

# A Cross-Pollination of Ideas about Distributed Ledger Technological Innovation through a Multidisciplinary and Multisectoral Lens: Insights from the Blockchain Technology Symposium '21

Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini,  
and Jeremy Clark

“Cross Pollinators can create something new and better through the unexpected juxtaposition of seemingly unrelated ideas or concepts.”

Tom Kelley

Author of *Creative Confidence*, *The Art of Innovation* and *The Ten Faces of Innovation* and partner at the renowned design and innovation consultancy IDEO

Blockchain Technology Symposium 2021 (BTS' 21) is a forum where academic researchers, industry professionals, and decision makers came together to present recent advancements, discuss adoption barriers, tackle common challenges, and explore future roadmaps surrounding blockchain and its related technologies such as consensus algorithms, smart contracts, cryptocurrencies, and distributed ledger technologies generally. As a follow-up to BTS'18 & BTS '20, which were hosted by Ryerson University and The Fields Institute, and by popular demand, BTS 2021 gathered a diverse audience from academia, industry, and policy makers to engage in a dialogue around crucial topics in the adoption of blockchain technology, with the aim of cross-fertilizing ideas from these communities to address the challenges and seize the opportunities brought forward by this promising technology. BTS'21 featured multidisciplinary and multi-sectoral talks and presentations on four major themes: (1) decentralized finance (DeFi), (2) decentralized identity, (3) decentralized health and (4) decentralized supply chain management. This article provides reflections on some of the key insights found in the BTS'21 presentations.

## Introduction

In his 2004 book, *The Medici Effect*, Francis Johansson describes how creativity and innovation emerge when new ideas are begotten of existing ideas (Johansson, 2004). As ideas bounce off one another, they sometimes stick and form new combinations, and these recombinant ideas generate better ideas. When a person steps into the intersection of disciplines or cultures, the combination of ideas that results can lead to an extraordinary amount of creative new thinking. Thus, from the intersection between two or more fields or sectors, and their underlying ideas, arises technological innovation.

An example of this can be found in the Nobel Laureate, Michael Smith, of the University of British Columbia, who established a then-new interdisciplinary institute, the UBC Biotechnology Laboratory in 1986. This lab brought together established scientists working in the various sub-disciplines of biochemistry to solve important problems in protein structure-function analysis. It is in the spirit of generating this “Medici Effect” through inviting a variety of contributions in a “laboratory” environment that the authors of this article developed Blockchain Technology Symposium '21 and its forerunners.

The Blockchain Technology Symposium is Canada's

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

premier blockchain conference. Previous symposia were held in 2018 (BTS '18) and 2020 (BTS '20) at the Fields Institute in Toronto, organized by Ryerson University. The BTS intends to be a forum where academic researchers, industry professionals, and decision makers can come together to present recent advancements, discuss adoption barriers, tackle common challenges, and explore future roadmaps surrounding blockchain and related distributed ledger technologies (DLTs), such as consensus algorithms and smart contracts [1].

BTS '21 was hosted by Blockchain@UBC at the University of British Columbia. The event coincided with Blockchain@UBC's fifth anniversary commemoration, and once again brought academic researchers, industry professionals, and decision-makers together, this year around the four "meta-themes" of: decentralized finance (DeFi), decentralized identity, decentralized health, and decentralized supply chains. Our goal was to explore and chart recent advancements, adoption barriers, common challenges, and successful strategies for overcoming those challenges across these four areas of blockchain and distributed ledger application. What resulted was a cornucopia of ideas concerning blockchain and distributed ledger innovation.

The objective of this article is to summarize some of the key ideas articulated in BTS '21 presentations in four sections corresponding to each of the four meta-themes.

