or collective cognitive perspectives in which multiple actors participate [5].

The research on organizational routines based on the implicit dimension emphasizes the dynamic nature of organizational routines, which plays a role in promoting organizational innovation [14]. Feldman and Pentland [1] assert that organizational routines encompass both the ostensive and performative aspects. The ostensive aspect represents an abstracted overview of organizational routines, the concept that guides their implementation [2]. On the other hand, the performative aspect embodies the concrete performance behavior of the routines, from their abstraction to their execution, and is responsible for putting the concept of routines into practice within the enterprise. The ostensive aspect influences the performative aspect by guiding specific behaviors. There are different ways that each routine can be carried out, which can lead to the creation of new rules, processes, and perceptions [17]. These in turn create, maintain, or change the apparent aspect, creating a recursive cyclic framework for analyzing organizational routines [18]. The continuous interaction between the ostensive aspect and the performative aspect is the fundamental source of the dynamic evolution of organizational routines [10]. In this continuous interaction, organizational routines realize self-transformation, and this transformational property drives organizational innovation [1, 5].

## **2.2. Routine Innovation**

Organizational routine innovation is the process of "search," "variation," and "selection" of organizational routines [10]. Organizational routines undergo constant changes [11]. Organizations proactively update their organizational routines to adapt to changing endogenous and exogenous elements, ensuring their survival [19]. The endogenous element arises from changes in the practitioners' perceptions, experiences, etc. during the implementation process, while the exogenous element originates from changes in the environment. According to Yao et al. [8], there are two ways to update organizational routines: the first involves eliminating old routines and introducing new ones through abandonment and optimization; the second involves eliminating routines that are poorly adapted to the environment through mechanisms of "trial and error" and "selection" when the internal effectiveness of the organization is insufficient to meet the changes in the environment, thereby achieving In the "trial and error" process, the organization will increase the routines that achieve organizational goals and reduce the routines that are not consistent with organizational efficiency. The "selection" mechanism is the selective implementation of the most efficient routine that best matches the current situation and external environment of the organization from numerous routines of the organization, and the selection is based on the experience gained by the enterprise in the process of trial and error [10]. Routine innovation can absorb new knowledge and skills in the environment, replace ineffective behavior patterns in the organization, introduce new knowledge and skills into the organization, and promote the dynamic matching of organizational routines with the current development strategy and external environment of the enterprise, which is conducive to enterprise innovation [8].

## **2.3. Routine Evolution**

Routines evolve themselves in development. Routine evolution is based on the two-aspect view of organizational routines, which has both an ostensive aspect and a performative aspect. Under the influence of multiple factors, routines will form different performative aspects, which in turn will influence the ostensive aspect and realize the evolution of routines [4]. The external environment as well as the internal members' perceptions, beliefs, and awareness are the drivers of organizational routine evolution [20]. The level of routine evolution varies from individual to group and then to organization. These three levels correspond to grass-roots routine, low-level routine, and high-level routine, respectively. The stages of routine evolution include search, variation, and selection. In the search stage, organizations begin to innovate, change, and adapt in response to environmental changes. During the variation stage, organizations absorb new knowledge and skills to form new routines. In the selection stage, organizations retain the routines that match the operational capabilities and resources of the enterprise [21]. Organizational routines are constantly evolving as the external environment and internal members' perceptions change, thus contributing to organizational innovation [22]. As the smallest unit of an organization, organizational routines are essentially a continuous evolutionary process [17].

## **2.4. Innovation Incentives Considering Organizational Routines**

Innovative incentives can fully mobilize the enthusiasm of employees, which is the core of enterprise management [23]. Incentives can influence employee behavior by stimulating their motivation, prompting them to make continuous efforts to achieve the organization's goals. Innovation necessitates incentive systems [24], and the external environment's uncertainty makes incentives particularly important for promoting corporate innovation [25]. An effective incentive system can improve employees' enthusiasm and initiative, guide them to research and development and innovation activities, stimulate technological innovation activity, and enhance enterprises' competitiveness [23].

The more organizational routines there are, the higher the level of tacit understanding among organizational members, and the higher the likelihood of reaching a consensus on the choice of innovation [26]. This tacit understanding can effectively reduce the cost of innovation incentives in enterprises. First, the common vision and normative consensus in organizational routines facilitate the dissemination of inter-organizational knowledge. By requiring organizational members to search for innovation knowledge in accordance with these routines, the enterprise's search and cognitive costs can be reduced [27]. Second, organizational routines serve as an effective means of regulating the organization. Employees can establish implicit and explicit communication mechanisms based on these routines [28], which fosters innovation exchange among employees and lowers the cost of innovation incentives [27]. Finally, the positive energy generated by organizational members based on routines can also effectively cultivate employees' innovative creativity, stimulate innovation potential, and ultimately achieve the effect of an innovation incentive [29]. Therefore, we can use routines as an effective means of integrating resources to reduce the cost of corporate incentives and promote the sustainable development of the dynamic capacity of corporate innovation incentives [30].

In summary, the study of organizational routines has entered a new era since Nelson and Winter defined the concept of organizational practices, transitioning from the explicit to the implicit level. Over time, researchers have comprehensively and systematically studied organizational routines, making them an indispensable factor in organizational research. However, while existing studies have conducted preliminary explorations of organizational routines innovation, further deepening of the current research on the detailed analysis of the relationship between corporate incentives and routines innovation is needed. Therefore, this paper, based on the perspective of organizational routines, constructs an evolutionary game model of the relationship between corporate innovation incentives and employee routine innovation. This model takes into account the characteristics of limited rationality and incomplete information of both enterprises and employees. It then analyzes the evolution law and characteristics and explores the use of corporate innovation incentives and organizational routines in corporate governance.

### **3. RESEARCH HYPOTHESIS AND MODEL**

#### **3.1. Research Hypothesis**

(1) Players: This model assumes that there are two finite rational participants: one is assumed to be the enterprise whether or not to incentivize innovation, referred to as the Enterprise A. The other is assumed to be the employees of the enterprise who choose whether or not to practice innovation, referred to as the Employee B. Without considering other constraints, both participants follow the basic assumptions of limited rationality and incomplete information. Both parties continuously learn and improve until they reach equilibrium in the game process.

(2) Action: Enterprise A' behavior is divided into two types: innovation incentive and conservative. Employee B' behavior is divided into two types: routine innovation and routine maintenance.

