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Blockchain for Supply Chain Management: Practice-Based View

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Abstract

In the context of supply chain management, technological and strategic management practices play a critical role in managing supply chain processes that generate operational performance gains for firms. In this paper, we investigate the potential implications of blockchain for both supply chain management and operational processes management practices to develop the higher-order capability of information system integration. This capability enables firms to manage information flow from operational processes and allows information sharing with supply chain partners. From the perspective of practice-based view (PBV), we developed our research model and propositions to address the authenticity of food safety issues and sustainability in the context of the supply chain. We also highlight the need for blockchain implementation within the food industries that create an information-based approach for better operational performance.

Keywords blockchain, supply chain management, operational processes management, practice-based view, information system integration, operational performance

Introduction

Firms are investing in technologies to extend their partnerships in the supply chain context, and to expand their businesses and capabilities. The impact of IT on firms' performance has positively improved the overall firm's operations by increasing productivity and improves the quality of products and services (Rai et al. 2006). Current studies in the strategic management attempt to explain macro-level firm behaviors and influence specific characteristics of the firm's performance (Bromiley et al. 2014). Digital platforms play a critical role in managing and controlling business processes within the firm and its partners, which generate sustainable performance gains for firms. In the context of the supply chain, blockchain technology can be integrated with supply chain technology in information level, since it consists of ledgers that store transactions in a decentralized database (Scholz et al. 2018). Also, it is capable of providing information regarding the status of the raw materials and products within the supply chain activities (Treiblmaier 2018). The integration of blockchain with the supply chain can lead the organization to achieve disruptive transformation in the digital supply chain (Korpela et al. 2017). According to Kshetri (2018), the proponents of blockchain provide support for the 2015 E.coli outbreak at Chipotle Mexican Grill, which results in 55 customers ill. Details about food products such as factory, storage temperature, and shipping can be viewed and tracked by blockchain applications.

To emphasize the importance of blockchain in food industries, the implementation of blockchain would create value in the context of the supply chain by integrating and securing data about products in distributed ledgers. Also, it increases information transparency as well as operational efficiency. From supply chain management (SCM) perspectives, the most important is to coordinate the operational processes of firms to improve logistics productivity. All other supporting activities should also participate in the value chain to improve the overall firm's performance. In this case, blockchain as a technological aspect considered as a supporting practice that can be implemented to integrate and manage information flow within the supply chain activities. Previous studies addressed the impact of the supply chain on performance used

organizational capabilities, which is related to the resource-based view (RBV) (Huo et al. 2016). The RBV addresses how firms use rare, valuable, and imitate resources and capability to achieve sustained competitive advantage (Bharadwaj 2000). Researchers in strategic management argued that RBV would lead firms to achieve sustained competitive advantage through resources and capabilities. Whereas, practice-based view (PBV) is an alternative for operational processes management (OPM) practices where scholars attempt to explain the firm's performance through practices. Practices may lead directly to performance or indirectly through intermediate capability (Bromiley et al. 2016). To fulfill this implication, we strictly follow the PBV approach that was suggested by Bromiley et al. (2014). They defined practices as a set of activities that might be executed by a variety of firms. The lens of PBV indicates on building a new strategy of adopting practices that would impact on firms' performance.

This study intends to develop a conceptual model regarding the implementation of blockchain technology with SCM and OPM practices. These management practices considered as cross-functional practices that can create an information systems integration (ISI) capability which positively impacts the operational performance. More specifically, this study addresses two primary research questions: (1) What are the implications of the blockchain for supply chain management and operational process management practices? (2) Will the blockchain impact practices to create information systems capability and increase operational performance? The research questions of this paper were suggested by Treiblmaier (2018). The researcher provided guidelines for future pursuit research on the potential implications of blockchain on SCM. However, this paper aims to explain the implications of blockchain on both SCM and OPM practices. In other words, blockchain technology can support cross-functional data consistency for both SCM and OPM practices, which yield to create ISI capability and impact the operational performance of food industries. The model will be tested to support food industries in lacking information transparency for food traceability to ensure safe products will be delivered to end customers. The next sections present the theoretical background regarding blockchain, SCM, and OPM towards the strategy of PBV. Then, specify propositions based on the research model. Methodology and future research progress are discussed.

Theoretical Background

Blockchain Technology Towards SCM and OPM Practices

The potential impact of blockchain on SCM and logistics has already been acknowledged in academia. For example, Treiblmaier (2018) provided a theory-based framework of the implication of blockchain in the supply chain context. The main contributions of blockchain are to build trust and reliability for the exchange of goods and services between firms and stakeholders (Scholz et al. 2018). The implementation of IT in the SCM can coordinate the flow of information from suppliers to manufacturing and end-customers. To make better usage of information sharing, firms need to implement technologies that allow information integration. Huo et al. (2016) suggested that the implementation of supply chain technology would accommodate to solve supply chain issues by allowing information sharing about the operational processes between supply chain partners. Thus, blockchain has the potential to solve issues in the supply chain, such as the bullwhip effect (Van et al. 2018) by addressing the visibility and traceability of raw materials to its source. It has emerged in the supply chain context in multi industries; for instance, the automotive industry (Kshetri et al. 2019), pharmaceutical and food industries (Kshetri 2018).