### **Decentralized Finance**

BTS '21 opened with a "tour de force" presentation on the topic of central bank digital currencies (CBDCs) presented by Rainer Boehme, a professor for Security and Privacy, Department of Computer Science, University of Innsbruck, Austria. Notably, Dr. Boehme holds a master's degree in communication science and economics (2003) and a doctorate in computer science (2008), embodying the interdisciplinary knowledge so generative of foundational and new ideas associated with digital and cryptocurrencies that characterize discourse on decentralized finance and CBDCs. Boehme argued that CBDCs should allow central banks to provide a

universal means of payment for the digital era, while at the same time upholding consumer privacy and the private sector's primary role in both the retail payment system and financial intermediation. He set out the economic and operational requirements for a "minimally invasive" design of CBDCs and discussed implications for the underlying technology. Developments inspired by popular cryptocurrency systems do not meet these requirements, he argued. Instead, cash serves as the parallel non-digital model. Digital banknotes that run on "intermediated" or "hybrid" CBDC architectures, supported with technology to facilitate record-keeping that involves direct claims on the central bank by private sector entities, were said to be showing promise. The economic design should emphasize the use of a CBDC as medium of exchange and could limit its use as a store of value. Underlying this novel trade-off for central banks, he argued that they can either operate complex technical infrastructures or complex supervisory regimes. Many ways to proceed are possible, while all require central banks around the world to develop substantial technological expertise. Will they be up to the challenge?

This question was provided an answer in the following keynote presentation from Dinesh Shah, Director of Fintech Research at the Bank of Canada. Shah outlined the Bank of Canada's research agenda encompassing the analysis of emerging and potentially disruptive distributed ledger technologies with wide applications to financial system and market infrastructure. BTS '21 participants were given an overview of 5 years of innovative research led by the Bank of Canada considering the implications of blockchain and distributed ledger technologies for financial payments and stability, with the latest research concentrating on the design of a Canadian digital Loonie. Andreas Veneris, Connaught Scholar and Professor at the Department of Electrical and Computer Engineering, cross-appointed with Computer Science at the University of Toronto, provided further detail concerning the rapidly unfolding vision for the future of a decentralized digital currency in Canada. Veneris noted that technological developments in other sectors contrast to those in the financial sector, which, he noted, still operate on legacy infrastructure(s). The net effect is that current payment systems lack the flexibility to adapt to economic digitization. They remain slow, clunky, and expensive; with consumers often

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

receiving their digital service, or even physical goods, faster than the merchant receives the payment. Further, the emergence of decentralized finance (DeFi), through blockchain technology, has already demonstrated a capacity to disrupt the financial sector, impact national sovereignty, and affect established monetary transmission channels. Hence, it is no surprise that both national governments and tech firms are now building new digital infrastructures for finance, banking, and payments that circumvent those legacy practices. Veneris outlined research that he and his colleagues have been conducting with the Bank of Canada that advances the field in applying decentralized technologies to create the financial infrastructure of the future.

These keynote presentations were followed up by a series of short talks that further delineated DeFi innovations. Dr. Shin'Ichiro Matsuo from George Washington University's CyberSMART research centre discussed how to establish harmonization among regulatory requirements and technology development, specifically with respect to "anti-money laundering" (AML) and "know-your-customer" (KYD) privacy enhancement of key management. Matsuo reported that in late 2020, FinCEN published a draft of revised regulation on "virtual asset service providers" (VASP) and unhosted wallets. This year, the Financial Action Task Force (FATF) proposed a revised guidance, which may affect VASP and broader blockchain applications like DeFi and "non-fungible tokens" (NFTs). Though it is essential to integrate privacy-enhancing features to blockchain technology as a way to protect citizens' rights, we need to find a good balance of privacy protection and AML to achieve individual goals and social goals, Matsuo argued. At the Blockchain Governance Initiative Network (BGIN), multi-stakeholders, including engineers, businesses, regulators, and academia, drafted a common document to understand the problems and potential solutions. Matsuo reviewed the discussion at BGIN, including how multi-stakeholder discussions help to create a common understanding and provided a summary of discussions at the FATF's Virtual Assets Contact Group (VACG) and the Private Sector Consultative Forum event. Artemij Voskoboynikov continued the theme of key management and

cryptocurrency wallets by presenting some of his UBC doctoral research on UX issues, security, and privacy risks affecting crypto-asset users, and which prevent non-users from perceiving DLTs as suitable for adoption. Mahsa Moosavi presented work with Jeremy Clark discussing regulatory issues associated with trading on blockchains and distributed ledgers. Moosavi's talk outlined an evaluation framework comparing four major trade execution systems for blockchain-based assets: (1) central exchanges (CEX) (Binance, Bitfinex), (2) on-chain dealers (Uniswap), (3) hybrid designs (EtherDelta, 0x, IDEX), and (4) on-chain order books. Using the evaluation framework, he argued that fully on-chain exchanges have a better threat model, yet rarely exist in practice because they tend to be slow and difficult to regulate. He then pointed to how infeasible it is to drop a continuous-time order book onto a blockchain when designing a fully on-chain order-driven exchange, highlighting such limitations as slow and non-continuous block intervals, lack of support for accurate time-stamping, dropped or re-ordered transactions, and the potential for front-running. To overcome these limitations, Moosavi presented a novel proof-of-concept system, Lissy, and its primary operations based on a priority queue (PQ) as the core data structure for the call market and illustrating results of the improved design with results from a variety of tests and optimizations, including testing the full call market on an Ethereum Layer-2 scaling solution, Arbitrum.

