

# **Blockchain Assimilation in Fisheries Supply Chain**

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## **Abstract**

Technology adoption remains a key driver of achieving a competitive edge over competitors, better operational effectiveness and reducing operating costs. An under researched area of technology adoption is how a technology diffuses and is assimilated throughout an organisation. We first introduce an overview of Blockchain followed by a summary of Blockchain in fisheries supply chain. Next, IT assimilation is described. Finally, this paper presents an existing IT assimilation framework that is utilised as a roadmap for the assimilation of Blockchain technology in the fisheries supply chain.

## **1. Blockchain**

Blockchain has been defined as a peer-to-peer distributed data infrastructure [1]. This infrastructure can 'store/record data and transactions backed by a cryptographic value' [2, p. 1]. Blockchain has been deemed one of the newest disruptors/innovations in the I.T. sphere. This practice has become widespread in the technology industry with some organisations created for this purpose alone [3], [4]. Blockchain is a tamper-proof distributed ledger technology (DLT) which is not susceptible to easy change. Its operation occurs in a shared environment where all the transactions are validated by users and are traceable [2]. This is done without a central intermediary. Traditionally, a ledger is a collection of transactions that usually took the form of pen and paper. More recently, these ledgers have been stored digitally primarily in databases operated by the ledger owner on behalf of clients/customers, etc. The key difference with distributed ledger technology is that control does not lie with one

actor but with several or all network participants. This differentiates it from cloud computing and data replication as these technologies employ existing shared ledgers. This affords distributed ledger technology its immutable characteristic – no single actor can amend or approve new additions to the ledger [5], [6]. The creation of Blockchain is credited to Satoshi Nakamoto, who in 2008 published an article describing a peer to peer electronic cash system that was to become Bitcoin [7]. This work built on previous concepts developed in the 1980s and 1990s by Leslie Lamport describing a consensus model built on network of computers where the computers or network may be unreliable [6].

## **2. Blockchain in Fisheries Supply Chain**

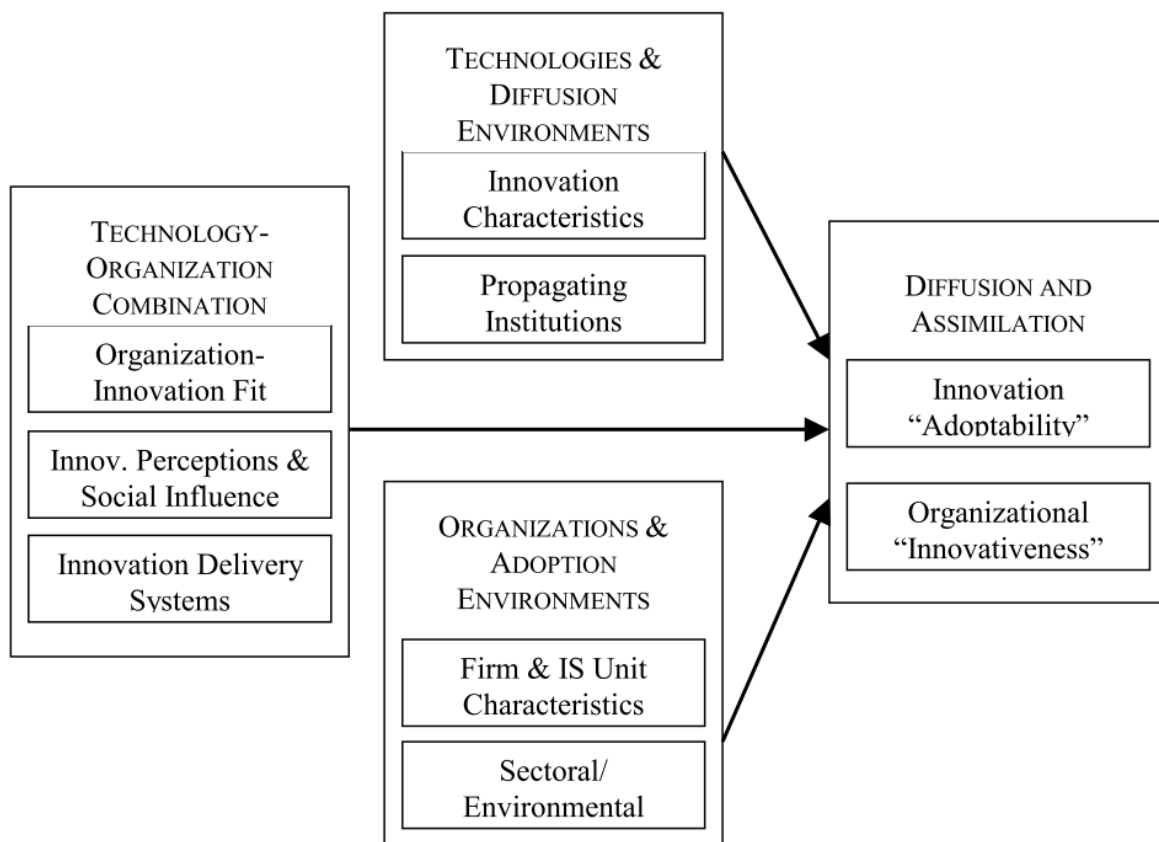
Supply chains are complex adaptive systems that incorporate a number of organisations, locations, personal and financial relationships, and interlocking phases. Supply chains are characterised by increasing complexity owing to the inclusion within the chain of suppliers, logistics, distribution, and manufacturing functions. There are a number of supply chain areas that would benefit from the application of blockchain technology such as operations, supply chain management, auditing, activity control, fraud detection, competitiveness, and logistics. Purported benefits of these applications include smart contracts, product traceability, enforcement tracking, stock control, transaction and settlement, and information immutability [8]. Fisheries supply chains are primed for blockchain utilisation. The aforementioned applications and benefits would be realised primarily because of their intrinsic complexity. Fisheries supply chains traditionally incorporate a wide spectrum of organisations, individuals, products, and processes. For example, Ireland's fishing fleet encompasses five different segments, and the fish processing industry is made up of over 160 different companies [8].

