The Theme Cooperation Mechanism of Science and Technology Enterprise Incubation Alliance Based on Multi-agent System under Computer Control

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Abstract. From the point of view of self-organization evolution, complex adaptive system theory, evolutionary game theory modeling and simulation method, comprehensive use of multi-agent system to simulate the establishment of the cooperative strategy mechanism between the objects of the technical enterprise incubation alliance in different credit cooperation environments. The dynamic process of cooperative strategy selection of the main body of the incubation alliance of science and technology enterprises under different cooperative conditions and market credit environment is studied systematically and with computer control. This paper analyzes the strategic selection mechanism of cooperation among the main bodies of the science and technology enterprise incubation alliance. When participating in the incubation alliance's strategic cooperation in the credit environment, unified environment and fraud environment, the technology incubation service institutions should adopt the strategy of cooperation with other entities.

Keywords: Technology Incubation, Strategic Mechanism, Multi-agent Simulation Modeling, Evolutionary Game, Computer Control

1. Introduction
The development of China's innovation environment needs a new type of incubation service system[1]. Changing the operation and service mode of traditional incubators is of great significance for improving the survival rate of start-up technology enterprises, promoting the whole social entrepreneurial atmosphere, improving the level of China's scientific and technological innovation, and accelerating the construction of an innovative country. Through cooperation with government departments[2-3], scientific research institutes, financial institutions, testing, and experimental institutions, and intermediary service institutions, technology enterprise incubators will form a technology enterprise incubation alliance[4], innovate operation modes through various mechanisms, and provide systematic and high-quality incubation services for technology enterprises, which will greatly promote the development of China's high-tech undertakings, and effectively improve their own comprehensive services Competitive[5].

The cooperation subjects of the technology enterprise incubation alliance come from different fields such as education, scientific research, finance, manufacturing, and service, there are significant
differences in enterprise strategy, enterprise direction, institutional background, legal person background, profit-making mode, etc\cite{6}. Besides, the technology enterprise incubation alliance is a complex adaptive system that regularly exchanges with the external environment, with a wide range of interaction between cooperation subjects, strong impact of market integrity environment on cooperation, and uncertainty in the type of cooperation relationship. To address this issue, we conducted a study on the cooperation strategies of each cooperation subject in the incubation war alliance of technology enterprises in this paper, to explore the type of game triggering strategies each subject takes to protect the interests of individuals and alliances in different external environment with good faith.

2. Establishment of multi-agent system

Given the above factors, based on the multi-agent simulation experiment method, this paper constructs the evolutionary game multi-agent system which is suitable for different cooperation relations of prisoner game, Eagle pigeon game and deer hunting game multi-agent system under different market credit forms. By comparing six typical game triggering strategies, it is determined that in different cooperation cycles, under different credit environments The winning strategies of cooperation subjects in different cooperation relations.

The technology incubation alliance composed of N subjects is established and randomly placed in a space of $M \times M$. In this system, each cooperative agent can have multiple types of collaborative triggering strategies, which constitute the strategy set of the cooperative agent $D_t = \{d_1, d_2, \ldots, d_t\}$, $t \in \{1, 2, \ldots, N\}$. When the cooperative subjects I and j play a game, the revenue set of the alliance composed of these cooperative subjects is $U_{ij} = \{u_{i, j(t)}, u_{j, i(t)}\}$, $i, j \in \{1, 2, \ldots, N\}$, $i \neq j$. In each round, each subject randomly plays games with other subjects.

2.1. Given the sample data set

$$D = \{x_1, x_2, \ldots, x_n\}; \quad x_i \in R^d, i = 1, \ldots, n. \quad (1)$$

Assuming that the first sample is labeled, it is denoted as $e = (x_i, x_2, \ldots, x_j)$, and the corresponding label $\eta = \{y_1, y_2, \ldots, y_j\}$

In the multi-agent system, attribute information that represents the integrity record is added for each cooperation subject $H_i$, which is used to record the behavior of the cooperative subject in each game, and respectively uses “Y” and “n” to represent “compliance” and “breach of contract”. For a cooperative subject I who has experienced t rounds of cooperative games, the credit record of its cooperation strategy is as follows:

$$H_i = \{(h_{i,1}, \ldots, h_{i,t-1}, h_{i,t}) \mid h_{i,t} \in \{Y, N\}\} \quad (2)$$

Due to the incomplete symmetry of the information, the cooperation subject can only get part of the cooperation strategy record information of the cooperation subject. In this multi-agent system, it is assumed that the cooperation subject of the technology enterprise incubation alliance can get the latest cooperation strategy information of the partner, i.e. $h_{i, j}$. Based on the value of $h_{i, j}$, the credit situation of the cooperation subjects and their behavior are determined in the T + 1 round of game.

2.2. Cooperation strategy among subjects

Six typical strategies in game theory are selected to analyze the strategy space set $D_t = \{d_1, d_2, \ldots, d_t\}$, each strategy represents the following types.
$d_1$: Random strategy. That is, the cooperative subject does not refer to the information of the opponent and the environment, and only makes the act of compliance or breach of contract randomly. Although the decision-making process of this strategy is not scientific, it is very common in real life.

$d_2$: Cooperation strategy. That is, no matter what the integrity record of the other party is, the cooperation subject believes that the other party will keep the contract, and he has always taken the behavior of keeping the contract.

$d_3$: Betrayal strategy. That is, the cooperative subjects do not trust other partners at all. In order to protect themselves from losses, they always adopt the strategy of breach of contract.

$d_4$: Tit for tat strategy. The cooperative subject starts the first round of the game by abiding by the contract, and immediately breaks the contract in the next round of the game in case of the breach of the contract by the competitor to retaliate. After the competitor abides by the contract, the cooperative subject also immediately returns the behavior of abiding by the contract.