(3) Payoff: The payment matrix for Enterprise A and Employee B consists of their benefits and costs. The game between the two parties satisfies the basic assumptions of the evolutionary game, where both parties adapt their strategies according to the strategies of the other members and consider their own fitness in the group. The cost invested by the Enterprise A in choosing the strategy of conservative is  $C_1$ , and the revenue generated is  $R_1$ . The cost invested by the Employee B in choosing the strategy of routines maintenance is  $C_2$ , and the revenue generated is  $R_2$ . The cost invested by the Enterprise A in choosing the strategy of innovation incentive is  $C_3$ , the cost invested by the Employee B in choosing routine innovation is  $C_4$ . When Enterprise A adopts the innovation incentive strategy and Employee B adopts the routine innovation, the system will produce the revenue value  $S$ , Enterprise A and Employee B together as the beneficiary to share the revenue. The revenue is distributed between Enterprise A and Employee B according to the distribution coefficient, the

distribution coefficient of Enterprise A is  $a$ , denoted as  $aS$ . The distribution coefficient of Employee B is  $1-a$ , denoted as  $(1-a)S$ , where  $a \in [0,1]$ . At the same time, this paper introduces the third-party element, when the Enterprise A chooses the innovation incentive strategy, the government will give Enterprise A reward, the reward probability is  $m$ , the reward amount is  $P$ .

Based on the above assumptions, the game payoff matrix is constructed as in Table 1.

**Table 1.** Payoff matrix of the game players

		Employee B	
		routine innovation	routine maintenance
Enterprise A	innovation incentive	$R_1 + mP + aS - C_3 - C_1$	$R_1 + mP - C_3 - C_1$
		$R_2 + (1-a)S - C_2 - C_4$	$R_2 - C_2$
	conservative	$R_1 - C_1$	$R_1 - C_1$
		$R_2 - C_2 - C_4$	$R_2 - C_2$

### 3.2. Equilibrium Stability Analysis

The probability of Enterprise A choosing the innovation incentive strategy is  $x$ , and the probability of Enterprise A choosing the conservative strategy is  $1-x$ . The probability of Employee B choosing routine innovation is  $y$ , and the probability of choosing routine maintenance strategy is  $1-y$ ,  $x, y \in [0,1]$ . Combined with the payoff matrix of Enterprise A and Employee B, the expected utility of Enterprise A choosing innovation incentive and conservative strategy can be obtained, as shown in equations (1) and (2):

$$E_{11} = y \cdot (R_1 + mP + aS - C_1 - C_3) + (1-y) \cdot (R_1 + mP - C_1 - C_3) \\ = yaS + R_1 + mP - C_1 - C_3 \quad (1)$$

$$E_{12} = y \cdot (R_1 - C_1) + (1-y) \cdot (R_1 - C_1) = R_1 - C_1 \quad (2)$$

The average utility of Enterprise A is shown in equations (3):

$$\bar{E}_1 = x \cdot E_{11} + (1-x) \cdot E_{12} = xyas + xmP - xC_3 + R_1 - C_1 \quad (3)$$

The expected utility of Employee B choosing routine innovation and routine maintenance strategies can be obtained, as shown in equations (4) and (5):

$$E_{21} = x \cdot (R_2 + (1-a)S - C_2 - C_4) + (1-x) \cdot (R_2 - C_2 - C_4) \\ = x(1-a)S + R_2 - C_2 - C_4 \quad (4)$$

$$E_{22} = x \cdot (R_2 - C_2) + (1-x) \cdot (R_2 - C_2) = R_2 - C_2 \quad (5)$$

The average utility of Employee B is shown in equations (6):

$$\bar{E}_2 = y \cdot E_{21} + (1-y) \cdot E_{22} = xy(1-a)S - yC_4 + R_2 - C_2 \quad (6)$$

Therefore, the dynamic equation of replication when Enterprise A chooses innovative incentive strategy is shown in equation (7):

$$F(x) = dx/dt = x \cdot (E_{11} - \bar{E}_1) = x(1-x)(yaS + mP - C_3) \quad (7)$$

The dynamic equation of replication when Enterprise A chooses innovative incentive strategy is shown in equation (7):

$$F(y) = dy / dt = y \cdot (E_{21} - \bar{E}_2) = y(1-y)(x(1-a)S - C_4) \quad (8)$$

Equations (4) and (5) describe the replication dynamics of this evolutionary game system. The system's replication dynamic equation is shown in equation (9):

$$\begin{cases} F(x) = dx / dt = x \cdot (E_{11} - \bar{E}_1) = x(1-x)(yaS + mP - C_3) \\ F(y) = dy / dt = y \cdot (E_{21} - \bar{E}_2) = y(1-y)(x(1-a)S - C_4) \end{cases} \quad (9)$$

Let  $F(x)=0$ ,  $F(y)=0$ , the differential equation (9) obtains five equilibrium points in the plane space  $\{(x, y), 0 \leq x, y \leq 1\}$  as  $A(0,0)$ ,  $B(0,1)$ ,  $C(1,0)$ ,  $D(1,1)$ ,  $E(\frac{C_4}{(1-a)S}, \frac{C_3 - mP}{aS})$ .

The equilibrium point only makes sense if it falls in plane space  $\{(x, y) | 0 \leq x \leq 1, 0 \leq y \leq 1\}$ , so we get stability condition  $0 < C_4 < (1-a)S, 0 < (C_3 - mP) < aS$ .

According to the stability theory of differential equations, the stability of the differential equation (9) at each equilibrium point can be obtained by analyzing the local stability of the Jacobi matrix of the system. The Jacobi matrix corresponding to the equation (9) is shown in equation (10):

$$J = \begin{pmatrix} \frac{\partial F(x)}{\partial x} & \frac{\partial F(x)}{\partial y} \\ \frac{\partial F(y)}{\partial x} & \frac{\partial F(y)}{\partial y} \end{pmatrix} = \begin{pmatrix} (1-2x)(yaS + mP - C_3) & x(1-x)aS \\ y(1-y)(1-a)S & (1-2y)(x(1-a)S - C_4) \end{pmatrix} \quad (10)$$

Note that the determinant of the matrix is  $\det(J)$  and the trace of the matrix is  $\text{tr}(J)$ . If the following conditions can be met, the equilibrium point is the asymptotically stable point, which is the evolutionarily stable policy (ESS):

$$\begin{cases} \text{tr}(J) = a_{11} + a_{22} < 0 \\ \det(J) = a_{11}a_{22} - a_{12}a_{21} > 0 \end{cases} \quad (11)$$

