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Blockchain Technology Improves Supply Chain Finance For Effective Supply Chain Management

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***Abstract*—** *Under competitive global environment increasing pressures like short-term financing needs push companies trying hard to release potential fund within supply chains. The next frontier to improve productivity is then connected to the new concept of supply chain finance. Better visibility, authenticity, immutability, transparency and other features originated from blockchain technology have a special meaning to the complex transaction patterns of the supply chain. Together with smart contract, blockchain technology will improve the quality of supply chain finance by resolving issues like disadvantages of trust, enabling greater efficiency in financing activities, and avoiding fraudulency. This paper's intention is to produce a conceptual framework of effective supply chain management with blockchain-facilitated supply chain finance. How to establish a new ecosystem will be explored to find an optimal situation for buyers, suppliers and financiers to improve liquidity, product offering, and capital allocation throughout the value chain. As the Industrial 4.0 is bringing so many changes we believe the blockchain-driven supply chain will get more prosperous in global business.*

***Keywords*—** *blockchain; supply chain finance; transaction; smart contract; integration*

I. INTRODUCTION AND RESEARCH BACKGROUND

The more and more complex supply chains (Sousa et al. 2017) reflect the increased dynamics of globalization and information technology development (Mari et al. 2015). Virtually, all companies become part of supply chains that span across different industries, regions and countries (Gattorna 2017/2003). Financing pressures especially on short-term needs push companies to search for potential funds and release those within supply chain (Lekkakos & Serrano 2016; Chod et al. 2019). Cash flow managed collaboratively will reduce default risk by improving liquidity (Liebl et al. 2016) and optimize the working capitals for all supply chain partners. Thus, it comes the new term - supply chain finance, which responses directly to the evolving situation of the global trade conditions and offers an alternative solution for financing businesses (Hofmann et al. 2018a). As big buyers (or called hub companies) increasingly provide financing alternatives to their supplying partners (Martin & Hofmann 2019), supply chain finance is described as the optimized way to plan, manage, and control cash flow in facilitating efficient material flows in supply chains (Carnovale et al. 2019; Lind 2018; Omran et al. 2017).

From the other point, financial influence is ignored in supply chain managerial literature (Liebl et al. 2016). Although the concept of supply chain management was introduced during early 1980s through logistics consultants (Habib & Hasan 2019), the cost of financial flows has been reached limited, under-investigated, and the implementation

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is fragmented (Bals 2019; Jansen et al. 2018; Caniato et al. 2019). This phenomenon is reflected by the significant time lag from the buyer's introduction of supply chain finance to the adoption from its partnership suppliers (Tseng et al. 2018; Wuttke et al. 2016).

Digitization poses heavy impact on the financing services field (Puschmann 2017). As an emerging Fintech (financial technology), blockchain's advent can be traced back to the existence of Bitcoin, a digital crypto currency with controversial image (Vorabutra 2016). However, the founding technology is flawless and can work widely in many fields include finance (Crosby et al. 2016). With features of traceability, transparency, and security that root from distributed digital ledger, blockchain technology is capable to ease those financing problems related to supply chain management (Saberi et al. 2019). Then what will be the effect of combining this cutting-edge technology with supply chain finance? Will it transform and remodel the relationships of all members within supply chain systems just like Queiroz & Wamba (2019) described?

II. Issues and Problem Statement

Lack of the provenance knowledge, incomplete information of transaction, and the unclear relationship of supply chain partners … are supply chain's disadvantages (Casado-Vara et al. 2018). These weaknesses will definitely affect the supply chain finance practice. When blockchain platform becomes increasingly noticeable in financial field (Zachariadis et al. 2019), questions regarding this technology's suitability to compete with or replace existing supply chain financial systems or if need to redesign the financial infrastructures to pursue a better supply chain management, are arising. Three questions will be explored in this paper: a) at what aspects can blockchain technology influence supply chain finance? b) how is the environment involving the implementation of this technology? c) what is the correlation between blockchain-based supply chain finance and supply chain management?

