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A Review on
Block Chain System for Supply Chain Network

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Abstract: **Blockchain associatedstudy is still in its beginning, and is focuses mostly on security and scalability. Very fewof this research workclarifies its impact and design problems from management point of view, specifically from thepoint of view of Supply Chain Management (SCM). To examine the effect of blockchain technology (BCT) onSCM and the implicit design issues, we contemplate a generic stochastic model, where anorganizationtry to maximizethe total expected concessionalbenefit, by jointly dealing (i) blockchain design, (ii) production and ordering verdicts,and (iii) dynamic pricing and selling. We first display that the applying BCT can supportorganization in decreasingorder numbers, dropping selling prices and decreasing target-inventory levels. It is also shown that instability ofeither supply or demand decreases the probable profit. The study is vigorous with some foremostextensions, such aslost-sales of demand and arbitrary capacity.**

***Key words*: Blockchain Design, Blockchain-Savvy Consumers, Supply Chain, Random Yields, Dynamic Pricing.**

1. Introduction

Blockchain Technology (BCT) has been extensivelycomprised as ainnovative technology, however it isstill in an emergingphase; cf. Babich and Hilary (2018). Indeed, the route to wide blockchain implementation appearluminously and outstandingly well covered. In a most recent survey for the PwC Annual Report2018, out of 600 executives from 15 territories, 84% claim their firms have had at leastsome contribution with BCT. To grab on this innovative and disruptive technology, firmshave either experimented in the lab with BCT, or have started to build proofs of concept; cf. PwC (2018).Gartner Inc. presents that blockchain's value-added business will grow to $176 billion by 2025, andthat BCT will makeayearly businessof greater than US $3 trillion by 2030; cf. Piscini et al.(2017). Hopefully, it can be assumed that 10% to 20% of the worldwidefinancial infrastructure will
be operating on blockchain-builtstructures by that same year (ibid). Hence, the capability to organize BCT to generate the next era of digital supply chain systems and platforms will be a vitalplayer in business success; cf. Pawczuk (2017).

This innovative technology and its flourishingexecutions have also involved the attention of academic world. As mentioned in Simchi-Levi (2018), it is authoritative for the MS/OR

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communityto observe "*the impact of emerging technologies such as Blockchain and the Internet of Things (IoT) onthe management of operations and supply chain*". Recently, Babich and Hilary (2018) deliveraextensiverepresentation on the researchguidelines of BCT in the OM field. In specific, it is highlighted thatOM researchers can use insights from the literature to enumerate the value of the Blockchaintechnology in processes. This study influences to this academic call in aappropriate manner.

1.1. Introduction of Blockchain Technology

Though the key idea behind BCT was introduced in 1991, it only brought the attention of the community in 2009 with the introduction of Bitcoin. Till now, there is very precise research providing a completeand wide study of BCT, specifically with regard to its role in supply chain management.Hence, in this introductory segment, we begin by providing a complete review of BCT.

Blockchain technology states to a circulated database that keeps a continuously-growing list of data records that are protected from altering and revision. It comprises of blocks having groups of individual transactions. Each block comprises a timestamp and a connection to a prior block;cf. Nakamoto (2008), and Kim and Laskowski (2018). Traditional business models sustain thecomplete history of activities in a single centralized database, which is very exposed to cyberattack.BCT allocates databases (ledgers) to all users, which presents the consent mechanismconcept; since it is very tough to attack multiple databases concurrently, the blockchainsystem is supposed to be both secure and transparent. The feature of consent in blockchainsystem rejects any concern that a single centralized organization may operate transactiondata, or ask high fees for crucialfacilities, etc. Fig. 1 describes a basic blockchainsystem process.

Generally, BCT has the following prominent features and advantages:

(i) *Transparency*: Blockchain uses the idea of distributed consent, all its usersare proficientfor reading the complete history of activities, which in turn significantlyimproves datatransparency.

(ii) *Traceability*: Access to timestamped archivespermits users to successfully andproficiently tracedata history.

(iii) *Security*: A distributed record rises the trouble of staging a cyberattack, whichexpressivelyreinforces data security.

