Research on Social Cooperation Mechanism Based on Evolutionary Game Theory

Jiayi Yang

International School, Shenyang Feiyue Experimental School, Shenyang, Liaoning, China

jiayiyang2005@163.com

Keywords: Evolutionary game theory; Social cooperation mechanism; Network Reciprocity; Social Dilemma

Abstract: As the social cooperation mechanism enters a new era and social cooperation enters a stage of high-quality development. This paper first discusses the convergence point between evolutionary game theory and social cooperation mechanism and emphasizes the importance of method change to cooperation mechanism. Subsequently, the paper discusses the challenges of cooperation evolution caused by network reciprocity and social dilemmas, including the complexity of network structure and errors in social norm-based decision-making. Analyzes further the risks associated with technology dominance, including information, moral, and system risks. This paper proposes several response strategies, including technology to escape social dilemmas, system optimization and governance, as well as a return to culture and reconstruction of cooperation. This paper ultimately focuses on the goal of the development of the social cooperation industry, which is to provide society with a mechanism for cooperating that meets expected standards, continuously improves the quality of cooperation, and increases social satisfaction, which is possible to achieve high-quality social cooperation development, promote social cooperation mechanisms, and meet social needs by strengthening the control of internal circulation, building interactive mechanisms, and implementing evaluation systems.

1. Introduction

Building social cooperation mechanisms is one of the primary responsibilities of social development and is also known as social prosperity. It can be divided into basic cooperation mechanisms and non-basic cooperation mechanisms, which are composed of norms and reciprocity, respectively. In order to promote social collaboration, social institutions also entrust technology to facilitate collaboration. Since the information age, technology has become the key to social cooperation, and cooperation mechanisms have become a criterion. Unlike traditional cooperation methods, modern cooperation emphasizes network reciprocity, social norms, and technical support. Therefore, the topic of social cooperation mechanisms was raised, and technology provided new support for cooperation mechanisms.

The social cooperation mechanism originates from research centered on evolutionary game theory. Its theoretical connotation is rich and diverse, and it is also a tool for cooperation mechanisms. From the perspective of the structure of the cooperation mechanism, the cooperation mechanism pursues social efficiency and realizes the modernization of social cooperation through the combination of norms and reciprocity. However, this is only at the theoretical level. Today, the social cooperation mechanism has implemented a unique path that meets social development needs. The comprehensive advancement of the social cooperation mechanism not only innovates the way of social cooperation and embodies the wisdom of social cooperation but also revolutionizes the pattern of social development and poses a major challenge to the social system. Therefore, when discussing social cooperation mechanisms, we must have a grand vision and an overall view. A research proposal on social cooperation mechanisms is presented in this paper within this context.

For the achievement of social synergy, the social cooperation mechanism is an essential condition and guarantee. From a practical point of view, the social cooperation mechanism has progressed, but

  DOI: 10.25236/icemudss.2023.024

there are also shortcomings. The social cooperation mechanism has not yet fully found an effective path to adapt to social development and needs to continue to work hard. In this regard, it is necessary to study the social cooperation mechanism in depth, which is not only of academic value but also necessary for advancing society as a whole. Based on the above background analysis, this paper proposes research on social cooperation mechanisms based on evolutionary game theory, aiming to promote the innovation of social cooperation mechanisms and solve social cooperation's challenges using theories and methods. The main focus is on evolving cooperation mechanisms and dealing with risks, which is of great theoretical and practical importance.

2. The "Fitting Point" between Evolutionary Game Theory and Social Cooperation Mechanism Realizes New Changes in Cooperative Evolution

2.1 Methodological Changes in the Content of Evolutionary Game Theory

Evolutionary game theory is a concept developed in parallel with game theory, which is "soaked" in biological and sociological ideas, highlights human cooperation and competition orientation, and reflects the evolutionary strategies of biology and society since natural selection [1]. However, obtaining consistent and precise answers is still difficult when we try to construct the definition and essence of evolutionary game theory using certain mathematical or logical standards. The fit model between evolutionary game theory and social cooperation mechanism is shown in Figure 1.

