



Research and Analysis of the New Pattern of Ecological Evolutionary Development Based on the Context of Big Data

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Abstract. This paper introduces the prospect theory based on the traditional game approach, uses the value function in the prospect theory to analyze the evolutionary game process of the entrepreneurial ecosystem of crowdsourcing spaces, and further explores the strategy selection process of each subject through the benefit perception matrix. Firstly, based on the prospect theory, the evolutionary game model between the operation and management of the crowdspace platform and the entrepreneurial innovation group is constructed, the evolutionary stable strategies of both sides of the game are analyzed, and the impact of different parameters on the strategy choice of each game subject is analyzed by using MATLAB simulation. Then, in order to analyze the government's regulatory mechanism in the entrepreneurial ecosystem, this paper also constructs a tripartite evolutionary game model of the government, the operation and management side and the entrepreneurial innovation group, integrates the prospect theory to derive the perceived benefit matrix of the three parties of the game, and uses phase diagram and stability analysis to study the evolutionary process of each subject. Finally, according to the above analysis process, combined with the actual case of UFO crowdspace in Zhengzhou City, the process of reaching the steady state of the system is derived by using simulation analysis.

Keywords: Crowdspace · Entrepreneurial Ecosystem · Prospect Theory · Evolutionary Gaming

1 Introduction

In the early era of the Internet and artificial intelligence, the traditional entrepreneurial behavior of the past, with the laboratory as the carrier, the development of science and technology as the precursor, and the researchers as the core, is gradually shifting to the innovation 2.0 model with social practice as the platform, shared thinking as the guide, and full open and shared innovation with active user participation [1]. With the support of domestic and international crowdsourcing platforms, innovation is not only the preserve of laboratories, but ordinary people can also participate in innovation and entrepreneurship [2]. Crowdsourcing spaces are open to the entire public, providing

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equipment, facilities and materials needed for entrepreneurial and innovative activities, and providing low-cost development space for entrepreneurs, with the characteristics of sharing and inclusion. It can also help startups to apply for subsidies, apply for business registration, polish their projects, etc. It facilitates entrepreneurs to share their views, project roadshows and product demonstrations [3].

2 A Three-Way Evolutionary Game Analysis Based on Prospect Theory

The entrepreneurial ecosystem of crowdsourcing spaces is a system based on supporting services, operation and management, infrastructure [4], and a series of entrepreneurship-related policies for public innovation and entrepreneurship [5]. The government, operation, and management as well as social investors can be the platform subjects of crowdsourcing spaces [6].

The dynamic evolution trend and phase diagram of the government in different states are shown in Fig. 1.

For the operator-manager of the crowdspace, the derivation of Eq. 1 yields:

$$F'(j) = (1 - 2j)j(1 - j)\{i \cdot [k \cdot v(-F_m) - v(-F_m)] - k \cdot v(-F_m) + C'_m - C_m$$

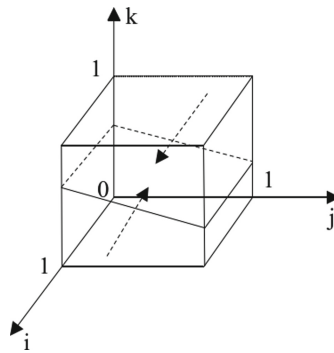


Fig. 1. Evolutionary phase diagram of the government

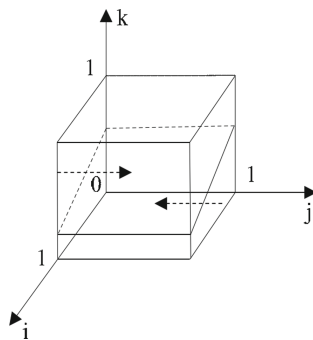


Fig. 2. Evolutionary phase diagram of the O&M side

When $i = \frac{C_m - C'_m + k \cdot v(-F_m)}{v(-F_m) - k \cdot v(-F_m)}$ Time, $F(j) = 0$, At this point all j is in a steady state, when $i = \frac{C_m - C'_m + k \cdot v(-F_m)}{v(-F_m) - k \cdot v(-F_m)}$ When the $F(j) = 0$ is the case, we can find that $j = 0, j = 1$ is the two stable points.

