Dizistics Puts Face on Benefit — Stay Ahead of Air Cargo Business Model

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***Abstract*—As global economic and technological development continues to reshape the air cargo industry, various technologies have developed effectively to diversify air cargo services, simplify processes, and optimize resource use in line with digitization. A developing peer-to-peer system where decentralized-computer-terminal participants, referred to as block chain and also known as distributed ledger technology (DLT), enables exchange-and-verify real-time data and information; requests, direct contracting between members of its' network without employing conventional intermediaries. Objective of this research is to develop and ascribe to Dizistics to utilize block chain technology and present a primary concept for continued development of Dizistics for new air cargo business flow, changing interplay with stakeholders, and building efficient key-value, confidence, and automated transactions by eliminating air freight forwarders, intermediaries, in the air cargo transport sector. The output of this research at the preliminary stage of exploration is how Dizistics concept could be applied and then facilitate the development of a new air cargo business model. This research provides a new understanding overview of how block chain technology, applied to Dizistics, impacts several dimensions of the air cargo business model by decentralized financial and data transaction, peer to peer network, smart contracts, and trustworthiness of digital records and real time data exchange and proceeding.**

***Index Terms*—Air cargo, block chain technology, Dizistics, freight forwarders, peer to peer network.**

I. Introduction

Air cargo volume has increased over the last decades. IATA (2018) expects 62.5 million tons of air cargo in 2018, a 4.5% increase over the 59.9 million tons in 2017; the value of goods air cargo carried is expected to exceed $6.2 trillion in 2018, representing 7.4% of world GDP; and IATA expects this growth to continue due to huge potential of e-commerce in the near future [1]. In this regard, digitization in the air cargo industry became a most important key enabler, increasing the value of the air cargo transport service to shippers through development of innovative services and solutions.

The traditional practice of air cargo transportation requires air freight forwarders to perform as a leading actor with its fundamental functional roles: booking space on airlines; preparing shipping documents, such as airway bills as an appointed agent of the airlines; sharing relate information and documents with shipper, consignee or their agents; arranging insurance, customs brokerage, and inland transportation from a point of origin to final destination; as well as provide relevant value-added services. To act practically as intermediaries in an era of e-commerce, proper sharing information and developing relate technology is a prime task from an air freight forwarder's perspective. According to Coyle, Bardi, and Novack [2], not only logistics service providers but also air freight forwarders have considerably cut off their asset base, cost of operating, and improved their key functional areas in order to improve in these fields over the last decades.

There is continuous research and discussion with regard to digitization in the area of air cargo transportation, as to what models and technologies can effectively diversify services, simplify process, and optimize resource use in line with digitization. The main subject of this research comes from those discussion forms.

In air cargo transportation, key stakeholders are leading to facilitate development in IT systems and enlarge the field of services: all-in-one cloud-based booking platform that brings air freight forwarders' customers online and process booking, issuing airway bills and tracks their shipments; Radio-Frequency Identification (RFID) has improved air cargo monitoring and RFID tags are used in controlling cargo location movement, detecting tracking data discrepancies to prevent any waste on passage; with regard to paperless e-freight and e-customs, the International Air Transport Association (IATA) launched an e-freight project in 2007 that aims to eliminate more than 30 documents generated and used by related parties involved in air freight chain, paper-free air cargo operating processes by implementing regulated data exchange and standardized electronic messages [3]. The Internet of things (IoT) not only constantly communicates with air freight handling devices for maintaining and commanding, but provides timely inventory management information over a social network medium [4].

According to Monterio [5], in spite of IT infrastructure and data governance structures, several security concerns and risks still exist: continuous monitoring, effective standardization, and internal controls. These require system reliability and cyber-attack detection. A recent spike in digital freight forwarders' cloud-based platform offers several advantages to users: variety of price/performance levels, estimated scheduling and routing/ lead time; shipments booking and tracking; as well as calculate freight charges. However, Moore [6] insisted the lack of improvement still exist to wide use due to multi-step in process, multi stakeholders in supply chain, as well as multi-payment steps and participants involved along the process of settlement. Murphy and Daley [7] reported barriers to electronic data interchange (EDI) usage by air freight forwarders, most

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important barriers involves high setup cost and incompatibility of hardware/software among trading partners.

