BLOCK CHAIN APPLICATIONS FOR SME TRANSFORMATION: A PILOT FRAMEWORK

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Abstract - As block chain technology matures, governments, banks, healthcare organisations, asset management companies and other corporations explore the potential of the new technology to transform transactions and improve security, efficiency and profitability. While certain aspects of block chain, such as decentralisation and immutability, are well understood, the technology has evolved beyond the original Bit coin block chain, resulting in the need to provide a framework that classifies blockchain infrastructure and aids potential adoption decision making. The framework is particularly relevant to and urgently needed by SMEs, who stand to benefit from the new technology but are disadvantaged by the lack of knowledge and expertise. This paper follows a pilot study that looks into block chain applications taxonomy and proposes such a framework.

Keywords - Block chain, FinTech, innovation, block chain classification

I. BACKGROUND

FinTech is the area of finance that provides and supports financial services by means of technological innovations, making transactions faster, cheaper and safer. Starting with mobile banking and investment services, it has seen a huge increase in global investment transforming the ways we exchange value (Arner, et al., 2015; Skinner, 2016). Among the technologies transforming FinTech, blockchain technology seems to be the one set to revolutionise record-keeping, offering a decentralised, distributed, secure, transparent and immutable ledger (Cognizant, 2017; Puthal et al., 2018).FinTech on the other hand is not the only area of application. Supply chain, utilities, Internet of Things, government-to-citizen, healthcare, peer-to-peer energy trading and other data-driven sectors are blockchain use cases (Christidis&Devetsikiotis 2016; Iansiti& Lakhani 2017; Crosby et al, 2017; Allan 2018).

By blockchain we mean a distributed database of records that are verified by consensus and shared among participants. Once a record is added, it cannot be deleted. When the records refer to transactions for example, participants need not rely on a central, trusted authority: they know that a transaction happened once its record has been added to the ledger. The first known blockchain is the foundation of Bitcoin, the original digital cryptocurrency (Nakamoto, 2008)that became notorious through its association with Silk Road and the dark web (Bradbury, 2014). The International Monetary Fund, United Nations and countries with FinTech infrastructure such as Japan, US and UK are exploring blockchain innovations (Pilkington, 2015).Banks such as JPMorgan, UBS, Credit Suisse and BBVA as well as corporations such as Samsung, Verizon and IBM are researching blockchain applications (Crosby et al, 2017). New financing opportunitiesandtransaction paradigms powered by blockchain, supply chain operations, reduction of risk and innovation opportunities based on smart contracts can potentially have a significant impact on small and medium enterprises (SMEs) and their operations (Shrier et al., 2016; de la Rosa et al., 2016; Lehmann et al., 2017). However, lack of expertise and technological knowledge create a barrier to digital transformation (Fridgen et al., 2018; Watson, 2010). There are many questions in need of answers for SMEs looking for potentially transforming blockchain applications. Whattypes of blockchains are there? What applications are they appropriate for? And how can they be classified? This article connects theory to practice and explores the aspects of blockchain in terms of capabilities and functionality to propose a classification framework for blockchain technologies that can be used by SMEs wanting to adopt blockchain solutions.

II. RESEARCH DESIGN

The study started with a systematic literature review which proved instructive but hardly comprehensive, especially in the area of real-life applications. The aspects of blockchain technologies covered in the literature are overlapping and often conflicting and we soon decided to follow theory with action research (Baskerville & Wood-Harper, 1998) based on a combination of participant observation (Jepsenet al., 1989) and in-depth interviews with FinTech practitioners. Seven (7) analysts/consultants, researchers and FinTech project managers were interviewed over a period of five months. They are consultants/advisorsforcompanies that specialise in blockchain technologies and project`s, industrial researchers and/or members of incubator programs. The analysis of the literature review informed our initial approach and the first analysis of the action research material was fed back into follow-up interviews where appropriate.Keyword network analysis (Borgatti et al., 2002) and network visualisation techniques were applied to the interview

keywords to identify clusters and highlight thematic groups (Kim et al., 2008; Lee & Su, 2010). Co-occurring keywords were linked to form pairs that created thematic networks. Analysis of the ensuing thematic networks and keyword clusters highlighted the key focus areas of the assessment process and formed the decision framework.

III. BLOCK CHAIN FUNCTIONALITY AND CHARACTERISTICS

The interviews brought up various issues that were analysed for similarities and importance. Topics pertaining to more technical matters (such as encryption, consensus agreement, and coding) were inconclusive and more data is needed for thematic analysis. They are therefore part of future research. Figure 1 represents the interviews' thematic tag cloud.

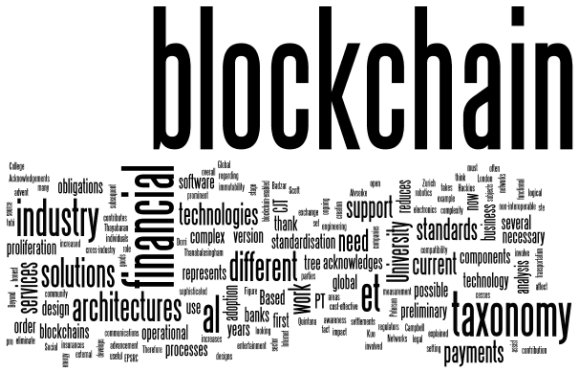


Figure 1. Interviews' tag cloud

Using network analysis on linked co-occurring keywords, six clear thematic clusters were identified by means of modularity class partitioning. Three of them are closely linked to functionality considerations (regulatory, transaction efficiency, storage), with the rest pertaining to technical issues (smart contract capability, access control and consensus). Figure 2 depicts the clusters identified in the interviews.Aspects of application focus (enterprise vs. consumer and market focus) were scattered almost equally among all groups and cannot be seen as a separate cluster.