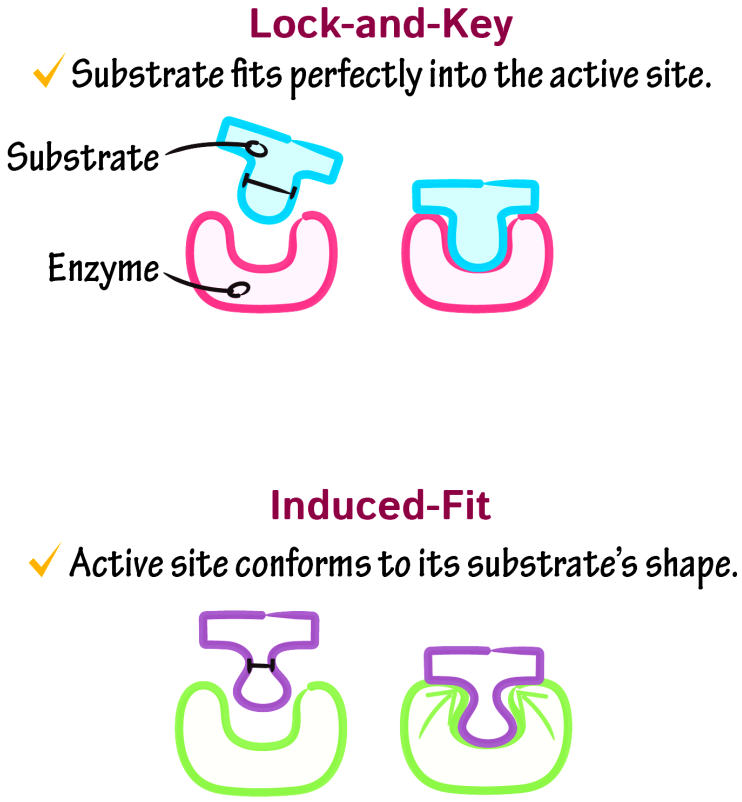

Figure 1 The fit mode of evolutionary game theory and social cooperation mechanism

2.2 Social Cooperation Mechanism, Evolutionary Stable Strategy and Cooperative Evolution

The social cooperation mechanism is an important standard of evolutionary game theory and a quantitative expression of social cooperation. From a biological and sociological perspective, Mailer and Norwalk discussed different definitions of social cooperation mechanisms. Some scholars believe that the social cooperation mechanism is the degree or the efficiency of cooperation, which is precisely because the social cooperation mechanism is somewhat more universal and belongs to the realm of applied science concerned with solving social issues. The history of research on social cooperation mechanisms can even be traced back to Darwin, and its main activities include observation, experimentation, and modeling. The concepts and methods of evolutionary stable

strategies are closely related to the development of evolutionary game theory [2]. Social cooperation mechanisms become an important responsibility of evolutionary game theory when they are developed using evolutionarily stable strategies. The main contribution of evolutionary game theory in the 1970s was the concept of evolutionarily stable strategies. Therefore, the concept of social cooperation mechanisms initially focused primarily on measures of cooperation based on standard properties of biology.

3. The Challenges of Cooperative Evolution Brought by Network Reciprocity and Social Dilemmas

3.1 Chaos of Network Reciprocity: the Excessive Complexity of the Network Structure Causes the Imbalance of the Cooperation System

Compared with traditional cooperation methods, network reciprocity emphasizes the mutual relationship between individuals and groups and has non-linear and dynamic characteristics. Many scholars maintain that network reciprocity can rationally evaluate social cooperation mechanisms, regardless of whether some scholars question that network reciprocity may not be directly related to social cooperation mechanisms. Norwalk et al. proposed a classic evolutionary game model of network reciprocity that includes four elements: individual, group, strategy and benefit. The concept of network structure has been developed from this model, which has become a typical tool for analyzing network reciprocity [3]. Scholars believe the network structure is diverse and has a "social topology." Only when the network structure meets certain conditions will individuals choose to cooperate. Therefore, social cooperation mechanisms are the result of network structure. Some scholars also summarize network reciprocity into a two-layer model, namely an individual-based micro model and a group-based macro model. The former focuses on the individual's behavior choice, and the latter focuses on the evolutionary dynamics of the group, that is, cooperative evolution. From a theoretical perspective, although network reciprocity has experienced some practical failures, it can explain and predict changes in social cooperation mechanisms. As a result, the concept of network reciprocity has gradually become a consensus in the research and practice of social cooperation mechanisms.

3.2 Social Dilemma: the Institutionalized Operation of Social Norms

3.2.1 The Mistakes of Social Normative Decision-making and the Irrational Deviation of Management: Based on the Framework Effect and the Anchoring Effect, etc.

The essence of the concept of social dilemma focuses on cooperation. Social norms are the application of human thinking in cooperation. In order to overcome the shortcomings of cooperation, the social norm framework has entered the research field as a new alternative model. The basic idea of this framework is that social norms should ensure the balance of interests between individuals and groups, set professional standards for the output of cooperative behavior, "capture" cooperators and defectors through techniques such as rewards and punishments and use evolutionary game methods to measure the effectiveness of cooperation [4]. The social normative framework reconstructs the social cooperation mechanism, emphasizing the need to enhance the stability of cooperation and build a cooperation system with high efficiency, high quality, high adaptability, and high innovation.

