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The Impact of Instrumental Stakeholder Management on Blockchain Technology Adoption Behavior in Agri-Food Supply Chains

Michael Paul Kramer *, Linda Bitsch and Jon H. Hanf

Institute for Wine and Beverage Economics, Hochschule Geisenheim University, 65366 Geisenheim, Germany; linda.bitsch@hs-gm.de (L.B.); jon.hanf@hs-gm.de (J.H.H.)
* Correspondence: michael.kramer@hs-gm.de; Tel.: +49-170-5417651

Abstract: Coffee is the second most important commodity in terms of global trade value, with its global market value exceeding $460 billion in 2020. Its supply networks, which encompass multiple stakeholders, are complex and nontransparent. Blockchain is a trust technology, and some coffee firms have embraced this technology to provide trust attributes to consumers while making their supply chain more transparent. For businesses to gain the expected productivity advantages, a technology must be adopted and used. As theoretical and empirical research on blockchain technology adoption is scarce, this article attempts to identify behavioral intentions of stakeholders in the supply network toward its adoption. Based on exploratory interviews, this article develops a blockchain technology adoption model based on factors relevant to individuals' use behavior. The results provide evidence that a normative stakeholder management approach positively impacts use behavior. Managers can use the model to benchmark and improve their corporate social responsibility strategy to obtain better returns on blockchain investments. This study closes a research gap as, to the best of the authors' knowledge, no research has been conducted so far on the impact of an instrumental stakeholder management approach on blockchain technology adoption behavior. Understanding how stakeholder management can compensate for the lack of consensus mechanisms in private and consortium blockchains, as well as understanding the factors influencing behavioral intentions toward the use of a technology, can provide for managerial guidance toward the development of an effective stakeholder management strategy, which eventually can result in a competitive advantage.

Keywords: blockchain; technology adoption; food industry; supply chain; stakeholder management

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1. Introduction

From harvest to the consumer's cup, coffee travels through vertically cooperated food supply chains (FSC), which are typically managed centrally with a focal firm being responsible for the coordination of the network (Hanf and Dautzenberg 2006). Today, FSCs face several challenges, such as transparency of transactions in the chain, traceability of food products, and information exchange (Miatton and Amado 2020). Spurred by food safety crises, consumers nowadays require provenance information and transparency about origin, production, and journey of the food item they consume (Saitone and Sexton 2017). Decentralized solutions, such as blockchain technology (BCT), could provide for supply chain transparency, immutable transaction data that is constantly visible to all stakeholders, as well as for secure and transparent recording of transport and storage conditions (Blossey et al. 2019), which results in increased consumer trust (Baralla et al. 2020).

The coffee industry, as part of the agri-food industry, has just recently started to implement blockchain solutions in their supply chain with the objective of establishing trust by sharing product-related information with consumers and by making supply chain activities more transparent to them and to relevant stakeholders (Miatton and Amado

2020). Traceability has become a fundamental competitive differentiator in the agri-food industry (Costa et al. 2013).

For businesses to gain the expected advantages, the technology must be adopted and used by the relevant stakeholders as, according to the theory of incomplete contracts, the actions of stakeholders affect the value of an asset (Hart 2017). Stakeholders should have control over the assets to maximize their utility and satisfaction. Although the use of this technology improves trust amongst stakeholders in the FSC (Baralla et al. 2020), their attitude toward the adoption of new technology is subjective and depends on the stakeholder management approach that is being exerted by the focal firm. Firms adhering to the principles of instrumental stakeholder management will demonstrate better economic performance (Donaldson and Preston 1995).

The normative path of stakeholder theory can lead to a strong commitment of the organization to adhering to the strategies that have been set by management (Lazzarini et al. 2001). We therefore investigated how a normative stakeholder management approach impacts stakeholders' use behavior. We hypothesized that the efficient use of BCT depends on certain factors that are determining the use behavior. The aim of this research is, therefore, to provide an analysis of the factors influencing blockchain technology adoption behavior of stakeholders in vertically coordinated coffee supply chain networks (SCN).

The contribution of this paper is twofold; first, it closes a research gap on the impact of the instrumental stakeholder management approach on blockchain technology adoption behavior of coffee firm employees operating the technology. As part of the exploratory research, and to identify factors that determine use behavior, this paper develops a blockchain technology adoption model for coffee and agri-food supply chain implementations. This research generates new knowledge, as it advances the understanding of the interaction between stakeholder management approach and technology adoption behavior. We therefore formulated the following research questions:

RQ1: How does stakeholder management, as part of corporate governance, impact blockchain technology adoption behavior?
RQ2: What are the social factors that impact the adoption behavior of the technology?

The article is structured as follows: Following the Introduction, Section 2 details the methodological approach of our research. Section 3 summarizes the results grounding on vertical coordination of agri-food networks and the supply chain theory, as well as the instrumental stakeholder and technology adoption theory, building the foundation of the research. Section 4 provides for discussion and managerial implications and Section 5 concludes the article, whilst providing for guidance in terms of possible directions of future research.

2. Materials and Methods

The exploratory research is grounded on several theories, including network theory, instrumental stakeholder management theory, as well as technology adoption theory. We used primary and secondary research methods. To provide the theoretical groundwork, we conducted an extensive in-depth literature review, which revealed that the impact of instrumental stakeholder management on blockchain technology adoption behavior of users has not been studied yet. Hence, we decided to conduct exploratory interviews with stakeholders in the coffee supply chain to determine the influence of the exercised stakeholder management approach on the adoption of blockchain technologies. The findings were further supported by a quantitative survey targeted at users of the blockchain technology at a coffee firm.

2.1. Literature Overview

As part of secondary research, we conducted an in-depth literature overview to describe the impacts of instrumental stakeholder management on technology adoption behavior of stakeholders. The literature overview was performed through a systematic search of this topic by using the terms "blockchain", "food", "supply chain", and "supply

chain network" in combination with the terms "technology adoption", "stakeholder management", "stakeholder", "coordination", and any combination of the mentioned keywords in relevant scientific journals, books, newspaper, and magazine articles. The internet-based search was conducted by using the above-listed keywords and applying a nesting technique, a combination of search terms (e.g., "blockchain" + "agri-food"), by using double quotation marks and truncation. We also conducted domain-specific research with the above-mentioned terms on key journal websites, such as www.mdpi.com (accessed on 9 December 2021). For example, the search command "site: www.mdpi.com/journal/jrfm blockchain+agri-food (accessed on 9 Decemebr 2021)" lists all articles of the MDPI *Journal of Risk and Financial Management* domain that include the terms "blockchain" and "agri-food". Bibliographic mining on the agri-food blockchain journal articles and books was also utilized. Articles that did not provide research results on how blockchain affects the agri-food supply chain were not further included in our in-depth literature overview. Journals that we reviewed additionally during the extensive literature overview phase included, but were not limited to, *The International Food and Agribusiness Management Review*, *Current Opinion in Environmental Sustainability*, *International Journal of Production Research*, and *Harvard Business School Publishing*. However, the in-depth literature overview provides the theoretical groundwork to apply the findings to the qualitative research and subsequent exploratory use case.

2.2. Qualitative and Quantitative Research

To determine the influence of the stakeholder management approach on the adoption of blockchain technologies by stakeholders in the coffee supply chain, in the first step, semi-structured interviews were conducted with the management of European coffee firms. In this first step, we interviewed a group of experts, including the management of the coffee producer Solino Coffee, an Ethiopian coffee firm with European distribution, the management of the blockchain technology provider engaging in agri-food implementations, and two experts from the coffee industry responsible for the implementation of blockchain technology to the supply chain. The reason for engaging with these experts is that they are operating a blockchain solution in the agri-food industry to track and trace, as well as to provide provenance information to consumers. They operate one of the very few agri-food BCT networks, and they have also been operating their agri-food BCT solution for several years now to improve business processes, thus having gained multifaceted practical experience. Following the initial meeting that took place at the beginning of March 2020, we engaged in a series of discussions during which the BCT solution provider joined in. The ongoing discussions provided practical insights into the impacts of blockchain implementations. Prior to the interviews, the participants were informed about the research objectives and intent. As all participants had prior knowledge about blockchain technology, a technical introduction could be skipped. The semi-structured interviews followed a written protocol that included open questions on topics such as blockchain adoption challenges and governance in the coffee supply chain. Due to the exploratory research character, the qualitative content analysis followed the approach of Gläser and Laudel, focusing on extracting information through which themes were identified and analyzed in the realms of business strategy and institutional stakeholder management (Gläser and Laudel 2010). The qualitative content analysis is based on the use of a category system and the assignment of categories to the text (Mayring 2005). However, Mayring stipulates that only approximately 30–50% of the material needs to be matched with the category system. His approach is also based on analyzing the occurrences instead of extracting information. Gläser and Laudel suggest performing the analysis with an open category system, so that new categories can be added during the research process instead of adding text to unchangeable categories where they potentially do not fit properly (Gläser and Laudel 2010). With this approach, new categories can be added during the research process. The objective of these interviews was to analyze which type of stakeholder management approach has been chosen for the blockchain-induced coffee supply chain

and how that impacted the behavioral intentions and use behavior of stakeholders in the coffee supply chain. Due to the novelty of the technology, there are only limited operationalized blockchain projects in the European coffee and agri-food industry.

