Trust Management Mechanism in Blockchain Data Science

Ge Gao
https://orcid.org/0000-0002-5881-319X
Zhuhai College of Science and Technology, Jilin University, China

Ran Liu
https://orcid.org/0000-0003-4663-4861
Central Connecticut State University, USA

INTRODUCTION

With the development of new technologies, e.g., the Internet of Things (IoT), Big Data, and blockchain data technology, economic development relies on refined specialization (Slamet et al., 2017; Tian et al., 2018; Xie et al., 2019). Meanwhile, the interaction between supply chain enterprises is becoming increasingly more comprehensive. More and more companies are seeking supply chain partners globally to achieve complementary advantages, cooperation potentials, and to integrate the enterprises with the upstream and downstream players of the supply chain to form a supply chain alliance (Nyaga et al., 2010; Wallenburg & Schäffler, 2014). However, with the extension and increasing complexity of supply chains, trust becomes a big issue between supply chain partners. For instance, due to the immature credit system and inconsistent punishment mechanism under the traditional supply chain model, each member holds limited information that is difficult to share. Additionally, the lack of trust between members leads to a failure rate of 50% to 70% of actual supply chain transactions (Kale et al., 2002; Taylor, 2005; Mingang et al., 2017). Part of the reason is supply chain partners have interests that are not aligned with one another, which may lead to potential opportunistic behaviors, resulting in failures in collaborations (Das & Rahman, 2010; Gerwin, 2004). Therefore, new technologies and management models are urgently needed to solve this issue.

The cutting-edge development in information and data technology plays an increasingly essential role in any market decision and firms' performance (liu et al, 2021). The emerging blockchain data technology provides new opportunities and ways to solve the trust issue in supply chain system. First, the decentralized nature of blockchain data is very suitable for supply chain systems. With blockchain data, supply chain partners can trade without knowing one another's basic information, achieving a high level of trust without establishing a trust relationship. Trust can be achieved through the technical architecture of blockchain data, including smart contracts, making transactions between members determined by intelligent machines and related algorithms automatically. Furthermore, each participant of the supply chain system can establish a mutually beneficial and coordinated mechanism of trust using the blockchain data consensus mechanism. This can guide enterprises' operating a dynamic block supply chain alliance while realizing the value creation of the supply chain, eliminating the various risks caused by lack of trust.

This combination's rationality and feasibility are discussed from the three dimensions of trust, including cultural, social, and economic attributes. This paper further explores the smart contracts' operation

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mechanism, mutual trust mechanism, and related technologies in supply chain trust management with the proposed framework. Layer by layer then enumerates the specific smart contract application types and introduces a blockchain data consensus mechanism suitable for supply chain trust management.

Supply Chain Trust Issues

Supply chain trust issues have been around for a long time, from a personal level to an organizational level, and intertwined throughout the entire supply chain system. Scholars have carried out relevant research on the trust problem in the supply chain from different angles. Initially, most academic research was focused on the cognitive aspects of trust in the cooperation of members in supply chain systems. Leng et al. (2019) interpreted trust in supply chains as a kind of emotional judgment and evaluation of interpersonal communication. In social communications, it is the interpersonal attitude formed by the interaction of rational thinking and irrational emotions. Scholars have proposed different solutions on how to improve and solve the trust problem in supply chain systems. Kwon and Suh (2004) started with the relationship between trust and commitment and proposed establishing a trust mechanism with information sharing to improve the efficiency of cooperation among members of the supply chain. Das and Rahman (2010) found that opportunism among partners in a supply chain is mainly determined by economic factors such as payoff inequity, relational factors such as cultural diversity, and other factors such as time. Meanwhile, the establishment of trust needs to consider multi-stakeholders, such as buyer, seller, technology, and customers, and its construction needs a process orientation to form a multi-dimensional model. On the basis of this, Özer et al. (2014) further analyzed the impact of trust and supply chain system credibility level on global supply chain partnership management from two main factors: geography and culture. Zhang and Zhang (2017) explored the rigid management mechanism of mutual trust in a supply chain system and revealed the influence of institutional trust deviation on the willingness of secondary cooperation among supply chain nodes. Li et al (2018) empirically tested the positive effect of supply chain inter-firm calculate-trust and kindness trust on supply chain companies' improvisation ability and studied the mediation role of supply chain flexibility.

The status of trust in a supply chain system is not just a singular form (Marsh & Dibben, 2005). Li & Sun (2011) studied the trust crisis in supply chain cooperation in China and proposed a multi-agent grey diagnosis method for diagnosing organizational trust crisis possibilities in supply chains. For different trust issues, this method can effectively diagnose the source of the trust problem. Based on analyzing massive speculator behaviors caused by changes in market supply and demand, Li et al. (2014) introduced the speculative crisis of trust as an objective in an optimization model and obtained the supplier's optimal pricing strategy and the equilibrium number of speculators. Mora-Monge et al. (2019) found that in the context of web-enabled supply chains, trust, and integration, rather than trading partner power, significantly impact business performance, and establishing successful trust relationships with suppliers has proven to be a critical competitive advantage.

From the review of the research presented, it can be seen that although the trust problem in the supply chain system and consumer behaviors has been in existence for a long time, relevant research is still in its infancy (Irshad et al., 2020). Under complicated market conditions, the supply chain trust problem may cause a series of chain reactions, affecting the supply chain enterprises' normal operation. Therefore, an effective way or technology to manage supply chain trust is needed.