

## ACHIEVING TRANSPARENCY THROUGH BLOCKCHAIN: SUSTAINABILITY OF FISHERY SUPPLY CHAIN MANAGEMENT

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### ABSTRACT

**Objective:** This paper aimed to discuss how blockchain technology would incorporate several changes in the fishery supply chains, in order to make them more reliable and sustainable. **Method:** This is a qualitative study, using an exploratory method with descriptive approach. In addition, the literature review in this study presents theoretical contributions regarding utility. **Main Results:** The study highlights the importance of incorporating blockchain features into seafood supply chains, which are currently fragmented and lack of real-time information, focusing on its traceability potential to leveraging fishery supply chains operations and outcomes. It identifies a sequence of strategic checkpoints that provide real-time information by using blockchain in fishery supply chains. **Relevance / Originality:** This manuscript presents a diagram of a seafood supply chain considering how blockchain allows the data gathering in each stage in order to provide traceability to the supply chain. Hence, the study serves as a map, as well as a model, for upcoming research on how to understand the incorporation of technology into supply chains stages.

**Theoretical / Methodological Contributions:** Supply chains support international business operations. Furthermore, as digital revolution moves aggressively forward, supply chains need to adapt to it in order to fit for the new stakeholders' expectations. This study uses sustainable supply chain management and blockchain technology as positioning literature.

**Management Contributions:** The study provides an overview of how fishery supply chains would work by incorporating blockchain technology, which extends the literature about sustainable supply chain management and proposes paths for actions for policymakers in order to make them improve the business ecosystem. This study implies a practical contribution to global value chain perspective and the discipline of business.

### INTRODUCTION

Sustainable development goals (SDGs) of the United Nations (2015) conduce us to think in terms of how daily decisions, both organizational and individual ones, may affect social, environmental, and economic

concerns. As complex as it may seem, we must connect all the systems already involved in our common behavior, broadening our sight (Rimanoczy, 2017), in order to achieve a complete understanding on how an action or decision within the entire ecosystem triggers predicted outcomes, as well as unexpected ones

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(Ryan, 2019), and how to manage the appearance of potential negative trade-offs between sustainability and organizational development (Cordova & Coronado, 2021). Hence, fueling a car in the gas station connects the consumer with those shipping lines that brought the oil from some middle-East country, in the same way that buying tulips in a flower store can connect the same consumers with airplanes' refrigerated containers that brought them from some part of Europe. On the other hand, buying sneakers in a luxury shopping mall could be related also with exploited under-age labor, as well as open a bag of vanilla cookies could be linked to some desperate farmers trying to turn off the fire in their fields, which were badly damaged due to informal palm oil production interests.

The latter situations drive to the following questions: how trace and follow all the connections within global supply chains? How could this increased visibility provide sustainable solutions and performance advantages to supply chains' participants? However, it seems almost impossible to be fully aware of all the decisions and actions every day and every time within supply chains. In order to solve this problem, technology rises above, providing devices and mechanisms that allow a broader sight and awareness of the extent of daily activities and their consequences in the entire system.

Digital transformation is rapidly embedding itself in almost every organizational activity, generating a torrent of disruptive changes, which must be properly faced by managerial practices and processes (Schweitzer, Handrich, & Heidenreich, 2019). Due to this digital revolution, as well as the preference of supply chains configuration as better to compete rather than merely isolated actors (Cooper, Lambert, & Pagh, 1997), these supply chains are evolving faster, changing the way how connect suppliers, producers, and customers through a sequence of logistics efforts and imprinting them with sustainable and innovative practices (Carter & Rogers, 2008; Seuring & Müller, 2008; Gonzalez-Perez & Leonard, 2016). Novel technological driven mechanisms, such as blockchain, emerge in order to secure data and to facilitate a reliable traceability of goods (Hald & Kinra, 2019), overcoming traditional systems' failures on this. Hence, blockchain permits supply chains to give additional and relevant information to all their participants, as well as provides sustainability features according to stake-

holders' expectations (Hartley & Sawaya, 2019). Furthermore, this traceability needs to fit for goods industries and for services ones, pushing up their requirements in order to support a well-informed buyer and enhance consumers' experiences. Seafood sector is one of those which lacks of this visibility across its supply chains, as well as traceability of its operations, leaving room for negative practices such as illegal fishing, mislabeling frauds, and workers' rights violations (Fish 2.0, 2017a). In addition, seafood sector has been rapidly growing and becoming highly attractive for investors due to its high-protein feeding potential, its accessible market prices, even to poorest population, and its production costs, which are lower than livestock and others (Fish 2.0, 2017b).