$d_5$: Never condone the strategy. The cooperative subject starts the first round of the game by keeping the contract. Once the opponent default is identified, it will take the default behavior in all subsequent rounds of the game.

$d_6$: Tolerance strategy. The difference between this strategy and the tit for tat strategy is that the cooperative subject continues to keep the contract with a certain probability after discovering the default of the game opponent. This strategy means that in the process of cooperation, the cooperation subject will further consider the reasons behind the partner's breach of contract, whether it is intentional or caused by mistake, and allow the other party to correct their behavior. This strategy can quickly make the two parties with short-term conflicts cooperate.

2.3. Form of Environment Integrity

The proportion of actors with various behavioral tendencies constitutes the form of social honesty. Where there is a large proportion of the cooperative subjects who abide by the contract, it is regarded as a form of social integrity of integrity. Where the proportion of the subjects abiding by and breaching the contract is equal, it is called a form of social integrity of uniformity. Where there is a large proportion of the subjects who break the contract, it is called a form of social integrity of fraud. These three forms are quantified in the self-organization evolution multi-agent system of technology enterprise incubation alliance, and they are respectively represented as follows.

Integrity type: in the initial setting of the multi-agent system, most subjects adopt $d_1$ cooperation strategy, the minority adopt $d_2$ betrayal strategy, and the average number of subjects adopt the other four strategies.

Fraud type: the initial setting of the multi-agent system is opposite to the integrity type. The subjects adopting $d_1$ cooperation strategy are very few, the subjects that adopt the $d_2$ betrayal strategy are most, and the number of subjects that adopt the other four behavior strategies is average.

Uniform type: in the initial setting of the multi-agent system, the number of subjects of six behavior strategies is average.

If the proportion of behavior subjects who adopt each strategy in a specific time section of the multi-agent system is set. For the strategic alliance of incubation of scientific and technological enterprises studied by this multi AGENT system, the proportion of various actors under three forms of integrity is set, as shown in Table 1.

| S/N | Behavior Strategy       | Weight | Cooperative type | Homogeneous type | Betrayal type |
|-----|-------------------------|--------|------------------|-----------------|--------------|
| 1   | $d_1$: random strategy  | $ω_1$  | 1/6              | 1/6             | 1/6          |
| 2   | $d_2$: cooperation strategy | $ω_2$ | 3/10             | 1/6             | 1/30         |
| 3   | $d_3$: Betrayal strategy | $ω_3$ | 1/30             | 1/6             | 3/10         |
| 4   | $d_4$: tit for tat strategy | $ω_4$ | 1/6              | 1/6             | 1/6          |
| 5   | $d_5$: no forgiveness strategy | $ω_5$ | 1/6              | 1/6             | 1/6          |
| 6   | $d_6$: tolerance strategy | $ω_6$ | 1/6              | 1/6             | 1/6          |
2.4. Settings of multi-agent simulation system
In this paper, a self-organization evolution multi-agent system of cooperation strategy selection among the subjects of technology enterprise incubation alliance is established. The NetLogo 5.0 simulation platform is used for programming modeling.

The initial state settings of the multi-agent system are as follows: the environment space domain is $20 \times 20$, a total of 300 agents are randomly distributed in the environment space, each agent occupies a grid, and has one of six behavior strategies. At each time point, agents move randomly and play two games with the agents they meet.

In each simulation cycle, the two agents play cooperative games. When the number of simulation cycles reaches once, the cooperation state of the system is nearly stable. In this multi-agent system, the number of operations is set to 50,000 according to the actual observed results.

3. Relationship analysis of constituent subjects of technology enterprise incubation alliance
In the strategic alliance network including the government, incubator, venture capital organization, technology enterprise, and technology service organization, each alliance subject implements its independent operation through its enterprise operation mode, which is not only the service provider but also the service demander in the alliance. With such mutually complementary and mutually promoting cooperation relationship, it is believed that the strategic alliance can be stable and long-term Development, the members of the alliance achieve their sustainable development while achieving the overall goal of the alliance, which in turn allows the alliance to stay in the cooperation system for a long time, and maintain the stability and development of the system through their efforts. A stable strategic alliance requires a unified management system. This management system must have strong resource integration capacity to gather various social forces, form a benign interactive network system, and use this resource scale to incubate start-up technology enterprises, promote the creation of regional innovation and entrepreneurship atmosphere and promote the vigorous development of economy by helping enterprises grow. In the strategic alliance of technology incubation, the relationship of each cooperation subject is shown in Figure 1 below.

![Figure1. Cooperation relationship of subjects in the technology incubation strategic alliance](image-url)

4. Conclusions
Given the vigorous development of modern technology enterprises and the information industry, each cooperation subject in the technology enterprise incubation alliance will face massive partners, and the
cooperation situation varies. Meanwhile, the credibility of the external environment also has a significant influence on the strategic choice of collaboration. In short- and long-term repeated games, different strategies have various pros and cons. According to the above analysis, the following policy recommendations are proposed to ensure the smooth cooperation among the subjects of the technology enterprise incubation alliance. Firstly, the government and various economic entities in the society should be committed to creating a good social integrity environment and keeping a fair, equitable cooperation environment of technology business incubation alliance to drive the healthy and rapid development of the economy. Secondly, the construction of the organizational management system for the technology business incubation alliance should be strengthened. All subjects should be involved in building and managing the organization and establishing the related constraint, incentive and guarantee mechanisms to ensure the normal operation of the cooperative management. Third, the construction of the institutional security system of the technology business incubation alliance should be enhanced. The relevant alliance operating system should be formulated to ensure that the cooperation entities in the technology enterprise incubation alliance can further open to the outside world, share resources, and adopt active cooperation strategies.

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