In the second step, and to further strengthen our research, we conducted semi-structured interviews following the same approach as in step one with two supply chain managers of two different European coffee firms sourcing coffee beans from Africa. We also interviewed a senior coffee and food safety expert from a German University who is engaging in research activities in the fields of brewing and coffee technology. These semi-structured interviews followed a written protocol based on open questions, covering the topics of blockchain use cases in the supply chain, opportunities for business processes, and the role of stakeholders in the coffee supply chain. Based on the qualitative content analysis, themes were identified and analyzed in the realms of operating blockchain technology by stakeholders' adoption of technologies (Gläser and Laudel 2010). The objective of these interviews was to identify potential social factors that are instrumental for the implementation and operation of blockchain technology in their supply chains. The discussions were of an exploratory nature due to the novelty of the research topic.

Due to the impact of the COVID-19 pandemic on personal meetings, all sessions took place by utilizing video conferencing software, as well as traditional telephone connections. The meetings were prepared with an outline of the topics of discussion, which acted as guidance. The exchanges lasted, in general, 30 to 60 min, and notes were taken for further synthesis.

In the third step, we explored, based on the results of the exploratory interviews, the factors relevant to the adoption of blockchain technology by stakeholders to determine how they are impacted by a chosen stakeholder management approach.

3. Results

3.1. Food Supply Chain Networks

Food networks have been classified as strategic networks where the focal firm is responsible for all attributes of the food item in the network (Hanf 2005). The focal firm, which can be the producer of the food item or a retailer distributing private brands, is responsible for the quality and safety of the specific food item. The participating stakeholders are being vertically coordinated by the focal firm (Hanf and Dautzenberg 2006). The FSC is pyramidal/hierarchically organized, where the focal firm also sets the strategy and aligns the actions in the network (Jarillo 1988). Due to the increasing number of stakeholders, which includes amongst others, suppliers, intermediaries, and a coordinating authority, FSCs have developed into complex, centralized, and vertically cooperating supply chain networks (Ievoli et al. 2019). Collaboration in such a pyramidal/hierarchical supply chain network requires building trust and commitment between trading entities (Hanf and Dautzenberg 2006). Stakeholders are dependent on the focal company because of explicit or implicit contracts. In a blockchain technology enabled FSC, the hierarchic structure is replaced by a decentralized network. Decentralization enables peer-to-peer value exchange and shifts power away from the central authority, as BCT enables the elimination of intermediaries from transactions (Crosby et al. 2016). Transactions are now being conducted by the participating entities non-hierarchically in a peer-to-peer format. In this decentralized network, trust is now established through the BCT between the entities rather than by a single authority in a hierarchic environment. Decisions are being made between participants directly, where each participating entity has equal rights to access the transaction data. As a result, BCT with its decentralized network architecture and peer-to-peer trading enables disintermediation (Saberi et al. 2018). Generating transactions without intermediaries, BCT has the potential to significantly change the structure and organization of SCN and the supply chain management (Davidsson 2019; Treiblmaier 2018). The current FSC systems are lacking transparency and are highly inefficient, as FSC processes are also being impacted by numerous intermediaries (Tripoli and Schmidhuber 2018). As a result, amongst the key challenges of the FSC today is how to ensure traceability,

transparency, and efficiency across the network from smallholder in the first mile to the consumer in the last mile of the supply chain. Supply chain transparency and monitoring of activities performed during the food product life cycle can be achieved through tracking and tracing, which is the ability to provide trust attributes and data about past and present locations of an item during its journey through the various stages (Trienekens and Beulens 2001). Until recently, these trust attributes could only be provided sporadically, utilizing centralized solutions.

3.2. Blockchain Technology

The digital transformation of society and economy spurred by the global COVID-19 pandemic is resulting in new technologies that are being implemented across industries, transforming centralized and vertically cooperated agri-food value chains into distributed, networked ecosystems (Zhao et al. 2019). One of the key enablers in this process is BCT, which can automate business processes through smart contracts and create direct interactions between stakeholders (Chang et al. 2020). Blockchain is a distributed ledger technology (DLT), a constantly synchronized data storage facility distributed across locations and entities. Both BCT and DLT are oftentimes used interchangeably. However, BCT has been designed to set up rules for transactions, permitting, amongst others, the development of applications and smart contracts. One of the key characteristics of blockchain is the decentralization of the network architecture, enabling peer-to-peer transactions, which eliminates the need for a coordinating trusted entity. BCT, despite its decentralized characteristic, has been successfully implemented in vertically coordinated food networks, predominantly providing provenance, as well as tracking and tracing information (Kramer et al. 2021).

Although BCT has been designed not to be managed by a central authority, blockchain platform types (BCTPT) exist that provide for a centralization of control. Three different platform types exist today: the public (permissionless), private, and consortium (both permissioned) platforms. They predominantly differentiate through access rights and their rights to read from and write data into the ledger. What all BCT platforms have in common is the distributed ledger technology, peer-to-peer transaction capability, as well as consensus mechanisms. However, different governance mechanisms, such as incentives and consensus algorithms, apply to each of the platform types. Decision making by consensus and economic incentives are governance categories, both in organizations and firms (Gulati et al. 2000), as well as in blockchain technologies (Beck et al. 2018). Public and permissionless blockchains operate under the governance type of public consensus, as transactions can be verified by any participating node. The access to the network is permissionless, which allows everyone with a computer and an internet connection to join the public network. The consensus algorithms, such as Proof of Work (POW) or Proof of Stake (POS), operate on permissionless platforms. As such, the governance mechanism decision making and incentives through consensus are driving the behavior of stakeholders. In private blockchain technology platform types the consensus is coordinated by a single central authority. The consensus algorithms deployed in those platforms, therefore, differ from those of public BCTPTs. Examples of consensus engines in private networks are Tendermint or Practical Byzantine Fault Tolerance (PBFT). They predominantly ensure that transaction blocks are chronologically stored on each participating node, while a central authority is responsible for the verification. The governance type in private BCTPTs is, therefore, reverted to a single management of transactions. The governance type used with consortium BCTPTs differs slightly from that of private ones. The key difference is that the consensus is coordinated by a few, assigned entities who are authorized to perform governance-related tasks. Same consensus engines are used as in private BCTPTs. As a result, different governance mechanisms apply for the three BCTPTs.

While public blockchains permit any entity to become a stakeholder and participate in the network governance, permissioned blockchains, such as private and consortium BCTPTs, are lacking the governance mechanism attributes of public consensus and incen-

tive, as either a single authority or a few pre-determined stakeholders are managing the consensus algorithms with permission. As a result, in private and consortium BCTPTs, the majority of the stakeholders are excluded from contributing to achieving consensus on transactions and on the state of the blockchain network. As a consequence, alternative governance mechanisms need to be applied in private and consortium BCTPTs, as consensus and incentive mechanisms are no longer available as governance attributes.

There are various operational challenges that blockchain operators are still being faced with, such as improper raw material treatment, data gathering and recording errors, falsification of data, insufficient internet connections, or missing mobile coverage (Dutta et al. 2020). In addition, the choice of the BCT platform will have a profound effect on the efficiency of the agri-food SCN because coordination mechanisms are being addressed differently by the various platform types and blockchain solutions. The coffee firms we interviewed operate centrally coordinated permissioned systems, although BCT implies that stakeholders perform transactions peer-to-peer, without any central authority coordinating the SCN. However, it has been demonstrated that successful BCT implementations can be predominantly found in vertically coordinated ecosystems revolving around providing provenance, as well as tracking and tracing information, both needed as credence attributes in the agri-food industry. It has been found that the current BCT implementations are predominantly successful when the participation of firms is mandated by a centrally acting entity (Groombridge 2020).

3.3. Use of Blockchain in the Coffee Supply Chain

Spurred by food safety crises, consumers nowadays require provenance information and transparency about origin, production, and journey of the food item they consume (Saitone and Sexton 2017). Supply chain transparency and monitoring of activities performed during the food product life cycle can be achieved through tracking and tracing, which is the ability to provide trust attributes and data about past and present locations of an item during its journey through the various stages (Trienekens and Beulens 2001). Until recently, these trust attributes could only be provided sporadically, utilizing centralized solutions. Supply chain visibility through end-to-end tracking and tracing solutions has also been suffering from incompatibilities between different technologies used by various stakeholders and firms (Shamsuzzoha and Helo 2011). Even with the recently introduced cloud-based solutions, the disadvantage of centralized systems prevails, as load-based performance problems, single database storage, and server outages might result in limited access or, even worse, in the unavailability of the service. As system availability depends on a central authority, security concerns exist where one entity manages all user data. Central systems also rely, in many cases, on relational databases, which permit data to be modified and deleted, so that immutability of data cannot be guaranteed (Wolf and Henley 2017). In contrast, and to solve this dilemma, decentralized solutions such as blockchain technology (BCT) could provide for peer-to-peer transactions and immutable transaction data that is constantly visible to all stakeholders, as well as for secure and transparent recording of transport and storage conditions.