3.2.2 Social Norms and Trust Risks

(1) Social Norms and Trust Passivation: Based on Selfishness and Inertia, etc.

As the primary obstacle to social cooperation mechanisms, trust risk emphasizes the self-interest of individuals and directly reflects the trust status of individuals and groups. Some components of the development of trust risks are gradually taking shape, and trust and various evaluation systems are gradually receiving attention. However, from the perspective of social norms, the practice of some cooperation still stays at the surface stage, contrary to the logical framework and generation mechanism of social norms, leading to the problem of social norms. Social norms refer to the psychological state in which an individual is dissatisfied or disgusted with the social norms

themselves or their effects while complying with social norms. Social norms may lead to the passivation of individual trust in cooperation, which means the individual's expectation and motivation for cooperation are reduced, and the effect and significance of cooperation are doubted or denied. Trust passivation may be based on selfishness, inertia, and other reasons, affecting individual cooperative behavior and cooperative results.

(2) Social Norm Theft: Based on Deception, Imitation, etc.

From the social norms perspective, the social cooperation mechanism is the basic link of cooperation and the core embodiment of cooperation. In this regard, social cooperation mechanisms are driven primarily by social norms. Social norms are the main driving force of cooperation and the main participants in cooperation. At this stage, social norms strengthen cooperation control from an institutional perspective, and there are three main forms: First, contract. Clarify the rights and obligations of individuals in cooperation and realize the distribution and protection of interests. The second is evaluation. Through the development of cooperation quality standards, cooperation effect standards, and open cooperation standards to the public, standardized control of cooperation. Third, the internal process of reengineering cooperation. In recent years, the Internet and blockchain have used technical means to improve cooperation efficiency and quality [5]. However, compared to online reciprocity, current social norms require further improvement in innovativeness. Social norm theft refers to the behavior of individuals who, on the surface, comply with social norms but use social norms to obtain improper benefits or information. The theft of social norms may affect the trust and effect of social cooperation mechanisms based on deceptive and imitative reasons.

3.3 The Birth of Derivative Risks under the Dominance of Technology

3.3.1 Information Risk: Based on Information Asymmetry, Information Distortion, etc.

Technology and social cooperation mechanisms differ fundamentally in their value attributes. Technology's value standard and evaluation criteria are aimed at efficiency, and technological development mainly reflects innovation and progress. In the evolutionary game structure of technology, accurate information, information sharing, information feedback, and information protection are the core values and highest principles. The diversity of current technology types and the differences in social cooperation mechanisms have led to asymmetric and distorted information. Although technology can enhance the efficiency and quality of social cooperation mechanisms, technical specifications are still imperfect, so it lacks a mechanism for monitoring the effectiveness of the technology. Therefore, this has created a "shortboard" of information risk, affecting the trust and effectiveness of social cooperation mechanisms [6]. It is important to note that information risk refers to the possibility that an individual or group may suffer losses or be harmed due to information asymmetry or information distortion during the course of cooperation. Information risk may affect the cooperative decision-making and cooperative behavior of individuals or groups based on the incompleteness, inaccuracy, timeliness and unreliability of information.

3.3.2 Moral Hazard: Based on Lack of Incentives and Supervision, etc.

From the moral hazard perspective, technology cannot accurately provide the incentives needed for social cooperation mechanisms. A major feature of social cooperation mechanisms is satisfaction evaluation, but the technology lacks relevant information and feedback mechanisms. There may be an issue of trust at the heart of this problem. In evolutionary game theory, trust is often described as the "glue of cooperation", and its impact on the social cooperation mechanism directly reflects the interests of individuals and groups. However, technology is mostly about efficiency, quality, and other information, and trust is relatively lacking. In general, trust is difficult to obtain or measure. Moral hazard is directly affected by information asymmetry and imperfect supervision. A moral hazard is the possibility that individuals or groups may deviate from cooperation goals or violate cooperation norms due to insufficient incentives or inadequate supervision. It is possible for moral hazard to arise from individual self-interest, inertia, evasion, or other factors affecting the efficiency and quality of social cooperation mechanisms [7].