(iv) *Efficiency*:BCT substitutes the necessity for a centralized database, disintermediation can be accomplished. That is, it is no longer compulsory to have a reliable intermediary, such as

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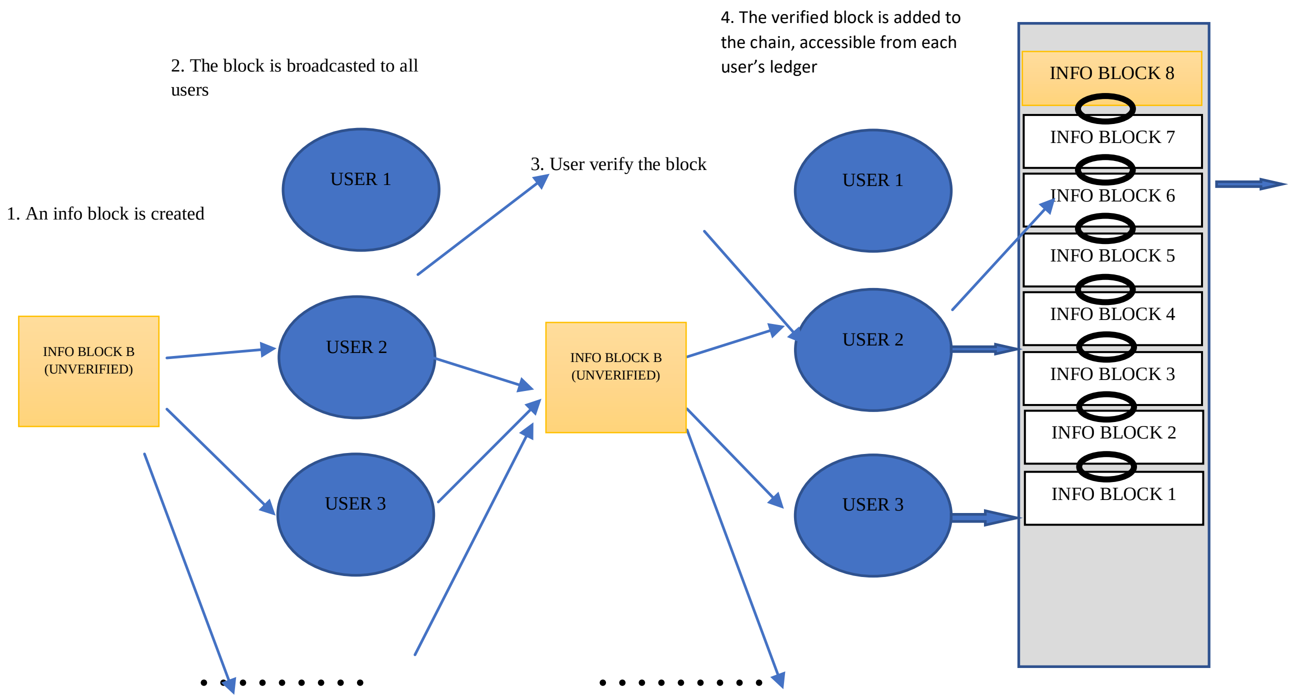
a bank, to maintain the database; hence, both transaction processing time and cost can bedecreased.

(v) *Confidentiality*: A blockchain's decentralized archivesignificantlyincreases security and transparency; though, it increases other concerns as to privacy, since each usercan view all activities on the network. As anoutcome, BCT tries to protect the privacy of users and their data byusing pseudo addresses and advanced cryptology to hide some features of theiractivities.

(vi) *Immutability*: Once a transaction or action is authenticated by a blockchain system, it can nolonger be inverted or modified. In opinion of this, the integrity of its data can significantly decrease the cost of assessing.

Figure 1 The Blockchain Process

FIGURE: Blockchain Characteristics of Transparency: Distributed Consensus



A block carried information is created by a user and then distributed to all users for verification. Once the info block is verified by all users, it is then added to the existing blockchain in all users' ledgers. The distributed consensus concept thus comes from the idea that information is no longer verified and maintained by a centralized organization but distributed to all blockchain users. The entire information history is visible to all users via distributed ledgers and is thus representing information transparency.

Specified the above-mentionedfeatures of *immutability, security, transparency and efficiency*, BCTremarkably strengthens trust amongst participants. If efficiently applied, it is capable of ensuringthat all the information accessed by participants is reliable and has not been available to alteringin any way, which greatly resolves the problem of information asymmetry.

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The first extensively known case of using BCT is in the financial services, specifically, the uses ofBitcoin as a now multiplying crypto currency. The above-mentioned features of BCTpermit Bitcointo do transactions in anextremely secure and efficient way.Additionally,Bitcoin's fabulous(although controversial) achievement leads people to think of the opportunity of applying it in othercircumstances, such as in supply chain management. Fig. 2 definesarole of BCT for organicfruits, such as apples.