III. Significance of Study

This paper will research those perceived benefits with the usage of blockchain. The literature review will give an insight of how to evaluate blockchain practice and leverage this best-in-class concept to the financing activity within supply chain management. Conceptual framework will be set up to see if a positive supply chain finance ecosystem of buyers, suppliers, and financiers can be set up to effectively advance the supply chain management.

IV. Literature Review and Industry Updates

The concept of supply chain finance was formed under the demanding for operational cash flow, improved financial performance and mitigated risks (Jansen et al. 2018). Before the existence of blockchain, supply chain finance already exploited the strength from new information and communication technologies and supply chain links to optimize the working capital and create value for the organizations involved (Gelsomino et al. 2019). Although during the past decades and especially after the 2008 global financial crisis interest in supply chain finance has significantly increased (Vousinas 2018), dealing with numbers across different and enormous ranges of transactions under a huge network is prone to be much riskier (Manuj & Mentzer 2008).

IV.I At what aspects can blockchain influence supply chain finance?

a) Blockchain technology resolves problems caused by information asymmetry and incompleteness. Some

researches think that by basing on hub companies, supply chain finance can realize the integration of upstream and downstream flow of logistics, funds, and information efficiently, and transform those risks of many single companies into the controllable risks of the whole supply chain (Yue et al. 2019). But other studies show that it is hard to perform KYC (know your customer) policies in supply chains. With a globalized marketplace the exact sources of the products produced and transported are obscured (Kim & Laskowski 2018; Montecchi et al. 2019). Hofmann et al. (2018a) pointed out that for multi-national companies with suppliers worldwide it would be a typical time-consuming and costly task to identify customers and collect relevant information. With limited information from contracts, it is hard for financial parties to really understand the buyer-supplier relationship, predict market expectation (Huertas et al. 2018), and manage risks.

Such information incompleteness and asymmetry can be resolved by blockchain technology with more accurate decision information basis (Fu & Zhu 2019). Blockchain is characterized as a self-governed, decentralized, source-opened, and distributable database for storing transaction information with collective consensus (Francisco & Swanson 2017; Pavan & Ramya 2019). The transaction between any two parties can be recorded verifiably and permanently (Ahlstrand 2018; Iansiti & Lakhani 2017). Blockchain's public availability means that it is possible to trace back every product to the origin of the raw materials, and transactions can be linked to identify users (Kshetri & Loukoianova). Through establishing such provenance knowledge via blockchain (Montecchi et al. 2019) risks related to intermediary's interventions can be mitigated, including vulnerability to political turmoil, contractual disputes, and instability of financial institutions (Min 2019). For those higher-risk instruments the blockchain can offer substantial usage to make a visible flow of goods (Hofmann et al. 2018a).

Blockchain technology brings real-time visibility, security, and transparency by anonymous because with blockchain transactions, although traceable, it is secure without disclosing one's identity (Simon et al. 2017; Pilkington 2016). According to Korpela et al. (2017), blockchain technology promoters state that the identities of parties to the transaction are known is the underlying reason for security breaches. Thus, blockchain shows promise for easing supply chain management problems, for example, getting a better risk control (Saberi et al. 2019).

b) System integration under blockchain optimizes financing solutions. In any supply chain network the integration of financing activities with the physical supply chain, like the flow of information and goods, is essential (Silvestro & Lustrato 2014). A competitive supply chain is to move all stakeholders (like hub firms, intermediate companies, logistics providers, suppliers, and financial service providers) jointly toward standardized integration of business transactions and collaboration processes (Korpela et al. 2017). Dias & Ierapetritou (2017) stated that an integrated decision-making framework could guarantee solutions closer to optimality, and supply chain's integration indeed improves financial performance (Chang et al. 2016).

However, most time in a supply chain files produced by suppliers are incompatible with the buyers' information system (Korpela et al. 2017). It is really a huge challenge to manage information, control each interaction, and record

transactions of all products in a complicated supply network (Abeyratne & Monfared 2016). For instance, setting up a supply chain finance program requires a strong collaboration between the finance and procurement departments (Bogdan & Sava 2018), but even the large hub companies need to put big efforts and improve knowledge and capabilities in designing or deploying integrated end-to-end supply network (Korpela et al. 2017).