BCT is a digital trust technology that is commonly known to be used for creating and transferring cryptocurrencies. However, the technology has developed far beyond the financial industry, providing, in particular, supply chain transparency through tracking and tracing solutions in the FSC (Blossey et al. 2019), which results in increased consumer trust (Baralla et al. 2020). In the coffee industry, BCT solutions are currently being implemented with the objective of establishing trust by sharing product-related information with consumers and by making supply chain activities more transparent to them and to relevant stakeholders (Miatton and Amado 2020). Traceability is therefore becoming not only a requirement but a fundamental competitive differentiator in the agri-food industry (Costa et al. 2013). According to the instrumental stakeholder theory, enabling and maintaining close ties between management and stakeholders can also provide for a competitive advantage (Jones et al. 2018).

BCT-enabled supply chains, in addition to many other benefits, now provide a direct connection between the two ends, enabling information exchange and feedback between consumers and smallholders, generating additional income for the smallholders (Anzalone 2020). Smallholders benefit from an increase in trust and fairness in the coffee supply chain through the application of BCT, as this novel technology can be used to reward quality and transfers credence attributes across the entire supply chain. Recording credence attributes, such as provenance, type, quality, and quantity, will be immutably kept, as BCT is a trust technology that enables secure data storage and encryption where data can be retrieved but neither modified nor deleted. It eliminates the need for a trusted central authority or intermediaries validating credence attributes. For example, the application of BCT within Fair Trade certification schemes has been addressed in recent research (Balzarova and Cohen 2020; Schahczenski and Schahczenski 2020; Fairtrade 2021).

3.4. Coffee Supply Chain

Typically, green coffee is being exported and then roasted, packaged, and distributed at the country of consumption. It is then moved through the supply chain from the first mile to the consumer's coffee machine by means of intermodal transportation, supported by multiple stakeholders linked together to provide products and services to consumers. Figure 1 outlines a typical coffee supply chain with its potential stakeholders.

Figure 1. A typical coffee supply chain and the potential actors.

BCT can only develop its full potential when it is being embraced by the stakeholders responsible for recording transaction data and adding credence attributes to the distributed ledger. Stakeholders in the upstream coffee supply chain include smallholders, collectors, cooperatives, transporters, coffee roasters, packing specialists, label printers, quality managers, as well as logistics managers. As BCT solutions are intended to span from the first to the last mile, all these stakeholders are affected by BCT solutions that are being introduced to the coffee supply chain. For businesses to gain the expected advantages, the technology must be adopted and used by the relevant stakeholders, as according to the theory of incomplete contracts, the actions of stakeholders affect the value of an asset (Hart 2017). Stakeholders should have control over the assets to maximize their utility and satisfaction. Although the use of this technology improves trust amongst stakeholders in the FSC (Baralla et al. 2020), their attitude toward the adoption of new technology is subjective and depends on the stakeholder management approach that is being exerted by the focal firm. Firms adhering to the principles of instrumental stakeholder management will demonstrate better economic performance (Donaldson and Preston 1995).

3.5. Instrumental Stakeholder Theory

When new technologies are introduced by management, they can be faced, on the one hand, with the challenges that accompany the pure technical implementation but more importantly, on the other hand, they can be confronted with stakeholder resistance, unwanted attitudes toward usage, and potential anxiety of the users. The latter is the reason why we chose to analyze the behavioral intentions of stakeholders toward adopting and using BCT and put this into perspective of the chosen stakeholder management approach, especially against the background of the novelty level of BCT. Employees in an organization can use their power and resist the changes through forms of behavior that do not support the objectives of the organization. It is therefore imperative that management must be aware of the stakeholders' attitudes and behavioral intentions toward the usage of new technology.

As part of his instrumental stakeholder theory, Freeman defines a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 2015). Freeman considers his theory being used in the realm of management's strategic decision making. The traditional instrumental stakeholder theory focuses specifically on independent, dyadic relationships, whereas a newer strand argues that organizations are represented by a complex network of horizontal and vertical relationships (Rowley 1997; Lazzarini et al. 2001). While stakeholder management has a direct impact on the economic performance of the firm, it also requires the attention of all stakeholders regarding the organizational framework, governance, policies, and operational decisions. Stakeholders and the firm have reciprocal functional interests in each other, and stakeholders have intrinsic value which goes beyond simply creating positive returns for the firm. Therefore, each group of stakeholders needs to be viewed individually by the management of the firm (Donaldson and Preston 1995). According to Donaldson and Preston, what constitutes stakeholder management is the management of expectations and desires of stakeholders framed through the attributes attitude, structure, and business practice. Stakeholder theory has been argued to be descriptive (the collaboration amongst stakeholders), instrumental (assessing stakeholder management conduct and supply chain performance), and normative (describing the attitudes of the firm toward its stakeholders). All three attributes support each other and are based on a normative foundation, focusing on the value of economic fairness and corporate social responsibility (CSR), or on factors determining what an economy should represent (Donaldson and Preston 1995). Lazzarini et al. show that the normative path of stakeholder theory can lead to a strong commitment of the organization to adhering to the strategies that have been set by management (Lazzarini et al. 2020). The normative view of stakeholder theory focuses on the state that should be achieved. Management and stakeholders therefore need to take each other's objectives, motivations, intentional behaviors, and concerns into account to jointly strive for the envisioned economic rent of the firm. Consequently, management has to ensure the acceptance of technology by affected stakeholders in order to achieve the expected economic rent. Stakeholder theory can be applied to IT projects and will be effective in that industry (Walley 2013). As blockchain is a software protocol that is being implemented with the IT infrastructure, it can be viewed as an information technology asset (Kramer et al. 2021). Stakeholder theory asks managers to understand the needs, motivations, and interests of stakeholders and factor in their experience and skills to increase the supply chain efficiency (Doh and Quigley 2014). In addition to typical vertical relationships in an FSC, stakeholders also develop and maintain horizontal relationships, and their behavior has a mutual impact. This architectural model can be described as netchain (Lazzarini et al. 2001). Governance as part of the stakeholder theory focuses on the activities of all stakeholders of the firm connected through the netchain. One of the key tasks of the firm is to reduce or even eliminate frictions between stakeholders to increase the efficiency of the netchain. Firms adhering to the principles of instrumental stakeholder management will demonstrate better economic performance (Donaldson and Preston 1995). To be economically successful and outperform their peers, firms should also enter into contractual agreements with their stakeholders, following the instrumental stakeholder theory (Jones 1995). This coincides with the strategic value chain approach, which views the value chain as a single solution improving the competitive position by putting the customer and their expectations first, to improve the overall chain performance (Clay and Feeney 2019). Trustful relationships and cooperative information sharing are attributes of instrumental stakeholder theory. Consequently, the development of close ties between the firm and its stakeholders has the potential to result in sustained competitive advantage (Jones et al. 2018).

3.6. Human Trust versus Digital Trust

While human trust is being exercised on the social and economic level, digital trust is being exercised on the crypto-technology level. The combination of both trust levels enables the development of novel business models. Consumers are increasingly demanding a

high level of product quality and safety, and they expect transparency about their food products, including information about provenance, suppliers, production, and transport conditions (Saitone and Sexton 2017). The increased demand for FSC transparency initiated a redesign of the food chain, which is driven by trust attributes, such as product quality and food safety (Hanf 2005). Trust has become a significant element of product quality and safety which is represented by the focal firm using its brand to constantly ensure high standards. Consequently, agri-food firms need to provide food product information such as provenance with the objective to increase trust, which could increase customer loyalty and which in turn offers the opportunity to convert one-time buyers to repeat buyers. As trust attributes need to be transferred through all stages of the FSC, vertical cooperation in the agri-food industry is driven by trust and credence attributes, such as food quality, provenance, and safety.

Trust attributes in the FSC can be split into three categories: the metaphysical, chain transparency, and risk-related category (Hanf 2005) and can be used as differentiators to enforce price premiums (Pelupessy and Díaz 2008). While global coffee consumption has increased 8% between 2015/16 and 2020/21, global production has increased even more by 14%, putting additional pressure on coffee prices (USDA 2020). A potential strategy to counter the decline in coffee prices is to apply sensory and non-sensory credence attributes with the intent to obtain price premiums (Pelupessy and Díaz 2008). Examples of metaphysical, non-sensory credence attributes include, but are not limited to, coffee completely produced at the place of origin (Solino 2021) and coffee that has been hand-picked or hand-picked exclusively by women (Kaffeekoop 2021). In our research, we combine metaphysical and chain transparency trust attributes. Trust is also a central driver for achieving collaboration in vertical cooperation (Rindfleisch 2000), and it is instrumental in managing the risk of cooperation problems in FSC (Hanf and Dautzenberg 2006). In the FSC, trust has the potential to reduce transaction costs while fostering cooperation (James and Sykuta 2005). Research has also shown that trust has a positive effect on agricultural stakeholders' technology adoption efficiency (Wang et al. 2020).

