Blockchain-based Global Value Chain: A Conceptual Model for Adaptive, Efficient, and Agile Management

A paper by

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Abstract

This paper integrates the economic motivations of global value chain management (using transaction cost economics, or TCE, theory) together with organizational adaptive learning, in order to create a new theoretical basis from which to understand effective blockchain-based value chain management in international business. Established theory and application from cross-border distribution, technological discontinuities and international process flow facilitation are incorporated within this conceptual framework. Given the great opportunities afforded by the potentially paradigm-shifting nature of blockchain adoption within business functions, this paper is presented as a theoretical model from which to better understand and utilize this technology within a digitized and internet-connected world. The result is an adaptive learning moderated, TCE explanation of blockchain-based global value chain management. The paper has significant managerial implications in that it presents an actionable and comprehensive understanding of blockchain application capability in international business management and marketing. It also has significant academic implications in building theory regarding the blockchain phenomenon.

I. INTRODUCTION

Multinational enterprises (MNEs), as well as many small and medium sized enterprises (SMEs), have been operating in an environment of mass digitization and rapid technological advancement since the internet (and web-driven) age began more than two decades ago. From e-commerce to m-commerce, companies engaged in market-seeking and cost-reducing activities, along with a host of facilitation, organizational and promotional tactical/strategic realignments (Leamer & Storper, 2001). To add to this complexity, most leading firms have operated in a global environment with varying national business systems when it comes to managing their suppliers' inputs, and the outputs they themselves produce and guide through distribution networks (Lundvall, 1999). Competitive firms add value to inputs, and expect their suppliers upstream and distributors downstream to be doing the same – simply put, a value chain. In Porter's (1985) view, the value chain of activities results in greater value to the resulting products at the end of the chain as opposed to simply the sum of individual parts. This concept of value chain, along with its related "demand chain", has steadily become preferred terminology used in marketing and international business, as opposed to "supply chain"- given inherent emphasis on creating value for the customer. Adding value at every node in the chain at a global level, though, is challenging; consequences of war, political turmoil, opportunism, corruption and, indeed, pandemics can greatly accentuate these challenges. A key research question that this paper addresses is how blockchain technology may offer a governance medium to better manage such challenges. Could blockchain represent a "technological discontinuity" that significantly enhances global value chain management (VCM)?

It has now become clear that the advent of web-based commerce represented a classic technological discontinuity, in Tushman & Anderson (1986) terminology, from previous forms of business. This was evident in the competence-destroying discontinuities initiated by new firms (e.g. Google/Alphabet or Amazon) that have since become valuation juggernauts, but also apparent with competence enhancing discontinuities initiated by existing firms which retained or consolidated market leadership (e.g. Microsoft and Apple). While the term "blockchain" was not used in the now famous white paper introducing the cryptocurrency Bitcoin, Nakamoto (2008) did, in fact, create the first actionable distributed ledger, calling it a "chain of blocks" - what is now commonly referred to as blockchain. The distributed ledger is essentially a "decentralized digital database of transactions, which is maintained and updated by a network of computers that verify a transaction before it is approved and added to the ledger" (Morkunas, et al. 2019, p.2). Since the seminal Nakamoto (2008) paper and subsequent academic/industry work in developing enhanced blockchain technologies, some attention has focused on delineating the fundamental blockchain-building technology (often referred to as distributed ledger technology or DLT) from the financial technology (FinTech) application – cryptocurrency - for which it was introduced.

While prominent globally through media coverage and its dramatic rises (and falls) in valuation, Bitcoin (for which Nakamoto invented the distributed ledger) has generated great interest and development in fintech – with a multitude of other cryptocurrencies and tokenization developed. There is, however, a far larger field of usage for blockchain, and Morkunas, et al (2019) suggest a lasting effect on existing business models. A derivative term - Blockchain 2.0 - has also being widely used to refer to the "smart contract" – a blockchain application particularly well-suited for adoption by international business (Kim & Laskowski, 2017). However, while blockchain technology has been understood and applied by experts and a few leading, technologically innovative corporations for about a decade now, its usage and adoption among the wider population of international businesses has lagged – often due to the lack of technical/mathematical understanding, up-front costs, complexity in application and inertia. However, as such implementation becomes less expensive and easier to use through software development, it is expected that blockchain technology will become more widely utilized in business management (Tapscott, et al. 2016). Gartner Research is projecting 10-20% of global economic infrastructure to be blockchain-based by 2030, with blockchain generated annual business value of $3 trillion by that year (PWC, 2021).

There is, however, an obvious lack of rigorous academic frameworks with which to effectively understand and manage the incorporation of blockchain technology in value chain activities of international business. Such a framework or model is conspicuously missing in the extant literature. This paper fills that gap in the literature, and affords a conceptual basis from which to understand more effectively - from a non-technical perspective - how to best utilize and implement what can be readily characterized, in Tushman & Anderson's (1986) foundational discussion, as a technological discontinuity. There are, in fact, signs that some technological development by new firms could become "competence-destroying" discontinuities (e.g. Ethereum and Ripple), and there are also signs that well-established existing firms are creating "competence-enhancing" discontinuities (e.g. IBM and Microsoft).This is, indeed, reminiscent of the early days of internet-based commerce; clarity, however, would need to be reserved for scholarship in hindsight much later.

This paper presents a Transaction Cost Economics (TCE) explanation, moderated by adaptive organizational learning, of blockchain-enabled global VCM. The paper has significant managerial implications in that it presents an actionable and comprehensive understanding of blockchain application capability in international business management and marketing. For academic research, it is a step forward in integrating established theory with a new approach to conducting international business transactions, and leveraging the resulting framework for further research and development.

Ia. Research Approach

The distributed ledger at the heart of blockchain may be considered an exhaustive, digital database tracking and verifying all transactions relevant to a particular blockchain – that is, each block of transaction activity is verified collectively (by all parties to the transaction) which then yields a consequent new transaction and collective verification in the following block, continuing thus down the blockchain - maintaining consensus agreement without the use of "middlemen". The blockchain can be distributed across an enormous number of computers globally with secure state-of-the-art cryptography, allowing a transparent "platform for truth and…trust" (Tapscott, et al, 2016). It can be in private or "permissioned" form or completely public and non-permissioned. Every authorized party to a blockchain can view the transaction history in totality (Pilkington, 2015), and anyone attempting to change the transaction would effectively have to change the entire history of that transaction, observed and verified by all parties to the transaction.