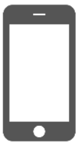
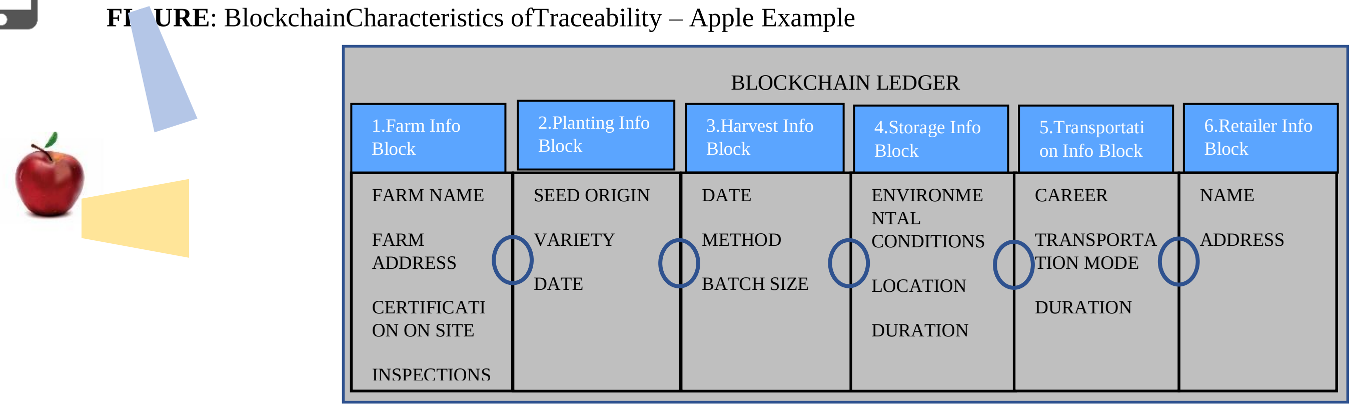


Figure 2 **Blockchain Example in SCM: Organic Apple**

FI URE: BlockchainCharacteristics ofTraceability – Apple Example



The accessibility of information for apples has been theoretically and empirically proven to be critical for market growth. With BCT, an apple may carry traceable and immutable information of the entire history from farm to market place, which can stimulate customers' willingness to pay and boost market growth.

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1.2. Blockchain for SCM

In association to its applications in the Financial section, the implementation of BCT in SCM is still in its initial stages; with very limitedidentified cases in use up to now; cf. Babich and Hilary (2018). The maindifference among the use of BCT in Finance and SCM lies in their core values. The core value forfinancial implementation is *information security*, however the core value for SCM application is system*transparency and traceability*.

Generally, BCT could be implemented in SCM in three convincing aspects:*disintermediation, smartcontracts and as a solution to information irregularities.*Accordingly, we shall develop on thespecific features that will stimulate our modellingnorms.

The transparency quality of BCT eliminates the requirement of atransitional forpaperworkprocessing (e.g., transportation,customs clearance, quality inspection, transactions, etc.), whichsignificantlyimprovesefficiency of business. This means that, BCT implementation could reduce the cost fromsuppliers. One of the eminentfeaturesaided by BCT is the *Smart Contract*. SmartContracts allow contracts to be automatically imposed and implementedinstantly when predefinedconditions/terms are shown and confirmed. One possibleSmart Contractimplementation is in the artindustry. In case of a music industry, a

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Smart Contract allows royalties to beautomatically circulated among artists and songwriters in actual time, based on a previousagreement among two parties. In case of the Smart Contract, BCT acceptance could secure highqualitysupply and improve both the production and profitrespectively.

In contrast to it, we should focus on the working of BCT for information irregularity issues.

It is known that the quality of information regarding a product or service is mainly asymmetric

between sellers and customers, it is proved, both theoretically and practically, that quality monitoringcertified by an approved third party is the best result to information irregularity; cf.

