Editorial: Distributed Ledger Technologies for Smart Digital Economies

Guest Editors: Steven Muegge & Gregory Sandstrom

Welcome to the June issue of the Technology Innovation Management Review. This edition returns to explore the topic of blockchain (distributed ledger) technology, which the TIM Review began publishing about in the October 2017 edition.

The reasons for focusing on the combination of "DLTs for smart digital economies" in this edition are multiple. The World Economic Forum in 2015, predicted that "10% of global gross domestic product (GDP) [would be] stored on blockchain technology" by 2027 (WEF, 2015). A 2019 Gartner industry report predicted that blockchain industry will deliver business value that reaches over $3.8 trillion CAD by 2030. Likewise, job growth in the DLT sector is expected to increase significantly in the coming years, including business, finance, legal, and management, beyond only computer science and software engineering positions. A 2020 Price Waterhouse Cooper industry report predicted that "blockchain technology could enhance around 40 million jobs globally by 2030" (PwC, 2020). Where these predictions meet with actual market-sized realities, since the previous TIM Review edition on blockchain, from October 31, 2017 to July 1, 2021, the total market cap of "cryptocurrencies" grew from $255 billion CAD to over $1.73 trillion CAD, at hour of publication. In the research arena, with scholarship picking up at universities and independent thinks tanks, publications about blockchain technology have increased significantly. Research output in the healthcare field alone between 2016 and 2021 had a huge compound annual growth rate of 254.4% (Hau & Chang, 2021).

"Blockchain", and the distributed ledger systems behind it, is nevertheless still a concept poorly understood, both in theory and in practise. Many people who are not early adopters of blockchain thinking, or "edge users" of volatile and sometimes risky cryptocurrencies, are unable to give a basic direct answer demonstrating that they have knowledge or awareness about current distributed ledger systems in action, that is, real world use cases. Blockchain thus currently seems to be one of the now popular "unknown knowns" for many people, while the distributed ledger industry nevertheless picks up steam, while a public relations problem holds its adoption back from being palatable for many mainstream users.

This special edition attempts to face this communications challenge, which ultimately expands into a broader conversation than "just blockchain" in attempting to better understand the digitalization path we are currently on. One way that blockchain has been defined is as "a peer-to-peer, distributed ledger that is cryptographically-secure, append-only, immutable (extremely hard to change), and updateable only via consensus or agreement among peers (power of decentralization)" (Bashir, 2018). Yet while informative on a technical level, this type of definition sounds like too much jargon for most people; academics, entrepreneurs, and businesspersons are no different in this regard. The default withdrawal from too much jargon tends to be: "blockchain —so what?" "What's the big deal about distributed ledgers - isn't it just a slow dynamic database?" Or simply, "It's interesting, but come back to me when the technology is more mature". A general lack of recognition thus remains across a range of likely users, involving what this technology is, what it does, and what it will require of us, both in theory and practise, including the impact it seems set to make on society in the near coming years.

Unless more awareness raising happens through education and research dissemination, it remains among blockchain's greatest current problems: a major social breakthrough that would "put blockchain on the map" with the ubiquity of the internet, has not yet happened on the global scale. That is, aside from the rise of "cryptocurrencies" starting in 2009 with Bitcoin, up to the more recent rise of central bank digital currencies (CBDCs), starting in 2018, most recently with the Chinese digital renminbi (e-yuan, e-CNY, 2021), as a digital currency electronic payment, and the government of El Salvador (2021) now accepting Bitcoin as legal tender. In another example of turning a new page, the government of Nigeria, which not long ago issued a moratorium on "crypto" in financial institutions, recently announced it is now exploring and potentially considering a future CBDC, while also preparing to put in place a national blockchain adoption strategy for the country (Nigerian Federal Ministry of Digital Communications and Digital Economy, 2020).

Considering these developments in the digital transformation of societies and economies around the world, this special issue additionally addresses the concept of "smart", and the process of "smartification"

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involving the use of DLTs. This is meant in the context of how we see the term "smart" paired with others on the topic of digital transformation: contracts, devices, labelling, technologies, storage, cities, and machines. From that, the issue presents a series of lessons through the articles that follow on how building DLT-based solutions is becoming part of a process that creates "smarter" digital economies.

The issue opens with **Mika Westerlund, Soham Nene, Seppo Leminen,** and **Mervi Rajahonka**'s research article, "An Exploration of Blockchain-based Traceability in Food Supply Chains", with a survey of contemporary uses cases. Their aim is to identify "the benefits of distributed digital records from farm to fork". The paper's findings suggest that blockchain-based traceability in food supply chains "can provide cost savings, reduced response time to food scandals and food-borne illness outbreaks, improved security and accuracy, better compliance with government regulations, and thus increase consumer trust" (pg. 6). They acknowledge that research on blockchain in supply chains is still emerging and that there is a "growing need for more scholarly studies on the topic" (pg. 13). With Mika Westerlund set as the incoming Editor-in-Chief of the TIM Review, perhaps this article and general edition on DLTs for smart digital economies will serve as a springboard for more of that to come in future editions of the journal.