Global food firms have implemented blockchain technology to enable trace traceability of products in the supply chain. IBM, Walmart, and JD.com e-commerce invested in developing blockchain technologies to improve the traceability of food and safety. The goal is to develop a "standards-based method" to collect data about food authenticity and safety issues in the context of the supply chain (Kshetri et al. 2019). The largest online retailer company in China, JD.com, has implemented a live traceability system for beef manufactures in the supply chain. Walmart struggled with serious issues to track its food products because food can be contaminated in transportation processes. Blockchain-enabled digitally tracks of food information in the supply chain such as factory, batch number, and storage temperature. These details help to recall products in case of food contamination and assess the authenticity of food safety issues. Moreover, Provenance conducted a pilot project to enable traceability in the fishing industry. The project results successful tracked of fish caught by fishermen in Indonesia by using mobile phones, blockchain, and smart tagging. Bext360's app and cloud-based software employ blockchain to offer traceability of the coffee beans from its origin farm to its customers (Kshetri 2018).

Practice-Based View Towards Blockchain, SCM, and OPM Practices

The studies of the SCM and OPM showed how management practices influence performance, considering these practices can be rare or imitable. For example, Carter et al. (2017) extended the view of PBV to supply chain practice view SCPV as a more tangible and more readily measurable of the relational performance. At the same time, these practices could improve the internal productivity of the firm through intermediate capability by allowing information sharing among supply chain partners. For example, Wade et al. (2004) provided persuasive examples from previous studies in IS literature on how the IS resources and management practices impact on building strong partnerships with the firm's partners. Also, practices would create value for the firm and maintain the sustainability of firms' performance (Bromiley et al. 2016).

Conceptual Model and Propositions Development

The Impact of the Blockchain on SCM and OPM Practices

From the PBV perspectives and according to Bromiley et al. (2014), the explanatory variables in PBV are practices that are imitable and amenable to transfer across the firm. They argued that practices lead firms to improve their performance, but not to achieve a competitive advantage. The purpose of information integration is to achieve real-time transmission data and processing in the contexts of operational management and supply chain (Prajogo et al. 2012). Thus, blockchain has the potential to manage information flow and plays a central role in both SCM and OPM practices in the following aspects. First, blockchain can increase the volume of information regarding the transactions that occur within the SCM and OPM practices. Second, it can provide real-time transaction information, including delivery status, production planning, and scheduling, which enables the firm to manage and control its business processes and enhance operational efficiencies. Third, support data consistency, which enabled automated systems for accurate data capture. Fourth, blockchain can also be viewed as antecedents to information flow, which supports both operational processes and supply chain activities (Treiblmaier 2018; Kshetri et al. 2019). Hence, we define SCM practices as a set of external activities that relate to raw materials and products in the supply chain activities. Whereas OPM practices are defined as the internal activities of manufacture that relate to products (ex. production processes). Previous studies in operations management found that firms use well-known practices such as IT practices, information management, and SCM practices would perform better than firms that do not adopt these practices. Also, they indicated that increasing the efficiency of information orientation would occur if IT combined with a component of information management practices (Marchand et al. 2000). Similarly, blockchain impacts both SCM and OPM practices and supports the food industries by increasing information value. Therefore, we proposed the following:

P1a: Blockchain is positively impacting on the SCM practices for the food industries
P1b: Blockchain is positively impacting on the OPM practices for the food industries

The Impact of Blockchain, SCM, and OPM Practices on the ISI Capability

The information capability called "information orientation," which measured the ability of the firm to manage and use the information for decision making within the firm's boundaries. Scholars have divided capabilities into two categories: operational capabilities (e.g., sales, productions) and dynamic capability, which refers to the ability of the firm to integrate and reconfigure internal and external competencies (Teece et al. 1997). More fundamentally, the ISI capability requires support from blockchain, SCM, and OPM practices based on the PBV, which in turn promotes the ISI and increases the value of internal and external information. Also, it helps to create an integrated information system collectively. Previous studies have found that firms with information capabilities developed within their boundaries have a higher value of information orientation, which reflects on the firm's performance (Marchand et al. 2000). For example, Huo et al. (2016) have examined the impact of supply chain technology on both internal and external information integration. They found that supply chain technology is significant and positively related to both internal and external information integration. Rai et al. (2006) provided evidence regarding the integration of IT infrastructure with SCM applications enables processes of the supply chain to be transformed cross-functional. Also, they indicated that the integration of IT infrastructure for SCM requires both cross-functional application integration and data consistency. Indeed, the superior integration of all

practices would characterize the ISI capability for end-to-end management of both supply chain and operational processes. Therefore, we proposed the following:

P2: Supply chain management practices are positively related to information system integration
P3: Blockchain implementation is positively related to information system integration
P4: Operational processes management practices are positively related to information system integration

The Impact of the ISI Capability on Operational Performance

In food industries, firms are more likely to share internal and external information to increase products' quality. In SCM research, an operational performance considered as an asset usage of production efficiency for the best quality of products and services (Huo et al. 2016). Empirical studies have demonstrated that lacking integration between supply chain partners and firms would create a bullwhip effect. The bullwhip effect refers to "the amplification of demand variability from the downstream site to upstream site" (Lee et al. 2004). It causes problems for inventory management, such as poor production planning, which reduces operational efficiencies. Therefore, information sharing is necessary within the supply chain to reduce the bullwhip effect. Huo et al. (2016), revealed that external information integration is positively related to operational efficiency, and internal information integration is positively related to the service quality. The integration of information flow and physical flow of products are enhancing operational performance (Rai et al. 2006). Similarly, the ISI capability can improve operational performance by coordinating the production planning decisions of the food firms. Therefore, we proposed the following:

P5: Information systems integration is positively related to the operational performance

The integration of the blockchain with SCM and OPM practices are antecedents of ISI and not directly to operational performance to achieve higher levels of performance. In other words, all practices must be integrated to provide the capability to generate cross-functional information capability and reach higher levels of performance. Scholars of operations management attempt to explain which operations management practices that influence operational performance. Research has shown that effective application of management practices can support operational performance (Bromiley et al. 2016). Therefore, we proposed our conceptual model in Figure 1 based on the PBV approach.

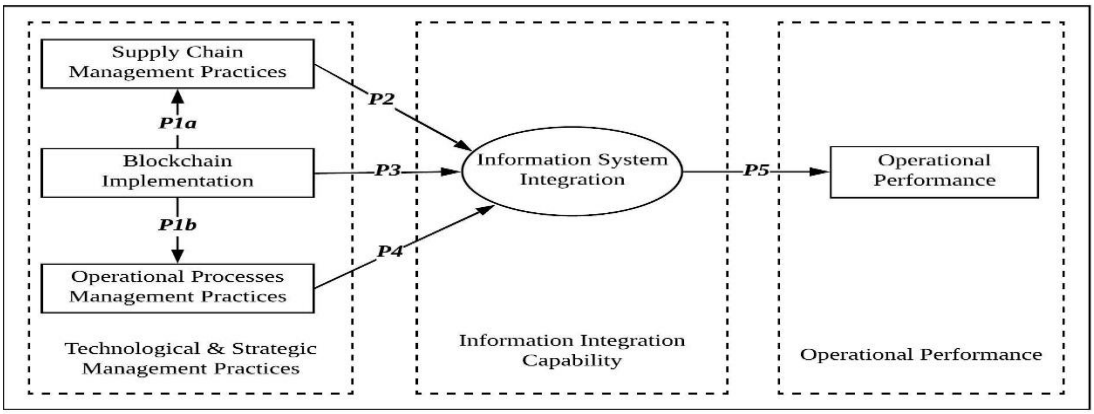

Figure 1. Conceptual Model of PBV Approach

Methodology and Future Research Progress

The target population for this study is all food firms. A survey questionnaire will be developed to measure each construct, guided by existing literature. We will gather data on whether a firm has implemented blockchain or not, and if so, the level of application and granularity of information capture across the supply chain. Scholars and subject experts will provide feedback on the questionnaire, and a pilot test will be conducted for improvement feedback. Then the instrument's items will be tested for reliability and convergent validity to ensure all items are reliable and valid. The structural equation modeling (SEM) technique will be used to analyze the data for hypotheses testing.

Discussion and Conclusion

This study explains the expected potential implications of blockchain on SCM and OPM from the PBV approach. The focus was to address the research questions on the implications of blockchain for SCM and OPM that impact operational performance through ISI capability. Three theoretical contributions of this study can be defined. First, the integration of the blockchain with the supply chain, this contribution sheds light on the information transparency of food products and sustainability in the supply chain context for food industries. Second, the integration of blockchain with internal and external operational processes would deliver safe, efficient, and high quality of food products. Third, we contribute to existing literature on the integration of technological and management practices through blockchain from the perspective of the PBV (Bromiley et al. 2014). Future research will include an empirical examination of the theoretical model in the food industry. This project will contribute to food firms as a successful implementation of blockchain with SCM and OPM practices would influence to creation of the ISI capability that will improve food safety as well as sustainability in processes efficiency.

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