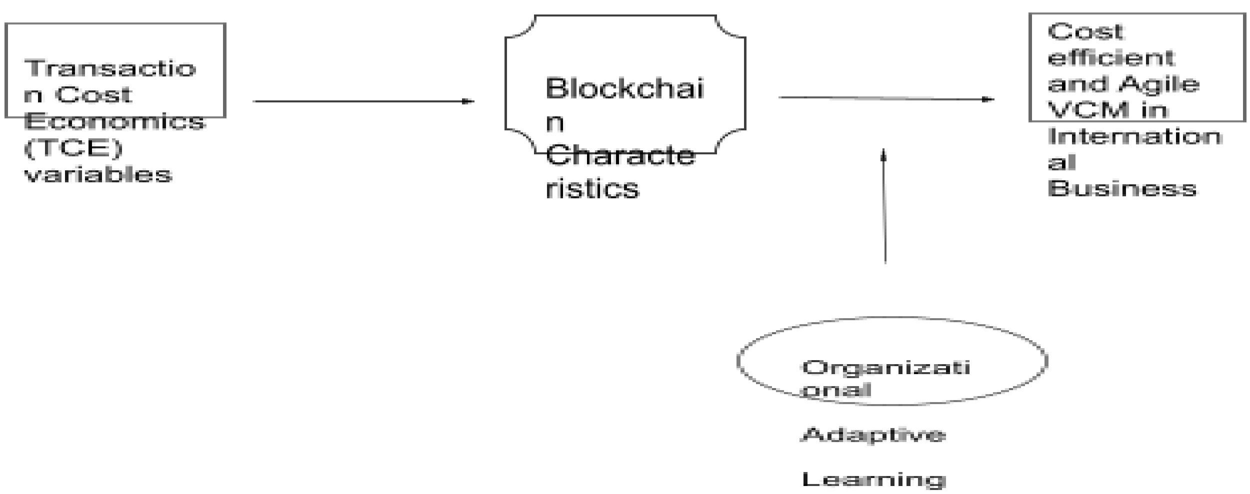
The following are the key, unique characteristics of blockchain technology that foster applications across international business, and also, we posit, mediate TCE variables:

> *Disintermediation*: removal of "middlemen". This removes costs directly associated with these intermediaries, especially those securing trust and process facilitation.
> *Transparency, trust maximization and continuous tracking:* an automated form of trust is enacted through the blockchain, since all transactions are collectively apparent to all authorized parties at all times. Transactions can be continually tracked.
> *Autonomy and autonomous efficiency*: immediate movement between environmental or determinant change and consequent decision effect.
> *Immutability*: Transactions are permanent, requiring agreement and verification by all parties of a transaction in order to edit or change the blockchain or underlying distributed ledger; any such edits formulate a new block and are also permanent, and so forth.
> *Smart Contracts & adaptable coding*: Variety of self-executing contracts, with conditions and contingencies that would affect implementation, can be coded/created through a blockchain network.

Given the preceding discussion, this paper proposes that the afore-mentioned key blockchain characteristics directly mediate fundamental TCE variable (as summarized by Williamson, 1979) in subsequently yielding desirable outcomes in overall transaction costs within international business VCM. While TCE variables are central to realization of transaction costs when it comes to VCM activities, the adoption of blockchain technology directly impacts each of the TCE variables associated with such VCM activity or transaction/exchange. This impact is further moderated by organization adaptive learning – which must be managed effectively in order to sustain positive effect of blockchain characteristics. International business distribution and process facilitation provide the transactional context of VCM in this study. This paper, thus, leverages TCE as the underlying theoretical foundation on governance mechanisms, and consolidates it with work done on adaptive learning (in the organizational literature), cross-border trade and distribution (from the international marketing literature), and process flow facilitation and supply chain efficiency (from supply chain management literature). **Figure A** is a skeletal representation of the central thesis.

<INSERT FIGURE A HERE>

<u>Figure A: The Research Thesis</u>



We identify TCE variables, resulting transaction costs, and how these are affected by the characteristics of blockchain. The paper, then, proceeds to discuss organizational adaptive learning and how this moderates the relationship between blockchain-mediated TCE variables and consequent costs and value-adding activities in VCM. This results in the blockchain-based model of effective, efficient, agile and adaptive value chain management outcomes in international business, formulating the theoretical model presented in this paper. We discuss applications of this theory to real-world situations and discuss managerial implications. The theory, propositional framework and overall model provides a foundation for academic research and development in this new and burgeoning field.

II. EXISTING THEORY (LITERATURE REVIEW)

IIa. Transaction Cost Economics (TCE)

TCE has been referred to as "perhaps the single most influential theory found in social sciences" (Carroll & Teece, 1999; p. 3). Operationalized by Williamson (1979; 1985), TCE essentially suggests that organizational form should be the efficient result of a given economic relationship. That is, it indicates what governance mechanisms will best manage a given set of antecedent conditions. These conditions are determined by two properties of the underlying transactions (asset specificity & uncertainty) and two properties of the human nature accompanying these transactions (bounded rationality and opportunism). Williamson (1985) also divides transaction costs into direct costs of the transaction and opportunity costs associated with an inferior transaction decision. In the present research, the four properties of the underlying transaction are treated as variables, and together provide an analytical framework for understanding a firm's transaction costs.

The reasoning behind utilizing transaction cost economics in order to explain the rational side of value chain strategic and tactical operations is based on the fact that it is the exchange itself that is at the heart of partner transaction behavior in international business, and it the governance of exchange that TCE explains (Carter & Hodgson, 2006) . The underlying properties of the transaction and the properties of the human nature accompanying these transactions together can effectively explain the rational side of organizational transactions in value chain decision making. Indeed, while the approach has been popularly utilized in the literature before to explain firm behavior, it has been indicated to be an effective paradigm flexible enough from which to also view the rational side of consumer transaction behavior (Gronhang & Gilly, 1991; Teo & Yu, 2005). This rational TCE approach, we contend, can be utilized to explain benefits of blockchain technology. Can this rational approach to transaction behavior (particularly for firms engaged in B2B transactions in international business) then be enhanced and made more efficient? Studying the extant literature, we find that the concept of organizational adaptive learning may offer a compelling answer in the affirmative. The central concept incorporated within adaptive learning (that of personalization, specification and application of relevant knowledge) enhances or diminishes the outcomes yielded by blockchain-mediated TCE variables. That is, while blockchain technology directly impacts TCE variables (yielding desirable effect), organizational adaptive learning acts in a moderating capacity between these blockchain-mediated TCE variables and the yield of desirable VCM outcomes in international business. As organizations learn from direct experience and as the new technological discontinuity is demystified and normalized with greater ease-of-use, we expect a more positive impact on TCE variables from blockchain adoption in the service of global VCM in international business.

IIb. The TCE Variables

Table 1 summarizes the four general TCE variables, with related definitions and examples in VCM practice. As a central paradigm utilized to explain international business strategy and organizational governance (Williamson, 1985; Coase, 1937), TCE is particularly well-suited to understand how blockchain technology can impact such strategy and governance. The key blockchain characteristics given in the previous section directly impact each of these transaction cost variables in linear ways – either further increasing or decreasing their relative effects. Transaction examples are provided in the chart below in order to illustrate the positive effect of block-chain usage.