In the next paper, **Sevda Dede, Mesut Can Köseoğlu,** and **H. Funda Yercan** continue the exploration of blockchains in supply chains. They provide an overview for "Learning from Early Adopters of Blockchain Technology", in making "a systematic review of supply chain case studies". The article starts by looking generally at use cases driving adoption of blockchain in terms of its potential impact on GDP. It then turns specifically to focus on blockchain adoption in supply chains, through an analysis of articles in the Web of Science Core Collection. The paper explores the rationale behind adopting DLTs for supply chains, including the pros and cons, benefits and challenges. The authors note the suitability of blockchain features to the "complex network structure comprising of multiple stakeholders, eliminating intermediaries and paperwork, and increasing transparency, traceability, and efficiency" (pg. 26). For these reasons, blockchain makes immediate sense when hearing how it is being applied and adopted for supply chain uses cases. The addition of a brief use case discussion of the global Trade Lens, dealing with traceability or provenance, adds value for understanding how a network effect can be achieved globally with a mutually agreeable consensus use case.

Turning from supply chains, while maintaining the focus on distributed and decentralized systems thinking and market solutions, **Michel Legault** presents "A Practitioner's View on Distributed Storage Systems: Overview, Challenges and Potential Solutions". The paper identifies how distributed storage is being applied in the "information lifecycle" involving the retention and disposition of business records, in the face of legal and regulatory requirements. It compares five current distributed storage solutions, according to features of the information lifecycle, regarding the creation/modification, classification, storage, retrieval/use, retention, and disposition of data. The paper provides advice on managing content involved in data transactions with respect to personally identifiable information (PII), which the author recommends should be stored "off-chain" for safety and security purposes.

To provide context or the special edition on DLTs and smart digital economies, the TIM Review Managing Editor, **Gregory Sandstrom** draws on a key trio of concepts in "Distributed Ledger Technologies and Social Machines". A basic question frames the background to the paper: "How to 'smartify' the economy with blockchain-based digital extension services?" The paper presents a broad approach to "distributed ledger" thinking by invoking the notion of "distributed ledger communities", as crucially involved in creating a DLT scaleup strategy that aims to achieve a network effect that is humanizing rather than mechanizing. By conceptualizing DLCs as "social machines", the paper expands the topic initially explored by Tim Berners-Lee and Mark Fischetti in their work Weaving the Web (1999). By connecting this conceptualization with the notion of "digital extension services", the paper aims to move ahead the now global humanitarian and educational tradition of "extension services", which formed the basis of both the "Green Revolution" of the 1950s and 60s, and the university and agricultural extension movements of the 1860s and 70s in the UK and USA. The paper in this way feeds into discussions and planning around the world on the topic of digital transformation and DLTs that aim to "smartify" a variety of sectors, leading to

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economic development.

The issue closes with a report from **Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini,** and **Jeremy Clark**, that provides a summary of insights from the top distributed ledger-oriented conference in Canada, the recently held Blockchain Technology Symposium (BTS'21). The report reveals "A Cross-Pollination of ideas about Distributed Ledger Technological Innovation through a Multidisciplinary and Multisectoral lens". Having invited a variety of contributions to be shared in a kind of "laboratory" environment, the report draws on the four main themes of this year's event: (1) decentralized finance (DeFi), (2) decentralized identity, (3) decentralized health and (4) decentralized supply chain management. On the topic of DeFi, presentations were delivered on the current state of central bank digital currencies (CBDCs), as well as the design of a digital Canadian Loonie (dollar denomination). The decentralized identity presentations addressed the push for creating a "self-sovereign identity", several of which noted that the COVID-19 pandemic has accelerated the attitudes of Canadians towards greater readiness to adopt a secure, trusted, and privacy-enhancing "digital ID" (DID). The DID topic continued in the session on decentralized health, with additional focus on accuracy and fairness in representing and accessing individuals' health data records, including permissioned access for caregivers, and those involved in guardianship of patients in need of additional care and coordinated attention. Regarding decentralized supply chain management, event speakers promoted incentive-driven participation, as well as resilience in supply chains through decentralization. One use case example of mining and minerals management involved efficiency, coordination, and provenance, in ways that hold promise also for "green" or "fair trade". The papers in the current TIMR edition by both Legault and Sandstrom were presented for the first time at BTS'21. Overall, the report sets the stage for further advances and greater collaboration within and across the Canadian university blockchain community.

For future issues, we invite general submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and scaling technology companies, and for solving practical business problems in emerging domains such as artificial intelligence and blockchain applications in business. Potential contributors could also consult the TIM Review topic model (https://topicmodeling.timreview.ca/#/model) to examine the dominant publication themes so far, which might help with ideas for valuable future contributions. Please contact us with potential article ideas and submissions, or proposals for special issues.

This edition also marks the last in the 2-year tenure of Prof. Stoyan Tanev as Editor-in-Chief of the TIM Review. We wish to thank Prof. Tanev for his service to the journal, in engaging and promoting the international network of scholars and practitioners that the journal serves, published in association with the Technology Innovation Management (TIM) Program at Carleton University, where he continues to serve as a member of the TIM Faculty.

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Steven Muegge
Director, TIM Program &
Gregory Sandstrom
Managing Editor, TIM Review

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