

Research on Employee Behavior Safety and Product Quality Control Based on Evolutionary Game Theory

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Abstract: Ensuring the safety of employee behavior and maintaining product quality control are vital components of effective enterprise management. Conventional management approaches may fall short in adequately addressing these critical aspects. With the rapid evolution of the internet, the online retail sector is experiencing unprecedented growth. This surge, rooted in e-commerce, is reshaping traditional business paradigms and propelling a shift in economic frameworks. Through a case study focused on apparel products, this research utilizes questionnaire surveys to gather data, employs evolutionary game theory to construct pertinent models, conducts in-depth analysis, draws conclusive insights, devises actionable strategies, and introduces a fresh perspective to comprehensively address issues concerning employee behavior safety and product quality control.

Keywords: Evolutionary Game Theory; Safety Control; Quality Control; Behavior Safety; E-commerce

1. Introduction

With the advancement of information technology and the processes of globalization, enterprises are confronted with increasingly intricate security challenges. Employee behavior safety stands as a pivotal facet of corporate security management, while quality control serves as a critical link in ensuring the effective implementation of security measures. However, conventional security management methodologies often struggle to keep pace with the ever-changing landscape of security threats [1]. Hence, the quest for a novel management approach to enhance the oversight of employee behavior safety and product quality control becomes paramount. Evolutionary game theory represents a mathematical model studying interactions and

strategic decisions among individuals [2]. Within evolutionary game theory, individuals select action strategies based on their self-interest, and the evolution of these strategies is influenced by the environment and the behaviors of other individuals. Through delving into evolutionary game theory, one can unveil underlying patterns and regularities, thereby furnishing theoretical support for addressing practical issues.

2. Current State and Issues in E-commerce Development

Through investigations, it has been revealed that the primary challenges within the realm of e-commerce are centered around “product quality” [3]. While online shopping brings convenience to consumers, it also presents certain drawbacks, such as counterfeiting, misrepresentation, discrepancies between product quality and image descriptions, the prevalence of substandard products, and the circulation of counterfeit goods, all of which pose challenges to the integrity of product quality within the e-commerce sphere. E-commerce live streaming, utilizing video formats to recommend and sell products to consumers on online platforms, has garnered favor due to its interactive and real-time advantages, establishing itself as a crucial marketing channel in modern goods circulation. However, it concurrently harbors issues like false traffic generation, deceptive advertising, and the proliferation of counterfeit goods, raising concerns regarding the assurance of product quality [4].

3. Application of Evolutionary Game Theory in E-commerce Product Quality Safety Control

Evolutionary game theory, merging game theory with evolutionary principles, primarily investigates how participants optimize strategies through learning, adaptation, and evolution in dynamically changing

environments. In the realm of e-commerce product quality safety control, evolutionary game theory aids in comprehending the interactions and evolutionary processes among e-commerce platforms, suppliers, and consumers.

Initially, the game relationship between e-commerce platforms and suppliers exemplifies a classic evolutionary game scenario. E-commerce platforms need to ensure product quality safety provided by suppliers through effective regulatory strategies, while suppliers strive to earn consumer trust by enhancing product quality continuously. Throughout this process, both e-commerce platforms and suppliers adjust their strategies in response to each other's moves to maximize their respective benefits.

Moreover, when consumers make purchasing decisions for clothing products, they consider factors such as quality, price, and reputation. Upon detecting quality issues in products, consumers may opt not to purchase or spread negative feedback to others, impacting the reputation and sales of suppliers adversely. Hence, suppliers must enhance product quality to secure consumer trust and foster long-term growth.

Furthermore, with the widespread popularity of online shopping and the significant support from governments for the integration of e-commerce with various industries to expedite the development of emerging sectors, the existing issues within the e-commerce industry have become integral aspects of social network regulation [5]. While game theory applications in various domains of regulation are relatively advanced, studies on the regulatory games concerning e-commerce platforms within domestic literature are notably scarce [6]. Thus, this study delves into research and discussions concerning the regulatory effectiveness of government oversight, e-commerce platforms and sellers, and consumer involvement in strategic decision-making games, aiming to validate the necessity for effective regulation.

4. Strategies for E-commerce Product Quality Safety Control Based on Evolutionary Game Theory

In addressing the aforementioned issues, the following strategies grounded in evolutionary game theory can be proposed for enhancing

e-commerce product quality safety control.