<INSERT TABLE 1 HERE>

Table 1: Transaction Cost Economics (TCE) Variables

Variables	Definitions	Examples in VCM (old vs.new)
Asset specificity	This is the state of being unique, specific, or customized to a particular user. This state may be indicated by investments undertaken in support of a particular transaction (Williamson, 1985).	OLD: Funds set aside for a specific purpose, e.g. new or upgraded software. NEW: Blockchain powered immediate delivery of funds

Uncertainty	This refers to the uncertainty inherent related to another party's action and/or uncertainty related to the future.	OLD: Volatile market conditions, price changes, efficiency in delivery NEW: Blockchain-enabled certainty.
Bounded rationality	This is the "assumption that decision makers have constraints on their cognitive abilities and limits on their rationality (Rindfleish & Heide, 1997)". The higher the level of bounded rationality, the greater the potential for error in decision making.	OLD: Competitor's prices, alternative products satisfying same need NEW: Distributed ledgers underpinning blockchain provide same and exhaustive information to all parties to a transaction.
Opportunism	This is defined by Williamson (1985) as self-interest seeking with guile. This implies the motivation to unscrupulously seek the most benefit for one party to the transaction	OLD: Lying, cheating, contract reneging, misrepresentation, payment fraud, spam NEW: As truth is apparent through the distributed ledger database and all blocks within the blockchain are known and immutable, opportunistic behavior is greatly mitigated.

High asset specificity results when a firm is heavily invested in the transaction, in terms of time, effort and money, leading to high transaction costs (Oliva, et al, 1992). In the VCM context, this may arise due to, for example, a downstream partner spending a great deal of time investigating product features listed on a supplier's specifications sheet when making a much-needed software purchase. Conversely, low asset specificity - and subsequently low transaction costs - would manifest when, for example, a customer can easily see on the blockchain the entire history of required product features already verified.

A fundamental aspect of uncertainty, and in inverse ways proxy to it, is trust (Grabner-Kraeuter, 2002). Where a downstream customer is uncertain as to, for example, delivery of product or the misappropriation of payment, he/she will perceive high transaction costs. Conversely, where there is sufficient level of trust within the supply chain, parties will likely perceive low transaction costs, and be rationally more willing to engage in transactions (Bryant & Colledge, 2002).

Similarly, high transaction costs are perceived if the consumer becomes aware of opportunistic behavior or guile by a partner in the value chain (Saban, et al, 2002). Perceived opportunistic behavior can also include violation of privacy concerns (Sheehan & Hoy, 1999).

Given that blockchain transactions are entirely transparent to authorized parties while being inaccessible to unauthorized parties, such privacy concerns can also be significantly mitigated or managed. Conversely, low transaction costs are perceived if VCM parties perceive no, or negligible, guile or opportunistic behavior from others. The transparency inherent in the blockchain greatly removes uncertainty as well as opportunism.

A low level of bounded rationality will mean that a party is well aware of many alternatives (e.g. product or vendor substitutes) and has rationally selected the present alternative, and thus will perceive relatively low transaction costs in the present transaction. A party with insignificant knowledge of alternatives – thereby experiencing high level of bounded rationality – will, on the other hand perceive high transaction costs. Here, the blockchain characteristics of transparency and immutability, along with the ability to code for contingencies in smart contracts, greatly reduces bounded rationality – and so lowering transaction costs.

Based on the preceding discussion, then, we present the definition of high and low transaction costs for value chain management (VCM) as follows: *A condition of LOW transaction costs for a party in VCM is one in which there is low level of asset specificity, low level of uncertainty, low level of bounded rationality, and low level of opportunism. A condition of HIGH transaction costs for a party in VCM is one in which there is high level of asset specificity, high level of uncertainty, high level of bounded rationality, and low level of opportunism.* All other factors being equal, a firm (and its supply chain partners) will rationally be more likely to execute a transaction when the perceived transaction costs are low and be less likely to do so when perceived transaction costs are high.

III. MODEL DEVELOPMENT (THEORY BUILDING METHODOLOGY)

IIIa. Impact on TCE variables by Blockchain:

O'Dair and Beaven (2017) discussed the basic three advantages of blockchain technology: guaranteeing authenticity, provenance, and payment facilitation. Integral to these benefits are the blockchain characteristics highlighted in the previous section. A vast, well-organized, transparent distributed database allows for trust maximization, along with rapid trade and exchange facilitation with minimal errors. There is a constant and permanent record of transactions, making traceability remarkably efficient. Usage and ownership of data and any related asset or liability is clearly and easily distinguishable. Removal of intermediaries and effectively shortening the value chain is a key feature relevant to business VCM. Tokenization, cryptocurrency usage and finance/payment ramifications are also relevant features/applications of blockchain technology – collectively classified as fintech (financial technology). While fintech has received, by far, the most general press coverage, it should be emphasized again that blockchain applications are far more diverse.

Adoption of blockchain technology as the underlying basis of VCM affects each of the TCE variables – it changes their expression or how they are manifest. As indicated in Table 1, mediation by blockchain results in "new" realities, altering what may be "old" realities in traditional VCM activities. So, where bounded rationality may have previously resulted in decision making limited by asymmetric information between two or more parties to a transaction, the "new" reality of same and exhaustive information available to all parties through distributed ledgers' database minimizes asymmetry. This idea of "same and exhaustive" deserves further explanation: effective value chain managers, utilizing blockchain technology (primarily through its underlying database) can ensure that all – and only those authorized – will have access to all relevant information (*exhaustive*) related to a transaction. With such information being immutable, all such authorized parties will access exactly the *same* information. And where opportunism could be expressed previously in lying or exaggerating about transactional information, such behavior is near-eliminated when operating through the completely transparent and trust-maximizing blockchain. Similarly, where uncertainty or time delays regarding transactions may have been part of the "old" reality, blockchain powered transactions are certain and immutable without any time delay. Where asset specificity of "old" may, for example, have been expressed in specific funds set for a transaction in the form of letters of credit, it is now manifest in the "new" blockchain powered near-immediate transfer of funds without middlemen.

It becomes clear that blockchain technology directly affects the actual TCE variables such that they are expressed or manifest in significantly different ways. Indeed, blockchain adoption may thus result in the overall conditions of low level of asset specificity, low level of uncertainty, low level of bounded rationality, and low level of opportunism. By definition discussed above, that is LOW perceived transaction costs. Therefore,

Proposition 1: *Effective usage of blockchain technology in value chain management activities will yield lower transactions costs.*

IIIb. Blockchain-mediated TCE Resulting in VCM Outcomes:

Outcome variables are those that can be measured and observed directly, and provide some indication of business performance (Porter, 2001). In our study, these are the set of activities engaged with value chain management (VCM). The previous discussion has established how TCE variables are mediated by blockchain technology in order to yield lower transaction costs. These lower transaction costs are passed through the activities within which the lowering of transaction costs is occurring – that is, VCM. However, organizational adaptive learning (OAL) is moderating this process. This means that the effective level of OAL will impact (enhance or limit) the benefit of lower transaction costs created by blockchain adoption. The existing literature in VCM is vast (see Walters & Lancaster, 2000), but we can summarize the wide-ranging universe of VCM activities in international business as follows into three types:

Type 1: Supply chain partner exchange and relationship activities
Type 2: End consumer value enhancement and delivery
Type 3: Finance, accounting and information support operations

It is the cross-border set of activities that this study is primarily focused on, given our focus on international business. It should be mentioned, however, that businesses of a purely domestic nature may also benefit from much of the theory explained in this paper – especially as many such businesses tend to have international supply-side or distribution-side exposure. In this paper, we focus on *cross-border or international* Type 1, Type 2 and Type 3 TCE outcomes in VCM. These will be referenced in the following sections.