Digital integration of supply chain progressively becomes a competitive differentiation of enterprises by improved asset utilization and new database services (Pundir et al. 2019). To Korpela et al. (2017) blockchain is a many-to-many integration model deployed in the public cloud to conduct secured transactions rapidly at low cost, and is the good fit for facilitating supply chain digitization. Blockchain technology improves interoperability across organizations (Abujamra & Randall 2018) by replacing disparate systems with only one single system (Randall et al. 2017). Blockchain-driven buyer-supplier dyad will bring a significant positive effect (Wandfluh et al. 2016) like delay payments to suppliers, and collect money from customers much faster (Huff & Rogers 2016).

c) Third party elimination enhances trust and reduces cost. When to commence financing application companies execute data and process integration by treating banks or trade finance companies as a trusted third party, normally involving one party for the supplier and another one for the buyer (Korpela et al. 2017), thus incur significant financing costs (Huertas et al. 2018). Moreover, relying on the third party to deal with such sensitive and valuable information also means a great deal of trust (Abeyratne & Monfared 2016).

By using blockchain's smart contract feature, transactions are executed without relying on the trust of a third party (Francisco & Swanson 2017; Kubáč 2018; Casado-Vara et al. 2018). It indicates the creation of a contract, which is coded and included as part of a blockchain (Gal & McCarthy 2018). Under a common protocol, assets and agreements can be tracked by contracting parties; as a result, many in-house and third party verification processes will be streamlined or even completely collapsed (Treleaven et al. 2017). For example, auditors and accounting firms will go away (Saberi et al. 2019).

A smart contract based ecosystem allows companies to quickly implement customized financing solutions at a lower cost (Huertas et al. 2018) by bypassing slow, expensive payment networks (Rabah 2017). For instance, normally interbank transactions take time to be cleared and final settled, especially in off-work situation, but with blockchain transactional time can be reduced to minutes and available all the time (Rabah 2017). With distribution details being stored automatically and securely (Yoo & Won 2018) the blockchain application effectively reduces fraudulence and overpayment (Randall et al. 2017), and brings efficiencies together with a lower administrative cost (Haunschild & Wilkerson 2018).

IV.II How is the environment involving the implementation of this technology?

Companies are eager to invest in this new Fintech technology (Marsalek et al. 2019). Results show that adopting blockchain technology is not only a technical or business feat but also an emotional and social endeavor (Manrique

2018). The scenario is obvious by the staggering growth rate of the development of software related to the blockchain technology (Marchesi et al. 2018).

One of the advantages of utilizing a public ledger like blockchain to store data is that the infrastructure needed to ensure the security and visibility of data is "outsourced" to the global network (Chod et al. 2019). By customization blockchain can be adjusted to different business situations (Rückeshäuser 2017). In comparison with the complex situation of coordinating different software system in a supply chain operation, blockchain is relatively easier to be programmed and implemented (Randall et al. 2017). Special emphasis has been placed on the roles of the incorporation of the IoT in blockchain-based solutions (Kshetri 2018).

One of the reasons considered by Marsalek et al. (2019) is that the failing to integrate this technology into real-world business applications often lies in specific requirements related to data security and privacy. Since it is still an emerging technology, the importance is to make sure the blockchain-based system functions in a right way, not only know how to design (Dumas et al. 2018).

Another element for consideration is cost. Comparing to the centralized solutions, blockchain has a drawback since users have to pay for the transactions and computational power. Centralized solutions also charge but prices are more hidden and users will not be constantly reminded that an action has a fee (Koteska et al. 2017).

IV.III What is the correlation between blockchain-based supply chain finance and supply chain management?