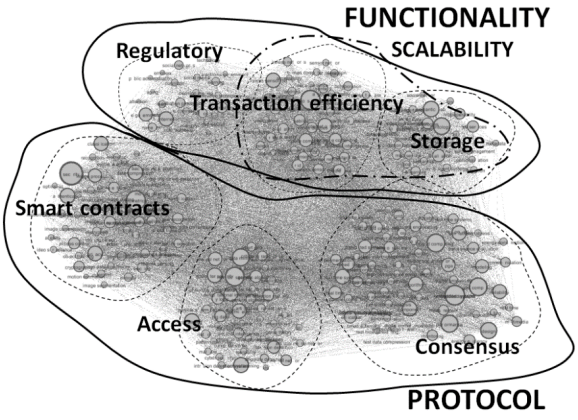


Figure 2. Thematic clusters

Following the clustering, the focal issues were assembled into the following groups:

Consensus. Proof-of-Work (PoW), Proof-of-Stake (PoS), Proof-of-Authority (PoA), Proof-of-Capacity (PoC). In PoW, favoured by cryptocurrencies, devices in a peer-to-peer network validate the proposed transactions-to-be-added while competing against one another to find the solution of inverting a cryptographic function. The first to do so appends their block of transactions to the blockchain. In PoS, the block generated is based on the proof of ownership of an agreed volume of digital assets of the particular blockchain. In PoA, favoured in consortium private networks, preselected authorities control the blocks added by allowing certain nodes to create and "sign" the new blocks with private keys.PoC implements the "space as resource" principle, where the miners give hard-drive capacity to better their chances of successfully mining a block.

Public vs. private. Public blockchains (e.g. bitcoin) are open and permission-less: no access control is needed. Private blockchains operate network access control and validations are controlled by the network owner. Consortium blockchains are semi-decentralised, permissioned by a number of organisations (instead of one only).

Smart contract capacity. Smart contracts are secure digital processes triggered to verify, enforce or facilitate a contract. Smart-contract-enabled blockchains can optimise contract execution, taking care of complex terms, potentially reducing transaction costs

Transaction efficiency. Transaction processing capacity is important for efficiency and scalability. This is measured in terms of throughput and latency, with some blockchains performing worse than others (e.g. Bitcoin blockchain), so that they cannot compete with existing products(e.g. credit card payments).

Storage issues. Block storage specifies what type of information is actually stored on a block (e.g. in Bitcoin the information is only transactions). Network storage specifies whether all nodes of the network have the full blockchain (redundancy, resilience) or some nodes only (scalability, efficiency).

Regulatory issues. This depends on whether the blockchain is open-source, proprietary or mixed. Open-source communities coordinate upgrades from within. Mixed models see organisations sharing technology platforms and standardsfor mutual benefit.

IV. FRAMEWORK

The analysis resulted in a pilot framework that seeks to inform SMEs about the capabilities and suitability of blockchain adoption based on protocol, functionality and application. The framework can be seen in Figure 3 below.

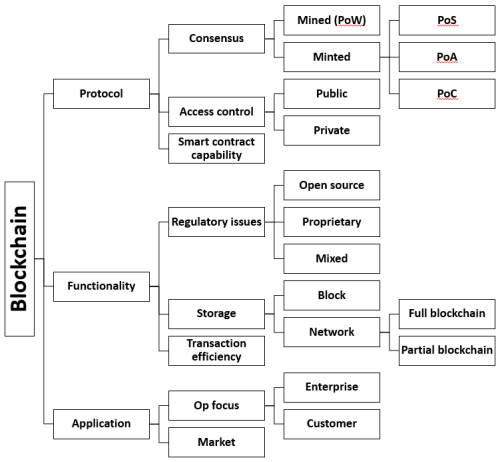


Figure 3. Blockchain adoption decision making for SMEs

CONCLUSIONS AND FUTURE RESEARCH PLANS

Blockchain is not just the technology behind bitcoin and other cryptocurrencies. Smart contracts, medical, identity management and supply chain applications are among the areas that are already using, or researching/piloting blockchain technologies. As the technology matures the priorities shift and the hype fades. A good third of the interviewees remain unconvinced that the" blockchain revolution" is imminent or happening at all. They mostly agree that where a secure database solution is "working" there is no rush to change it. Concerns over technical expertise and know-how issues related to smaller companiesare widespread.The consensus is that (a) there is strong indication that SMEs stand to benefit from blockchain applications and (b) there is need to develop a framework/taxonomy to help with blockchain understanding and adoption decision making.Our findings led to the development of a pilot framework which highlights three areas of decision making: protocol, functionality and application focus. The research carried out emphasised that supply chain finance, innovation, accounting and assurance are the top fields related to SME blockchain adoption. This is further confirmed by related research (Jiang, 2018; Hofmann et al., 2018; Morabito, 2017; Dai &Vasarhelyi, 2017; de la Rosa et al, 2016). These opportunities need to be further explored in relation to SMEs' structural models and value creation. This is the area of further research.

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