The stability analysis of each equilibrium point in the system is shown in Table 2:

**Table 2.** Stability analysis of system equilibrium point

Equilibrium points	det (J)	symbol of det (J)	tr (J)	symbol of tr (J)	stability
A (0, 0)	$-C_4 (mP - C_3)$	+	$mP - C_3 - C_4$	-	ESS
B (0, 1)	$C_4 (aS + mP - C_3)$	+	$aS + mP + C_4 - C_3$	+	unstable
C (1, 0)	$(C_3 - mP) ((1-a)S - C_4)$	+	$C_3 - mP + (1-a)S - C_4$	+	unstable
D (1, 1)	$(aS + mP - C_3) ((1-a)S - C_4)$	+	$C_3 - mP - S + C_4$	-	ESS
$E(\frac{C_4}{(1-a)S}, \frac{C_3 - mP}{aS})$	U	-	0		saddle point

$$U = \frac{a(1-a)C_4(mP - C_3)(aS + mP - C_3)((1-a)S - C_4)}{a^2(1-a)^2S^2}$$

According to the results of evolutionary stability analysis, equilibrium points A(0, 0), D(1, 1) are evolutionarily stable strategies, which means that Enterprise A chooses the innovation incentive strategy and Employee B choose the routine innovation strategy, or Enterprise A chooses the retention strategy and Employee B choose the routine maintenance strategy. The behavioral evolution process of Enterprise A and Employee B is shown in Figure 1:

### 3.3. Parameter Analysis

When the initial state of Enterprise A and Employee B fall near point E, the change of parameters can change the dynamic evolution results of both sides of the game. Let  $Z_1$  be the area of region ABED and  $Z_2$  be the area of region BCDE. The final strategy choice of the game between Enterprise A and Employee B depends on the comparison between  $Z_1$  and  $Z_2$ . When  $Z_2$  is greater than  $Z_1$ , Enterprise A and Employee B tend to innovate. When  $Z_2$  is less than  $Z_1$ , Enterprise A and Employee B tend to stick to choose conservative and routine maintenance strategy.

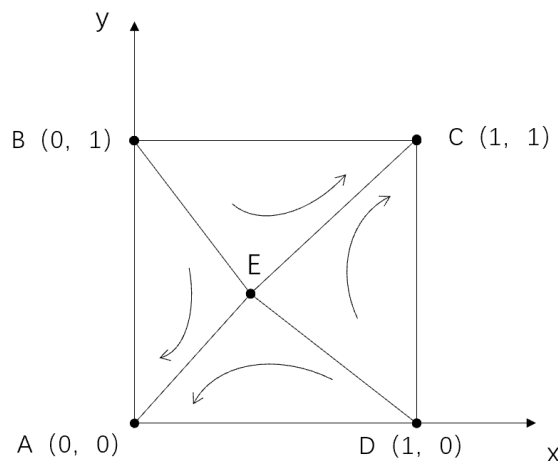
$$Z_2 = 1 - \frac{1}{2} \left( \frac{C_4}{(1-a)S} + \frac{C_3 - mP}{aS} \right) \quad (12)$$

$$\frac{\partial Z_2}{\partial a} = -\frac{1}{2} \left( \frac{C_4}{S(1-a)^2} - \frac{C_3 - mP}{Sa^2} \right) \quad (13)$$

$$\frac{\partial Z_2}{\partial S} = \frac{1}{2} \left( \frac{C_4}{(1-a)S^2} + \frac{C_3 - mP}{aS^2} \right) > 0 \quad (14)$$

$$\frac{\partial Z_2}{\partial C_4} = -\frac{1}{2(1-a)S} < 0 \quad (15)$$

$$\frac{\partial Z_2}{\partial C_3} = -\frac{1}{2aS} < 0 \quad (16)$$



**Figure 1.** Enterprise and employee behavior evolution phase diagram

$$\frac{\partial Z_2}{\partial m} = \frac{P}{2aS} > 0 \quad (17)$$

$$\frac{\partial Z_2}{\partial P} = \frac{m}{2aS} > 0 \quad (18)$$

According to the partial derivation of each parameter in  $Z_2$ , the relationship between  $Z_2$  and these parameters can be obtained. The symbol “+” means positive correlation, “-” means negative correlation, and “/” means unjudged, as shown in Table 3.

**Table 3.** Analysis of the influence parameters of game player strategy

Parameters	Symbol of partial derivative	Impact on $Z_2$
a	/	/
S	>0	+
C <sub>3</sub>	<0	-
C <sub>4</sub>	<0	-
m	>0	+
P	>0	+

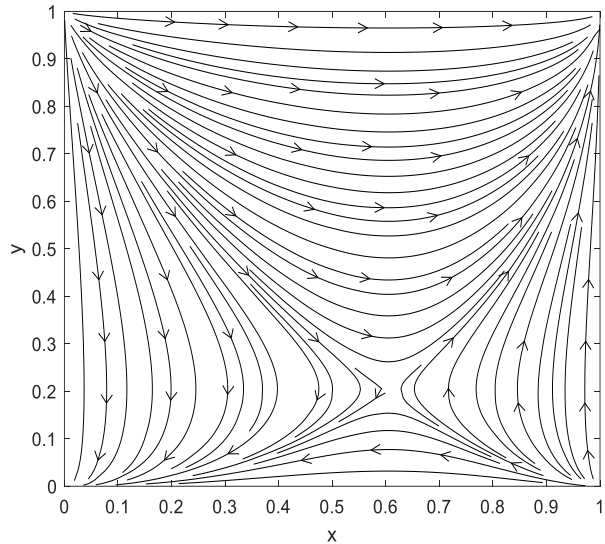
As can be seen from Table 3:

- (1)  $Z_2$  is negatively correlated with C<sub>3</sub> and C<sub>4</sub> input costs of Enterprise A and Employee B C<sub>3</sub>, C<sub>4</sub>. When C<sub>3</sub>, C<sub>4</sub> increase,  $Z_2$  decreases. It can be understood that when the increase of input costs exceeds the available benefits, Enterprise A and Employee B will tend to choose conservative and routine maintenance strategy, which is not conducive to enterprise innovation.
- (2)  $Z_2$  is positively correlated with the revenue value S available to enterprises and employees, the probability m of government reward, and the value P of government reward. When s, m, p increase,  $Z_2$  increases. It can be understood that as the larger the revenue, probability of government reward or value of government reward, the stronger the attraction to Enterprise A and Employee B, and the more inclined to choose innovation incentive and routine innovation strategies.
- (3) The relationship between  $Z_2$  and the income distribution coefficient of Enterprise A and Employee B  $a$  cannot be judged according to the existing conditions.