Blockchain technology (BT), as a part of this digital transformation, turns into a disruptive new challenge for connectivity across sustainable supply chains, specifically for the fishery industry, which would lead to high-quality gastronomy services in the hospitality sector, enhancing local businesses through leveraging an international business driver such as supply chains. Thus, a discussion about how blockchain is capable to provide digital advantages to fishery supply chains' outcomes would provide valuable insights for policy-makers, academics, and practitioners related to the field of sustainable supply chain management and international business, as well as for the fishery industry itself.

Furthermore, decision-making processes could focus on supply chains' operations in order to fulfill their stakeholders' expectations regarding a well-informed consumers' experience in the gastronomic activity, improving hospitality sector whole performance. Hence, the main purpose of this paper was to discuss how BT would incorporate several changes in the fishery supply chains, in order to make them more reliable and sustainable. Thus, the study answers the following research question: how BT could enhance traceability into fishery supply chains, as well as provide competitive advantages to supply chains' participants?

To answer the previous question, a qualitative research method with a descriptive approach was used. The data collection instruments are an extensive literature review from secondary sources such as reports and written and digital documents and papers.

The sections of the article are organized as it follows. Besides this first one, the second section enrolls

the theoretical discussion about supply chain management of the fishery industry, sustainable supply chain management, and blockchain studies in sustainable supply chains and international business. The third section briefly explains the methodology used in the study, describing the sources of data and instruments utilized in the process. The fourth section describes the context and background of the study regarding fishery industry, focusing on how relevant its supply chains are for the current global economy. It also includes the background for global sustainability trend across supply chains management, as well as for technological revolution advancements in supply chains operations. The fifth section aimed to discuss the results of the study under the conceptual perspectives developed in the third heading. Finally, the sixth section presents the conclusions of the study and proposes new paths for further research.

## **1. LITERATURE REVIEW**

### **1.1. Fishery supply chain management and sustainability**

Supply chains concept evolved from simple transportation in the 1950s, passing through a physical distribution approach, then into business logistics perspective, to arrive finally on the 21<sup>st</sup> century under a complex system named supply chain (Southern, 2011). Supply chains are orderly sequences of processes, which are deployed by three or more organizations involved in the upstream and downstream flows of goods and services, as well as money and information, from a source to a destination (Mentzer et al., 2001). Being aware of the multiple connected processes that are under supply chains' scope, as well as coordinating functions and tactics within these supply chains, they provide organizations with a broad vision in order to gain competitive advantages, improve their overall performance, and operate according to global scale demands (Mentzer et al., 2001; Fontalvo-Herrera, De La Hoz-Granadillo, & Mendoza-Mendoza, 2019).

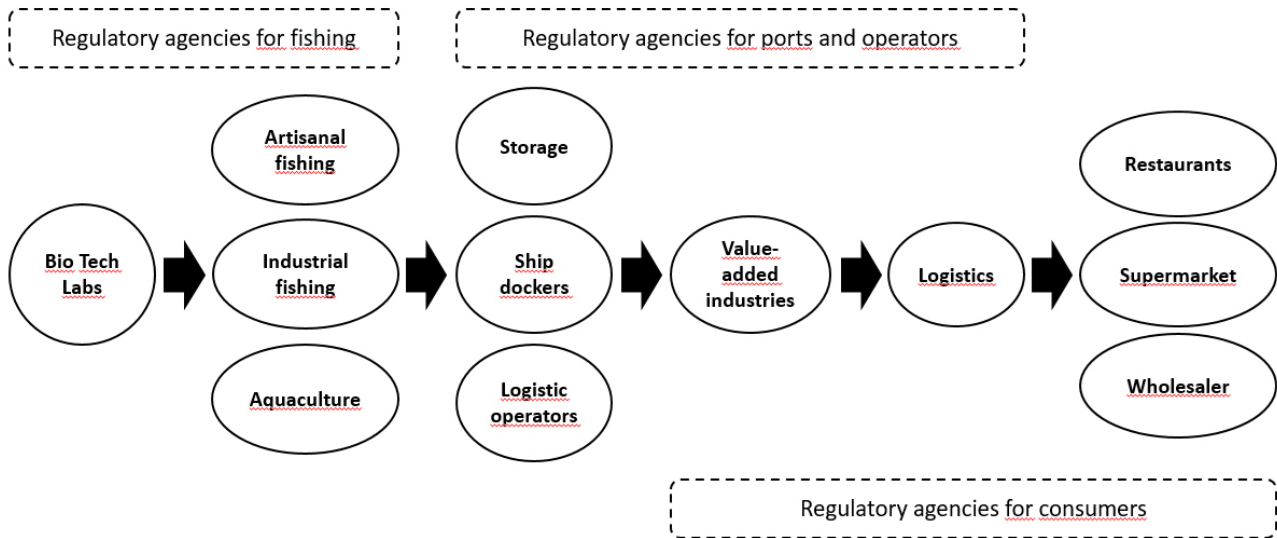
Supply chains are continuously evolving across time, responding to new consumers' needs and stakeholders' expectations. Worldwide common concern about climate change and environment detriment encourages supply chain leaders to incorpo-