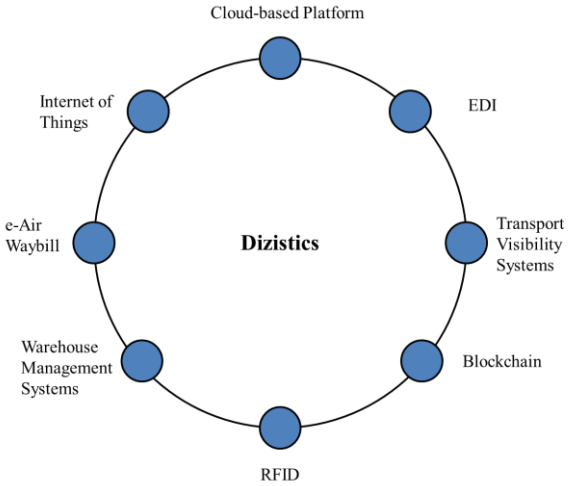

Fig. 1. The major element of technologies in Dizistics for sustainable development of air cargo business industry

As noted earlier, global economic and technological development continues to reshape the air cargo industry. In this regard, this research presents the Dizistics concept to streamline the existing air cargo business flows and overcome the multiple challenges in today's competitive air cargo industry. Lim [8] defines Dizistics (Digitization + Logistics) as "digitized logistics management in planning, implementation, and control of transport and valued added activities while ensuring efficiency along the supply chain by using advanced digital technology." This study adopted and modified Lim's framework for the concept of "Dizistics."

Fig. 1 shows, the major technologies and digitized solutions Dizistics allows: real-time exchange of information, data and related documents; requests and executions; and direct contracting and freight charges settlement between key air cargo service providers and users without engaging any intermediaries (e.g., air freight forwarders and air cargo service providers) makes sustainable development of air cargo business industry.

A. New Air Cargo Logistics Business Model

Tapscott [9] reported that block chain transforms not only the way to organize and manage businesses but also enables supply chain stakeholders to eliminate transaction costs, effective resource utilization, and vertical integration within supply chain. Additionally, block chain can offer solutions for structural problems [10] of existing air cargo business models. Polim, Hu, and Kumara [11] also insist that block chain is an appropriate technology for when negotiation and search of logistics contract due to every service air cargo service users allow accessing the pricing policy here decentralized and transparent ledger. This research is motivated by these competencies and characteristics of block chain, and they can add value to air cargo industry. Consequently, this research focusing on development of attributions of Dizistics utilizing block chain technology and suggest an applicable primary concept for setting new operational flows and streamlining interaction among stakeholders while building credibility and trust by eliminating air freight forwarders, middleman in air cargo transport chain. Specifically, this research investigates following research questions:

(RQ1) Is it possible to design a solid alternative, such as Airbnb service, to replace legacy air freight forwarders and its' service?

(RQ2) How will block chain technology develop the air cargo business flow?

This research proposes a theory development that relies on theoretical framework and literature review. The research proceeds as follows: detailed examination of the concept of Dizistics, whether it is applicable to air cargo business as a new option; practical block chain transaction in air cargo business; and conclude the research by discussing the implications of this research.

II. Block Chain as a New Air Cargo Transport Option

According to Brandon [12], a block chain is a decentralized, distributed, ledger that verifies and saves every transaction added and updated to the block chain network and allows reducing cost, time, and risk of money transfer. Saving business transactions would be huge. Gromovs and Lammi [13] highlighted that a block chain came into the picture of digital business flows that could create a new era of logistics and supply chain information technologies in the future. Applying block chain with compatible technologies in the air cargo business industry will not only disrupt traditional air freight forwarders' existing business model and provide a solid alternative in air cargo transport chain, but will also suggest solutions for structural problems facing:

1) B2B/B2C sales and marketing – A block chain allows service users to define their requirement with air cargo transport service providers on a peer-to-peer basis: The resulting service descriptions will correspond more closely to actual functional needs; recombining process lends itself to a creative approach and it allows for true understanding of what should be done [14], with various promotional rewards but all stakeholder do not need to be concerned about service users' payment [9].
2) Building confidence about payment – Air cargo service providers have no reason for anxiety about payment from unknown service users due to the contract being executed automatically once details of contact are fulfilled in master ledger.
3) Customer requirements identification – It is useful for users to define their needs and will be corresponded: more closely to their needs; enlarge the focus of their importance; true understanding.
4) Cyber-attack and theft detection – Jensen [15] reported cyber threat issues in regard to cargo transportation information that may combined with maximum of 50 different kind of systems owned and operated by different parties, including air/seaports, banks, cargo service brokers, customs authorities, in-land truckers, and information portals, which do not having standardized IT infrastructure, platform, or sharing any sustainable cyber security. For example, Jordan [16] at CNBC reported that global container shipping line, Maersk, was hit by cyber-attack in 2017 resulted widespread panic and lost revenue estimated around

$300 million. The financial loss caused from lost customers' shipment booking for 2 days after cyber-attack due to customers unable to book their required space. Within block chain environment, peer-to-peer shipment booking to carriers is allowed without freight forwarders' or shipping lines' booking systems. In addition, real-time current location status shared with stakeholders facilitating the detection of theft while transport.