Based on the above analysis, it can be seen that the strategy choice of Enterprise A and Employee B is affected by multiple parameters such as cost, income and distribution coefficient.

#### 4. SIMULATION ANALYSIS

This paper uses Matlab for numerical simulation to make a more intuitive analysis of the game between whether Enterprise A chooses innovation incentive strategy and whether Employee B chooses routine innovation strategy. Under the stability condition of  $0 < C_4 < (1-a)S$ ,  $0 < (C_3 - mP) < aS$ , let the initial parameter value in the model be:  $a=0.5$ ,  $S=10$ ,  $m=0.5$ ,  $P=10$ ,  $C_3=6$ ,  $C_4=3$ , and the evolution result is shown in Figure 2:

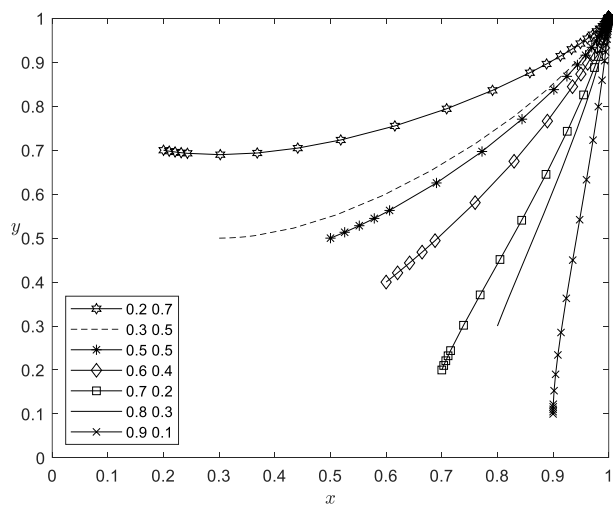


**Figure 2.** Evolution strategy phase portrait of game players

As can be seen from Figure 2, the final result of evolutionary game converges to (0, 0), (1, 1). Enterprise A chooses innovation incentive strategy, Employee B chooses routine innovation or Enterprise A chooses conservative strategy, Employee B chooses routine maintenance strategy.

**4.1. The Effect of Changes in Initial Probabilities of Enterprise A and Employee B on Evolutionary Stabilization Strategy**

Under the stability condition of  $0 < C_4 < (1-a)S$ ,  $0 < (C_3 - mP) < aS$ , let  $a=0.5$ ,  $S=20$ ,  $C_3=6$ ,  $C_4=3$ ,  $m=0.5$ ,  $P=10$ , and set 7 groups of different initial probabilities : the initial values of probabilities are (0.2, 0.7), (0.3, 0.5), (0.5, 0.5), (0.6, 0.4), (0.7, 0.2), (0.8, 0.3), (0.9, 0.1). The influence of initial probability changes on the evolution path of the game between Enterprise A and Employee B is obtained, as shown in Figure 3:



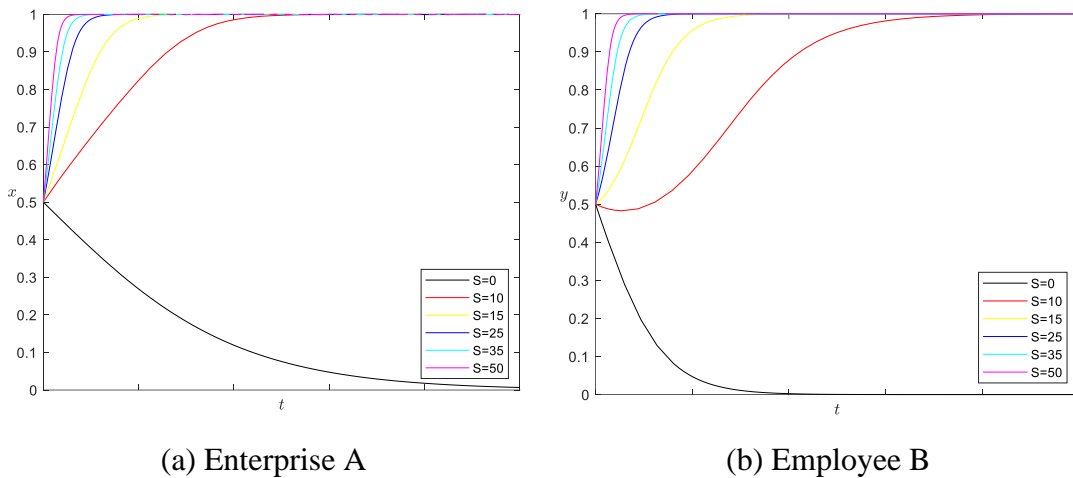
**Figure 3.** Evolution phase portrait with different initial probabilities

According to Figure 3, even though the initial probabilities of Enterprise A and Employee B choosing innovation incentive and routine innovation are different, under reasonable parameterization, they will eventually evolve to (1, 1), i.e., Enterprise A chooses innovation incentive and Employee B chooses routine innovation.

## 4.2. The Effect of Changes in Revenue on Evolutionary Stabilization Strategy

Under the condition of  $a=0.5$ ,  $C_3=6$ ,  $C_4=3$ ,  $m=0.5$ ,  $P=10$ , the revenue value  $S$  takes six different sets of initial values: 0, 10, 15, 25, 35, and 50 (0 does not meet the stability condition, and 10, 15, 25, 35, and 50 meet the stability condition), and obtains the simulation results of the effect of the change of the revenue value on the evolution paths of Enterprise A and Employee B, which are shown in Figure 4.

According to Figure 4, the strategy choices of Enterprise A and Employee B are influenced by revenue. The larger the revenue, the faster the Enterprise A and Employee B evolve to reach the ideal strategy, which has a good incentive effect. When the value of revenue  $S$  is 0, the incentive is insufficient, the strategy choice of Enterprise A and Employee B is (conservative, routine maintenance).