rate practices oriented to reduce carbon emissions of logistics activities (Lloyd, 2011; Fritz & Cordova, 2021). Nevertheless, including pro-environmental practices into supply chain processes derives in what is known as green supply chain management, without special focus on social concerns or economic growth (Fritz, 2019). Hence, adding social and economic perspectives would provide a complete sustainability approach for supply chains decisions and main activities (Gonzalez-Perez & Leonard, 2013, 2016), in which all participants have to work together towards a common sustainable purpose (Cordova & Gonzalez-Perez, 2019).

According to Fish 2.0 (2017a) and Moga (2017), seafood supply chains begin at regulatory agencies (which are actually present along the supply chain) and biotech labs which provide regulations and quota, and fish seeds, respectively, acting as primary drivers for the initial phase of fishery activity. As a second step, capture and production organizations are responsible for extractive and aquaculture processes. Then, different intermediaries collect sea products from these producers, in order to storage and move them across the supply chain, heading for organizations that add value through industrialized processes. To do this, these intermediaries need the proper infrastructure, vehicles and tanks in order to maintain the cold chain that ensures products' safety and adequate conditions for transportation in case of live seafood. After the preparation of value-added products, other intermediaries take the responsibility of transport seafood to its final destination (restaurants, wholesalers, supermarkets, etc.) using different transportation modes such as cargo airplanes, container ships, or refrigerated trucks. Sometimes after seafood reaches wholesalers, they resell them to other small markets or small not specialized restaurants. Figure 1 shows how these participants take their roles as a sequence in the seafood supply chains.

### **1.2. Potential effects of blockchain into seafood sustainable supply chains and international business**

BT is defined as a decentralized reliable system that ensures valuable information availability, collective maintenance, and transactional security, which are the reasons of its attractiveness for governments



Source: Own elaboration based on Fish 2.0 (2017a) and Moga (2017).

**Figure 1.** Seafood supply chains and their processes sequence.

and several economic sectors (Wang & Yuan, 2016). This decentralized system operates under immutable information protocols in order to deliver reliable data, as well as entire-scale distribution over operational networks (Zheng, Xie, Dai, Chen, & Wang, 2017). Hence, blockchain would be itself a powerful innovative mechanism to keep and trade data. Hald and Kinra (2019) argued that BT enhance specific supply chain processes such as traceability, innovation, and contract management. Moreover, according to Catalini and Gans (2016), BT allows recording data and sharing it easily in order to enhance verifiability processes. Due to this, it also encourages a more flexible contract design among supply chains' participants, increasing the amount of business activities (Tinn, 2018; Cong & He, 2019).

Moreover, many economic sectors need technological transformation and higher innovation levels, such as the incorporation of BT, in order to find new paths for global growth (Kizildag et al., 2020). Previous studies have exhibited the relevance of blockchain to leverage trust along supply chains, enhancing traceability and providing valuable information to their stakeholders (Borrero, 2019; Saberi, Kouhizadeh, Sarkis, & Shen, 2019), preventing losses, securing seafood quality, and improving customers' satisfaction (Sultan, Routroy, & Thakur, 2020). Hence, current trust concerns about piracy, slavery, abuse, among other across fishery supply chains would be tackled

by BT features related to resourcing and fundraising initiatives towards cleaner oceans and well-integrated seafood supply chains (Howson, 2020).

