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Editorial

Complex System Models and Their Application in Industrial Cluster and Innovation Systems

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Industrial clusters and innovation systems are complex systems composed of heterogeneous subjects. They present complex characteristics such as self-organization, nonlinearity, emergence, and adaptability [1–3]. This makes it impossible for traditional reductionist ideas to study and explore them in depth. The traditional linear approach cannot explain the dynamic interaction behavior of multiple subjects in complex systems. In the research of industrial clusters and innovation systems, the linear idea of reductionism becomes more and more powerless as the research dimension increases and the research difficulty gradually increases. With the effective application of complex systems theory in the field of natural science research, more and more scholars also consider it as an effective tool in the field of innovation management research [4–6].

With the development of system theory, new theories such as quantum theory, synergy theory, dissipative structure theory, and catastrophe theory have opened new doors for us to study socially complex systems. They can address complex features that cannot be explained by reductionism, especially the dynamic interaction behavior of subjects in industrial clusters and innovation systems. Quantum theory can explain the breakthrough innovation of knowledge in innovation systems, the leap of technology trajectory. Based on the nonlinear model in the field of physics and chemistry, it can study how some self-organized systems break through the threshold and evolve from disorder to order. Mutation theory can explain the reasons for the sudden nature change of innovation systems [7–10]. Therefore, the application of complex system models to solve problems in innovation management research is conducive to in-depth research in social sciences and promotes the development of innovation management.

The traditional reductionism is no longer applicable to the study of socially complex systems. It is imperative to propose new theories and new methods. Based on the theory of complex systems, the research model of social complex systems can effectively describe the complex characteristics of industrial clusters and innovation systems through intelligent technology, mathematical models, physical models, and chemical models. It is helpful to explain the complex environment in the innovation management research field and reveal its essence and law. Therefore, the application of complex system models to solve the problems in innovation management research is conducive to the in-depth study of social science and promotes the development of innovation management.

1. Model Extension and Algorithm Optimization

Y. Wei et al. optimized the traditional PageRank algorithm by incorporating a text similarity approach (TSA) into their study and validated the algorithm using Chinese environmental health standards. F. Zhang et al. optimized an industrial product service system. They incorporated affinity propagation (AP), quality function development (QFD), and axiomatic design (AD) to solve many difficulties such as uncertain customer requirements, subjective experience design, and long debugging time. J. Liu et al. examined

university ranking from the perspective of complex systems and proposed an innovative university ranking method. L. Zhang and W. Chen used complex network theory as the basis to construct a multilayer knowledge sharing network environment and proposed a knowledge sharing model in the complex network environment. H. Jiang et al. expanded their research, reconstructed the echo model, and extended the theory of complex adaptive systems.

2. Industry Cluster Innovation and Regional Innovation

Y. Zhao et al. explored how R&D alliance networks relate to knowledge attributes and organizational innovation capabilities based on a multilevel network approach. They studied 86 groups in a network of R&D alliances in five high-tech industries in China and found that centrality in R&D alliance networks plays a limited role in the relationship between knowledge attributes and organizational innovation capacity. B. Zhang et al. explored the upgrading process of China's automobile industry and provided a scientific basis for industrial policy adjustment and industrial structure optimization. F. Zhou and B. Zhang detected and visualized the Beijing-Tianjin-Hebei city cluster innovation community based on a patent cooperation network and concluded that Beijing-Tianjin-Hebei collaborative innovation should strengthen the cooperation between Tianjin and Hebei. Y. Su constructs a tripartite evolutionary game model with government, parent company, and subsidiary to study reverse knowledge transfer in cross-border M&A of Chinese high-tech industries.

3. Multicriteria Decision Making

A new CNPI team member selection model was constructed by J. Su et al. using fuzzy sets and social network analysis. They verified its validity with real cases. Y. Zhang et al. proposed an evolutionary game model from the perspective of behavioral deviance. It can provide help for corporate strategy selection.

4. Corporate Innovation and Growth

X. Yu et al. found that digital companies exhibit discontinuous growth as they move from existing core businesses to new ones. This growth pattern often ends in failure. This is mainly because companies devote most of their resources to maintaining the value network of their existing core business, which eventually leads to a "lock-in" effect. They use fractal theory to eliminate the threats posed by this phenomenon and provide effective countermeasures and suggestions for business growth.

5. Innovation Ecosystem

Y. Chen et al. discuss how to build a good innovation ecosystem, using the example of a representative Chinese artificial intelligence company, KDDI. W. Yang et al. analyzed the digital transformation of the innovation ecosystem in the era of digital economy.

The above studies make effective use of complex system models. These studies can provide a more scientific, accurate, and comprehensive response to the internal interaction behaviors of social complex systems and provide contributions to the study of social complex systems.

Conflicts of Interest

The editors declare that there are no conflicts of interest regarding the publication of this paper.

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We would like to thank all the authors who have made valuable contributions to this special issue, who have been of great help in the application of complex systems models in the social sciences. We would also like to thank all the reviewers for their efforts in providing valuable suggestions. We hope that this special issue will provide valuable scholarly perspectives and facts for complex science and social science and provide a good foundation for further scholarly research in this direction.

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