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Research conducted by Hackius & Petersen (2017) shows that the community of supply chain management are quite positive about the blockchain since they have already realized the profound influence of this new technology.

a) More effective supply chain management with safer and easier business process. Just like the financial market to the whole economy system, financial service is essential to the supply chain (Wei 2017). The interplay of financial activities and another two supply chain management factors, like flow of physical goods and information among supply chain partners, provides value (Jansen et al. 2018). Blockchain facilitates this process by key-access restrictions, intermediary/transaction costs reduction; finance transactions enhancement, and protection against cyber attacks (Wamba et al. 2018). Based on Thurner (2018) blockchain-facilitated supply chain finance can provide efficient cash settlement, simplified invoice validity check, and integration of product and money flow.

b) More effective supply chain management with engaged workforce. The self-auditing blockchain technology helps companies monitor operations in the supply chain (Supranee & Rotchanakitumnuai 2017). Without requirement of employees' physical presence, by the help of blockchain, management can obtain task visibility in a high level over employees' work and employees can get motivated by knowing their contribution are recognized fairly (O'Leary et al. 2017). It is essential to keep the talent financial staff satisfied, engaged, and make more progress not only benefit the company but also help employees develop their own career roadmap.

IV.IV Industry update on blockchain application.

As a part of Industry 4.0 blockchain technology has drawn close attention from different countries, no matter developed or developing countries. The US, the UK, China, Japan, Russia, India, South Africa have successively initiated research on blockchain technology, and especially in the banking industry blockchain technology has a promising application (Guo & Liang 2016). Annual financial reports present the rising enthusiasm for blockchain technology amongst Chinese banks (China Banking News 2019). China Zheshang Bank (CZBank) has put the blockchain technology into its exploration of supply chain finance. CZBank granted lines of credit to Zhejiang Rifa Textile Machinery Co's downstream small and medium clients to bridge the funding gap for their equipment purchases based on the Rifa's creditworthiness. More than 100 downstream companies not only upgraded their equipment but alo decreased the financial costs around 20%. Rifa's sales revenue also increased by 300 million yuan (China daily 2019).

Marco Polo Network, the largest and fastest growing trade and working capital finance network in the world with headquarters in New York, launched in 2017 a platform, which uses open application programming interfaces and the blockchain, to connect a range of counterparties in the supply chain - banks, corporate customers, credit insurers, logistics companies, and payment providers - so they can exchange trade data and assets and seek financing more easily (Global Finance 2019).

E-commerce giant Alibaba recently launched a new blockchain supply chain finance subsidiary called Ant Shuanglian Technology, which can be literally translated that means into Ant Double Chain. Ant Double Chain will focus on core companies' accounts payables, enabling credit from these companies to circulate around the supply chain with blockchain technology and helping small and medium enterprises in the supply chain receive inclusive financial

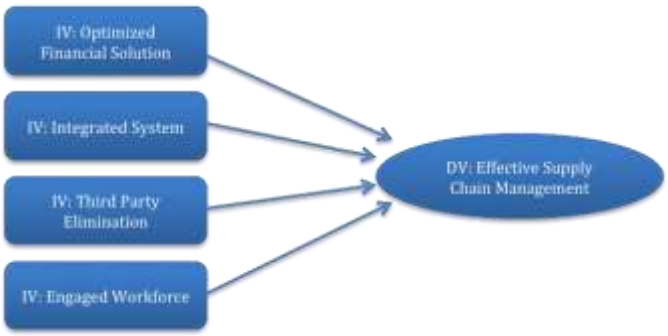
service efficiently (Ledger insight, 2019).

Malaysia's National Policy on Industry 4.0 or Industry4WRD was launched in 2018. Both blockchain and supply chain have been addressed as part of the strategy.

V. CONCEPTUAL FRAMEWORK

Based on above discussion we can develop a following conceptual model:

Figure 1



VI. CONCLUSION

Blockchain-driven supply chain finance not only supports day-to-day operations (Oswald & Kleinemeier 2017) but also essentially improves the turnover of supply chain finance from asset based lending to asset based securitization. Research suggests that it is better to initiate blockchain-driven financial instruments earlier into the supply chain operating process (Hofmann et al. 2018b) to facilitate better payment terms for buyers and easier suppliers' access to finance (Wuttke et al. 2016). Accompanied by major companies' investment both in blockchain technology and supply chain financial management, acceptance and normalization of "blockchain-driven supply chain finance" will grow (Woodside et al. 2017).

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