**Figure 4.** The strategy choice evolution diagram of both sides of the game based on the change of income

In the previous analysis of revenue  $S$  for region  $Z_2$ , the area of  $Z_2$  increases with  $S$ . Enterprise A and Employee B are more inclined to choose (innovation incentive, routine innovation). It is consistent with the results of the simulation analysis on  $S$  in this section. Revenue promotes Enterprise A and Employee B to choose innovation incentive and routine innovation strategies.

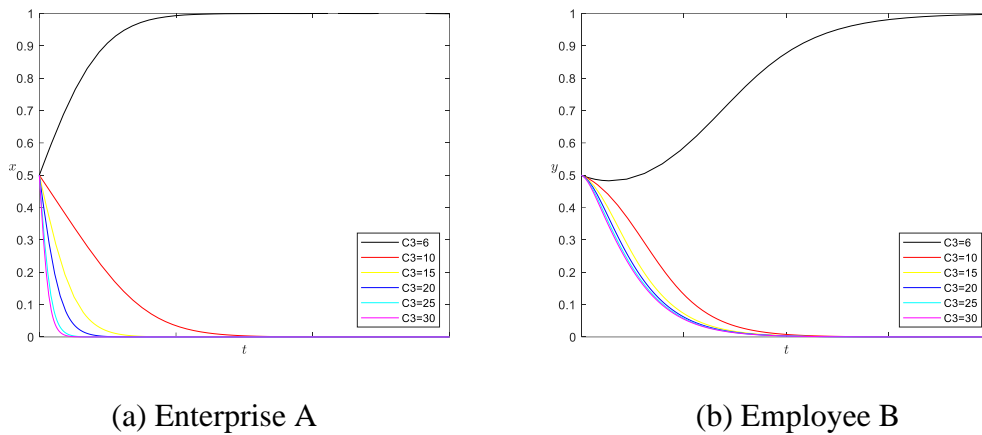
## 4.3. The Effect of Cost Changes on Evolutionary Stabilization Strategy

Under the condition of  $a=0.5$ ,  $S=10$ ,  $C_4=3$ ,  $m=0.5$ ,  $P=10$ , the innovation incentive cost  $C_3$  invested by Enterprise A takes 6 groups of different initial values: 6, 10, 15, 20, 25, 30 (10, 15, 20, 25, 30 does not meet the stability condition, and 6 meets the stability condition), and obtains the simulation results of the effect of cost changes on the evolution paths of Enterprise A and Employee B, which are shown in Figure 5-1.

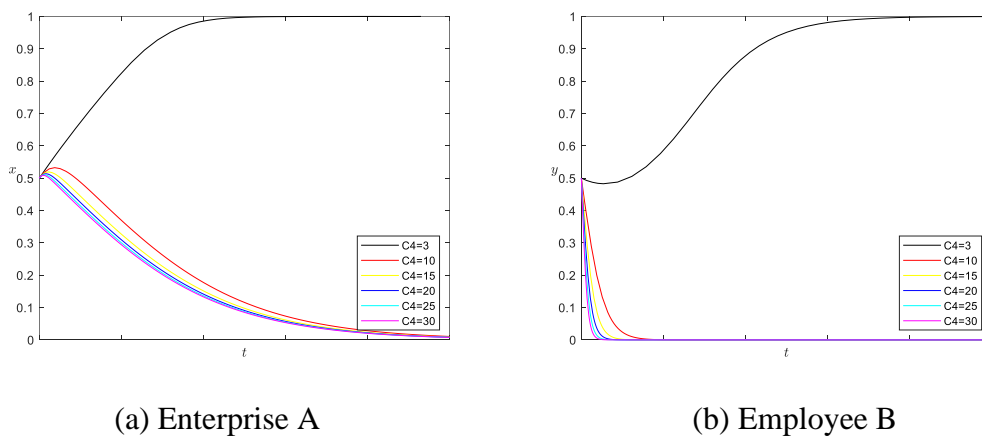
Under the condition of  $a=0.5$ ,  $S=10$ ,  $C_3=6$ ,  $m=0.5$ ,  $P=10$ , the routine innovation cost  $C_4$  invested by Employee B takes 6 groups of different initial values: 6, 10, 15, 20, 25, 30 (10, 15, 20, 25, 30 does not meet the stability condition, and 3 meets the stability condition), and obtains the simulation results of the effect of cost changes on the evolution paths of Enterprise A and Employee B, which are shown in Figure 5-2.

According to Figures 5-1 and 5-2, as the cost increases, the ratio of Enterprise A innovation incentive and Employee B routine innovation gradually converges to 0. When Enterprise A innovation incentive cost increases to the point that the revenue is not enough to bear, Enterprise A and Employee B choose the conservative and routine maintenance strategy. The higher the cost, the less attractive

innovation is for the Enterprise A and Employee B, and the strategy choice of Enterprise A and Employee B will evolve towards (conservative, routine maintenance).



**Figure 5-1.** Strategy choice evolution diagram of both sides of the game based on the change of enterprise innovation incentive cost

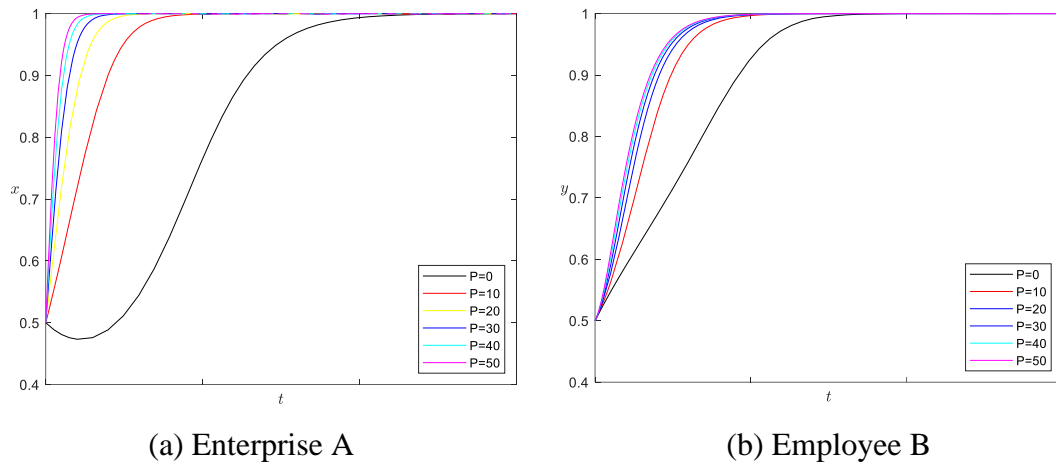


**Figure 5-2.** Strategy choice evolution diagram of both sides of the game based on the cost change of employee custom innovation

In the previous parameter analysis of region  $Z_2$ ,  $C_3$ ,  $C_4$  are negatively correlated with  $Z_2$ , which is consistent with the simulation analysis results of  $C_3$ ,  $C_4$  in this section. The increase in cost will cause Enterprise A and Employee B to choose conservative and routine maintenance strategies.