McCluskey (2000), Giannakas (2002), Rousseau and Vranken (2013). Considering organic food as anexample with respect to the credence feature, customers are unable to find difference between organicfoods and conventional foods, either before or after consumption. Also, the productioncost of organic foods is somewhat higher than that of conventional foods. As customers haveno source of distinguishing between them, they are only prepared to pay the same for both types ofproducts, which in return does not provides any incentive for sellers to produce organic foods, and hence the organic food market may failultimately. In order to inspire the organic foodmarket, a significant amount of research projected that labelling certified by an approved thirdparty (e.g., FDA and USDA) is the only method for providing organic product information thatwill help customersdistinguish. Numerous studies show that araising number of customersare interested in products grown in a social-, environmental-, eco- and health-friendly way;*ibid.* Rousseau and Vranken (2013) demonstrate that customers are willing to pay an around 25%price more for organic apples even without the facility of information.With the facilityof information on the genuine environmental health effects of organic apple growth, the pricepremium grows to about 42%. This result discloses two main aspects on price and demand: First,customers are ready to pay more for organic foods; second, the system of information wouldincrease demand. This will assist as anmost important assumption for price-active and blockchain-savvy customers in our model, namely, that customers are active to both selling price and blockchainacceptance. Hence, decisions made on both selling price and BCT acceptance are imperious toconfirming business success.

To record the aforesaidmain features of BCT, we contemplate a generic model in x3, with cost effective, development of random yield, and enrichment of unusual demand restricting from BCT adoption. As previously discussed, disintermediation and having a Smart Contract cansignificantly improve operative efficiency and improve partnerships along the supply

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chain.Consequently, in our model we firstly consider that BCT implementation can efficiently reduce ordering and functioning cost, and that the higher the degree of BCT implementation, the more cost efficienta businesscan attain. Secondly, thanks to the Smart Contract, we consider that the supply yield is randomand certainlyinterrelated with the degree of BCT implementation. The fundamentaljustification is that once acompany adopts to reveal more product information to its possibledealers, it is more possible to find a better dealer that can offer a more better yield rate, reflecting a consistent supplyalong with high quality. Thirdly, the traceability shown by Blockchain technology's "*proof of work*"concept disables the information irregularityproblem among the participants along the supplychain. Considering, blockchain-savvy (or, broadly tech-savvy) customers, we consider that the arbitrary demand can be increased by BCT implementation - the greater the degree of implementation, the greaterthe demand, in the better sense.

In summary, thanks to the above-mentioned features, BCT has been comprised as a powerful tool to solve the problem of information irregularity. Many case studies have described that informationavailability and truthfulness are two major forces for making a flourishingcredibility goods market. Accordingly, we noticed that BCT can assist as the best solution for sharing information through the supply chain while at the same time confirming its authenticity.

The rest of this paper is structured as follows. In Section 2, we have shown literature appropriate to our study and clarify the involvement of this study.Finally, Section 3 concludes the paper.

2. Literature Review

BCT basically offers a stage that enables users to access secure, consistent and tamper-proof facts in an efficient manner. Currently, there is limited research studying the effect of BCT and related design issues from management point of view, specially from the perception of SupplyChain Management; cf. Simchi-Levi et al. (2008). Most recently, Babich and Hilary (2018) provide awide depiction on the research guidelines stemming from BCT in the OM field. They find fivekey strengths and the equivalent five main weaknesses, and point out three research subjectsfor applying BCT to OM. Pun et al. (2018) examine how BCT can be used to combat counterfeitingby a consideration of the relationship between a manufacturer and a counterfeiter. Besides theabove-mentioned academic studies, there are various technical reports relating to BCT, such asStaples et al. (2017), Luu (Jan. 26, 2018), Geer (2018), O'Byrne (Mar. 27, 2018), Hertig (Mar 21, 2018),Pawczuk (2017) Piscini et al. (2017), Brody (2017), Casey and Wong (2017), and many others. Incontrast to the above literature, our

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study goals to examine the design of BCT for supply chainmanagement by the development of a holistic stochastic model, where the acceptance of BCTimpacts both the up-stream (suppliers) and the down-stream (consumers).

Given that data transparency shows a key role in BCT, we next focus on the literature relating to *information sharing* and *information asymmetry*. Table 1 displays a side-by-side comparisonof our study with current Information *Sharing*[1] and *Information Asymmetry*[2] literature. It alsohighlights the impact of our study makes to the currently extant literature.