3.7. Technology Adoption in the Food Supply Chain

Spending on IT has been constantly growing and, despite the COVID-19 pandemic, it is forecasted to continue its growth (IDC 2021). For businesses to gain the expected productivity advantages, IT must be accepted, adopted, and used by the relevant stakeholders of a firm. According to the theory of incomplete contracts, the actions of stakeholders affect the value of an asset (Hart 2017). As a result, stakeholders should have control over the asset, e.g., over the BCT, to maximize their utility and satisfaction. Consequently, in the blockchain-enabled coffee supply chain, stakeholders operating the blockchain by adding product and transaction data with the objective of increasing the value of the coffee product, should be given control over this technology. If control over the technology is handed over to the affected stakeholders, it must be made sure that the technology is being used according to its intended purpose, despite the lack of detailed contractual agreements covering every single exception and occurrence of events. It has to be taken into consideration by the management that technology adopters are not homogeneous, but that they are categorized into innovators, early adopters, early majority, late majority, and laggards, and their distribution in the organization is represented by a standard normal distribution curve (Roger 2003).

Several models describing the macroeconomic, as well as the microeconomic, effects of technology adoption have been developed lately. Technology adoption can be analyzed through the organizational or the personal stakeholder level (Tarhini et al. 2015). As our intention is to research the interorganizational rather than the societal effects of blockchain adoption, we argue that it is more appropriate to follow the personal stakeholder approach and analyze user adoption from a user perspective rather than from an organizational view, as the macro lens approach investigates the diffusion of new technology from its spread within a social network to create tailormade marketing programs for the masses (Bohlmann

et al. 2010). Research on blockchain technology adoption in the agri-food industry is very scarce. However, some research has been published recently that uses the Technology Acceptance Model (TAM) (Taherdoost 2018), addressing the organizational rather than the individual aspects (Rijanto 2021). Yadav et al. performed an extensive literature review to identify the main blockchain adoption drivers in the context of achieving sustainable food security (Yadav et al. 2021). These adoption drivers were related to the benefits that the technology provides to firms implementing the technology, rather than investigating use behavior of agri-food firm employees. Yadav et al. also concluded that blockchain adoption in agriculture is at a very early stage (Yadav et al. 2021).

Several models to analyze technology adoption and behavioral intention in the information technology sphere on an individual level exist (Taherdoost 2018). Amongst the three most common models is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003). It is based on four factors determining usage behavior and behavioral intention: performance expectancy (PE), which is the support of the technology for achieving the individual's objectives; effort expectancy (EE), which relates to the level of how easy an application is to be used; social influence (SI), which is the perceived influence of others to use the technology; and facilitating conditions (FC), the support of the organization for using the technology. UTAUT has been used in numerous studies to analyze and predict the acceptance and adoption of technologies, predominantly from the user perspective. The other two common models are Diffusion of Innovation (DOI) and Technology Acceptance Model (TAM) (Taherdoost 2018). DOI investigates adoption from an organizational aspect to obtain answers to the questions of how and how fast a technology is being adopted by an organization. As we are analyzing individual behavioral intent, we decided not to build on the DOI model. The Technology Acceptance Model (TAM) is one of the eight underlying theories that are building the UTAUT model (Venkatesh et al. 2003), and as it is already part of UTAUT, we therefore decided to not consider this model. Due to some limitations of UTAUT in the realms of hedonic motivation, habit, and price, Venkatesh added those attributes creating UTAUT2 as an extended version of UTAUT (Venkatesh et al. 2012). However, UTAUT2 has been tailored to include the consumer context, while we focus in our research on the personal stakeholder level. Hence, our proposed model is built on UTAUT. While UTAUT predicts the acceptance level of technology by individuals (Venkatesh et al. 2003), the Theory of Planned Behavior (TPB) predicts behavioral intent of individuals and the consequences of their behavior (Ajzen 1991). TPB was built on three independent factors of intention: attitude (AT) toward the behavior and answering the question of whether the use of the technology will make a positive difference; subjective norm (SN), which investigates the perceived peer pressure to use a technology; and perceived behavioral control (PBC), which answers the question of whether the user has the appropriate tools to be successful. Those three independent factors of intention make up the beliefs of an individual, which in turn drives their social behavior (Ajzen 1991).

3.8. Results of the Exploratory Interviews

Due to the exploratory nature of the research, we analyzed use cases derived from the premium coffee producer Solino Coffee (Solino) from Ethiopia and two other European coffee vendors. Solino's use case was selected, as this company started as one of the first companies in the coffee industry to implement BCT in their coffee supply chain back in 2018, following Moyee Coffee (Fairfood 2017) which started with a blockchain pilot project in 2017. Solino is a partnership under German law (Solino 2021). Coffee products are being produced completely in Ethiopia, shifting major parts of value creation to the country of origin. The tasks include sourcing, roasting, packaging, labeling, and coordinating the transport to its German distributor. The supply chain elements from Figure 1 "Transporter" and "Producer" are, therefore, swapped in the Solino coffee supply chain. Solino belongs to the small and medium enterprise (SME) category with 50–249. The research questionnaire was distributed to all 10 Solino employees who are working

with the blockchain solution. Out of the 10, we received 9 responses. The other two cases originate from European coffee firms importing their green beans from Africa and performing roasting in Europe. The business challenge for all three use cases is to provide trusted information about the coffee products in the supply chain in their quest to further increase customer loyalty, as consumers are increasingly asking producers to make the supply chain processes more transparent to them; at present, this applies especially to the provenance information relating to the products sold. However, BCT in the coffee supply chain, with its authenticated provenance, is in the very early phase of the innovation trigger phase, according to Gartner's most recent Hype Cycle publication (Gartner 2021). The two companies have just started to embrace the technology and chosen to gradually apply BCT to their FSC. While stakeholders in rural areas where the production of coffee is taking place have been included in these exploratory use cases, smallholders are added progressively depending on the state of the digital transformation of their business model. This is consistent with the findings from other use cases, where stakeholders in rural areas are being added subsequently, depending on the individual implementation strategy. Several years ago, Solino enhanced their business model by including BCT-enabled supply chain transparency to consumers, providing them with access to coffee provenance information. The production facility of Solino Coffee is located in the Ethiopian capital Addis Ababa. The business challenge was to provide trusted information about the coffee products in the supply chain in their quest to further increase customer loyalty, as consumers are increasingly asking producers to make the supply chain processes more transparent to them. The blockchain-based solution provides provenance data and enables consumers to verify provenance information. It is based on a permissioned, private BCT solution, which has the potential to be transformed into a consortium BCT. Permissioned blockchains are managing consensus algorithms based on permission. Governance mechanism attributes of public consensus, as well as incentives, are therefore not available for users of those solutions. As a result, in private and consortium BCT, the majority of the stakeholders are excluded from contributing to the state of the blockchain protocol. Solino's coffee products are being completely produced in Ethiopia, shifting major parts of the value creation to the country of origin. Tasks in Ethiopia include sourcing, roasting, packaging, labeling, and coordinating the transport to its German distributor. Solino is one of the first firms in the coffee industry that started their BCT implementation in 2018, while it is progressively adding more functionality to the supply chain. Every stakeholder of the Solino supply chain who adds data and value to the business process adds their data to the distributed ledger. In the case of coffee, smallholders, collectors, or cooperatives enter data about the date and location of harvest. Further information about the transfer of goods, roasting, and shipping are being recorded in the blockchain ledger. The blockchain technology in use provides benefits for both sides; Solino provides consumers with access to provenance information, while the management of Solino is transparently monitoring their supply chain activities, from harvesting to roasting and shipping to Hamburg. Consumers can now read information about the origin and journey of the coffee product through scanning QR (Quick Response) codes printed on the back of the coffee packaging by using a smartphone. As a result, information from the supply chain spanning from harvesting to roasting and shipping is presented in a visible and transparent way, potentially increasing trust in the coffee products and customer loyalty at the same time. Solino chose to conduct normative stakeholder management for their business operations in Ethiopia. The company and its stakeholders are jointly striving toward creating most of the added value in the country where the raw material, the coffee cherries, originates. The interests of the stakeholders are dominating the business conduct rather than focusing on the economic rent of the firm. This approach not only shifts more weight of the unbalanced value capture to the in-country value creation activities (Miatton and Amado 2020), but it also emphasizes morals and ethical conduct while displaying a high degree of corporate social responsibility (CSR). The two additional firms were selected because they have just recently operationalized blockchain solutions in the supply chain. As the food industry has just entered the operational phase, this

is the earliest possible point in time to conduct research with the objective of obtaining meaningful results.