#### 4.4. The Effect of the Change in Government Reward Value on Evolutionary Stabilization Strategy

Under the condition of  $a=0.5$ ,  $S=20$ ,  $C_3=6$ ,  $C_4=3$ ,  $m=0.5$ , government reward value  $P$  takes 6 groups of different initial values: 0, 10, 20, 30, 40, 50 (all meet the stability condition). The simulation results of the impact of the change in government reward value  $P$  on the evolution path of Enterprise A and Employee B are obtained, as shown in Figure 6.



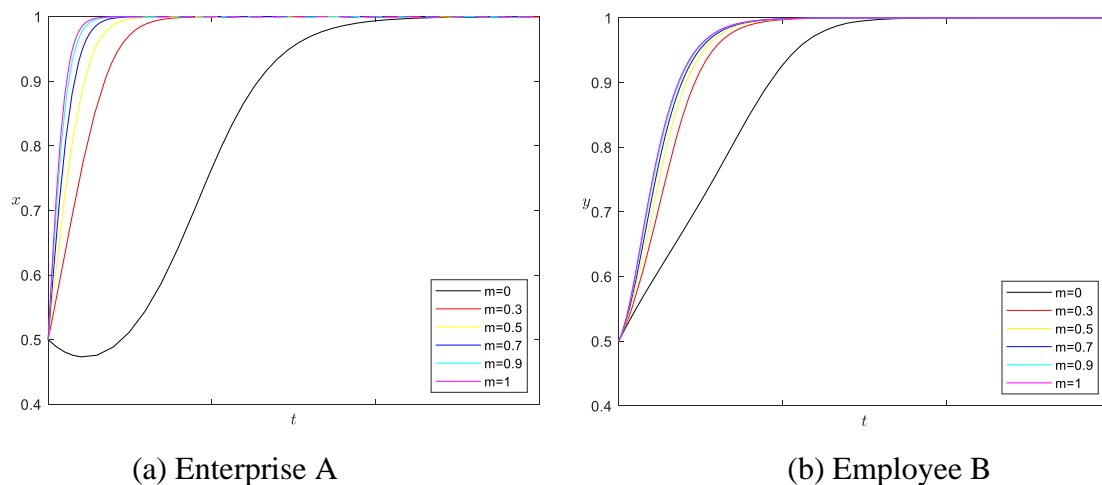
**Figure 6.** Strategy choice evolution of two game players based on the change of government reward value

As can be seen from Figure 6, the larger the government reward value  $P$ , the faster the evolution of Enterprise A and Employee B. When the government reward value is 0, the evolutionary stability strategy of Enterprise A and Employee B is still (innovation incentive, routine innovation). It can be seen that government reward has no decisive influence on the evolution path of Enterprise A and Employee B, but can accelerate the evolution speed of Enterprise A and Employee B.

In the previous parameter analysis of region  $Z_2$ , the government reward value is positively correlated with the area of  $Z_2$ . The larger  $P$  is, the more f Enterprise A and Employee B tend to choose innovation incentive and routine innovation strategy, which is consistent with the results of the simulation analysis on  $P$  in this section. The increase of government reward value can promote Enterprise A and Employee B to choose innovation incentive and routine innovation strategy.

#### 4.5. The Effect of the Change in Government Reward Probability on Evolutionary Stabilization Strategy

Under the condition of  $a=0.5$ ,  $S=20$ ,  $C_3=6$ ,  $C_4=3$ ,  $P=20$ , government reward probability  $m$  takes 6 groups of different initial values: 0, 0.3, 0.5, 0.7, 0.9, 1 (all meet the stability condition). The simulation results of the impact of the change in government reward probability  $m$  on the evolution path of Enterprise A and Employee B are obtained, as shown in Figure 7.



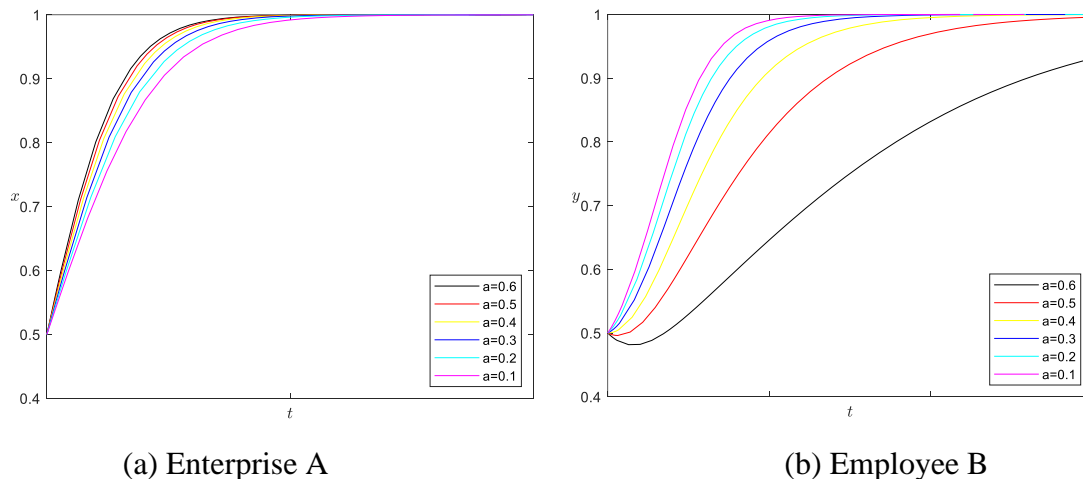
**Figure 7.** Strategy choice evolution of two game players based on the change of government reward probability

As can be seen from Figure 7, the larger the government reward probability  $m$ , the faster the evolution of Enterprise A and Employee B. When the government reward probability is 0, there is no government reward for Enterprise A and Employee B, but the final evolutionary result is still (innovation incentive, routine innovation). The government reward probability, like the government reward value, is not a decisive factor, but it can enhance the enthusiasm of Enterprise A and Employee B to innovate. The proportion of Enterprise A choosing innovation incentive and Employee B choosing routine innovation increases with the increase of the probability of government reward.