2.1. Literature on Information Sharing

The profits of information sharing within a supply chain have been broadly examined and discussed.Lee et al. (1997) show that the major cause of the Bullwhip effect is variability of ordering,and Srinivasan et al. (1994) propose that information sharing is an operative solution for the Bullwhipeffect so as to decrease order variation. Additionally, Lee et al. (2000) build mathematicalmodels grounded on a two-level supply chain system including of a manufacturer and a retailer,to show that information sharing would value manufacturers by reducing inventoryand saving cost. Yu et al. (2001) gives a rigorous analysis of supply chain strategic firms,and show that an information sharing-based firms can efficiently reduce inventory,
save cost, and improve the overall performance of a decentralized supply chain. The studies on
information sharing mostly focus on the organisation between the retailer and wholesaler (or vendor/manufacturer) to investigate the value of demand information sharing. Most studies draw theconclusion that a wholesaler would reap the profits of modification of order variation and reductionof inventory from the demand data shared by a retailer, who has straight contact with thecustomers and is thus more aware with their tastes and demands.

2.2. Literature on Information Asymmetry

Information asymmetry is a usual and long-lasting phenomenon along the length of the supply
chain, covering the whole way from upstream through to downstream. For the upstream supply
chain, supply agreement design is established based on the asymmetric information of supplier
reliability. Various supply risk management tools are developed to this, such as a finefor losses, backup production (Yang et al. (2009)), outsourcing earning service (Yanget al.

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(2012)), monetary subsidy (Babich (2010)), etc. The aim of the supply contract designis to increase buyers' benefit/profit by enlightening suppliers' true reliability established on the contract decisions made by suppliers. Yang et al. (2009) studies the asymmetric information of supplydistraction between a manufacturer and a supplier, and concludes that "*the quantity received bythe manufacturer from the supplier under symmetric information is stochastically*

[1]Information Sharing literature includes but is not limited to Lee et al. (1997), Srinivasan et al. (1994), Lee et al. (2000), Yuet al. (2001), Cui et al. (2015), etc.

[2]Information Asymmetry literature includes but is not limited to Akerlof (1978), Kivetz and Simonson (2000), Rousseauand Vranken (2013), McCluskey (2000), ect.

larger than the quantity received under asymmetric information".In other words, information disclosure increases supplyyield. Our study also undertakes that the acceptance of BCT enhances supply yield - the greater thedegree of adoption, the greater the yield rate, in the stochastic sense.

As for the downstream supply chain, Akerlof (1978) point out that asymmetric information about product quality could source market collapse. In a market with asymmetric information about product quality, such as the used car market, good quality products would be moved out

by bad ones, since customers are not clever of quality differentiation. Various empirical studies support that information disclosure by labelling is an effective way to sustain marketshaving asymmetric information about product quality. For example, Teisl et al. (2002) providemarket-based proof supporting that the dolphin-safe label increased the market share ofcanned tuna. Rousseau and Vranken (2013) find that customers are willing to pay a helpful pricepremium of some 33 eurocent per kilogram for labelled organic apples. In addition, honesty ofinformation is another critical issue. Giannakas (2002) indicates that labeling alone is not enoughto support a market with information asymmetry - consumers' perception toward the validityof information given by labels would be a prerequisite to sustaining the market. If mislabellingconquers, consumers will lose faith in the labels, and the market will still fail. In other words, theabove-mentioned studies support that accurate information (one of the salient features of BCT) playsa vital role in market success.

2.3. Literature on Blockchain-Based Business Practices

Various professional analysts claim that BCT will be the next technology to transform business

and reshape business structures and ecosystems. Accordingly, huge amounts of research and

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investigation have been made into Bitcoin and other crypto currencies, each of which has BCT as itsbackbone. Recently, more and more businesses have started to value opportunities to applyBCT to improve their supply chain performance. Walmart and Maersk recently club up withIBM to test the implementation of BCT in improving operational efficiency. In particular, Walmart'spilot project shows that BCT can positively reduce the time taken to touch the origin of a bag ofmangos from almost a week to just two seconds, which decodes in sizable cost savings. However,until now, only limited academic effort has been put into examining blockchain applications inSCM. Among this scarce research, most of them attention on blockchain-based business process design.For example, L´opez-Pintado et al. (2017) propose a blockchain-based combined supply chainprocess. Tian (2016) explores the possibility of BCT enabled by RFID to build up food safety,and a business process is planned accordingly. Mattila et al. (2016) claim that existing information. Mixing between participants within a