One of the most representative industries in the economy is the fishing industry. Seafood is currently the world's largest traded food commodity. The global seafood sector is \$ 390 billion dollars and it grows rapidly with a projection of 196 metric tons by 2025 (Jain, 2019). Nowadays, this industry becomes attractive for investment due to the global interest in its sustainable products and its contribution of protein and omega 3 for the human diet (Sagun & Saygi, 2021). However, the growing demand for sustainable seafood, food regulations, changing consumer preferences and increasing competition has a direct effect on incorporating new technology systems into the supply chain to identify, track and verify in real time the goods' origin (Takeno, Okamoto, Horikawa, Uetake, & Sugawara, 2008; Mai, Bogason, Arason, Árnason, & Matthíasson, 2010; Jose & Shanmugam, 2020).

There are three main reasons why seafood companies are incorporating more technology in their processes. Firstly, it meets the demands of new consumers (Sigurdsson et al., 2022); secondly, it improves the company's image by promoting sustainable business practices and transparency in operations as requested by international standards (Holm, Buck, & Langan, 2017; Koričan, Perčić, Vladimir, Soldo, & Jovanović,

2022); and, thirdly, it allows the incorporation of new management skills, generating competitive advantages (Parenreng, Pujawan, Karningsih, & Engelseth, 2016; Nguyen, Nguyen, Deligonul, & Cavusgil, 2017).

Therefore, a first element in meeting these sustainable supply chain demands is innovation. One of the innovations implemented in the fishing industry is the incorporation of BT into the supply chain to overcome logistical deficiencies and improve overall performance (Sengupta, Narayanamurthy, Moser, Pereira, & Bhattacharjee, 2021). The fishing industry has been characterized as an inefficient industry due to the lack of transparency and monitoring, and limited product traceability from point of origin to destination. These inefficiencies have caused the appearance of illegal, unreported, and unregulated fishing, as well as smuggling (counterfeit) and exploitation of workers (Fang & Asche, 2021; Longo et al., 2021). In this sense, BT modifies the business approach by allowing the connection of all chain levels to exchange and/or share information across the network in a decentralized manner and supporting a networked supply chain which would be a key element to business performance (Wang, Zhang, Ying, & Zhao, 2021).

Moreover, as soon as a transaction is made within seafood supply chains, information regarding it is broadcasted as a block, flowing immediately to all network participants, which can approve it or not, building the blockchain of sequential information and receiving updates of all executed transactions (Howson, 2020). Thus, without BT, information would not be fully available for all, and this situation could become an obstacle for business efficiency. Therefore, BT provides the possibility to verify the data recorded between one supply-chain actor (level) and another, and also blockchain records transactions and any changes to data from each supply-chain actor links to the entire historical chain. Likewise, with this technology, users have a single source of information (tamper-proof), and smart contracts will track data in real time across the supply chain (Saber et al., 2019). This technology would also provide direct interactions among parties promoting confidence and trust with no intermediaries. However, it will require broad participation by all supply-chain actors, who are often found in geographically, economically, and socially disparate groups (Cook, 2018), as well as proper

regulations to ensure fair trade conditions and business ethics compliance (Dierksmeier & Seele, 2020). Hence, BT would improve traceability of products and transparency of information in the logistic network to help combat fraud, illegal and unethical fishing practices, and exploitations of workers (Cook, 2018; Kshetri, 2019; Bran, 2020).

In addition, implementing BT across the supply chain of the fishery industry ecosystem will provide some additional benefits, such as protection of public health, increase and improve trade, promote sustainability practices, increase consumer trust, and improve quality of services and products, the image of the business, and regulatory compliance (Cook, 2018). According to Kshetri (2019), other key advantages of blockchain solutions in international trade include faster settlement of international payments, faster access to working capital financing at cheaper rates, and availability of one-stop solution for all needs related to international trade.

Moreover, depending on how and when a BT is implemented, some other benefits emerge, such as significant cost reduction (no intermediation and significant paperwork reduction), faster secure transactions, reduction of information recorded by customers, and transparency (traceability and verification) across the supply chain (Dai & Vasarhelyi, 2017; Weking et al., 2019). Hence, another advantage is having decentralized transactions relaying on individual organizations rather than from a centralized unit. Consequently, stakeholders would have more participation and execute control over transactions. The transparency of all information ensures security while promoting trust among members of the system (Zhu & Zhou, 2016), prompting autonomous organizations coordinated by smart contracts.