In response to the first research question, if the choice of stakeholder management approach as part of the corporate governance had an impact on the adoption behavior, we combined secondary and primary research to find evidence that the choice of a normative approach toward stakeholder management as part of corporate governance positively influences the behavioral intentions and subsequently the usage behavior. We conclude that a normative stakeholder management approach can positively influence use behavior toward blockchain technology adoption. Answering the second research question of whether social factors exist that impact the adoption, we found that attitude and perceived behavioral control are key factors that impact technology adoption behavior of stakeholders in the coffee supply chain.

In our interviews with Solino management, it was obvious that Solino decided to apply a normative stakeholder management approach. Close ties with stakeholders in Ethiopia, cooperation, and focus on shifting most of the added value activities to the country of origin, as well as long-term relationships with the coffee growers, are key elements of this normative path. As a result, the management chose an approach where most of the added value activities in the supply chain remain in the country of origin, which leaves more margin in the country, leads to the creation of qualified jobs, and provides for better education while also increasing its sustainability.

The interviews with supply chain managers of two coffee firms concluded that the blockchain technology was introduced as part of the ongoing digital transformation initiatives, with the objectives to increase, amongst other things, transparency, traceability, sustainability, reduction of pollution, reduction or even cessation of deforestation, and integration of farmers in the coffee supply chain. All respondents sought long-term relationships with the coffee growers, which is in line with the objectives of smallholders who also seek long-term and stable supply relationships, coupled with price stability and predictability. The stakeholders were reported as being enthusiastic toward the technology, as BCT provides for efficiency benefits. We found that relevant factors for BCT adoption exist, such as provision of tools by the organization to be successful at work and the necessary training to operate the technology efficiently. Based on the exploratory interviews with the management and supply chain managers of the coffee firms, we decided to further analyze the factors impacting use behavior and subsequent technology adoption. For that purpose, we developed a blockchain technology adoption model.

3.9. Blockchain Technology Adoption Research Model

Based on the theoretical models of technology adoption, we constructed a model to analyze the intent of stakeholders in the coffee FSC toward BCT adoption to determine how they are impacted by a chosen stakeholder management approach. Our proposed model combines principles of technology adoption, economics, and social psychology to investigate the behavioral intention of individual stakeholders toward the adoption of BCT. For this purpose, a blockchain technology adoption model was developed utilizing selected elements of the Theories of Planned Behavior and Unified Technology Adoption and Use of Technology. As UTAUT is also increasingly combined with other theories, we proposed a model consisting of UTAUT and TPB elements, as laid out in Figure 2, to predict individual behavior toward blockchain technology adoption. However, not all parameters from UTAUT and TPB were applicable to the use case, and we argue why we excluded certain aspects. UTAUT serves as the basis of the proposed model from which we selected the three appropriate parameters: PE, EE, as well as FC, which have been supplemented by two additional parameters from PBT, namely AT and PBT. The theory on technology adoption suggests that older people and women are more sensitive toward social influences (Venkatesh et al. 2003) and only in the early phase of technology usage. If the use is mandated, there is also significant evidence that the subjective norm influences the behavioral intent (Barki and Hartwick 1994). There is also still a lack of understanding

about the user acceptance or rejection of IT (Al-Jabri and Roztocki 2010). Consequently, we excluded the determinant subjective norm from TPB when building our proposed model. From UTAUT, we excluded the parameter SI because, according to Venkatesh, it only fits a small target group and could potentially dilute the result (Venkatesh et al. 2003). The pillars of our model have been summarized in Figure 2.

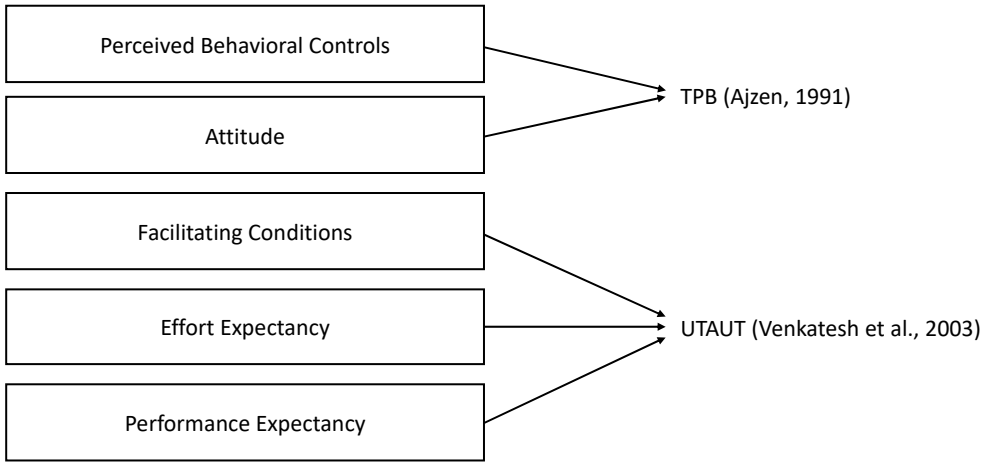

Figure 2. Pillars of proposed theoretical model (Source: authors, based on Ajzen 1991; Venkatesh et al. 2003).

Attitude is a key determinant of behavioral intentions and directly influences usage behavior (Dwivedi et al. 2019). Dwivedi found that attitude has also a direct effect on behavioral intentions and strongly influences usage behavior. Hence, attitude plays a key role in the adoption of IT. We included the findings in our model and, as a result, we proposed the following model in Figure 3, which should accurately predict FSC stakeholders' blockchain technology adoption behavior:

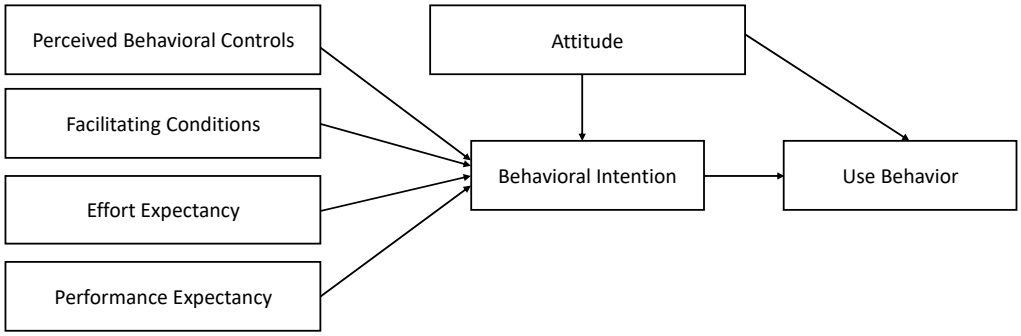

Figure 3. Proposed theoretical blockchain technology adoption model (Source: authors, based on Ajzen 1991; Venkatesh et al. 2003).

The attitude of individuals toward the adoption of new technology is subjective and highly depends on characteristics such as experience, general approach toward the technology, and age. To obtain inputs, stakeholders in the upstream coffee supply chain tasked with blockchain data recording were targeted. Coffee roasters, packing specialists, label printers, and transport and logistic managers in Ethiopia represented the upstream stakeholders. Based on the blockchain technology adoption model, we developed an online questionnaire comprising of elements from UTAUT and TPB targeted at Solino employees in Ethiopia who were tasked with recording BCT transaction data, to investigate the acceptance of BCT. Our questionnaire methodologically followed the reasoned action approach (Fishbein and Ajzen 2010). The questionnaire was based on the five factors determining usage behavior and behavioral intention, and it consisted of questions to

assess the theoretical factors of PE, EE, FC, AT, and PBC. The questions and the determining factors have been summarized in Figure 4 of the attachment.

Performance Expectancy	(Venkatesh et al. 2003)
Providing transparency about our production process will make our coffee more attractive	
The quality of the production process will benefit from the added transparency which we offer to our consumers	
With the increased transparency I expect my job responsibility to increase	
A more transparent coffee production process will increase the trust in our coffee products	
The direct customer feedback will make my job more secure	
Effort Expectancy	(Venkatesh et al. 2003)
I think that learning the process of how to integrate the blockchain technology into the production process is easy and understandable	
I have the knowledge and tools that are needed necessary to support the use of blockchain technology	
It is clear to me how my contribution impacts the process of recording data of the production	
I have a clear understanding of the benefits that bring the technology to me and my team	
In my opinion the process required to provide production data for the blockchain is easy to use	
Facilitating Conditions	(Venkatesh et al. 2003)
We have the necessary resources such as PC with Internet connection to work with the blockchain	
I have the necessary knowledge to support the use of blockchain technology	
I need special training to support the use of blockchain technology	
Blockchain is a special application and different to the other tools we use during our work	
If I have problems with the technology, I know whom to contact	
Attitude	(Ajzen 1991)
I would like to be involved where blockchain technology enables feedback from our customers	
In my opinion my company should use the blockchain technology to improve our product	
I intend to use blockchain in my job	
I would like to use blockchain in my job within the next 12 months	
In my opinion it is good for my job if customers can see more details about the production process	
Perceived Behavioral Control	(Ajzen 1991)
I plan to learn more about blockchain within the next 2 months	
If I could I would like to work where I have more interaction with customer feedback provided by blockchain technology	
It is up to me to be among the first ones to try out new technologies in order to improve our products	
I am confident that with blockchain we are able to establish a beneficial connection with consumers	
The direct feedback of our consumers is important to me	

Figure 4. Interview questions and behavioral factors, according to the blockchain technology adoption model (Figure 3).