IIIc. Moderation by Organizational Adaptive Learning:

While organizational learning theories encompass a broad and storied canvas, given the new, discontinuous nature of blockchain technology, it is expected that most organizations would not have organically developed “home grown” blockchain technology at their disposal. Thus, in the categorization developed by Levitt and March (1988), we focus on learning that is dependent on "learning from the experience of others" and transferring procedures and routines that would best fit their own organization. This is particularly helpful when the new technology is complex, cross-border and requires a steep learning curve (Luo, 2020). While the initial learning is done essentially by imitation, it is the subsequent demonstration of usefulness and positive differentiation in efficiency and effectiveness that allows such new learning to diffuse and be molded through the organization (Zucker, 1987; Kay, 1979); and this process is inherently innovative. Procedures and routines diffuse then with less resistance, as organizations strive to continually show value in the newly adopted discontinuity. The interpretation of this experience and the dynamics involved soon are manifest as "learning by doing" and steadily the organization develops organizational memory (Johnson & Kaplan, 1987). This can alter and become incorporated into an organization's own "theory of action" (Sullivan & Nonaka, 1986). Desirable organizational features like team building, consensus and trust can result (Nonaka & Johansson, 1985). Thereafter, the organization can drive the process of tacit knowledge transmission in addition to initial explicit knowledge diffusion which has prepared key individuals and created a sound knowledge base - through the potentially software-connecting utilization of blockchain (Xu, et al. 2016).

Effective knowledge transmission relies heavily on a "sound knowledge base" and is often in conflict with dominant status-quo organizational system (Heerwagen, 2002). Problem solving and innovation, particularly in the execution of Type 1 and Type 2 VCM activities, takes time and social persuasion of key members of the organizational or corporate leadership. Since most international businesses perform operations and execute VCM activities at the project team level, it is at this project team level that individual tacit knowledge begins to coalesce into actionable and relevant knowledge that can be effectively utilized for innovation and efficient performance by the firm (Koskinen, et al, 2003; Leonard & Sensiper, 1998). It should be noted that whereas creativity concerns the production of novel and useful ideas (Shalley, 1991), innovation relates to the adoption of useful ideas and idea implementation (Van de Ven, 1986). Through socialization mechanisms, innovative processes and ideas can be disseminated among multiple individuals working on a common objective - thus resulting in innovation at the project team level (Nonaka, 1994). This sustained interaction through the socialization process enhances innovation usage through the diffusion of tacit knowledge among the group (Leonard & Sensiper, 1998). Utilizing this new technology (blockchain, in this case), once an organization's success becomes apparent within a market or industry segment by an organization is established, competitors often follow suit (March, 1981). This further drives the innovative firm (in this case, the blockchain technology adopter) to consolidate and leverage its advantage, creating a positive feedback loop for further enhancement in OAL. This will logically create the organizational environment to further enhance the positive effect of blockchain technology in improving efficiency of TCE variables in lowering transaction costs. Observation of such in the marketplace will encourage other firms within the same industry segment to mimic the innovative firm's behavior. Therefore,

> ***Proposition 2a:*** *Learning blockchain technology and transmitting adapted knowledge efficiently throughout the firm will yield more innovative ways to conduct VCM activities. And,*
> ***Proposition 2b:*** *The early adopter of blockchain technology within an industry segment can show lower transaction costs and become the leader to mimic by competitors.*

VCM activities require an ecosystem of partnerships and transactional dealings with trusted suppliers and distributors. As such, once blockchain-driven lower transaction costs are established within a firm, such innovation knowledge should be transferred throughout a firm's ecosystem between project teams. Knowledge transfer is most obvious in Type 1 VCM activities, though needed in all three types of VCM activities. This constitutes transfer of external knowledge (as the firm is transferring knowledge outside its own constitution. Kogut and Zander (1992) indicated transfer of external knowledge can improve teams' overall innovativeness, and partner firms within the ecosystem should receive such benefit – often through the use of tacit knowledge transfer. In fact, as tacit knowledge requires' executives' personal involvement, such knowledge application success and limitations will directly benefit knowledge enhancement and diffusion in the original blockchain-adopting firm (cf. Lord & Ranft, 2000). As Levitt and March (1988) found, such learning is more likely to be expressed in quickly adapting behavior and organizational leadership. It is also likely to be the cause of more "mindful" organizational learning – with purpose and strategic depth (Levinthal & Rerup, 2006). Such agile, adaptive and purposeful learning is what we refer to as organizational adaptive learning (OAL). Defined as such, OAL is essential for dynamically managing sharp changes and heterogeneity in global demand and requirements among value chain partners (cf. Zhang, et al. 2019). An increase in the level of OAL, we suggest, should positively moderate the effect of blockchain characteristics on TCE variables, and a lower level of OAL should have a diminishing effect.

Unlike explicit knowledge (transfer of which would be most evident in Type 3 VCM activities), tacit knowledge transfer requires personal contact and involvement and, once successfully transferred, has a more significant impact on innovation (Seidler & Hartmann, 2008). In pursuit of such valuable tacit knowledge oversees, firms will tend to utilize international project teams as opposed to domestic ones (Subramanian, et al, 1998). This external tacit knowledge is sought so as to promote divergent thinking and creativity, while still retaining the practical outcome-based structure of the project team (Mascitelli, 2000). It will also enhance relationships and networking opportunities for an early adopting firm within an industry segment. Cantwell, et al (2010) posits patterns of evolutionary development between international business networks, lending credence to the suggestion that "competence-creating" individual firms can directly impact related firms and networks. In fact, the innovation literature has well-supported the view that tacit knowledge exchange interactions between members of a value chain lead to more innovation (Khan, 2017). With new innovative knowledge transmitted from the blockchain-adopting firm, a partner firm would also see opportunity for improvement within its own structure of operations. Thus a firm adopting blockchain-driven VCM could help diffuse its adapted knowledge throughout its ecosystem. Therefore,

> ***Proposition 3a:*** *VCM activities at a block-chain driven international business will be positively moderated by OAL. And,*
>
> ***Proposition 3b****: A blockchain driven international business is more likely to become a leading node for diffusion of valuable innovative knowledge throughout its VCM ecosystem.*

IIId. Context of Cross-border Distribution and Process Flow Facilitation:

Nooteboom (2000, p. 88) observed that "under conditions of complexity and rapid change of technology and markets, there is greater need for knowledge exchange". International business is inherently complex with environments often very different from one country to another, especially since the modern day supply chain often encompasses members in countries with vastly different levels of development and institutional systems. The adoption of blockchain technology also constitutes a radical change for firms, as transactional systems are immediately and significantly affected. Of the three types of VCM activities, the first two involving supply chain partners and end consumer value enhancement will require more intense tacit knowledge transmission than Type 3 activities. Additionally, regulatory issues and differences internationally in terms of trade facilitation and interoperability through blockchain technology, would require personalization and intensity (Macedo, 2018). This will likely require time, commitment and large initial investment as tacit knowledge require a relatively higher density of within and cross team person-to-person activities, making it a substantially more difficult process than transfer of explicit knowledge (Hansen, 1999). Given the global supply chain and networks utilized by international businesses, whether they are multinational enterprises (MNEs) or small and medium sized enterprises (SMEs), such personalized knowledge transmission involving a major technology shift in VCM activities would likely be more expensive and time-consuming than would be seen in domestically-oriented companies. However, this only applies to the initial investment and short term. In the medium to long term, once the new blockchain technology-based systems are in place, there should be little difference (between domestic or multinational companies) in the maintenance of a technology that is (theoretically at least) not impacted by national boundaries; that is, a long-term flattening. Indeed, though, contingencies and value chain governance issues may well periodically arise internationally (Torres, et al. 2020), acting thus as moderators to the projection of long-term flattening.

Seminal work by Granovetter (1972) postulated that dense groups locally clustered, and then interconnected by weak ties, lead to successful innovation-creating networks. They allow participants to develop quick, though initially weak, relationships across the globe. Frequent communication usage among a population already adept at internet applications online social media – especially firm-specific internal social media - would result in greater usage of such valuable tacit knowledge (Hage and Hollingsworth, 2000) by international project teams. Further, the internal network design most advantageous to the firm will focus “on the transferability of tacit knowledge within the firm, while retaining its inimitability outside the firm" (Khan and Jones, 2011: p. 243). External transmission, however, could still be utilized carefully and purposefully, given the reliance of VCM on Type 1 activities. Given the preceding discussion, therefore:

> ***Proposition 4a:*** *An international business, versus a domestic business, would see significantly more initial investment costs for adoption of blockchain technology in its VCM activities.*
>
> ***Proposition 4b:*** *A blockchain driven international business would see better performance in its VCM activities if engaged in greater tacit knowledge transmission within the firm and between its international partners.*

International businesses, particularly MNEs, account for the substantial share of international trade flows globally. The major contributor to these cross-border trade flows are the interactions and transactions between members or nodes of global supply chains these international businesses utilize. In search of enhanced efficiency and effectiveness, MNEs (to varying degrees of success) developed various models for supply chain integration. As most researchers have suggested, the linkages within the supply chain can be either tangible (e.g. physical facilities or information systems) or intangible (e.g. behavioral), or both (Mentzer, et al. 2001). Varying greatly between industry segments and between companies, the supply chain can of a short, direct nature or it may a complex arrangement of multiple intermediaries with both tangible and intangible linkages. The *purpose* of the chain, however, is ultimately the same – to facilitate the exchange function, and so it is fundamental to VCM activities and international business strategy. Given supply chain's centrality to the consequent value chain and firm strategy, there has been a resulting shift in competitive thinking among corporations, over the past several decades, and the nature of a firm's strategic business unit. Firms have often come to be seen to be competing at the value chain level – value chain against value chain as opposed to product vs. product. (Walters & Lancaster, 2000).

As indicated by Mohr and Nevin (1990), a variety of different facets of interfirm information exchange exist, including the amount, direction, medium, and content of communications. Multiple channels of distribution has now become the rule rather than the exception, given the fragmentation of markets, advancements in technology, and heightened inter-brand competition, among other things. Greater integration is thus sought by MNEs and conglomerates in search of efficiency. Intermediaries may become "integrated supply networks', which makes it more efficient for upstream manufacturers to execute their downstream distribution (Frazier, 1999). Such intermediary integration and consolidation developed well in the 1990s and the 2000s, so much so that they created "platforms" which had and still have great market power and bargaining power. This sometimes, counterproductively, had adverse cost and pricing effects in terms of VCM by MNEs and SMEs, even while these platforms enabled greater and quicker market coverage. Utilization of such powerful platforms by MNEs and SMEs must be managed carefully, given potential for opportunism and economic discrimination on such platforms (Edelman, 2014) with great information asymmetry present. Blockchain powered VCM, with its transparency and immutability, can be an effective means to effectively counter potential for such behavior; with quick removal of "over-charging" or inefficient intermediaries and similarly quick addition of cost-efficient intermediaries.

An example of Hewlett-Packard's response to the last economic recession of 2008 is also instructive Since that 2008 recession, HP streamlined their supply chain by acquiring some suppliers (e.g. 3PAR and Palm) and shipping products directly from their Asian manufacturing hub directly to retailers – a demand-driven value network (Moore, 2010). To offset decline of the overall PC market, HP acquired 3Com deep in the heart of the global contraction in 2009 – the purpose being to expand business service offerings and become a "one-stop" shop for customers. This diversified the company's revenue streams, and allowed it to compete effectively in more "safe" areas of revenue generation – especially as it targeted the lower end of enterprise solutions with particular interest in China (avoiding IBM and Cisco at the higher price points of service). This serves as a classic example of VCM enhancement, and HP did this successfully. Blockchain technology could have provided support for multiple steps in this process: acquisition of suppliers, direct shipping from Asian manufacturing hubs, expanding business offerings after 3Com acquisition, contracting with and implementing lower-end enterprise solutions. In doing so, given blockchain characteristics discussed in Section IIIa, blockchain adoption would have reduced transaction costs further.

In dealing with traditional global supply chain partnerships and relationships, an international business finds considerable drag on efficiency and a major component of avoidable costs. In mitigating such costs, virtual integration in global value chain management became prevalent particularly through the greater sophistication of internet and mobile technology (Kreskinocak &Tayur, 2001), and has continued to develop since, yielding markedly more cost-efficient VCM. Following in the developments made by virtual supply chain systems, and after overcoming initial significant outlay of investment in the short term, a blockchain based VCM system will lower cost further than the traditional non-blockchain systems prevalent today. Therefore, relative to traditional supply chain and value chain systems, we posit:

> ***Proposition 5a:*** *In the long term, a blockchain based global VCM system will reduce costs. And,*
>
> ***Proposition 5b:*** *In the long term, a blockchain based global VCM system will be quicker to respond to changes in demand along the value chain.*

IIIe. Adaptation to Environmental and Supply Chain Disruption:

In basic international business terms, "environment" refers to the six major types of environments affecting a firm's business: natural-geographic, legal-political, socio-cultural, technological, economic and competitive (see Hill, 2021). Environmental disruptions, thus, refer to disruptions within any of these environments. Such disruptions can often alter supply chain effectiveness and efficiency - and lead to supply chain disruption. It is in the ability of blockchain technology to implement "smart contracts" that very substantially changes how we view today's existing supply chains and consequent value chains. Szabo (1997) used the term "smart contracts" originally (in pre-blockchain times) referring to clauses and algorithmically coded contingencies within contracts that can be executed over computer networks secured by advanced cryptography Now utilizing blockchain as its security and trust base with state-of-the-art cryptography, such smart contracts can be seen as an optimal solution to dealing with environmental and supply chain disruptions in VCM.