Table 1 Literature Comparison

	INFO. SHARING	INFO. ASYMMETRY	OUR PAPER
SELLER-BUYER REALTIONSHIP DEFINITION	Seller: Vendor, supplier and manufacturer Buyer: Retailer	Seller: Suppliers of credence goods Buyer: Consumer of credence goods	Any seller and buyer within a supply chain
INFO. FLOW	Buyer to seller	Seller to buyer (Downward)	Seller to buyer (Downward)
INFO. CONTENT	Demand Forecasting Info	Product-centric info	Product-centric info
OBJEC OF INFO SHARING	Adjacent Upstream partners	Consumers of finished goods	Any consumer (of raw material, semi-finished goods) within a supply chain
RESEARCH FOCUS	Optimization of business decisions, e.g. lot size, safety stock, inventory level, production cycle, etc. Reduction of Bullwhip effect	Impact of information availability (via labelling, warranty, branding, etc.) to market, demand, and willingness to pay	Blockchain design and optimization of adoption degree
RESEARCH METHOD	Optimization/game theory, etc.	Surveys/interviews/ game theory, etc.	Optimization
EXAMPLES	Widely discussed, including perishable/ non-perishable goods, service, etc.	Credence goods	Search goods/ Experience goods/ Credence goods
SOLUTION	ERP, RFID, vendor managed inventory (VMI), etc.	Brand Name, labeling, certificate, warranty, etc.	Blockchain Technology

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SUGGESTIONS	A certain partnership within a SC is required	Availability and truthfulness of information is critical	Different adoption degree of BCT is proposed for different types of industry.

supply chain is ineffective and inefficient, and proposesBCT as an enabler for operative product-centric information sharing. Similarly, Korpela et al. (2017)assert that a blockchain is a suitable candidate for information integration within the supply chain,given its benefits of cost-effectiveness and interoperability among different business entities.

They further classify different levels of needs and readiness by different industries for digitizationof supply chain network information, but fail to additional examine the reasons behind it. It seemsthat the most fundamental research theme has not yet been fully analysed - whether or not BCTis helpful for all kinds of industries; if not, what is the level of data disclosure thatan industry/company/product should adopt when applying BCT? This is one of the corequestions that this study objective to address.

2.4. Literature on Inventory Management and Pricing

In terms of methodology and modelling, our work is also concern with the wide literature on joint pricing and inventory management under stochastic demand; cf. Li and Zheng (2006), Roels andPerakis (2006), and Adida and Perakis (2010).

The most complete literature is that of Li and Zheng (2006), who also provide a full literature review on joint pricing and inventory control. Attentive readers are recommended to refer to their work. Li and Zheng (2006) was the first to study the joint inventory replenishment and pricing barriers with both indefinite demand and supply in various periods, and our model is built on theirs with a substantial extension in depth of the continuing adoption of BCT, while focusing on the blockchain designing for SCM. In the presence of indefinite supply and demand, they show that, given different levels of inventory on hand, there exist optimum ordering/production quantity and price/demand levels. Both optimum price and ordering/production quantity decrease with the inventory level on hand. Additionally, they sum up that indefinite supply always results in a higher price and dangers the expected profit of a company. Our study differs from Li and Zheng (2006) in several ways. For example, we emphasize on the impression of BCT adoption on optimum operational decisions. Importantly, we take it a step further, by considering the design issue for the structure. Our study is also related to the OM literature on new technology adoption. For example, Liuet al. (2010) investigate the impact of RFID on supply reliability. Both study the impact of the new

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technology adoption on SCM, but RFID and BCT have different stages of impact along the supply chain network. In particular, BCT will have a broader impact throughout the entire supply chain, including both upstream (i.e., supply cost reduction and yield improvement) and downstream (i.e., demand stimulation). Some associated literature includes Feng and Shanthikumar (2018) considering big data, and Cohen et al. (2015) seeing green technology adoption.

2.5. Input to the Literature

The contribution our study makes to the literature is mainly in the following four features. First

of all, to the best of our knowledge, this is the primary study to systematically model and analysethe potentiality of blockchain development from a supply chain perspective. Secondly, this paperupdated from the traditional way that supply chain management studies approach the issueof information impact on supply chain performance. Instead of mainly focusing on the impactof retailers' upward demand information distribution to wholesalers, our model can begenerally applied to any body within the supply chain; the information flow of our study is in bothdirections, rather than upward only; the content of information in this paper is supply information, rather than demand information. Thirdly, this paper is inter-disciplinary across marketing, information system and operations management, so we apply some study results from marketing, including information irregularity for credence goods, leveraging BCT to boost marketgrowth, etc. The conclusion made by many marketing studies that information accessibility wouldboost demand and increase consumers' inclination to pay (CWP) is applied as an assumption bythis paper to examine the optimal information disclosure level for dealers. A business processimplemented using BCT, as proposed by the information study result, is applied by this paperto assist as a basis for investigating information flow. Fourthly, this study offers a modellingframework for BCT design by picking the adoption degree to share information throughoutsupply chain.