## **3. IT Assimilation**

The nature of information technology adoption is characterised by its' inherent complexity. Questions abound about determining factors, supportive strategies and mechanisms, points, and causes of failure and existing and potential barriers. In the past, several hypotheses have been proposed to explain the elements that promote information technology adoption. The technology acceptance model, the task-technology fit theory, the diffusion of innovation theory, the theory of reasoned action, the theory of planned behaviour, the unified theory of acceptance and use of technology, the technology, organisation, and environment model and

social cognitive theory are just a few of them [9]. The assimilation of information technology is another theory regularly espoused and forms a key research area as both a component of information technology adoption and as a standalone subject. Assimilation can be defined as ‘the process within organizations stretching from initial awareness of the innovation, to potentially, formal adoption and full-scale deployment’ [10, p. 1]. Alternatively, ‘IT assimilation refers to the success achieved by firms in utilising the capabilities of IT to enhance their business performance’ [11, p. 305].

#### 4. The Road to Assimilation



**Fig. 1 Factors Affecting IT Innovation Diffusion and Assimilation** [10]

Figure 1 maps out the factors affecting information technology innovation, diffusion, and assimilation. This framework’s focus can be broadly categorised into three key areas; technologies and their dissemination environments; organizations and their adoption contexts; and the intersection of technology and the organization [10]. This research is concerned with the *Technology-Organisation Combination* elements of the framework as it represents an under-researched area of information technology assimilation. This aspect of the framework is primarily interested in the factors that determine the tendency of an

organisation to adopt and assimilate a particular technology [10]. Complexity and novelty are frequently revealed to be impactful factors related to how new technology can advance. As such, the applicability of these elements of the framework are well suited for blockchain assimilation analysis.

#### *4.1. Organisation-Innovation Fit*

Many of the elements that influence innovation adoption and assimilation are not intrinsic to either inventions or organizations, but rather characterize a specific innovation-organization combination [10]. Essentially, there is no “one size fits all” when it comes to analysing adoption factors. Prior research on blockchain adoption factors in the fisheries industry has shown that in the context of the organisation, issues such as organisational readiness, top management support, technological readiness, innovativeness, business model readiness, facilitating conditions, and information intensity emerge as the key matters [8]. Furthermore, the nature of fisheries supply chains, geographically dispersed with numerous individuals and organisations, makes the decentralised nature of blockchain an attractive approach.

#### *4.2. Innovation Perceptions and Social Influence*

Prior research on innovation perceptions and social influence have shown that the perception of the innovation by the potential adopters is one of the main determinants of adoption [12], [13]. Further research has demonstrated that innovation perceptions operate on two different planes. The most common strand of research views the perceptions of leaders and key decision-makers as the primary determinant. A less examined view is that of the preference of individuals to use the innovation and the extent to which the innovation is acknowledged by users [10]. Blockchain is a salient example of an innovation that carries some negative perceptions. This primarily emanates from external factors like power consumption linked to climate change concerns and the negative connotations associated by some with cryptocurrency.

#### *4.3. Innovation Delivery Systems*

The innovation delivery system refers to how the implementation is supported and managed for the specific innovation. Prior research in this area has tended to focus on issues such as ‘the degree of top management support and technology championship, the level of training

and other resources invested in organizational learning and the extent to which the facilitating mechanisms developed by propagating institutions' [10, p. 19]. A neglected area of this aspect of the framework which applies to blockchain technology is the actual technological delivery system. Cloud computing and blockchain integration has been proposed as the facilitator of the new age of data security and service availability [14]. A number of key areas that emerge include interoperability, data encryption and data management. Interoperability in this context refers to inter-node communication thus enhancing transparency and authenticity. Data encryption refers to the ability of blockchain nodes to 'maximize data availability and data validity by projecting it as an on-demand service with no downtime' [14]. The combination of cloud computing and blockchain enables structured data storage, access, anonymity, elasticity, and on-demand service [14].

## 5. Conclusion

The use of blockchain in fisheries supply chains has been garnering increasing interest. As a complex technology being utilised in a complex business environment. IT adoption, diffusion and assimilation are crucial success factors. This technical brief proposed a potential avenue for future research in the domain of information technology diffusion, and assimilation. The utilisation of an established framework opens up future directions of research in the wider area of Blockchain assimilation. Furthermore, this may be utilised to solve the specific problem of Blockchain assimilation in fisheries supply chains.

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