International business firms are quite familiar with disruptions – major or minor. The HP example explained in the previous section provided one such illustration. COVID-19 pandemic related major disruptions are still being observed as of this writing. The year 2020 and the first half of 2021, for example, have seen massive blockages and loss of efficiency in global shipping and logistics, mergers & acquisitions activity, factory disruptions, along with major shortages in manufacturing key components such as microprocessors (Gohil & Thakker, 2021). Similarly, "trade war" rhetoric between Chinese and U.S. leadership in 2018 resulted in severe disruption in the agricultural sector. Such large-scale disruptions may not be common but can cause dramatic and widespread damage, while smaller scale industry or company specific disruptions do occur with more frequency. In keeping with discussion of efficiency and responsiveness to demand in the preceding section, we posit that a block chain based system will be more adept at responding to major disruptions to the global supply chain. For example, if a trusted supplier in one location is unable to meet their contracted delivery of goods because of a major political change or a natural disaster, a blockchain "smart contract" can immediately conduct an autonomous transition in obligation to another trusted supplier in an unaffected location and, thus, mitigate the disruption. The same can be done with more mundane changes in cost structures among suppliers. That is, smart contracts allow great flexibility and adaptability to international businesses facing environmental and supply chain disruption.

Honda, for example, manufactures in multiple locations around the world, and purchases components from a large number of suppliers in a vast supply chain of raw materials and parts. No single supplier is relied on by Honda to any significant extant (with no one supplier relied upon for more than 5% of product). This creates massive bargaining power within its supply chain, allowing it to minimize costs and reduce disruption. In the previous (2008) recession, Honda held its own on the revenue side as well despite some unrelated public relations adversity related to its products. The company had already invested in manufacturing plants worldwide, allowing it to reduce transportation costs and tariffs on a regional basis – and continued to be profitable. In response to the 2008 recession, the company did face reduced demand and increased competition from lower priced competition from South Korean and Chinese companies. Honda continued to utilize the just-in-time inventory supply chain that it had invested in heavily during the early 2000s – overcoming challenges by creating partnerships and reducing the number of intermediaries in the supply chain (Johnson & Nuzum, 2005). A focus on reducing costs of production and inventory control were Honda's hallmark during the recession.

At home in Japan, Honda also utilized Keiretsu (the Japanese intensive conglomerate social network system, with very high levels of tacit knowledge transmission) to manage suppliers and effective financing for its investments worldwide. If in the same situation today with another recessionary environment, Honda would be able to utilize a blockchain based VMS to offer even more efficient outcomes. It could have created transitions with pre-coded smart contracts between its network of suppliers in quick time without delays in negotiations and supply chain performance. It could also program customer-demanded features' development with parts manufacturers such that its consequent value chain remained strong, and further strengthened. In fact, this is not merely hypothetical. Honda has already been investing in a blockchain based supply chain management system in order to enhance its value chain in the following areas: "business process management, manufacturing, parts traceability and recall management, consumption, ethical sourcing and sustainability, transportation and logistics, and finance/payments" (Ledger Insights, 2021). That is, it is already setting up the conduct of blockchain-based VCM in all three types of VMS activities highlighted in this paper. It has done so working through MOBI, a nonprofit strategic alliance, collaborating with Ford, Accenture and IBM and other major MNEs. The fact that this alliance of major MNEs, along with many others, have already agreed upon standards for such blockchain-based VMS and supply chain activities bodes very well for the eventual evolution of major players in international businesses incorporating blockchain-based VMS.

Indeed, block chain smart contracts can be coded for a vast variety of contingencies and predesigned for autonomous implementation – creating what would be a sea-change in managing disruptions. Kim & Laskowski (2021) found smart contract implementation, with due considerations of antecedents and complexity, to be useful and effective in reducing uncertainty in value exchange. Where blockchain is the distributed database in which all transactions are secure, transparent and immutable, smart contracts are the "special network-embedded software" which govern generation of transactions based on predetermined conditions and contingencies, which can be public or limited – permissioned - to specific nodes of the network (Lucena, et al., 2018). Utilizing the example of a grain exporter network in Brazil, Lucena, et al.'s paper explained effective implementation of this technology, in order to enhance governance of quality assurance, and showed consequent significant increase in valuation of cross-border trade. Certainly, beyond quality assurance (which in itself is a key factor in value enhancement for customers), most factors perceived as valuable to customers across a wide variety of industry segments can be coded through smart contracts in similar manner to enhance ultimate value to the end user or consumer. Based on the preceding discussion in this section, therefore,

> ***Proposition 6a:*** *Blockchain based global VCM system allows "smart contract" implementation to effectively and efficiently adapt to disruptions in the value chain (adaptive blockchain-based VCM). And,*
> ***Proposition 6b****: Blockchain based global VCM allows "smart contract" implementation to continually enhance factors of value to end consumer (adept blockchain-based VCM).*

IIIf. RESULTS: The New Theoretical Model – BVMS

In the previous sections of model development, the entirety of the propositional framework has been posited. It is summarized here in Table 2. A total of six sections of theory comprising eleven propositions together constitute this conceptualization of Blockchain-based Value Chain Management – BVCM.

Table 2: The BVCM Theoretical Framework

Proposition 1: *Effective usage of blockchain technology in value chain management activities will yield lower transactions costs.*

Proposition 2a: *Learning blockchain technology and transmitting adapted knowledge efficiently throughout the firm will yield more innovative ways to conduct VCM activities.*
Proposition 2b: *The early adopter of blockchain technology within an industry segment can show lower transaction costs and become the leader to mimic by competitors.*

Proposition 3a: *VCM activities at a block-chain driven international business will be positively moderated by OAL.*
Proposition 3b*: A blockchain driven international business is more likely to become a leading node for diffusion of valuable innovative knowledge throughout its VCM ecosystem.*

Proposition 4a: *An international business, versus a domestic business, would see significantly more initial investment costs for adoption of blockchain technology in its VCM activities.*
Proposition 4b: *A blockchain driven international business would see better performance in its VCM activities if engaged in greater tacit knowledge transmission within the firm and between its international partners.*

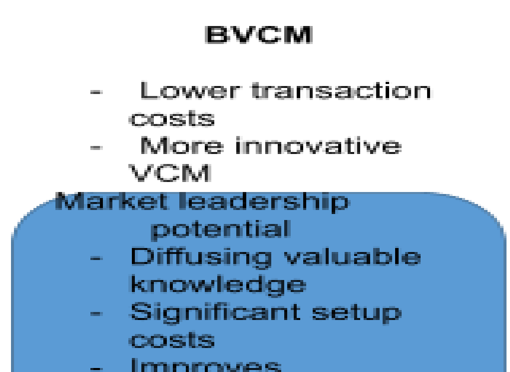
Proposition 5a: *In the long term, a blockchain based global VCM system will reduce costs.*
Proposition 5b: *In the long term, a blockchain based global VCM system will be quicker to respond to changes in demand along the value chain.*