2.6. Practical Insights with Numerical Studies

Based on previous experience of new technological uprisings (e.g., those involving the Cloud Computing, AI, Big Data, IoT, etc.), there appears to be a main wonder in the existingbusiness environment that whenever new technology appears, many companies irrationally rushto be the first to implement it and exploit the first mover advantage. Naturally, no one wants tobe an abandoned failure. This study, therefore, develops of timely value, since it objects to aid as aguideline for defining whether a business is suitable for using BCT, and if so, it then advises

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the appropriate level of adoption. To illustrate some useful managerial intuitions, we conduct numerical studies in two dimensions: i) Vertically, we consider different types of products; and ii) horizontally, we consider different stages of a product development.

First, for the vertical dimension, we look into different goods that can be wedged by different blockchain-savvy buyers. Based on the observability of superiority, goods can be classified into threecategories: 1) search goods; 2) experience goods; and 3) credence goods[3]; cf. Nelson (1970), Darby and Karni (1973).

1) *Search goods*: There is seamless information about quality for search goods, which explains thatconsumers can easily differentiate good from depraved products before consumption.

2) *Experience goods*: It is problematic or pricey for consumers to inspect the quality of experience goods prior to consumption; whereas consumers can determine their quality after consumption.

[3]SEC arrangement is slightly subjective, because the ability of assessment of product quality differs by persons. For example, a technology geek might view PCs as search goods, but others, with limited computer knowledge, might consider PCs as knowledge goods.

3) *Credence goods:* It is problematic or pricey for consumers to determine the quality of credence goods even after consumption. Examples of credence goods include works of arts (e.g., antiques),organic products, used cars, luxury goods (e.g., diamonds), high end food (e.g., wine, seafood,beef), facilities (e.g., doctors and medical services, auto mechanical service, lawyer service,donated eggs/sperm, etc).

As one of the major outcomes, it is exposed that, subject to tech-savvy customer behaviour, some types of goods (e.g., credence goods and experience goods) benefit from the application of BCT, but it may not prove advantageous to power BCT for some of the others (e.g., search goods).For the horizontal dimension, we study the lifecycle of a distinctive product (e.g., experiencegoods), comprised of Introduction, Evolution, Maturity, and Deterioration. One major insight from this study leads to endorsing the adoption of BCT as early as possible and for adopting it to a advanced degree at an earlier phase.

3. Concluding Remarks

In this paper, we have studied the impact of block chain technology on supply chainperformance, and its optimum design. In specific, we have considered a ordinary firm that ordersfrom its supplier and sells to its tech-savvy consumers. From the viewpoint of both

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its up-streamsupply and down-stream customers, BCT implementation impacts the casual supply and demand ina stochastic way. The firm seeks to make the most of the total expected reduced profit, by equallymanaging (i) blockchain design, (ii) production and ordering decision, and (iii) dynamic pricing andselling. It has been revealed that the positioning of BCT can help firms decrease order quantities, lesser selling prices and decrease the target-inventory levels. It has also been made known that the instabilityof either supply or demand damages the expected profit.Althoughwe have tried to consider the main features of BCT, there are absolutely some other convincingfactors that need to be considered to enhance the research. As one potential future researchproject, blockchain technology could significantly shorten the lead times of transactions, as well asat the same time speed up both information processing times and paperwork processing.

References

1. Adida, E., G. Perakis. 2010. Dynamic pricing and inventory control: Uncertainty and competition. OperationsResearch **58**(2) 289–302.

2. Akerlof, G. A. 1978. The market for “lemons”: Quality uncertainty and the market mechanism. In Uncertaintycin Economics 235–251.

3. Babich, V., G. Hilary. 2018. Distributed ledgers and operations: What operations management researchersshould know about blockchain technology. *Manufacturing & Service Operations Management* Forthcoming.

4. Cohen, M. C., R. Lobel, G. Perakis. 2015. The impact of demand uncertainty on consumer subsidies for greentechnology adoption. Management Science **62**(5) 1235–1258.