Following the talks, a group of diverse experts in decentralized finance— Greg Hagen from the University of Calgary's Faculty of Law and author of a submission to the Bank of Canada's recent Call for ideas relating to the establishment a Canadian CBDC; Andy Leung, CEO of the decentralized finance company, Acquanow; Alfred Lehare, Associate Professor, Haskayne School of Business, University of Calgary; and Andreas Park, Associate Professor of Management, Rotman School of Business, University of Toronto— presented their perspectives on DeFi development challenges and opportunities, expertly guided through a series of questions and answers by Zach Masum, who leads the British Columbia Securities Commission's Fintech and Innovation Team (FIT), which handles a broad spectrum of fintech-related matters including DeFi, AI/machine learning, DLTs, robo-advising, crowdfinancing, online

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

trading, and other technology-focused business models.

### **Decentralized Identity**

The following day opened in an equally spectacular keynote from Jan Camenisch, VP of Research & Crypto at DFINITY and Director of the DFINITY Zurich Research Lab. He also serves on the decentralized identity blockchain Sovrin's Technical Governance Board. Before joining DFINITY, Jan was a Principal Research Staff Member at IBM Research —Zurich, where he led the Privacy & Cryptography research team and was a member of the IBM Academy of Technology. Those familiar with research in cryptography will be aware of Camenisch's enormous impact in the field of cryptography (see, for example, Camenisch and Standler, 1997; Camenisch and Lysanskaya, 2001; and Brickell, Camenisch and Chen, 2004, to name just a few of his contributions). Camenisch's presentation showed his latest research on the history of cryptography and use of distributed ledgers as the basis for an "internet computer". Camenish recounted how, for centuries, cryptography had been the art of encrypting messages, while now it has become an immensely powerful tool to extend the internet's functionality from connecting billions of people to also providing millions of developers and entrepreneurs with a public compute platform. This is creating a revolutionary new way to build websites, enterprise systems, DeFi, and open internet services, about which Camenisch gave a masterclass in cryptography past, present, and future.

Camenish's more theoretical talk was followed by Joni Brennan, President of the Digital ID & Authentication Council of Canada (DIACC), who presented a recently completed survey of Canadians' attitudes toward the adoption of decentralized ID. The study found that the COVID-19 pandemic has rapidly accelerated Canadians' openness to Digital ID adoption, noting that three-quarters of Canadians feel that it's important to have a secure, trusted, and privacy-enhancing digital ID to make transactions online safely and securely. As governments across the country focus on post-pandemic recovery, investing in digital ID makes strong economic sense, especially for small and medium-sized businesses (SMEs). For SMEs, the

impact of digital identity could be used to improve processes that are difficult today. This is especially true in situations where businesses need to provide proof of identity to another business. Considering that SMEs account for approximately 30 percent of Canada's overall GDP (\$450 billion CAD), if we assume that the average SME could be just one percent more efficient with access to trusted digital identity, adopting digital IDs could result in a potential \$4.5 billion CAD of added value to SMEs and reinvestments in the Canadian economy.

The short talks that followed highlighted various dimensions of digital ID research and adoption, with Michael Cholod's rousing presentation on the need to protect personally identifiable information and online privacy, Mike Brown of ATB Financial recounting four years of experimentation in the journey towards adopting digital identity in Alberta led by ATB, and Gregory Sandstrom presenting a more theoretical talk connecting decentralized IDs and technologies with the notion of "social machines" first articulated by Tim Berners-Lee and Mark Fischetti (1999), calling attention to a constructive framework for thinking about how to build better ecosystems. This presentation made a basic appeal about incoming opportunities in DeFi and digital identity currently arising via business ecosystems enabled by DLTs, in particular by means of "digital extension services" that allow for mass global scaling of decentralized solutions.