## 2. METHOD

Multidimensional studies in international business such as supply chain management and new dynamic topics in a globalized world have new opportunities of analysis through qualitative methods (Birkinshaw, Brannen, & Tung, 2011). This is a qualitative study, using an exploratory method with descriptive approach, that presents an analysis related to a recently-studied subject through data collection of an event or phenomenon of recent interest (Hernández-Sampieri &

Mendoza, 2018). The study uses an inductive method, in which researchers start from particular or concrete facts in order to reach conclusions (Hernández, Méndez, Mendoza, & Cuevas, 2016). The descriptive scope helps to specify properties, characteristics and profiles of the phenomenon under study. This kind of studies allows researchers to capture deeply richness of a phenomenon (Arino, LeBaron, & Miliken, 2016). The paper uses secondary data, which came from the literature review about previous studies such as official reports and written and digital documents and papers. Reports from Deloitte and McKinsey, databases and resources from Fish 2.0 Initiative about the sustainable seafood sector, and some initiatives from the World Wide Fund for Nature (WWF) were consulted as main secondary sources of information. Other studies about BT, supply chain at the fishery industry and sustainable practices from scientific papers support this study. After data collection, a content analysis was conducted to process all data and interpret results.

According to Corley and Gioia (2011), a literature review in qualitative studies have theoretical contributions regarding originality and utility — the second one since it implies scientific contribution to the field of study and practical implications for managers and organizations. In this regard, BT becomes an element in the supply chain when connecting bones in all the network. The contribution and practical implications in IB are to global value chain theory.

The origin of the global value chain theory was provided by Gereffi (1994, 1999), with important contributions about globalization and inter-connectiveness to focus on inter-firm relationships rather than relations between center and periphery states (Strange & Humphrey, 2019). In other words, Gereffi focused on the way different external activities or elements such as blockchain technology can be coordinated in order to improve different activities in the global value chain (GVC). “The GVC literature is thus particularly strong on the upgrading strategies (product, process, functional and inter-chain) pursued by small firms in developing countries” (Strange & Humphrey, 2019, pp. 11).

The contributing value of this study is in the qualitative findings, from the interaction with different stakeholders and the use of BT along the fishery supply chain (Cordeiro & Olsen, 2021). The literature re-

view focused on the new implications of technology and innovation in one industry. Data collection from secondary data supports the practical implications of technology in organizations and industries. This study contributes to the knowledge in managerial and international business disciplines and the application and impact of BT in the global value chain.

### 3. CONTEXT AND BACKGROUND

Fourth industrial revolution advances forces firms to focus on main pillars such as environment adaptability, human capital, markets, and innovation, in order to boost their long-term global competitiveness (WEF, 2019). According to Barringer and Harrison (2000), firms tend to establish several forms of inter-firm relationships that allow them to work together, through valuable connections with other firms, even in the same industry. Following this, firms find new opportunities for competitiveness as groups, rather than isolated individuals (Lambert & Cooper, 2000). These collaborative structures formed by organizations which share sequential processes, known as supply chains, need to add sustainability practices in order to address stakeholders’ demands and global concerns (Gonzalez-Perez & Leonard, 2016). According to the World Bank (2018), in its Logistics Performance Index report, countries ranked in the upper quintile of logistics performance stated sustainability practices as a very important issue.

The Sustainable Development Agenda of the United Nations has organized the major global concerns under 17 SDGs (United Nations, 2015). Of those, two of them would have a direct relationship with the fishery industry:

- zero hunger (SDG No. 2);
- life below water (SDG No. 14).

According to United Nations (2015), by 2030 fishers need to double their production, as well as agriculture systems, in order to provide enough food for world’s population. Furthermore, lives and livelihoods of all are increasingly threaten, while oceans ecosystems are exploited and suffering a biodiversity diminishing. Human activities such as overfishing, pollution and carbon emissions are dramatically affecting sea life, and generating undesired climate changes too (United Nations, 2020).

Global climate change and global crises are reorganizing how all Earth's ecosystems are functioning, pushing fishery industry to rethink management strategies, adding a changing ecosystem perspective rather than only a life cycle one. Furthermore, as well as introducing ecosystems change into managerial decisions, nowadays efforts to rebuild marine ecosystems have to be observed under a historically perspective, aiming to recover depleted or reduced species from their original productivity levels (Rosenberg et al., 2005).