5. Darby, M. R., E. Karni. 1973. Free competition and the optimal amount of fraud. The Journal of Law andEconomics **16**(1) 67–88.

6. Geer, D. 2018. How smart contracts can create a competitive edge- removing third parties speeds transactionsand reduces their cost. Tech. rep., Journal of Accountancy.

7. Giannakas, K. 2002. Information asymmetries and consumption decisions in organic food product markets.Canadian Journal of Agricultural Economics/Revue Canadienne D’Agroeconomie**50**(1) 35–50.

8. Hertig, A. Mar 21, 2018. How much should a blockchain cost? the compelling case for higher fees. Coindeskhttps://www.coindesk.com.

9. Kivetz, R., I. Simonson. 2000. The effects of incomplete information on consumer choice. Journal of MarketingResearch **37**(4) 427–448.

10. Korpela, K., J. Hallikas, T. Dahlberg. 2017. Digital supply chain transformation toward blockchain integration.Proceedings of the 50th Hawaii International Conference on System Sciences .

11. Lee, H. L., V. Padmanabhan, S. Whang. 1997. Information distortion in a supply chain: The bullwhip effect.Management Science **43**(4) 546–558.

D.O.I : 10.46528/DRSRJ.2020.V10I07N08.01

12. Lee, H.L., K.C. So, C.S. Tang. 2000. The value of information sharing in a two-level supply chain. Management Science **46**(5) 626–643.

13. L´opez-Pintado, O., L. Garc´ıa-Ba ˜ nuelos, M. Dumas, I. Weber. 2017. Caterpillar: A blockchain-based businessprocess management system. In Proceedings of the BPM Demo Track, 15th International Conference onBusiness Process Modeling (BPM 2017), Barcelona, Spain .

14. Luu, L. Jan. 26, 2018. Blockchain adoption: How close are we really? Forbes https://www.forbes.com/.

15. McCluskey, J. J. 2000. A game theoretic approach to organic foods: An analysis of asymmetric informationvand policy. Agricultural and Resource Economics Review **29**(1) 1–9.

16. Nakamoto, S. 2008. Bitcoin: A peer-to-peer electronic cash system https://bitcoin.org/bitcoin.pdf.

17. O'Byrne, R. Mar. 27, 2018. Supply chains and blockchain - making it work URLhttps://www.logisticsbureau.com.

18. Pawczuk, L. 2017. When two chains combine: Supply chain meets blockchain,. Tech. rep., Deloitte.

19. Piscini, E., D. Dalal, D. Mapgaonkar, P. Santhana. 2017. Tech trends 2018 - blockchain to blockchains: Broadadoption and integration enter the realm of the possible. Tech. rep., Deloitte Insights.

20. Roels, G., G. Perakis. 2006. The price of information: Inventory management with limited information aboutdemand. Manufacturing & Service Operations Management **8**(1) 98–117.

21. Rousseau, S., L. Vranken. 2013. Green market expansion by reducing information asymmetries: Evidence forlabeled organic food products. Food Policy **40** 31–43.

22. Simchi-Levi, D. 2018. From the editor. Management Science **64**(1) 1–4.

23. Simchi-Levi, D., P. Kaminsky, E. Simchi-Levi, R. Shankar. 2008. Designing and managing the supply chain: Concepts, strategies and case studies. McGraw-Hill Education.

24. Staples, M., S. Chen, S. Falamaki, A. Ponomarev, P. Rimba, A. B. Tran, I.Weber, X. Xu, J. Zhu. 2017. Risksandopportunities for systems using blockchain and smart contracts. Tech. rep., Data61 (CSIRO), Sydney

25. Teisl, M.F., B. Roe, R.L. Hicks. 2002. Can eco-labels tune a market? evidence from dophin-safe labeling.Journal of Environment Economics and Management **43**(3) 339–359.

26. Yang, Z., G. Aydn, V. Babich, D. R. Beil. 2012. Using a dual-sourcing option in the presence of asymmetricinformation about supplier reliability: Competition vs. diversification. Manufacturing & ServiceOperations Management **14**(2) 202–217.

27. Yang, Z.B., G. Aydın, V. Babich, D.R. Beil. 2009. Supply disruptions, asymmetric information, and a backupproduction option. Management Science **55**(2) 192–209.

28. Yu, Z., H. Yan, T. C. Edwin Cheng. 2001. Benefits of information sharing with supply chain partnerships.Industrial management & Data systems **101**(3) 114–121

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