Marc Kneppers, Chief Security Architect at TELUS, then led participants through a panel session with experts in the area of digital ID: Mathieu Claude, CEO of Northern Block; Doug Heintzman, VP of Global Strategy at Soveren and Insolar, Chetan Phull, Associate Lawyer in Cybersecurity, Technology and Data Management Law | Deloitte Legal Canada LLP, and Darrell O'Donnell, a well-known strategy and technology advisor on digital identity. Panellists pointed to many digital ID projects illustrating the fact that decentralized digital identity solutions are not only becoming a reality, but also we can now see that they are set to add real social and economic value.

The day wrapped up with an enlightening presentation by Tatsuya Kurosaka, President and Chief Executive Officer, Kuwadate Incorporated, and Tatsui Narita,

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

Councillor for Competition Policy in Digital Economy, Cabinet Secretariat, Japan, presenting on digital ID developments in Japan and calling for global collaboration on research and implementation. Additional global perspectives offering feedback were provided by Volker Skwarek, Professor for Embedded Systems and Head of the Research and Transfer Centre for Digital Business Processes at Hamburg University, and Victoria Lemieux, Associate Professor of Archival Science and Co-Lead of Blockchain@UBC at UBC.

### **Decentralized Health**

It is no surprise, given how the global pandemic has concentrated peoples' attention on the need to innovate in healthcare, that the third BTS '21 day focused on decentralized health, which presented evidence of remarkable advancements in this sector over the past year. Dr. Chandana Unnithan, Associate Professor, Torrens University Australia, and CISO/CTO Lifeguard Digital Health, opened the session by sharing insights from her involvement in Australian, Canadian, and World Health Organization initiatives focused on the use of blockchain and distributed ledger technologies in global disease surveillance. Dr. Unnithan noted how, globally, blockchain technology is being used to encourage consumer-centred health care and facilitate remote healthcare management. She argued that some inimitable features that render this technology an excellent catalyst in healthcare include its ability to validate transaction processes, prevent system failure from any single point of transaction, and approve data sharing with optimal security. In many countries, she noted, hospitals are already using blockchain in electronic medical record systems, while health professionals leverage the approval of data sharing as a best method for peer consultations with patient engagement. In the current context, Dr. Unnithan argued that blockchain has the potential to strengthen disease surveillance systems during outbreaks such as the SARS-CoV-2 outbreak, which result in health emergencies. The blockchain system enables classifying health security concerns, analysing preclusion methods, and facilitating rapid and impactful decision making. The potential for distributed health solutions to strengthen health care systems and reduce the global burden of disease, mortality, and morbidity is being researched around

the world, and stands to make an enormous contribution to the betterment of global health.

Dr. Wendy Charles, Chief Scientific Officer at BurstIQ, next presented the concept of "Ethics by Design", drawing upon work discussed in Charles et al. (2019). She argued that as commercial blockchain organizations develop blockchain platforms for healthcare, these organizations should be mindful of patient-centered designs and need for data protection. These principles then influence decision points for maximizing data access, control, analytics, and engagement. She went on to discuss the ethical principles, challenges, and opportunities for responsible design and implementations of decentralized health technologies based on real-life experiences with the implementation and operation of blockchain solutions in a wide variety of global contexts. Dr. Charles' generosity in sharing a wide variety of strategies and solutions from her own experience was particularly appreciated by participants, picking up issues involving the assurance of data accuracy and fair representation of individuals in relation to health data records stored "on chain".

Following the keynotes, three short talks exemplified some of the developments and issues discussed by the keynote presenters. Noelannah Neuberger presented innovative work being led by Dr. Lili Liu at the University of Waterloo on applying self-sovereign identity solutions to address challenges faced by those suffering from dementia. This ongoing project has aimed to: (1) develop a lay definition of self-sovereign identity (SSI) that is understandable to persons with dementia and their caregivers, and (2) obtain feedback from the dementia community pertaining to the use of guardianship within the context of SSI, including how it can be applied specifically for those living with dementia. Dr. Neuberger outlined the research team's two-phase study, with the first phase consisting of concept development that involved a search of the grey and scholarly literature, conducting interviews, and focus groups including persons with dementia and their caregivers. Key elements of SSI highlighted by participants and in the literature included digital identity, decentralized authority, ownership and control, privacy and security. This was captured in a short video for knowledge translation [2]. To meet the second objective, the team then conducted semi-structured

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

interviews with persons living with dementia, caregivers, members of industry, and community organizations from Canada, the United States, the United Kingdom, the Netherlands and Australia. Results were divided into three categories: (1) current guardianship practices, (2) potential benefits and limitations of SSI on guardianship, and (3) considerations regarding guardianship and SSI. The findings from this project will be used to determine the feasibility of integrating SSI to assist in collecting valuable data from missing persons with dementia.