5) Improving air cargo transport service price transparency – International Civil Aviation Organization [17] highlighted that price transparency is a concern shared from the perspective of all air cargo transport service users. Transport service users usually set time volume contracts with committing to a specific yearly volume for potential freight price saving [18]. Though the price structures of traditional air freight forwarders are quite different [17], block chain gets rid of need for centralized authority for pricing control by removing the requirements for middleman's trust management role [18]. Since the ledger is decentralized, all stakeholders permit to access every air cargo service providers' price tariff [11]. Airlines' cargo transport service price level based on aircraft types, routes and frequencies is visible to service users enables to consider appropriate product even before the confirmation of the transaction. The main morphological feature of applying block chain in air cargo transport is improving price transparency not only limited to air freight price but also all other relevant service charges (e.g., Customs declaration, fuel surcharge, inspection, issuing transport documents, in-land transport, labeling, packaging and terminal handling charges).
6) Peer-to-peer contract between service users and air cargo service providers – As it has noted before, block chain eliminates demand for intermediaries but providing tools for secure contracts [19] between air cargo service providers and service users. Block chain will make all the payment process a breeze between two (or more) stakeholders that do not know each other [20]. With block chain, service users can share about their information using a computer code which is a key process that supports communication service providers (e.g., airlines, customs brokers, banks, and in-land truckers) in building confidence, trust, and carry out a contract automatically once a contact conditions are fulfilled by related parties [21].
7) Real-time exchange of process flow and events – The complexity in the unintegrated systems among air cargo service providers can cause delays of process that result in lower on-time performance. High quality exchange of data among stakeholders is expected to reduce delays and improve on-time performance in air cargo operations [22] Shipments visibility is shared to stakeholders in block chain network allowing its all-time track and tracing. Visibility information (e.g., Actual departure and arrival time, estimated departure and arrival time, delay and current location of shipment) is exchanged between all stakeholders in a more harmonized fashion.
8) Real-time documents data exchange – A block chain also can make air cargo transport documents makes simpler and replaced with ledger entries noting, based on sale agreement of contract [23]. The operational documents for air cargo transport (e.g., Airway bill, arrival notice, invoice, manifest, pre-notice and pre-alert) are exchanged and stored readily and securely between all stakeholders in real-time. Alcazar [18] stated that a ledger logics of block chain ensure not only ensure remittances and paying-in but also the generation of contracts, agreements and shipping order forms, maintains each documents' reliability, accessibility and incorruptibility .
9) Real time temperature and moisture control – This issue was raised in healthcare [24] and food sector where monitoring cargo temperature and moistness in real time and make those data availability required. With the increasing utilization of IoT and in combination with block chain technology, different types of air cargo transportation devices can be commanded and maintained for its' constant temperature and moisture control.

III. Air Cargo Transport Service Innovation Theory Development and Discussion

The existing functional roles of freight forwarders as intermediary can be disrupted by Dizistics leveraging on block chain and digitized information technology solutions that can enlarge streamlined operations flow, increase visibility, and maximize optimization of resources and demand forecasting by knowing data points for air cargo business sector. Block chain technology is a distributed transaction database in different nodes that is encrypted as a unit of block [25] in distributed ledger and complete history to be used for selling, buying, bills, signatures and double-entry book keeping for freight service. Once the new transaction is discovered in the block chain network, it breaks consensus and requests other parties to either validate or update their records with latest changes or reject the new addition to the ledger [21]. Air cargo business, an intermodal transport chain. requires proactive stakeholder engagement and proper management of relationships under different levels of agreement, with collaboration and integration [26]. Fig. 2 shows comparison the conceptual links between the traditional transaction and block chain transaction in air cargo business sector.

An example of an air cargo booking transaction flow between Airlines A and exporter B:

1) Two parties can access a database of each party to read and write from/to.
2) Two parties agree on a transaction their deals of air cargo transport service.
3) A block is created on line to represent details of air cargo shipment transaction.
4) A new contract of airlines A with exporter B transaction is validated by digital signature of Airlines A.
5) A new contract of exporter B with Airlines A transaction is validated by digital signature of exporter B
6) A cryptographic hash (The hash is a common indexing

technique, used to connect the new block to last one in the chain) is calculated based on: details of contract; signature of airlines A and exporter B; and previous block.