4. The Coping Strategies of the Development Process of the Social Cooperation Industry under the Technical Challenge

4.1 Two-way Adaptation: Technology Gets Rid of the Challenge of Social Dilemma

Regarding social dilemma challenges, social norms have long restricted technology's ability to innovate. Throughout the 21st century, technologies integrating information technology, intelligence, and networking have changed social cooperation mechanisms through technological advancement. However, the shortcomings of traditional social norms still hinder the development of technology. Not only due to the lagging nature of social norms but also due to the mandatory influence of social norms, the autonomy of technology has yet to be improved. Technology can be used to resolve social dilemmas and is regarded as a direct way to improve technology efficiency and quality under social cooperation mechanisms. However, the actual role of technology-based cooperation models in social cooperation mechanisms remains to be discussed. At the same time, due to the difficulties in technical specifications, the technology lacks effective supervision and evaluation. Therefore, technology to eliminate the challenges of social dilemmas does not always seem to achieve the desired goals. It can be seen that the challenge of technology getting rid of social dilemmas is not only a technical problem but also a moral and value problem.

4.2 Institutional Sharing: Institutional Response to System Optimization and Institutional Governance

It is true that technology and social cooperation mechanisms cannot avoid human beings' "moral responsibility" in terms of value. In social cooperation mechanisms, systems are standard and effective tools for cooperation and play a key role in technology, making the system not only a technical concept but also a moral concept. As a result, cooperation based on " Institutional sharing " has become a mechanism for coordinating technical and social cooperation. Generally, institutional sharing is interpreted as a gradual optimization path based on evolutionary game theory, although some innovative attempts are incorporated into this process. From contract to evaluation, the system is closely around trust from beginning to end. Although the institution should strive to improve trust to adapt to the requirements of social cooperation mechanisms. Under the influence of technology, however, this also creates a dilemma: the phenomenon of moral hazard. In general, there is still room for improvement in information, incentives, supervision, and other aspects of the institution, and its governance capacity needs to be further improved, which is also an important task for the system of institutional sharing.

4.3 Cultural Reversion: Correcting Technology and Restoring Cooperation

The development of cultural reversion aims to construct mechanisms and optimize systems to provide social cooperation mechanisms with technology that meets expected standards and is committed to restoring the essence of cooperation. The concept of cultural reversion is not new, but it combines technology with ethics, values, trust, and other elements in an innovative manner. In addition to highlighting the cultural dimension of social cooperation mechanisms, it also expands the technical connotation and shows the significance and value of integrating technology with humans, society, and nature. Cultural reversion has been successfully explored in localization, humanization, ecologicalization, and other aspects, providing experience and reference for developing social cooperation mechanisms. However, it requires further optimization compared to the theoretical construction and mechanism design of evolutionary game theory and the current stage of social development, which needs to be closely aligned with social norms at a deeper level to satisfy the trust and effectiveness of social cooperation mechanisms.

5. Conclusion

The social cooperation mechanism has entered a new era, which poses new challenges and requirements for technology and social norms. Technology is a symbol of the "efficiency" of social cooperation mechanisms and an important means of cooperation, which is also an urgent need to

achieve social collaboration, safeguard social interests, and essentially embody the inherent requirements of human beings. Under the guidance of technology, evolutionary game theory constructs the theoretical analysis framework and practical mechanism of social cooperation mechanism. Modern information technologies, such as the Internet and blockchain, have stimulated the innovation of social cooperation mechanisms, empowered them through network reciprocity, and improved the accuracy and scientificity of cooperation. Its value is in line with evolutionary game theory. Therefore, based on network reciprocity also provides a new path for social cooperation mechanisms. In short, the sustainable improvement and development of social cooperation mechanisms can help better promote social coordination and achieve social prosperity.

References

[1] Traulsen A, Glynatsi N E. The future of theoretical evolutionary game theory[J]. Philosophical Transactions of the Royal Society B, 2023, 378(1876): 20210508.

[2] Wang G, Chao Y, Cao Y, et al. A comprehensive review of research works based on evolutionary game theory for sustainable energy development[J]. Energy Reports, 2022, 8: 114-136.

[3] Avila P, Mullon C. Evolutionary game theory and the adaptive dynamics approach: adaptation where individuals interact[J]. Philosophical Transactions of the Royal Society B, 2023, 378(1876): 20210502.

[4] Wang Z, Song Z, Shen C, et al. Emergence of punishment in social dilemma with environmental feedback[C]//Proceedings of the AAAI Conference on Artificial Intelligence. 2023, 37(10): 11708-11716.

[5] Li W J, Chen Z, Jin K Z, et al. Options for mobility and network reciprocity to jointly yield robust cooperation in social dilemmas[J]. Applied Mathematics and Computation, 2022, 435: 127456.

[6] Wang C, Zhu W, Szolnoki A. When greediness and self-confidence meet in a social dilemma[J]. Physica A: Statistical Mechanics and its Applications, 2023, 625: 129033.

[7] Bagavathiannan M V, Graham S, Ma Z, et al. Considering weed management as a social dilemma bridges individual and collective interests[J]. Nature Plants, 2019, 5(4): 343-351.