A second short talk was presented by Dr. Rob Fraser, CEO of Molecular You, an AI-driven personalized healthcare company. Dr. Fraser noted that one of blockchain's key applications has been to decentralize the management of privacy. Blockchain protocols such as Hyperledger's Indy and Aries, the platform used to develop Molecular You's novel blockchain solution, MyPDx, which is being developed in collaboration with the University of British Columbia and StonePaper, with funding support from Canada's Digital Technology Supercluster, have been specifically designed to give users control over their health data to achieve decentralized privacy management and secure data sharing. The solution design gives users custody and control over their personal health data credentials in a manner that fundamentally respects users' privacy. Nevertheless, it still allows for and incentivizes the sharing of verifiable credentials that contain personal health data to advance knowledge in an ecosystem of mutually beneficial healthcare partnerships.

Finally, Dr. Mark Martz, Director of the Arizona Center for Tobacco Cessation and Assistant Professor of Practice in the Mel and Enid Zuckerman College of Public Health at the University of Arizona, presented on the suitability and application of blockchain technology in a use case aimed at encouraging smoking cessation. Picking up on earlier themes discussed by Dr. Unnithan, Dr. Martz noted the global phenomenon of people facing an inability to access preventive, population-based health care services efficiently and effectively. Additional challenges were identified in areas with limited access to technology and scarce financial resources. Information technology has enabled health care providers to improve patient

access to preventive services. However, when providers rely on external care providers to provide such services, gaps potentially arise when delivering services in a timely manner that can influence adherence in the patient program. Dr. Matz highlighted these challenges in the context of the Arizona Smokers' Helpline (ASHLine), a tobacco cessation service provider located in Arizona that delivers education, behavior change, and pharmacotherapy interventions to support successful quit attempts. He explored the viability of implementing a DLT-based architecture to fill this gap in patient enrollment for improving patient program adherence and quit outcomes for ASHLine clients.

During the last panel session, Evgueni Loukipoudis, Chief Technology Officer, Canada's Digital Technology Supercluster; Chang Lu, Postdoctoral Research Fellow, University of British Columbia; Lucy Yang, Community Director, Covid-19 Credentials Initiative; and R. Mohan Tanniru, Professor, University of Arizona, all shared their impressions and insights on the state of current technical, adoption, and regulatory challenges, along with existing opportunities in the area of decentralized health. The panellists updated participants on the global decentralized health landscape, discussed new uses, prime movers, industry leaders, early adopters and the unique challenges of rolling out a novel emerging technology in a sector that is not known for adopting information technology innovations.

The day's final session offered information about The University of British Columbia's new micro-certificate in "Blockchain Innovation and Implementation" [3], a part-time program designed for professionals who need to identify, assess, and lead blockchain initiatives. This program represents one of a growing number of new blockchain programs and educational offerings now available across Canada and globally [4].

### **Decentralized Supply Chain**

The final keynote was delivered by another international luminary in the field, Dr. Aggelos Kiayias, Chair in Cyber Security and Privacy and Director of the Blockchain Technology Laboratory at the University of Edinburgh. Dr. Kiayias focused his presentation on "Rethinking Information Technology Services as Incentive Driven Collaborative Systems", picking up on themes from

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

Sandstrom's talk on "social machines". With the introduction of Bitcoin and blockchain technology, Dr. Kiayas noted, we are witnessing the first example of an information technology service deployed via open and incentive-driven participation. Viewed in this light, the IT service emerges out of self-interest from computer node operators who enroll themselves to support the system's operation, which they do in exchange for rewards provided by the system's digital (or crypto) currency. In his talk, Kiayas fleshed out this approach as a novel paradigm for deploying general purpose IT services, discussing design challenges and use cases beyond financial transactions, such as anonymous communications and supply chain management.