3.10. Summary

Our research combines social sciences with economics and aims to analyze how instrumental stakeholder management, social norms, and behaviors of individuals affect the adoption of BCT in the coffee supply chain. Our findings suggest that close ties between management and stakeholders positively influence behavioral intentions and, subsequently, the usage behavior of stakeholders toward blockchain technology adoption. The application of a normative stakeholder management approach coincides with strong positive behavioral intentions and strong positive usage behavior. Our proposed model can be utilized to measure the grade of this behavior, and we suggest using the model as one of the KPIs (Key Performance Indicator) for determining the supply chain performance.

Although BCT adoption research should have included all stakeholders, due to the very early implementation stage, we found through the discussions with industry experts that most of the BCT solutions have not yet covered the complete end-to-end supply chain.

This is consistent with what other coffee supply chains are reporting (Forbes 2020). Albeit including the smallholders in the first mile as quickly as possible, this represents a technical challenge due to fragmented mobile coverage or alternative means of communication that need to be established consistently at the coffee farms to permit the recording of data at the point of origin. The data recording issue is currently solved by either the farmers recording data at the point of origin and transferring the data asynchronously as soon as a connection has been established, or by adding the data of origin at the earliest possible point of mobile coverage, which is typically at the point where collectors take over the dried coffee beans.

With the blockchain technology adoption model, we identified performance expectancy, effort expectancy, facilitating conditions, perceived behavioral controls, and attitude as key factors impacting behavioral intention and usage behavior toward BCT adoption. Our findings express a consistently high level of the attitude factor amongst stakeholders in the upstream portion of the supply chain toward adopting BCT. Stakeholders view the adoption of BCT as a critical success factor which affects them personally, as the use of BCT will make a positive difference in their job and future career development. In addition, stakeholders strongly confirm through the PBC and FC factors that the enterprise is providing the appropriate IT tools to be successful. Stakeholders exercise a high belief in technology to support them in achieving their individual job objectives. The results of the interviews also highlight the importance of EE, which refers to the ease of use of the application that is driving the behavioral intention. AT and PBC are the strongest influencers of behavioral intentions that drive usage behavior. As per our model, attitude is directly impacting behavioral intentions as well as usage behavior, the key determinants of adopting IT technology. AT and PBC factors strongly impact BCT adoption behavior of stakeholders in the agri-food supply chain. PE, EE, and FC conditions also impact the adoption but with a less strong characteristic. We also found that PE, EE, FC, PBC, and AT positively influence the usage of BCT in the coffee production process, independent of age, gender, job function, and professional experience. We conclude that BCT adoption has a mediating role and is one of the key factors affecting supply chain performance.

A normative stakeholder management approach leads to positive usage behavior, which again leads to efficient use of resources and is a competitive differentiator for the firm introducing blockchain technology. Amongst the key challenges we found are effort expectancy, in terms of how easy the technology is to be used, and performance expectancy, which plays a key role for the employee in achieving their objectives. To overcome the challenges of adoption, sufficient and customized training needs to be provided, as is expected by the users. Learning to use the technology will increase the employees' confidence level. The training should consist of a classroom-based portion and on-the-job training to prevent an interruption of the business processes.

4. Discussion

Vertical cooperation in the agri-food industry is driven by trust and credence attributes, such as food quality, provenance, and safety. As BCT adoption is one of the key factors affecting supply chain performance, management must ensure that stakeholders fully embrace its adoption to also transfer credence attributes reliably across the coffee supply chain. Therefore, the grade of technology adoption is an indicator of successful management–stakeholder cooperation. While aspects of consumer demand have been researched extensively, research on technology adoption at the upstream supply chain, starting at the first mile, is still missing, albeit failing to consider the various facets of stakeholders' attitudes and behavioral intentions toward adoption of enabling technologies will hamper the management's quest in striving for efficient methods of the use of assets, as well as information sharing in the FSC.

Previous research has shown that trust has a positive effect on agricultural stakeholders' technology adoption efficiency (Wang et al. 2020). According to the instrumental stakeholder theory, enabling and maintaining close ties between management and stakeholders can provide for a competitive advantage (Jones et al. 2018), and firms adhering to

the principles of instrumental stakeholder management will demonstrate better economic performance (Donaldson and Preston 1995). As the instrumental stakeholder theory is grounding on normative aspects, our research shows that a normative approach of stakeholder management seems to result in a high level of technology acceptance amongst stakeholders. Based on the results of the interviews and the grade of attitude influencing behavioral intentions, close ties between management and stakeholders already exist. We suggest that the level of technology acceptance should be used as a qualitative KPI to measure the supply chain's effectiveness. As this research is based on an exploratory use case and analyzes one group of stakeholders, we suggest that management needs to view each group of stakeholders individually.

Coffee cherries are typically grown in rural areas where internet access and mobile coverage can be limited, either of both being a prerequisite for operating smallholders' smartphones. Despite marketing claims of some coffee brands that their BCT solution is encompassing the total value chain, smallholders and stakeholders in rural areas still need to be equipped with connecting technologies, such mobile and fixed-line internet, to enable live data entry at the point of origin. The gradual approach toward BCT implementation to honor the transparency and provenance promise is a proven method of technology introduction. As the value capture in the coffee value chain can be considered as unbalanced, stakeholders in the first mile would benefit from increased transparency, wider market access, and market price information (Miatton and Amado 2020). In the case of Solino Coffee, 60% of the value capture remains in the country of origin, mainly due to roasting and packaging activities which account for most of the value capture (Solino 2021). However, smallholders who account for 89% of the value chain population have not yet increased their mere 5% of value capture, according to Miatton et al. Both Miatton and Thiruchelvam found that blockchain will provide farmers with better market access, so that they can achieve higher prices for their products, which might result in a shift of value capture toward the farmers (Thiruchelvam et al. 2018). It is therefore imperative that, as a first step, the blockchain needs to be extended to the first mile of the supply chain, providing farmers with the opportunity to benefit from transparency and information access. However, market transparency can only be achieved with a consortium or public type of blockchain platform solution. Extending the blockchain to the first mile is the objective of all firms that we interviewed. The firms are also striving for long-lasting relationships with their coffee grower partners. In the subsequent step and to fully benefit from the increased transparency and initiate a potential shift in value capture, farmers need to adopt and use the novel technology.

The preceding objective of BCT is the peer-to-peer data and information exchange between untrusted partners. Although consumers acting in the last mile of the supply chain networks typically do not connect with first mile stakeholders, BCT now permits this direct interaction. Consumer behaviors have a higher level of influence on the objectives of the organization than those of employees (Neville and Menguc 2006). Consequently, consumer requirements on certain food attributes affect the behavior of stakeholders growing and producing the coffee products. Combining the claims of first and last mile stakeholders will increase the probability of influencing the objectives of the organization and hence, the impact on business processes in the supply chain will rise (Neville and Menguc 2006). It is, therefore, an important aspect for managers to determine the type and level of influence consumers have on the other stakeholders.

The model we developed can be used to determine the technology adoption intention toward using new technology, and potential adoption issues could be identified and rectified prior to its implementation. While we assume that the results can be transferred to farmers in the first mile to investigate their behavioral intentions toward the use of blockchain technology, additional research is necessary to analyze the technology adoption behavior of these stakeholders. Smallholders in the first mile need to be equipped with the necessary digital tools and connectivity to record and transfer data at the point of origin. A normative stakeholder management approach and adequate training in the usage of

the novel technology are necessary to increase the technology adoption rate and to create added value for the smallholders. Fostering digitization of the first mile can potentially be achieved through the introduction of digital payments to smallholders; a payment option that is being envisioned by industry experts we interviewed, in addition to the cash transactions and bank transfers utilized today. Mobile adoption in Ethiopia is high and with two more network operators that are scheduled to receive permission to offer services during 2021, the coverage and connectivity will potentially increase as a result of the intensifying competition between mobile network operators.

Blockchain also enables the implementation of smart contracts, which in turn allow for automatic transactions and payment in the supply chain. Smart contracts are software programs that are based on BCT with fixed rules for automatically executed transactions based on a set of predefined conditions that must be met. They allow the tracking of products through the supply chain, managing ownerships, and authorizing automatic payments. They could replace the trust that has been established by central authorities and intermediaries, so that parties that have not met and performed trades before can rely on the integrity of the transaction. Key benefits of smart contracts are the increased transparency and trust in a decentralized system with no single ruling authority (Zhao et al. 2019) and the reduction of the ex-ante and ex-post transaction costs (Ciatto et al. 2020). In combination with the current plans for digitization, payments to smallholders through smart contracts could be introduced to the coffee supply chain and FSC in general.

