1. Appendix

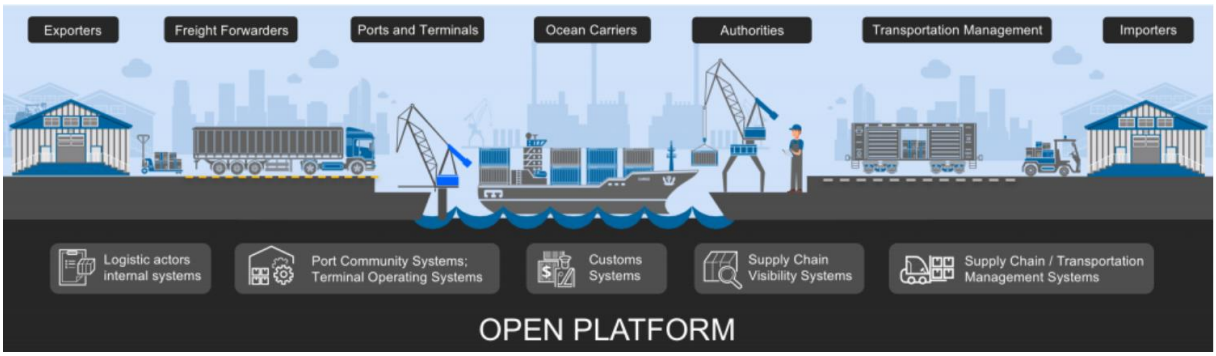
Table 1: Average transaction fees, transaction time, transaction capacity and energy efficiency

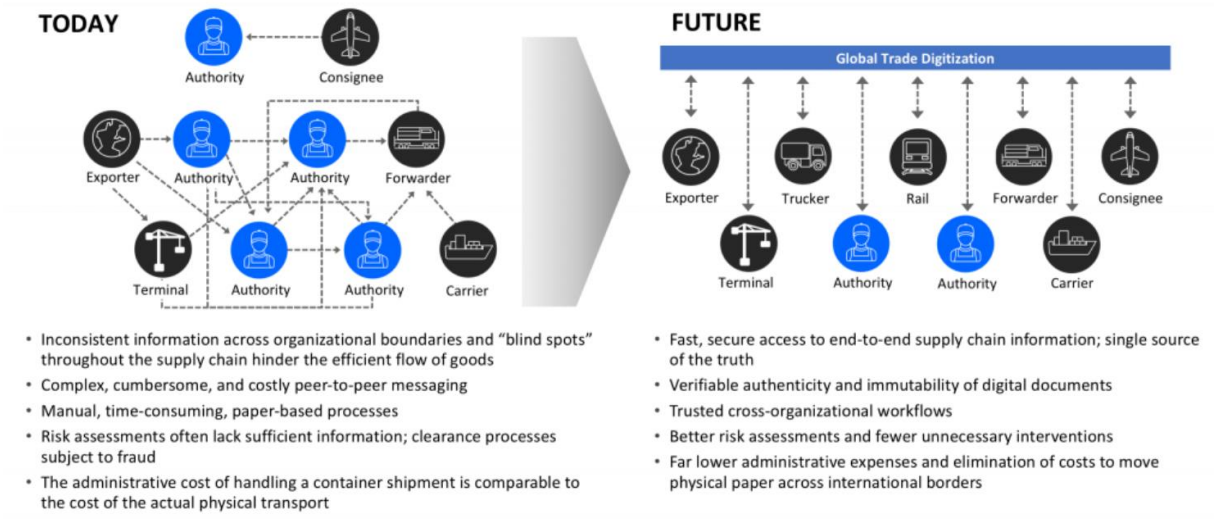
Cryptocurrency	Average transaction fee in US$	Average transaction time	Transaction capacity per second	Energy efficiency	Additional features
1. Bitcoin	7.32	9-10 minutes	7	Low (PoW blockchain)	
2. Ethereum	0.22	14 seconds	20	Low (PoW blockchain)	Supports smart contracts
3. Bitcoin Cash	0.32	9-10 minutes	50	Low (PoW blockchain)	
4. Ripple	0.0000024 (+ IOU fee)	3.5 seconds	1,000	High (Voting-style algorithm)	Enables IOU transactions in any currency
5. Litecoin	0.15	2 minutes	56	Low (PoW blockchain)	
6. Dash	0.30	2-3 minutes	(4,000)	Low (PoW blockchain)	
7. NEO	None (+ variable fee)	A few seconds	1,000	High (PoI blockchain)	Supports smart contracts
8. IOTA	None	No data available	500-800	Rather high (PoW Tangle)	Especially suited for IOT devices
9. Monero	2.43	2 minutes	1,700	Low (PoW blockchain)	Advanced privacy features
10. NEM	0.21	30 seconds	(3,000)	High (PoI blockchain)	Integrated reputation system

Note: This table is based on data from 20 November 2017. It represents a snapshot and may be subject to significant changes within short time spans. Furthermore, the accuracy of the data on transaction times and capacities varies and is in some instances only based on estimates. It should, however, give the reader a feeling for the rough dimensions of the speeds and capacities of the listed crypto currencies. [PoW = Proof of Work; PoI = Proof of Importance.]