According to the United Nations Conference on Trade and Development (UNCTAD, 2020), COVID-19 crisis is an opportunity to replenish those fish stocks, while supply chains are partially constraint, as well as hospitality sector businesses. Moreover, an additional challenge for this is that seafood sector's supply chains are usually fragmented, including several intermediaries, which turn them into complex and diffuse operational systems, in which data is scarce, and processes are inefficient (Fish 2.0, 2017b). This fragmentation of seafood's supply chains carries out a serious limitation regarding human's capability for control and inspections inside a large ocean, where thousands of global samples are mislabeled and millions of tons of fish are discarded every year (Purkayastha, 2019), generating losses for the industry for approximately \$ 10 B–\$ 23 B per year, basically driven by illegal, unreported, and unregulated activities in the seafood sector (Fish 2.0, 2017a). Some of these illegal activities include protected species caught and exceeding the allow catch quotas (Reporte Indigo, 2020).

Because of these ocean ecosystems' needs and seafood supply chains constraints, several governments, as well as private sector organizations, have conducted technological initiatives in order to facilitate different sustainable practices. According to Crónica Pesquera (2020b), BT could be warehousing important data related to tuna fish journey through seafood supply chain, from the caught moment in boats to supermarkets and customers' hands, using radio frequency identification (RFID) and quick response (QR) labels at different points across supply chains. This project, led by an organizational joint effort among the WWF, ConsenSys, TraSeable Solutions, and Sea Quest Fiji, resulted in a considerable reduction of illegal practices and the stop of abusive

labor conditions in the tuna industry (Reporte Indigo, 2020). Another example is the company Earth Twine and Provenance, which aims to allow a tamper-free auditing through all supply chains' processes and enhance the tracking of Yellowfin and Skipjack tuna journeys in Indonesia from the ocean to the consumers, respectively, using BT (Provenance, 2016).

In addition to this, BT may drive to do smart contracts within supply chains' partners, leveraging consignments quality conditions through a series of sensors which would read for quality along supply chain operations, checking consignments as soon as ownership transfer occurs. Following this, the use of sensors, identification tagging, and well-established points of checking would enable recognition of ownership transfer, locations, timestamps, and verification procedures (Purkayastha, 2019). Finally, according to Kehoe, O'Connell, Andrzejewsky, Ginder and Dalal (2017), BT turns into a powerful ally for fishery supply chains due to its capacity to deliver traceability, compliance, flexibility, and stakeholder management, through real time applications related to auditability, immutability, smart contracting, and disintermediation, respectively. These features combined aim to solve main issues in seafood supply chains regarding unsustainable and illegal practices.

On the other hand, even when technological applications tend to increase seafood supply chains operations' efficiency, some of them could derive on more detrimental for oceans' ecosystems. Global positioning systems (GPS), as well as other technological devices to trace fish groups, can be harmful for the stock lives in the ocean, even though allowing fishing fleets to double their caught capacity every 35 years (Crónica Pesquera, 2020a). In addition to this, introducing technological improvements into seafood supply chains such as BT may cause high expenditures levels, which could turn into a serious constraint for some countries which lack the funds to afford such an investment (Reporte Indigo, 2020).

#### 4. RESULTS AND DISCUSSIONS

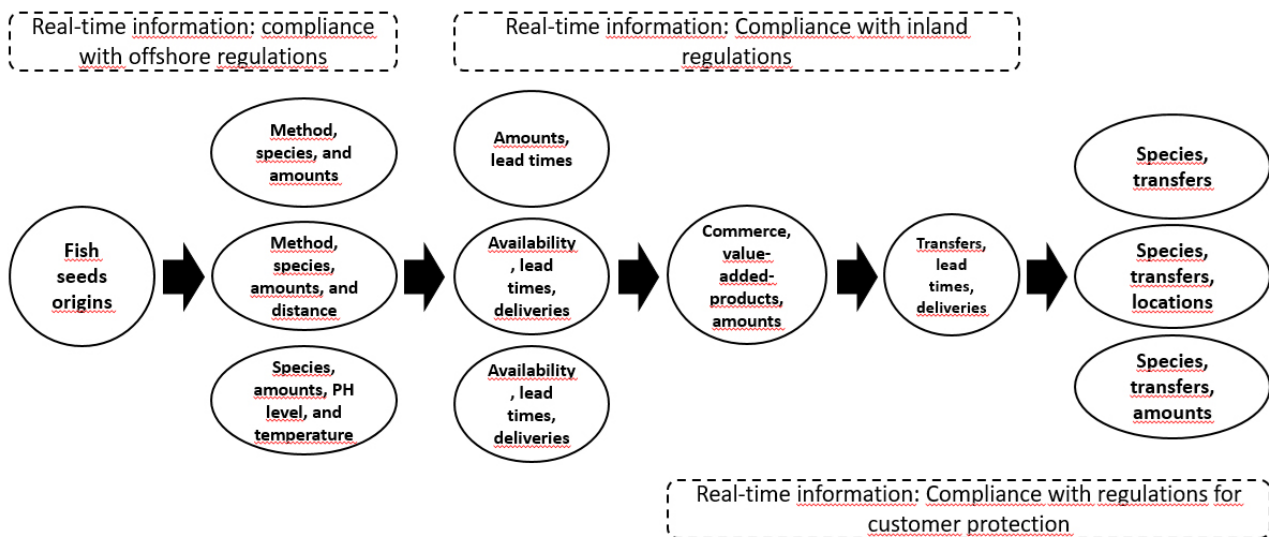
Following the conceptual discussion of this study, it seems that BT is a mechanism of the digital revolution capable to tackle several fishery supply chains issues, mitigating their constraints and boosting their operational activity, as well as their