When $i > \frac{C_m - C'_m + k \cdot v(-F_m)}{v(-F_m) - k \cdot v(-F_m)}$ Time, $F(j) > 0, F'(j)|_{j=1} < 0, F'(j)|_{j=1} > 0$, At this point $j = 1$ is the stabilization strategy, and the operation manager will choose the strategy of performance.

When $i < \frac{C_m - C'_m + k \cdot v(-F_m)}{v(-F_m) - k \cdot v(-F_m)}$ Time, $F(j) < 0, F'(j)|_{j=1} > 0, F'(j)|_{j=1} < 0$, At this point $j = 0$ is the stable strategy, and the operation manager will choose the strategy of not performing. The dynamic evolution trends and phase diagrams of the ODM in different states are shown in Fig. 2.

For the entrepreneurial innovation group, the derivation of Eq. 1 yields. $F'(k) = (1 - 2k)[i \cdot v(R_p) - C_p]$

When $i = \frac{C_p}{v(R_p)}$ Time, $F(k) = 0$, At this point, all k is in a steady state, when $i \neq \frac{C_p}{v(R_p)}$ Time, make $F(k) = 0$, knowable $k = 0, k = 1$ are two stable points.

When $i > \frac{C_p}{v(R_p)}$ Time, $F(k) > 0, F'(k)|_{k=1} < 0, F'(k)|_{k=0} > 0$, At this point $k = 1$ is the stable strategy and the entrepreneurial innovation group chooses the strategy of supervision.

When $i < \frac{C_p}{v(R_p)}$ Time, $F(k) < 0, F'(k)|_{k=1} > 0, F'(k)|_{k=0} < 0$, At this point $k = 0$ is the stable strategy and the entrepreneurial innovation group chooses the unsupervised strategy. Its dynamic evolution trend and phase diagram in different states are shown in Fig. 3.

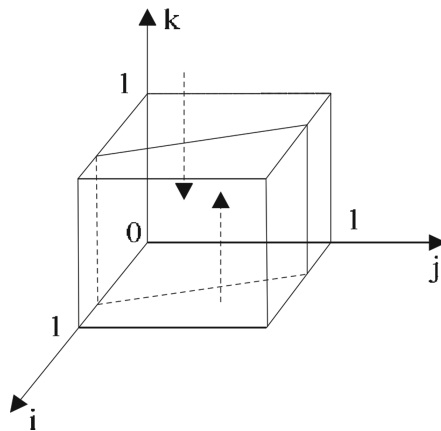


Fig. 3. Evolutionary phase diagram of entrepreneurial innovation groups

3 Simulation Analysis

In this paper, we will assign values to different parameters under specific conditions based on the actual operation of the UFO crowdspace, and use MATLAB numerical simulation to visualize the evolution of the system from the graph [7]. According to Tversky et al. in the prospect theory, the degree of avoidance λ of the loss and the marginal diminishing returns function in the expression of the value function is taken as 2.25 and the degree of sensitivity α of the marginal diminishing returns is assigned as 0.88 (Fig. 5).

Make $C_g = 25, C'_g = 9, C_m = 5, C'_m = 5, C_p = 10, F_g = 9, F_m = 10, R_g = 12, R'_g = 18, R_p = 12$ the results of the run can be obtained as shown in Fig. 4. At this point, the stability point of the system is (0,0,0), i.e., the government chooses the strategy of no regulation, the operation management chooses the strategy of no performance, and the entrepreneurial innovation group chooses the strategy of no supervision (Fig. 7).

Figure 6 shows when $C_g = 8, C'_g = 9, C_m = 20, C'_m = 11, C_p = 19, F_g = 9, F_m = 15, R_g = 12, R'_g = 10, R_p = 15$ The steady state of the system at this point is (1,0,0). The benefits of active government regulation $F_m^\alpha + R_g - C_g$ Greater than the gain in case of negative regulation $R'_g - C'_g$, then they will choose the strategy of active regulation to supervise the operation of crowdsourcing spaces from time to time to avoid their opportunism [8].