4.1 Establishment of Effective Regulatory Mechanisms

E-commerce platforms need to establish robust regulatory mechanisms to rigorously oversee the quality of products supplied by vendors. Moreover, periodic assessments and evaluations of suppliers are essential to ensure they consistently uphold high-quality standards. The higher the sensitivity of online consumers to product quality, the more it elevates the level of product quality control for suppliers and the quality inspection standards for live streaming e-commerce platforms [7].

4.2 Strengthening Information Disclosure and Transparency

E-commerce platforms should enhance information disclosure and transparency to empower consumers to gain comprehensive insights into product quality and supplier information [8]. This empowers consumers to make wiser purchasing decisions and fosters competition and survival of the fittest among suppliers.

4.3 Implementation of Reward and Punishment Mechanisms

E-commerce platforms can incentivize suppliers to enhance product quality by establishing reward and punishment mechanisms. Amplifying incentives effectively motivates e-commerce merchants towards honest sales practices and quality control, thereby enhancing product quality. Conversely, escalating penalties reinforce sales process management and external oversight, presenting online merchants with a potent deterrent effect to curb inferior product behaviors to a reasonable degree [9]. For instance, outstanding quality suppliers can be granted increased traffic and promotional resources, while underperforming suppliers may face penalties like demotion or delisting. Ultimately, e-commerce merchants must grasp the significance of external supervision and the severity of penalties, fostering a sound perception of honest sales practices and the costs of penalties.

4.4 Encouraging Consumer Engagement and Oversight

E-commerce platforms can incentivize

consumer participation in monitoring and evaluating product quality safety through avenues like establishing consumer rating systems and complaint resolution mechanisms. Not only does this elevate consumer engagement and satisfaction, but it also aids e-commerce platforms in promptly identifying and remedying product quality issues.

5. Employee Behavior Safety Control Model Based on Evolutionary Game Theory

5.1 Constructing an Evolutionary Game Model

Employees and companies can be viewed as two participants in a game. The choices made by employees regarding their behavior can be seen as strategies, while the safety measures implemented by the company can be seen as counter-strategies. By establishing a game model, one can analyze the interactions between employees and companies and determine optimal safety strategies [10].

5.2 Utilizing Evolutionary Algorithms

Algorithms can simulate the process of biological evolution by generating new solutions through operations such as selection, crossover, and mutation. In the realm of employee behavior safety control, evolutionary algorithms can be employed to optimize safety strategies, thereby enhancing overall security.

5.3 Analysis of Evolutionary Game Equilibria

By conducting equilibrium analysis on the game model, stable strategies between employees and companies can be identified. These stable strategies can serve as a reference for employee behavior safety control, aiding companies in devising more effective safety strategies. Evolutionary game theory can be applied across various scenarios concerning employee behavior safety. Internal threats pose a significant security challenge for companies, as employees may disclose confidential information, misuse privileges, or engage in other security violations due to personal motivations or external influences. Through evolutionary game theory, one can analyze employee behavioral motivations and company response strategies to more effectively identify and manage internal

threats.

5.4 Prevention of Social Engineering Attacks

Social engineering is a common attack method where attackers deceive, induce, or manipulate employees to gain sensitive information or breach a company's network. Evolutionary game theory can help companies understand the game dynamics between attackers and employees, enabling the formulation of appropriate defense strategies to enhance employees' ability to identify and guard against social engineering attacks.

5.5 Employee Training and Awareness Enhancement

Through the analysis facilitated by evolutionary game theory, one can ascertain the extent of employees' understanding of security policies, their level of security awareness, and their perception of potential risks. Based on these analytical outcomes, companies can tailor security training and awareness enhancement activities to help employees better grasp security policies, reinforce security awareness, and reduce instances of security violations.

6. Conclusions

Employee behavior and e-commerce product quality safety control represent a complex and crucial issue that necessitates collaborative efforts from e-commerce platforms, suppliers, and consumers. The research on employee behavior and e-commerce product quality safety control based on evolutionary game theory provides us with a fresh perspective and a new approach to ponder upon. By delving into the interactions and evolutionary processes among e-commerce platforms, suppliers, and consumers, we can devise more effective control strategies to ensure that clothing products sold on e-commerce platforms exhibit high quality and safety standards. This endeavor not only fosters the sustainable development of e-commerce but also enhances consumer well-being.

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