data integrity. Ensuring the conservation of data and facilitating a proper distribution of it through the entire supply chain may generate strategic benefits at an individual level and for the whole network too. Hence, Figure 2 exhibits how the incorporation of BT would enhance several seafood supply chains parts through traceability, visibility, and additional valuable information.

Figure 2 follows the same structure as Figure 1, showing how BT can enhance fishery supply chains' individual processes, delivering cross-sectional benefits to the whole system. According to Figure 2, blockchain is capable to trace the origin of fish seeds from the biotech labs and, then, identify capture methods, caught species, distance from the coast at the moment of fishing, and water tank characteristics such as pH levels and temperature, providing real-time information to offshore regulatory agencies. In addition, blockchain allows the traceability of transported amounts, transportation availability, executed lead times, and deliveries made by logistic operators and warehouses, in their way from ports to manufacturers of value-added sea products identifying the information of commercial transactions. Blockchain also permits to trace ownership transfers, executed lead times and deliveries made by transportation services that enable the product flow from manufacturers to the end of these supply chains, providing real-time information to inland

regulatory agencies. Finally, blockchain enhances shared visibility for what is happening with sea products as soon as they reach their destination: restaurants, supermarkets, and wholesalers. At this point, BT is capable of distributing to all network participants the information related to species consumed, ownership transfers, locations where transactions are made, and the amounts of trade, maintaining the traceability of sea products from the very first stage of fish seeds (in the case of aquaculture) or fishing vessels, to the final point of consumption.

This potential traceability that blockchain has would be impossible to achieve without RFID devices and QR labels, that allow quick identification, the information registers for every transaction (Crónica Pesquera, 2020b; Reporte Indigo, 2020), and the use of sensors, identification tagging, and accurate checkpoint along the supply chain, allowing the recognition of ownership transfers, host locations for transactions, and timestamps (Purkayastha, 2019). Moreover, Figure 2 demonstrates how including strategic checkpoints inside fishery supply chains in which valuable data would be extracted, can integrate the functions of seafood supply chains, incorporating auditability, immutability, smart contracting, and disintermediation features (Kehoe et al., 2017). Finally, having this traceability of lead times, deliveries, availability of transportation services, and capture methods across the supply chains



Source: Own elaboration.

**Figure 2.** Blockchain intervention inside seafood supply chains and their processes sequence.



would facilitate the identification of illegal practices, slavery, and other unsafe conditions for workers (Kehoe et al., 2017; Cook, 2018; Kshetri, 2019; Bran, 2020), providing trust and confidence into the supply system (Zhu & Zhou, 2016) through the distribution of reliable and valuable real-time information, even also to the regulatory agencies in the business environment.

## CONCLUSIONS

Blockchain represents a technological mechanism that allows the integration of the information and the sustainability achievement in fishery supply chains. BT is capable to provide strong procedures to ensure data gathering and real-time information distribution to all the participants in the seafood supply chains. As long as blockchain allows this, it would facilitate the international commerce. Hence, increasing speed and efficiency, reducing fraud risks, increasing access for financial resources, and reducing international commerce costs would derive in a digital and transparent international business strategy (Kshetri, 2019).