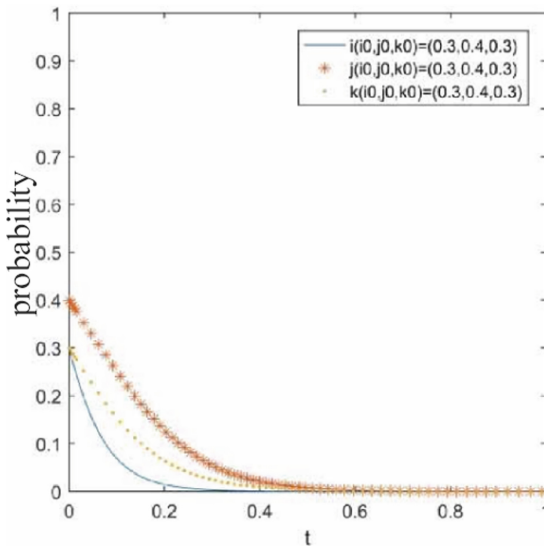


Fig. 4. Evolution of (0,0,0)

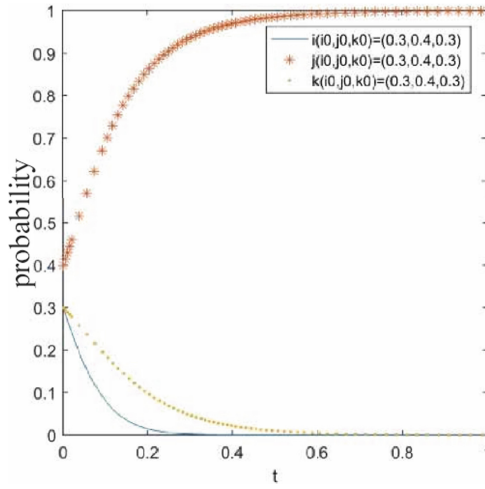


Fig. 5. Evolution of (0,1,0)

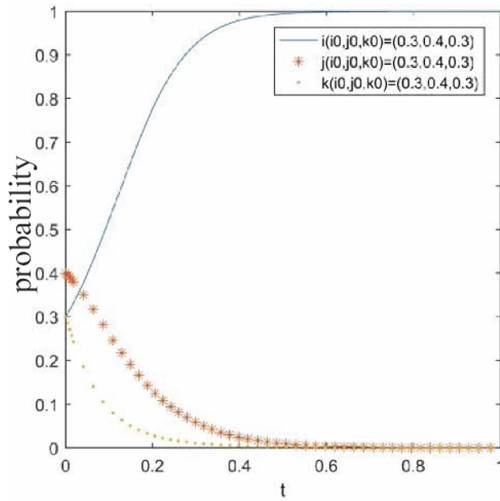


Fig. 6. Evolution of (1,0,0)

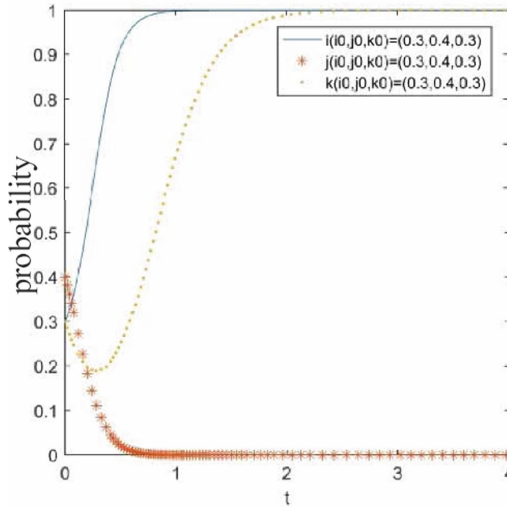


Fig. 7. Evolution of (1,0,1)

4 Conclusion

In this paper, in order to study the supervision and management of the entrepreneurial ecosystem of crowdsourcing space, with the help of the value function in the prospect theory, we construct a benefit perception matrix different from the traditional game matrix, as well as a three-party game matrix of the government, the operation and management of crowdsourcing space and the entrepreneurial innovation group, analyze the strategy selection process of each game subject [9], and use MATLAB simulation to analyze the dynamic change process of the evolutionary stabilization strategy by combining the actual development status of UFO crowdsourcing space to make the model more intuitive. From the above analysis [10], the following points can be concluded.

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