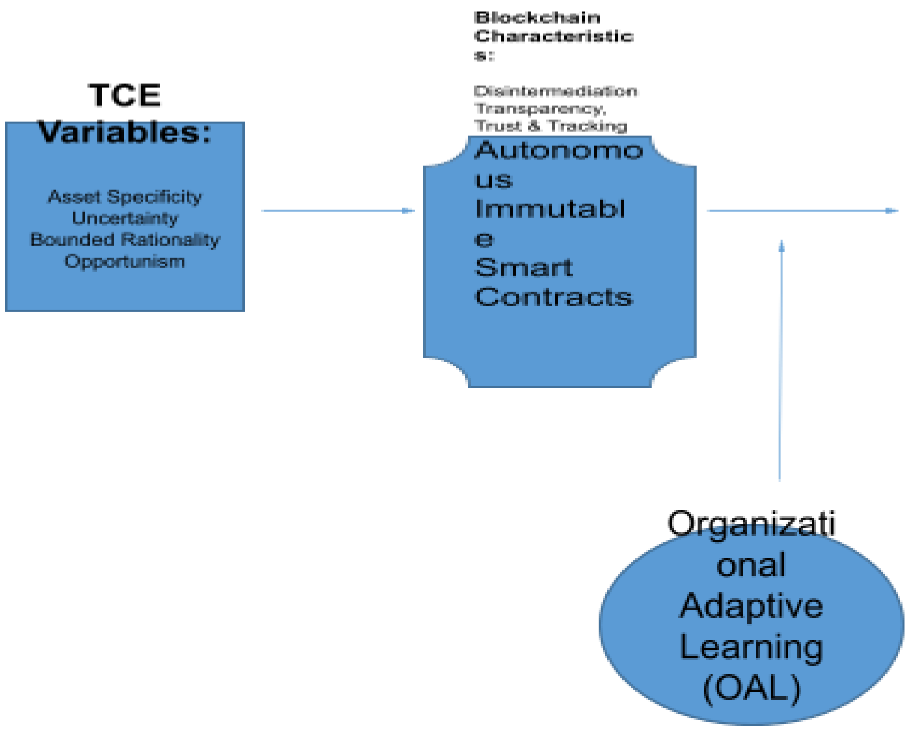
Proposition 6a: *Blockchain based global VCM system allows "smart contract" implementation to effectively and efficiently adapt to disruptions in the value chain (adaptive BVCM).*
Proposition 6b*: Blockchain based global VCM allows "smart contract" implementation to continually enhance factors of value to end consumer (adept BVCM).*

After the revolutionary changes in business created by the internet, blockchain technology adoption may well become the next big evolutionary step towards decentralized, transparent, trusted, secure, immutable, adaptive and agile value chain management across international business. Following is the complete BVMS model, developed in this paper, diagrammatically depicted.

<INSERT FIGURE B HERE>

Figure B: Blockchain-based Global Value Chain Management (BVCM) Model





IV. DISCUSSION AND IMPLICATIONS

As Lu (2021) reports, operational costs in international business have continued to rise, together with mounting efficiency concerns – for example Walmart's 2020 spending of little over half a trillion dollars amounted to about 70% of total U.S. Military spending in that year. Given its inherent cost efficiencies, the BVCM model presented in this paper may provide an excellent way to reduce such MNE spending over the long term. With major MNEs including Berkshire Hathaway, AT&T, Apple, Exxon Mobil and CVS Health among others reporting operational costs in the hundreds of billions of dollars, the need for mechanisms driving down such massive costs is clear. Even though some companies with stratospheric brand equity (e.g. Apple and Coca-Cola) are able to maintain very high operating margins, for most MNEs reduction and efficiencies in operating costs and spending are vital to competitiveness. The value chain delivering added value to the end consumer, however, cannot be compromised.

The BVCM conceptual model, developed in this paper, offers a means to significantly reduce such spending and accelerate profitability while maintaining effective value chain management. The implications for cost-efficiencies are clear, and many leading MNEs have already begun to incorporate blockchain into their business models. Honda, as discussed in the previous section, Walmart, MasterCard, Burger King, FedEx, American Express, Bank of America, Nestle, Siemens, Tencent, Ford, and Prudential are just some MNEs already utilizing or developing blockchain into their VCM activities (Castillo, 2021). Multiple MNEs within one industry segment after another are cooperating and consolidating resources in order to create industry-specific blockchain standardizations in order to facilitate international trade within the relevant industry segment (see Lucena, et al, 2018). Leading technology companies such as IBM, Microsoft, Amazon, Oracle, Intel, Samsung and Cisco have either already developed or are developing software, "cloudware" and hardware to easing blockchain accessibility. Many more company usage cases are expected to follow as profitability benefits – not just through costs reduction but also through revenue acceleration from innovative value-added services - continue to be widely realized and reported. While web use had proliferated across the globe in the late 1990s and 2000s, it was thought – at that time - the full potential of e-commerce would not be realized until the Web became a more integral part of the purchase process for consumers (Paylou & Fygenson, 2006). We are now well past that initial period of acceleration, and web-based retailing has already spread through Web 2.0 and beyond: social networking, mobile applications, Internet of Things, consolidation and usability of applications across platforms, and exponential technological development and integrated media channels into unprecedented levels of reach. Similarly, blockchain technology has been developing (accelerating in the last five years) well beyond fintech or cryptocurrency usage, and finding avenues of implementation across the wider, vast variety of industry. Smart contracts applications of blockchain technology are also already being implemented by market-leading firms Like Home Depot and Sonoco, reducing uncertainty in dealing with contingencies (IBM, 2021). Indeed, indicators seem very much in favor of widespread proliferation of blockchain adoption in similar fashion to web adoption a couple of decades ago. Simultaneously, similar to problems encountered during the early days of accelerated web implementation, companies adopting a blockchain VCM system will need to be wary of infrastructure and design integrity – which must be protected from attack or unscrupulous access. In order to avoid the pitfalls of ineffective implementation, organizational adaptive learning becomes of paramount importance.

The usefulness and relevance of TCE paradigm in understanding value and exchange along an organization's value chain has been leveraged in the extant literature (Zajac & Olsen, 1993) and we posit it being foundational to the model developed in this paper. Organizational adaptive learning is, in turn, key to effectively pursue the benefits of blockchain adoption. Given pandemic-induced disruption, there has been successful utilization of immersive virtual reality environments in order to exchange and transmit intensive and rich knowledge – such as that necessary for blockchain adoption in the value chain - throughout an organization and its partners (Abbas, et al. 2021). Such intensive knowledge transfer – especially through tacit knowledge transfer - is necessary in order to achieve effective organizational learning and adaptiveness (Khan, & Jones, 2011). Effectiveness of this OAL, in turn, allows achievement of the full benefits of BVCM. March (1981), decades before marvelous technological discontinuities of the web or blockchain, insisted that adaptive learning within organizations depended on leadership that would motivate and provide valuable knowledge and context in showing how the organization effectively responds to environmental and technological change.