7) The consensus mechanism confirms transaction and provides permanent record. At this point, all transaction is valid and updated block chain transmits to all stakeholders in block chain network. Therefore, all stakeholders have a matching copy of the master ledger [21].
8) Airlines A, the recipient receive the payment from exporter B.
9) Once cargo delivered to airlines' terminal, cargo details and flight information are saved, along with other transactions on a block.
10) Updated block is broadcast to all ledgers in the block chain network.
11) All other ledgers of stakeholders in the network validate previous transaction.

While these are not the only areas where block chain can replace the existing air freight forwarders' roles and activities, block chain technology has a high potential in air cargo and international transport industry.

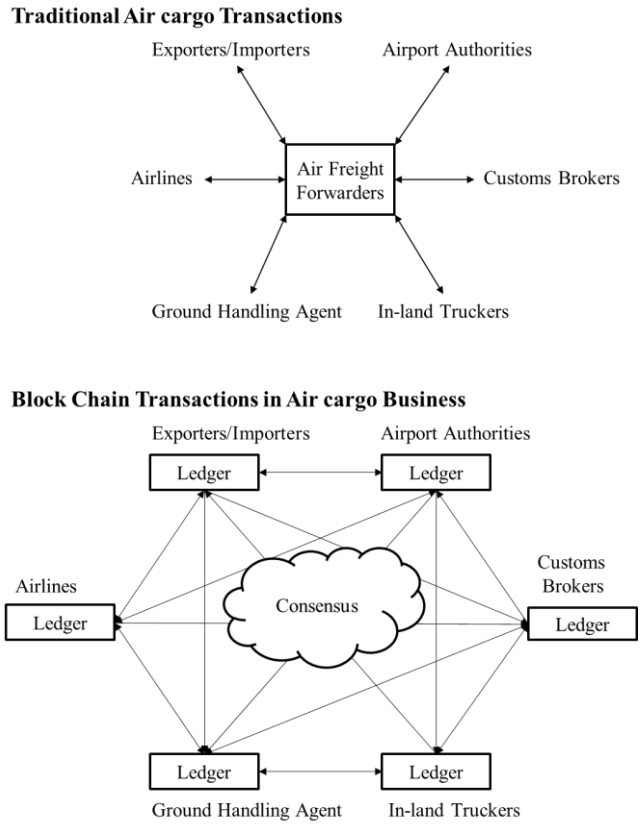

Fig. 2. Conceptual links between traditional and block chain transaction in air cargo business industry.

However, despite all of these potential opportunities of block chain technology in the air cargo transport industry, there are still major challenges: block chain exists currently as a concept, or as a number of prototypes with limited architectures in transport, logistics, and supply chain industry; development and governance of block chain technology for interoperability of block chain with various multiple internal and external systems; a lack of standardization of block chain network structure [21]; a complicated maritime law and regulations, commercial codes governs rights of ownership and possession along the air and sea routes and relate jurisdictions.

Consolidation of global body of law and relate institutions with nature of block chain and smart contracts are also exiting barriers [27].

IV. Conclusion

As middlemen in air cargo transport chain, air freight forwarders provide assistance to service users throughout flow [28]. By market demand, air cargo transport industry is required for keeping up with the evolution of technology to strengthen the competitiveness and efficiency. This research identifies Dizistics as a new digitized air cargo management option for planning, processing, controlling and adding value while ensuring efficiency along the air cargo transport chain by using advanced digital technology. The research presents extended the concepts that Dizistics can play a pivotal role in transforming air cargo transport model by eliminating the existing air freight forwarders and its' business model to all stakeholders take advantages through the application of block chain technology in the air cargo transport industry. Benefits of block chain will possibly arise: B2B/B2C sales and marketing; confidence about payment; customer requirements identification; customer requirements identification; cyber-attack and theft detection; price transparency; peer-to-peer contract agile more for value chain; real-time exchange of process flow, documents and events; real-time temperature and moisture control faster diffusion of innovation; building closer customer relationships [29] and specifically for international logistics and transport, block chain possess great promise for streaming transaction within the next decade [23]. This research aimed to develop a new air cargo business model, not only disrupt traditional air freight forwarders' existing business model but suggest solutions for structural problems of air cargo transport industry facing. Several key functions designed in this research provide alternative methods to the air cargo transport industry; where there is no longer air freight forwarders, central actors exist. The service users and air cargo service providers naturally improve trust in each other by peer-to-peer contract and transactions as well as decentralized platforms ensuring privacy and transactions. Though Dizistics and applying block chain technology in air cargo transport is still a new conceptual design and therefore not yet explored further up, the researcher hopes this study has provided initial direction and will stimulate further research development in air cargo and transport area.

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