Source: Ohnesorge (2018).

Figure 1: Maersk-IBM Project





- Inconsistent information across organizational boundaries and "blind spots" throughout the supply chain hinder the efficient flow of goods
- Complex, cumbersome, and costly peer-to-peer messaging
- Manual, time-consuming, paper-based processes
- Risk assessments often lack sufficient information; clearance processes subject to fraud
- The administrative cost of handling a container shipment is comparable to the cost of the actual physical transport

- Fast, secure access to end-to-end supply chain information; single source of the truth
- Verifiable authenticity and immutability of digital documents
- Trusted cross-organizational workflows
- Better risk assessments and fewer unnecessary interventions
- Far lower administrative expenses and elimination of costs to move physical paper across international borders

Source: White, M (2018)

	Pain Points	Digitalization need	Blockchain necessity to digitalize	Why?
Trade Finance	*Contractual ambiguities*	Low	Low	We could just impose common standards to respect while keeping the paper aspect of it. Digitalization could be applied to enable efficiency gains without the necessity of blockchain and its costs. Costs should exceed the benefits if not done for other purposes.
	Amendment cost	Medium	Low	The digitalization of LC's could help reduce amendment costs by setting faster replies from banks and other members compared to the current paper version. The necessity of a blockchain-based system is relatively low as other platforms to communicate between parties could easily deal with the problem. Benefits could exceed the costs in the long term if the amendment process is correctly automated.
	Documentary inefficiencies	High	High	The need to digitalize LC's is very high to solve documentary inefficiencies and blockchain-based system are crucial to operate the digitalization. Without blockchain, the transition from paper to digital documents would not change or even increase the level of fraud. Blockchain is crucial to verify the immutability and security aspect of the data. Its implementation is definitely worth the costs and should generate massive benefits.
	Information asymmetry	High	High	Recording the trade history of an agent with a paper-based system is very hard and costly. A blockchain-based system to digitalize the transactions is vital to guarantee that no records have been fraudulently modified and that all the needed parties can view the credit history of an agent in real-time. Costs should be compensated in the long run by the increase of participants generated by the informational improvement.
Supply Chain	*Visibility and auditability*	High	High	To have the ability to transparently track a product from the first to the last supplier, we must digitalize the transactions made. Moreover, to guarantee the authenticity of the data and have a real-time vision of the transit of products, a blockchain-based platform must be implemented. Its combination with IoT sensors would enhance even more the system as the data captured by the sensors would be immutably recorded and used by all stakeholders. Benefits should surely exceed the costs for companies.

	Risk Management	Medium	High	Implementing a blockchain-based system to improve the risk management of companies is relatively high as it would give them an overall view of their suppliers and customers to assess more precisely their holistic source of risk. The costs of implementation should be exceeded by the benefits of better risk assessment.
Cross-border	*Certificates and licenses*	High	Medium	Transforming the current certificates and licenses into digital ones could speed up the process to get and renew them. A blockchain-based platform would guarantee that the certificates are not tampered with. However, manual checking of the asserted information would still be required when inputted into the platform making the necessity of blockchain to digitalize the process medium. The benefits might exceed the costs if done properly.
	Customs clearance	High	High	The current paper-intensive system is very slow and costly whereas its digital version enhances its speed. When digitalized with a blockchain-based platform, it also improves the trustworthiness of the asserted data and the visibility of customs. The benefits should exceed the costs.
	Revenue collection	Low	Low	Considering the difficulty to fully digitalize the tax collection via a blockchain-based system and to integrate most of the taxpayers, the need to digitalize it is relatively low. Even though, the benefits could be massive for government authorities if they managed it properly. However, the massive costs and certainly low level of adoption should make the process unprofitable.

Table 2: Classification of digitalization and blockchain needs in international trade activities[1]

Source: Author

[1] All opinions expressed in this table are the ones of the author. The levels of digitalization and blockchain necessity go from low to high.