Environmental and supply chain disruptions are costly and disruptive, and can take place on such massive scale (like recessions) that they may cripple competitiveness (Mukunda, 2018). In such instance, and utilizing massive disruption caused by the 2008-09 Great Recession as our backdrop, we can look at two well-managed company cases to illustrate potential use of the BVCM model: Costco and China Mobile. Costco Wholesale's supply chain is its core competency. It purchases inventory directly from manufacturers and routes to depots (or, at times, directly to warehouses), from which they can directly ship to where needed most. Rapid inventory turnover is a hallmark of the business, which makes effective supply chain management and logistics a necessary condition of survival. While previously focused on removing intermediaries in its supply chain, during the 2008-09 recessionary period, Costco allowed value added function of distributors to enhance handling and transportation efficiencies. Merchandise purchased directly from distributors was in Costco point-of-sale warehouses at fast turnover rates unrivaled in the industry, allowing cost efficiencies (Forbes, 2009). Subsequently, the company has been outsourcing a greater percentage of its inventory costs to its suppliers, and limited marketing promotion expenses - focusing on monthly publications to current members. It has minimized labor costs of stocking by focusing on large quantity pallets, and it has reinvested in some value added businesses - like its websites, photo processing, pharmacy, travel, etc. Given its business model, Costco saw *increasing* revenues through the recessionary period – actually increasing the number of warehouses in operation and continued to invest in its supply chain. Its market capitalization doubled since 2009, and in 2014, it opened new warehouses in France and Spain. Utilizing the new BVCM model, cost efficiencies for Costco would have been enhanced, particularly in making rapid and equitable transitions between distributors – further strengthening its leadership in speed and supply chain efficiency. In fact, since 2017, IBM has been collaborating with Costco and some of its competitors (including, most successfully, with Walmart) in order to create a blockchain-based platform for food related value chain, where the inherent transparency and immutability of the blockchain allows retailers to quickly know, for example, exactly where a diseased batch of vegetables might have originated (thus dramatically improving recall efforts), or know in real time which suppliers/distributors are shy of productivity and efficiency targets, or create a more robust and interactive customer loyalty program (Beasley, 2020).

China Mobile's (our second company illustration) supply chain involves purchasing devices from "subsystem manufacturers", which it uses to connect to and integrate with data and cellular services provided by the government of China. These packaged services are then made available at retail service providers, and onto the end user. It is the world's largest telecom operator, but is state-owned. Their supply chain is greatly affected by trade barriers and non-market forces, but they also undertook cost cutting measures through the global recessionary period of 2008-09. The Chinese government used large-scale fiscal measure to aid recover in 2009, and was generally successful in getting the Chinese economy to recover faster than any other major economy in the world (Wen & Arias, 2015). As a state owned MNE, China Mobile directly benefitted from government initiatives, but also initiated streamlining through the organization. While expanding roaming partnerships throughout the world, the company limited its organizational presence to just a handful of cities globally in addition to the entirety of China

(Yu, 2009). Thus operational costs were minimized. However, given approaching market saturation in Chinese cities, their growth rate slowed significantly. China Mobile's response was to offer more value-added services, around which they could charge higher prices and increase revenues (e.g. TD-LTE technologies and 4G/5G services). The company invested heavily in infrastructure development in China to support its services, thus further reducing the ability of competition to respond effectively. In 2013, however, the Chinese government initiated plans to enhance competitiveness in this sector – but, even then, China Mobile was able to take competitive advantage, including the establishment of several subsidiaries in order to enhance operational reach. Over the previous decade, it has also invested heavily in its data services and has increased marketing promotion efforts. While it continues to focus on maintaining its market dominance in China, the company expressed agility in responding to consumer demands – increasing value-added services and quality. In such a case, use of the BVCM model presented in this paper would directly address the enhancement of agility through every step of the value chain in response to end consumer demands. BVCM would be particularly useful in transitioning and adaptability with its partners worldwide – especially in the streamlining China Mobile undertook in response to crisis. It could also be de directly incorporated in seeking new markets in Asia and elsewhere establishing modes of foreign market entry (like alliances, joint ventures, and subsidiaries) given saturation in its home market. In fact, the reality in recent years has been that China Mobile has become a pioneer in blockchain advancement through the telecom industry in China. Already home to the largest collection of blockchain server space in the world, due to government investments into development of blockchain technology, China has provided companies with excellent infrastructure for blockchain incorporation. As Morris (2018) reported, China Mobile along with major Chinese telecoms and other Chinese technology giants, created the Trusted Blockchain Telecom Application Group; the value-added solutions this Consortium has been developing since then include "Blockchain as a Service, Internet of Things logistics traceability, inter-operator clearing, and business operation support among others". Clearly, the company already recognizes the powerful impact blockchain-backed VCM activities have.

The preceding discussion, along with real-world company illustrations, shows that implications of BVCM for international business managers are clear. Leading corporations have either already implemented blockchain technology in their VCM activities or are investigating process and impacts involved. In today's digitized and internet-connected world, Blockchain use is already in progress across a wide diversity of industry sectors – from services (e.g. healthcare) to industrial manufacturing to government (PWC, 2021). The BVCM model presented in this paper presents an immediately relevant and actionable conceptual framework from which to proceed with VCM activities, incorporating this powerful, new technological discontinuity called blockchain. The paper provides a rigorous and integrated theoretical foundation from which to advance academic study and exploration in the field of blockchain driven business management.

The main limitation of this study is that, as a conceptual model, it needs further empirical studies conducted in order to confirm propositions, and further explore mediation/moderation effects presented in the BVCM model. Regional or legal-political contexts may likely affect blockchain mediation of TCE variables. Impacts of wide-scale platform adoptions - in the quest for interoperability - in different industry sectors is expected to greatly impact BVCM performance, in similar ways that large scale adoption of web based platforms and applications impacted web-enhanced management of international business in the previous two decades.

V. CONCLUSION

The paper presented a theoretically integrated model, based on multiple disparate research streams, to explain the blockchain-based value chain management (BVCM) model. Representing a significant step forward in conceptually understanding benefit and usage of blockchain adoption for firms engaged in international business, the study utilized transaction cost economics theory as its theoretical underpinning and consolidated it with work on organizational adaptive learning, supply chain management and global trade facilitation in order to create a comprehensive, theoretical model of blockchain adoption for firms engaged in international business, allowing advanced comprehension in the use of the new distributed ledger and blockchain technology for international business MNEs and SMEs. Grand View Research (2021) valued the blockchain-driven market at $3.67 billion in 2020, and predicts a growth rate of 82.4% from 2021 to 2028. Such strong projections only underscore that theoretical and application understanding must advance within this area. The current research has provided a comprehensive basis for managerial application and further academic study within this vital and exciting field.

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