In the previous parameter analysis of region  $Z_2$ , government reward probability is positively correlated with  $Z_2$ . The larger  $m$  is, the more Enterprise A and Employee B tend to choose innovation incentive and routine innovation strategy, which is consistent with the simulation analysis results of  $m$  in this section. The increase in the probability of government reward can also promote Enterprise A and Employee B to choose innovation incentive and routine innovation strategy.

#### 4.6. The Effect of Revenue Distribution Coefficient on Evolutionary Stabilization Strategy

Under the condition of  $S=10$ ,  $C_3=6$ ,  $C_4=3$ ,  $m=0.5$ ,  $P=20$ , revenue distribution coefficient  $a$  takes 6 groups of different initial values: 0.1, 0.2, 0.3, 0.4, 0.5, 0.6 (all meet the stability condition). The simulation results of the impact of the change in revenue distribution coefficient  $a$  on the evolution path of Enterprise A and Employee B are obtained, as shown in Figure 8.



**Figure 8.** Strategy choice evolution diagram of two game players based on the change of revenue distribution coefficient

According to Figure 8, the larger the distribution coefficient is, the more revenue Enterprise A can get from distribution, and the faster Enterprise A evolution speed is. The smaller the distribution coefficient is, the more revenue Employee B can get from distribution, and the faster Employee B evolution speed is. As a positive incentive, revenue has an impact on the strategy choice of Enterprise A and Employee B. The distribution coefficient divides revenue between Enterprise A and Employee B. The more revenue obtained, the faster the equilibrium will be reached.

In the previous parameter analysis of region  $Z_2$ , the relationship between the distribution coefficient and  $Z_2$  cannot be discerned. Based on the distribution coefficient, it is not possible to determine whether Enterprise A and Employee B prefer to choose (innovation incentive, routine innovation) or (conservative, routine maintenance). In the simulation analysis of this section, the increase of  $a$  will lead to faster selection of innovation incentive strategy by Enterprise A, the willingness of Employee B to select routine innovation strategy is weakened, and Enterprise A and Employee B will not consistently evolve in the direction of (innovation incentive, routine innovation). The results of the two analyses are also consistent.

## 5. DISCUSSION

### 5.1. Model Summary and Analysis

Organizational routines will take measures to actively update and innovate. This innovation introduces new ideas and knowledge to businesses, which has a positive impact on enterprise innovation. Mi et al. [31] looked into the structure of organizational routines and how internal intervention changes. They found that when changes in the environment add up to a certain point, the more internal coupling there is in the organization, the more obvious it is that organizational routines are changing little by little. Wang et al. [32] investigated the dynamic evolution mechanism of organizational routines, and the results showed that routines have a continuous self-evolutionary nature, which comes from the interactive behavior between the performative aspect and the explicit aspect. However, most of these studies focus on the level of organizational routines themselves and do not extend to the level of corporate governance to form universal management behaviors. Meanwhile, few studies have focused on the intrinsic link between corporate incentives and routine innovation. Therefore, this paper uses the method of evolutionary game analysis to establish an evolutionary game model between corporate innovation incentives and employee routine innovation. It then analyzes the evolutionary characteristics of the strategies between the two, leading to the following conclusions:

- (1) (Innovation incentive, routine innovation) and (conservative, routine maintenance) are the evolutionarily stable strategies for the system, and the evolutionary path depends on the values of the game payoff matrix parameters.
- (2) The expected revenue, the cost of innovation incentive, and routine innovation are important parameters that affect the strategy choices of both sides of the game. In the dynamic game process, if the expected revenue fails to offset the cost of inputs, it may not be sufficient to encourage enterprises to adopt innovation incentive strategies or employees to choose routine innovation strategies. Currently, the enterprises opt to retain their business, while the employees opt to stick to their routine.
- (3) Rewards from the government can accelerate the evolution of enterprises' and employees' strategy choices. When the value of government reward to enterprises is larger, or the probability of government reward to enterprises is larger, both enterprises and employees choose innovation incentives and routine innovation strategies more quickly. Although government rewards are not a determining factor in enterprises' and employees' strategy choices, they can have a positive impact.
- (4) The distribution of gains from innovation between enterprises and employees similarly affects the rate of evolution of enterprises' and employees' strategy choices. A smaller distribution coefficient, meaning fewer benefits for the enterprises and more benefits for the employees, accelerates the employees' evolution while slowing down the enterprises. In related research, Xu et al. [29] believe that employees themselves do not have the motivation to update their routines, and individuals in an organization always tend to maintain existing routines based on cost considerations [33]. Even if the existing situation produces negative impacts, individuals may not necessarily make changes immediately. Therefore, to encourage routine innovation among employees, companies should provide them with revenue incentives. These incentives should be sufficient to cover the costs associated with routine changes, alleviate employees' concerns about the future, and stimulate their routine. The revenue distribution coefficient has a direct impact on the available revenue for employees. When employees anticipate increased revenue from innovation activities and the ability to cover associated costs, they tend to adopt more proactive behaviors, thereby fostering organizational routine innovation [34].

In comparison with the existing studies, this paper also follows the two-aspect view of organizational routines, where the continuous interaction between the ostensive aspect and the performative aspect is the root of organizational innovation. Li et al. [35] came to the same conclusion as this paper: the

expected benefits, the cost of changing organizational routines, and the incentive cost of knowledge creation are all important factors that affect the gaming system. This is because they studied how knowledge creation behavior works and how organizational routines change over time. Li et al. [35] pointed out that the size of expected revenue, knowledge incentive cost, and routine conversion cost determine the strategy choice of the game subjects, which is consistent with this paper's conclusion. Furthermore, this paper reinforces the conclusion that routines positively influence innovation obtained from Xu et al.'s study of social capital incentives for innovation drive [29]. Xu et al. used routines as a starting point to consider the positive influence of routines on innovation drive, while this paper explores the relationship between corporate innovation incentives and employee routine innovation through the lens of the evolutionary game. As a result, Xu et al.'s [29] study complements this paper's study on the relationship between innovation drive and routines. In terms of research methodology, current research on organizational routines employ a single case study approach, such as Ouyang et al. [36], who concluded that organizational routines can undergo both stability and transformation. Lin et al. [22] discovered that the evolution of organizational routines is the key to organizational innovation. However, case studies are not sufficiently generalizable [13]. In case studies, scholars often focus solely on specific case problems, which diminishes the practical value and theoretical significance of the research, ultimately leading to a lack of generalizability [13]. Simultaneously, the current research does not incorporate time-series comparative analysis; this lack of dynamics results in insufficient reliability and applicability of the conclusions [6]. Therefore, this paper uses the method of evolutionary game analysis, and the research design is not limited to a specific enterprise, but also analyzes the dynamic evolution paths and evolutionary characteristics of enterprises and employees under the conditions of limited rationality and incomplete information. The obtained research can be further expanded and applied in enterprises with similar or the same situation.