Blockchain makes possible to keep a closer eye on key activities involved in international business such as the flow of goods, documents, and information. Hence, this technology can help the fighting against global frauds. Other key advantages of blockchain based solutions in international business activities include faster settlement of international payments, faster access to working capital financing at cheaper rates, and availability of decentralized solutions for international trade's requirements, which all together allow boosting services' performance. Due to this, seafood supply chains would be benefited by global traceability, which would enhance their international reputation, as well as make possible more efficient transactions.

Moreover, traceability is actually considered as a high-positive feature in the fishery supply chains, in which information is actually hidden, disperse and fragmented. The fragmentation of supply chains operations leads to the same for their information. Hence, blockchain acts as a reliable enabler of logistics activities integration, establishing strategic checkpoints across the fishery supply chain, and extracting real-time information for its participants'

decision-making processes, as well as for regulatory agencies auditing procedures. By providing transparency and traceability, blockchain can be part of the answer — providing full transparency and traceability, which are required for rewarding responsible and ethical manufacturers — and put against the ropes which behave illegally or unethically within the supply chain. Thus, following Saberi et al. (2019), the results of this study contribute to shed light about how fishery supply chains could overcome operational traditional barriers while adopting BT.

Even though blockchain could provide several benefits for seafood supply chains operations and strategy, technological advances could carry negative scenarios too. For instance, how digital revolution generates the over capture procedures in the ocean, the lack of appropriate regulation for BT, devastating entire fish and other sea animals' populations, as well as security risks related to information losses over supply chains, are topics that were not solved yet. Hence, besides BT, further research on other digital mechanisms applied on supply chains would shed light about new strategic checkpoints and business advantages and risks within supply operations. Also, additional research is needed in order to fill the gap about how much technology to incorporate is safe until it would represent a serious danger or threat for sustainability practices. Further research could help academics to find this threshold in which technology seems to be negative and understand which key factors are related to it.

Finally, this study contributes to the knowledge in managerial and international business disciplines and the application and impact of BT in the global value chain. Our results build upon global value chains literature emphasizing how highly-demanded features such as traceability and transparency could be achieved using BT, and also proposes an assessment framework that allows to analyze fishery supply chains in detail.

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## **ALCANÇANDO A TRANSPARÊNCIA POR MEIO DO BLOCKCHAIN: SUSTENTABILIDADE DA GESTÃO DA CADEIA DE ABASTECIMENTO DA PESCA**

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### DETALHES DO ARTIGO

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*Blockchain*

Inovação

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### RESUMO

**Objetivo:** Este artigo teve como objetivo discutir como a tecnologia blockchain incorpora diversas mudanças nas cadeias produtivas da pesca, a fim de torná-las mais confiáveis e sustentável. **Método:** Trata-se de um estudo qualitativo, com método exploratório e abordagem descritiva. Além disso, a revisão de literatura apresenta contribuições teóricas sobre a utilidade. **Principais resultados:** O estudo destaca a importância de incorporar características do *blockchain* em cadeias de abastecimento de frutos do mar. Considerando que essas cadeias de abastecimento estão atualmente fragmentadas e apresentam falta de informações em tempo real, o estudo foca no seu potencial de rastreabilidade para melhorar as operações e os resultados das cadeias de abastecimento da pesca. Ele identifica uma sequência de checkpoints estratégicos que fornecem informações em tempo real usando blockchain em cadeias de suprimentos de pesca. **Relevância / Originalidade:** Este manuscrito apresenta o diagrama de uma cadeia de suprimentos de frutos do mar considerando como o blockchain permite a coleta de dados em cada etapa para fornecer rastreabilidade à cadeia de suprimentos. O estudo serve como um mapa, bem como um modelo, para futuras pesquisas sobre como entender a incorporação de tecnologia nas etapas das cadeias de suprimento. **Contribuições Teóricas / Metodológicas:** As cadeias de suprimento suportam as operações de negócios internacionais. Além disso, à medida que a revolução digital avança agressivamente, as cadeias de suprimento precisam adaptar-se às expectativas dos novos stakeholders. Este estudo usa o fornecimento sustentável gerenciamento de cadeia e tecnologia blockchain como literatura de posicionamento. **Contribuições da Administração:** O estudo fornece uma visão geral de como as cadeias de suprimento da pesca funcionariam incorporando a tecnologia blockchain, que amplia a literatura sobre gestão sustentável da cadeia de suprimentos e propõe caminhos para ações para os formuladores de políticas, a fim de fazê-los melhorar o negócio ecossistema. Este estudo implica uma contribuição prática para a perspectiva da cadeia de valor global e a disciplina dos negócios.

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