As a balance sheet displays the financial state of a firm at a certain point in time, our findings represent a static state of the technology adoption behavior at a specific time. UTAUT is very static but, based on our model, the modeling of user behavior and their development via self-learning agents could be implemented in the context of agent-based modeling and computer simulation (ABMS). We suggest investigating the development of technology adoption factors over time with dynamic methodologies that provide data over an extended period of time. Simulation of complex socioeconomic systems with ABMS has been utilized as a substitute for experiments. ABMS will provide additional insights into the development of technology adoption factors within the coffee supply chain.

5. Conclusions

Employees in an organization can use their power and resist the changes through forms of behavior that do not support the objectives of the organization. It is therefore imperative that management must be aware of stakeholders' attitudes and behavioral intentions toward the usage of new technologies. Our article draws on the instrumental stakeholder theory, with focus on normative interests such as moral motivation rather than rational chain performance interest. In our article, we discussed how blockchain technology adoption behavior is impacted by applying a normative stakeholder management approach. Based on the exploratory interviews with key stakeholders, it was found that a normative management approach might positively impact the use behavior of stakeholders operating the technology. Attitude toward the technology and its perceived behavioral control are key factors that impact technology adoption behavior of stakeholders in the coffee supply chain where we performed exploratory research. Users of blockchain solutions expect that the use of the novel technology can lead to creation of qualified jobs, provide for better education, and eventually increase the job security. Concluding, a normative stakeholder management approach can lead to high blockchain adoption acceptance, which is an attribute of close ties between management and stakeholders. We demonstrated that following the instrumental stakeholder theory, successful cooperation between management and stakeholders can be achieved by applying and emphasizing a set of normative aspects. We developed an analytical model to determine technology adoption behavior. Managers can use this model to analyze the adoption behavior of stakeholders and use this as a key performance indicator to develop an effective stakeholder management strategy, which eventually can provide for a competitive advantage.

The implementation and use of blockchain in coffee and agri-food supply chains has barely started, and solutions that have left the piloting or field trial phases being operational are very scarce in the food industry. However, due to the strategic network nature of the analyzed coffee supply chain network, the results can be transferred to a certain extent to other agri-food supply networks and hence act as a general guidance.

We admit that the chosen research methodology has certain disadvantages, including, but not limited to, the exploratory character, where the interviews and subsequent survey are based on small samples due to the size of the enterprise and the novelty of the technology. The findings can only be applied to this specific case in the coffee supply chain. As blockchain is still in the introductory phase, there are only limited operational implementations complementing the coffee supply chain. This is the earliest possible point in time to conduct research with the expectance of obtaining meaningful results.

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References

Ajzen, Icek. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179–211. [CrossRef]

Al-Jabri, Ibrahim M., and Narcyz Roztocki. 2010. Adoption and Use of Information Technology in Mandatory Settings: Preliminary Insights from Saudi Arabia. Paper presented at 16th Americas Conference on Information Systems, Lima, Peru, August 12–15; Available online: https://ssrn.com/abstract=1965269 (accessed on 18 March 2021).

Anzalone, Robert. 2020. Big Coffee Sellers Use Blockchain To Connect Farmers And Customers. *Forbes Online*. Available online: https://www.forbes.com/sites/robertanzalone/2020/07/15/big-coffee-sellers-use-blockchain-to-connect-farmers-and-customers/#18cfd9244f1a (accessed on 14 September 2021).

Balzarova, Michaela A., and David A. Cohen. 2020. The blockchain technology conundrum: Quis custodiet ipsos custodes? *Current Opinion in Environmental Sustainability* 45: 42–48. [CrossRef]

Baralla, Gavina, Andrea Pinna, Roberto Tonelli, Michele Marchesi, and Simona Ibba. 2020. Ensuring transparency and traceability of food local products: A blockchain application to a Smart Tourism Region. *Concurrency and Computation: Practice and Experience* 33: e5857. [CrossRef]

Barki, Henri, and Jon Hartwick. 1994. Measuring User Participation, User Involvement, and User Attitude. *Management Information Systems Quarterly* 18: 59–82. [CrossRef]

Beck, Roman, Christoph Müller-Bloch, and John Leslie King. 2018. Governance in the blockchain economy: A framework and research agenda. *Journal of the Association for Information Systems* 19: 1. [CrossRef]

Blossey, Gregor, Jannick Eisenhardt, and Gerd Hahn. 2019. Blockchain Technology in Supply Chain Management: An Application Perspective. Paper presented at 52nd Hawaii International Conference on System Sciences, Maui, HI, USA, January 8–11.

Bohlmann, Jonathan D., Roger J. Calantone, and Meng Zhao. 2010. The effects of market network heterogene-ity on innovation diffusion: An agent-based modeling approach. *Journal of Product Innovation Management* 27: 741–60. [CrossRef]

Chang, Yanling, Eleftherios Iakovou, and Weidong Shi. 2020. Blockchain in global supply chains and cross border trade: A critical synthesis of the state-of-the-art, challenges and opportunities. *International Journal of Production Research* 58: 2082–99. [CrossRef]

Ciatto, Giovanni, Stefano Mariani, Alfredo Maffi, and Andrea Omicini. 2020. Blockchain-Based Coordination: Assessing the Expressive Power of Smart Contracts. *Information* 11: 52. [CrossRef]

Clay, Pablo Mac, and Roberto Feeney. 2019. Analyzing agribusiness value chains: A literature review. *International Food and Agribusiness Management Review* 22: 31–46. [CrossRef]

Costa, Corrado, Francesca Antonucci, Federico Pallottino, Jacopo Aguzzi, David Sarriá, and Paolo Menesatti. 2013. A Review on Agri-food Supply Chain Traceability by Means of RFID Technology. *Food Bioprocess Technology* 6: 353–66. [CrossRef]