## 5.2. Management Enlightenment

Based on the above findings this paper gets the following management enlightenments:

(1) Ensure incentive compatibility between enterprises and employees during the innovation interaction process.

According to Figure 2, enterprises need to incentivize their innovative activities, and employees must actively participate in these activities. Combining Figures 4 and 5 with Table 3, benefits and costs are the determining factors affecting the strategy choices of enterprises and employees. The greater the benefits of innovation, the faster the evolution of enterprises and employees, and the greater their inclination towards innovation incentives and routine maintenance. The higher the cost, the lower the willingness of enterprises and employees to innovate, leading to a more conservative approach to routine maintenance. Both enterprises and employees strive to maximize their own interests in the game process. To align employee behavior with the enterprise's desired goals, the enterprise must ensure incentive compatibility when promoting innovative activities. This ensures that employees' pursuit of their personal interests aligns with the enterprise's collective interests. Therefore, through governance practices, the enterprise can foster a community of interest between itself and its employees by implementing the following measures: ①safeguard the interests of employees. Providing employees with adequate compensation and benefits is crucial in fostering a community of interest between the employees and the enterprise. Establish a good corporate culture atmosphere. ②Establish a corporate culture and institutional processes that actively guide employees to integrate into the enterprise, shape healthy values, and enhance employees' sense of belonging. ③Incorporate organizational goals into performance management. Divide organizational goals into practical personal goals, incorporate them into performance management, and direct employees towards organizational goals that align with their interests.

(2) The government should strongly encourage innovative behavior of enterprises and employees.

According to Figures 6 and 7, government reward, although not a decisive factor, can positively contribute to the evolutionary speed of firms and employees. Both the value of government reward for innovation and the probability of reward can be important factors to attract firms to innovate. Therefore, to guide firms to innovate, the government can give innovation rewards to increase the proportion of firms in the industry that innovate, including material rewards and non-material rewards. Material reward includes a variety of bonuses, subsidies, and tax incentives; non-material reward includes publicity and recognition, talent introduction, and system process optimization. At the same time, the government needs to select the reward objects according to the willingness to innovate and the existing financial situation of enterprises; the stronger the willingness to innovate, the more urgent the need for funds, and the greater the possibility of government subsidies for innovation and research and development, so that the government subsidies can play a full role in innovation incentives.

### (3) Establish a reasonable revenue distribution mechanism

As the executor of organizational routines, employees need to participate in routine innovation, but employees do not have sufficient initiative for routine innovation based on cost. As can be seen from Figure 7, innovation benefits can promote employees to innovate. When employees expect to gain more benefits in innovation activities, they will take more initiatives to promote the innovation of organizational routines. Therefore, enterprises need to establish a reasonable revenue distribution mechanism to ensure that the input of employees is proportional to the revenue: ① diversified distribution. Diversified distribution methods are specified according to employees' work content, work characteristics and basic conditions of enterprises, combined with distribution according to work and capital, employees are encouraged to hold long-term compensation such as equity, employees' own interests are combined with the interests of the enterprise, and employees' sense of responsibility and enthusiasm for innovation activities are improved. ② Differentiated distribution. Revenue is distributed according to work performance and the proportion of employees' investment in innovation activities, to widen the revenue gap of employees and give consideration to fairness. Employees who invest more in innovation activities will get more benefits, so as to encourage employees to actively participate in innovation. ③ Dynamic distribution. The salary design should not be static, but should adapt to the development of enterprises, the growth of employees and the changes in the external market.

## 6. CONCLUSIONS

Organizational routines, as collective behavioral paradigms within an organization, are subject to modification and updating. When enterprises invest in innovation incentive costs, employees form new consensus, new processes and new norms about innovation, generate new ostensive aspects, and the ostensive aspects guide employees' specific performative operations, which in turn form new performative aspects, and in this process realize routine innovation. This paper uses evolutionary game analysis to create an evolutionary game model of how businesses can encourage innovation and how employees can come up with new ideas on a regular basis. It shows that when benefits and costs are fair, businesses and employees are likely to choose strategies that encourage innovation and encourage routine innovation. Government incentives for corporate innovation can also encourage it. For the benefits obtained from innovation, a reasonable distribution can enhance employees' initiative and promote their customary innovation behavior. Based on this, this paper derives three key insights: ① ensuring the compatibility of incentives between enterprises and employees in the process of innovation; ② the government should vigorously encourage the innovative behaviors of enterprises and employees in the region under its jurisdiction; ③ enterprises should establish a reasonable revenue distribution mechanism to ensure the interests of employees.

This study enhances the existing research on the relationship between enterprise incentives and organizational routine innovation. Under the reasonable revenue distribution mechanism, corporate incentives are effective measures to promote organizational innovation; they expand the application

of organizational routines in corporate governance. In the practice of corporate governance, organizational routines are the root of corporate innovation. The innovation of routines can effectively promote the innovation of the enterprise, stimulate the innovative behavior of the employees, cultivate the innovative consciousness of the employees, and transform the organizational practices into management behaviors with practical significance.

However, this paper has certain limitations: (1) Innovation incentives, while effective in promoting enterprise and employee innovation, may have a negative impact on organizational innovation. Additionally, government incentives, without a supporting regulatory system, may result in resource waste. Therefore, the subsequent research can analyze the reasonable incentive interval of organizational innovation and, at the same time, consider the impact of the introduction of innovation monitoring mechanism on organizational innovation, giving more practical advice on corporate governance. (2) Enterprise innovation is a complex process, and studying its incentives and organizational routines alone is not sufficient to draw comprehensive conclusions. Therefore, we also need to study organizational innovation from the perspective of more influential factors.

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