Crosby, Michael, Nachiappan, Pradan Pattanayak, Sanjeev Verma, and Vignesh Kalyanaraman. 2016. Blockchain Technology: Beyond Bitcoin. *Applied Innovation* 2: 6–9.
Davidsson, Madeleine. 2019. Blockchain in Agri-Food Chain: Shaping an Integrated Food Ecosystem. Master's thesis, Swedish University of Agricultural Science, Department of Urban and Rural Development, Uppsala, Sweden.
Doh, Jonathan P., and Narda R. Quigley. 2014. Responsible Leadership and Stakeholder Management: Influence Pathways and Organizational Outcomes. *Academy of Management Perspectives* 28: 255–74. [CrossRef]
Donaldson, Thomas, and Lee E. Preston. 1995. The Stakeholder Theory of the Modern Corporation: Concepts, Evidence and Implications. *Academy of Management Review* 20: 65–91. [CrossRef]
Dutta, Pankaj, Tsan-Ming Choi, Surabhi Somani, and Richa Butala. 2020. Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation Research Part E, Logistics and Transportation Review* 142: 102067. [CrossRef]
Dwivedi, Yogesh K., Nripendra P. Rana, Anand Jeyaraj, Marc Clement, and Michael D. Williams. 2019. Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model. *Information System Frontiers* 21: 719–34. [CrossRef]
Fairfood. 2017. Fairfood and Moyee Tackle the Coffee Industry with Blockchain. Available online: https://fairfood.nl/en/resources/fairfood-and-moyee-packs-the-coffee-industry-with-blockchain/ (accessed on 27 September 2021).
Fairtrade. 2021. Producer Networks and Producer Organizations. Available online: https://www.fairtrade.net/about/producer-networks (accessed on 12 October 2021).
Fishbein, Martin, and Icek Ajzen. 2010. *Predicting and Changing Behavior: The Reasoned Action Approach*. New York: Psychology Press.
Forbes. 2020. Moyee Coffee Has Harnessed Blockchain To Disrupt A Conglomerate-Controlled Industry. Available online: https://www.forbes.com/sites/mariannelehnis/2020/08/31/moyee-coffee-has-harnessed-blockchain-to-disrupt-a-conglomerate-controlled-industry/ (accessed on 12 October 2021).
Freeman, R. Edward. 2015. Stakeholder Theory. In *Wiley Encyclopedia of Management*. Edited by Cary L. Cooper. Chichester: John Wiley & Sons. [CrossRef]
Gartner. 2021. Hype Cycle for Emerging Technologies. Available online: https://www.gartner.com/smarterwithgartner/5-trends-drive-the-gartner-hype-cycle-for-emerging-technologies-2020/ (accessed on 27 September 2021).
Gläser, Jochen, and Grit Laudel. 2010. *Experteninterviews und Qualitative Inhaltsanalyse als Instrumente Rekonstruierender Untersuchungen*. Wiesbaden: Springer VS Verlag Bücher 4.
Groombridge, David. 2020. *Unpacking Blockchain Myths From the Reality*. Gartners Webinars. Stanford: Gartner, Inc.
Gulati, Ranjay, Nitin Nohria, and Akbar Zaheer. 2000. Strategic Networks. *Strategic Management Journal* 21: 203–15. [CrossRef]
Hanf, Jon, and Kirsti Dautzenberg. 2006. A theoretical framework of chain management. *Journal on Chain and Network Science* 6: 79–94. [CrossRef]
Hanf, Jonh. 2005. Supply chain networks: Analysis based on strategic management theories and institutional economics. Paper presented at IAMO—Forum 2005, How Effective is the Invisible Hand? Agricultural and Food Markets in Central and Eastern Europe, Halle, Germany, June 16–18.
Hart, Oliver. 2017. Incomplete Contracts and Control. *American Economic Review* 10: 1731–52. [CrossRef]
IDC. 2021. Global ICT Spending. Available online: https://www.idc.com/promo/global-ict-spending/forecast (accessed on 12 October 2021).
Ievoli, Corrado, Angelo Belliggiano, Danilo Marandola, Giuseppe Pistacchio, and Luca Romagnoli. 2019. Network Contracts in the Italian agri-food industry: Determinants and spatial patterns. *Economia Agro-Alimentare/Food Economy*, 275–306. [CrossRef]
James, Harvey S., Jr., and Michael E. Sykuta. 2005. Property Right and Organizational Characteristics of Producer-owned Firms and Organizational Trust. *Annals of Public and Cooperative Economics* 76: 545–80. [CrossRef]
Jarillo, J. Carlos. 1988. On strategic networks. *Strategic Management Journal* 9: 31–41. [CrossRef]
Jones, Thomas M. 1995. Instrumental stakeholder theory: A synthesis of ethics and economics. *Academy of Management Review* 20: 404–437. [CrossRef]
Jones, Thomas M., Jeffrey S. Harrison, and Will Felps. 2018. How Applying Instrumental Stakeholder Theory Can Provide Sustainable Competitive Advantage. *Academy of Management Review* 43: 371–91. [CrossRef]
Kaffeekoop. 2021. Kaffee Ganz aus Frauenhand. Available online: https://kaffee-kooperative.de/angeliques-finest/ (accessed on 27 September 2021).
Kramer, Michael Paul, Linda Bitsch, and Jon Hanf. 2021. Blockchain and Its Impacts on Agri-Food Supply Chain Network Management. *Sustainability* 13: 2168. [CrossRef]
Lazzarini, Sergio Giovanetti, Dirk Boehe, Leandro Simões Pongeluppe, and Michael L. Cook. 2020. From Instrumental to Normative Relational Strategies: A Study of Open Buyer-Supplier Relations. *Meeting Proceedings*. [CrossRef]
Lazzarini, Sergio, Fabio Chaddad, and Michael Cook. 2001. Integrating supply chain and network analyses: The study of netchains. *Journal on Chain and Network Science* 1: 7–22. [CrossRef]
Mayring, Philipp. 2005. Neuere Entwicklungen in der qualitativen Forschung und der Qualitativen Inhaltsanalyse. In *Die Praxis der Qualitativen Inhaltsanalyse*. Edited by Philipp Mayring and Michaela. Weinheim and Basel: Beltz Verlag.

Miatton, Federico, and Laura Amado. 2020. Fairness, Transparency and Traceability in the Coffee Value Chain through Blockchain Innovation. Paper presented at 2020 International Conference on Technology and Entrepreneurship—Virtual (ICTE-V), San Jose, CA, USA, April 20–21; pp. 1–6.
Neville, Benjamin A., and Bulent Menguc. 2006. Stakeholder Multiplicity: Toward an Understanding of the Inter-actions between Stakeholders. *Journal of Business Ethics* 66: 377–91. [CrossRef]
Pelupessy, Wim, and Rafael Díaz. 2008. Upgrading of Lowland coffee in Central America. *Agribusiness* 24: 119–40. [CrossRef]
Rijanto, Arief. 2021. Blockchain Technology Adoption in Supply Chain Finance. *Journal of Theoretical and Applied Electronic Commerce Research* 16: 3078–98. [CrossRef]
Rindfleisch, Aric. 2000. Organizational Trust and Interfirm Cooperation: An Examination of Horizontal Versus Vertical Alliances. *Marketing Letters* 11: 81–95. [CrossRef]
Roger, Everett M. 2003. *Diffusion of Innovations*, 5th ed. New York: The Free Press.
Rowley, Timothy J. 1997. Moving Beyond Dyadic Ties: A Network Theory of Stakeholder Influences. *The Academy of Management Review* 22: 887–910. [CrossRef]
Saberi, Sara, Mahtab Kouhizadeh, and Joseph Sarkis. 2018. Blockchain Technology: A Panacea or Pariah for Resources Conservation and Recycling? *Resources, Conservation and Recycling* 130: 80–81. [CrossRef]
Saitone, Tina L., and Richard J. Sexton. 2017. Agri-food supply chain: Evolution and performance with conflicting consumer and societal demands. *European Review of Agricultural Economics* 44: 634–57. [CrossRef]
Schahczenski, Jeff, and Celia Schahczenski. 2020. Blockchain and the resurrection of consumer sovereignty in a sustainable food economy. *Journal of Agriculture, Food Systems, and Community Development* 9: 79–84. [CrossRef]
Shamsuzzoha, A. H. M., and Petri T. Helo. 2011. Real-time tracking and tracing system: Potentials for the logistics network. Paper presented at 2011 International Conference on Industrial Engineering and Operations management, Kuala Lumpur, Malaysia, January 22–24; pp. 22–24.
Solino. 2021. Der Erste Seiner Art. Available online: https://www.solino-coffee.com/ (accessed on 27 September 2021).
Taherdoost, Hamed. 2018. A review of technology acceptance and adoption models and theories. *Science Direct, Procedia Manufacturing* 22: 960–67. [CrossRef]
Tarhini, Ali, Nalin Asanka Gamagedara Arachchilage, Ra'ed Masa'deh, and Muhammad Sharif Abbasi. 2015. A Critical Review of Theories and Models of Technology Adoption and Acceptance in Information System Research. *International Journal of Technology Diffusion (IJTD)* 6. [CrossRef]
Thiruchelvam, Vinesh, Mughisha Alexandre, Shahpasand Maryam, and Mervat Bamiah. 2018. Blockchain-based Technology in the Coffee Supply Chain Trade: Case of Burundi Coffee. *Journal of Telecommunication, Electronic and Computer Engineering* 10: 121–25.
Treiblmaier, Horst. 2018. The impact of the blockchain on the supply chain: A theory-based research framework and a call for action. *Supply Chain Management International Journal* 23: 545–59. [CrossRef]
Trienekens, Jacques, and Adrie Beulens. 2001. The Implications of EU Food Safety Legislation and Consumer Demands on Supply Chain Information Systems. Available online: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.100.967&rep=rep1&type=pdf (accessed on 12 October 2021).
Tripoli, Mischa, and Josef Schmidhuber. 2018. *Emerging Opportunities for the Application of Blockchain in the Agri-food Industry*. Rome: FAO, Geneva: ICTSD.
USDA. 2020. Coffee: World Markets and Trade. United States Department of Agriculture Foreign Agricultural Service, 2020/21 Forecast Overview. Available online: https://apps.fas.usda.gov/psdonline/circulars/coffee.pdf (accessed on 12 October 2021).
Venkatesh, Viswanath, James Y. L. Thong, and Xin Xu. 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *Management Information Systems Quarterly* 36: 157–78. Available online: http://www.jstor.org/stable/41410412 (accessed on 9 December 2021).
Venkatesh, Viswanath, Michael G. Morris, Gordon B. Davis, and Fred D. Davis. 2003. User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly* 27: 425–78. [CrossRef]
Walley, Paul. 2013. Stakeholder management: The sociodynamic approach. *International Journal of Managing Projects in Business* 6: 485–504. [CrossRef]
Wang, Geling, Qian Lu, and Sergio C. Capareda. 2020. Social network and extension service in farmers' agricultural technology adoption efficiency. *PLoS ONE* 15: e0235927. [CrossRef] [PubMed]
Wolf, Dave, and A. J. Henley. 2017. How to Create Database Tables for Bullhorn. In *Java EE Web Application Primer*. Berkeley: Apress. [CrossRef]
Yadav, Vinay Surendra, A. R. Singh, Rakesh D. Raut, and Naoufel Cheikhrouhou. 2021. Blockchain drivers to achieve sustainable food security in the Indian context. *Annals of Operations Research*. [CrossRef]
Zhao, Guoqing, Shaofeng Liu, Carmen Lopez, Haiyan Lu, Sebastian Elgueta, Huilan Chen, and Biljana Mileva Boshkoska. 2019. Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions. *Computers in Industry* 109: 83–99. [CrossRef]