Sergei Beliaev, EVP and Chief Strategy Officer for DLT Labs, is an emerging leader in applying blockchain to enterprise data management, for which his talk provided an overview. He made the point that nowadays companies don't compete; supply chains do. Business leaders need to realize the value of agility in a modern economy, especially as we prepare for recovery from a global pandemic. Digitization, automation, and blockchain are key considerations as companies attempt to shave costs and improve efficiency, according to Beliaev, while "hyper-automation" is grabbing headlines around the world as companies become more networked. A key challenge with multiple parties that need to work together is how to ensure that information is reliable, trusted, auditable, secure, and can be shared among parties. Beliaev views blockchain-based networks as having turbo boost power for hyper-automation, in that they establish tamper-proof real-time data-sharing networks. Coupled with fully automated execution that uses smart contracts, distributed ledgers offer the most effective foundation today for bringing independent market participants together, while minimizing the overhead burden of administration, and simplifying business processes.

The short talks that followed picked up on the keynote themes. Michel Legault's talk discussed the challenges of decentralized information management, when managing content as part of network transactions. Transactions on a DLT may require supporting documents, for example, photos, reference documents, or actual contracts. This type of electronic content has

typically been stored and managed on content management systems that include enhanced features, such as document version control, metadata tagging, and the retention and disposition of records. Legault highlighted several issues of importance as DLTs become an increasingly popular method to complete transactions and share information, such as whether electronic documents should be stored directly on a blockchain, or in a supporting content management system (either with a traditional system or a distributed storage system), the need to consider whether updates to supporting documents will be done within an existing, completed, or new transaction, and the retention and disposition of records governed by legal and regulatory requirements. Mohamed Sadegh Sangari, a postdoctoral researcher in the Cybersecurity Research Lab (CRL) at Ted Rogers School of Management at Ryerson University, presented work with Atefeh Mashatan on building resilience through decentralization and a data-driven analysis of blockchain implications for supply chain resilience. Dr. John Steen, Associate Professor & Director of the Bradshaw Research Initiative in Minerals and Mining (BRIMM) at The University of British Columbia discussed applying DLTs in the context of sustainable mining, observing that the mining sector is on the cusp of the biggest production surge in history driven by the need for metals as the global economy shifts to electric power. According to the World Bank we will need as much copper in the next 30 years as we have produced in the entire history of humanity. In facing this challenge, the mining sector has become an innovative adopter of blockchain technology in three main areas. First, making transactions between producers and customers more efficient. This is happening now and being used for bulk materials like iron ore. Second, coordinating inputs and information in mining operations. This also improves business productivity, while having the potential to make mining into a business of networks and consortia, much like the aerospace industry. Lastly, blockchain has great potential both to allow customers to see the product history of what they are buying as well how it was produced. This has potential for branding some metal products as "green" or "fair trade".

A closing panel session led by Dr. Atefeh Mashatan and featuring Dr. Henry Kim, Associate Professor of

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*Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark*

Operations Management and Information Systems, Co-Director, BlockchainLab; Patrick Mandic, CEO, Mavennet; Erik Valiquette, Canadian Blockchain Supply Chain Association; and Paul Horbal, Partner at Bereskin & Parr LLP, covered the current state of the supply chain industry, from procurement and logistics to transportation. Each panelist drew upon their expertise and experience to articulate some supply chain management shortcomings that could be addressed by the decentralizing processes afforded by blockchain technology. Cross-sectional challenges such as patenting intellectual property that touches multiple jurisdictions, lack of interoperability among supply chain platforms, governance issues, and standardization gaps were among topics that were extensively discussed during the session in the specific context of supply chain management. Finally, the panelists shared their future vision for decentralized supply chains, discussing both technical and non-technical challenges that need to be addressed before supply chains can more fully leverage the potential of decentralization.

### Conclusion

BTS '21 demonstrated how the past four to five years' research and development has given rise to many new ventures and initiatives that are bringing what were at one time only theoretical ideas into practical realities. Those who missed taking part in the BTS '21 event may wish to review recordings of the sessions that are available online [5]. BTS '18 was notably marked by the generation and proliferation of a wide variety of use case ideas for applying blockchain and distributed ledger technologies. BTS '20 saw much more talk about adoption, but from a primarily theoretical "looking ahead" standpoint. BTS '21 went further to demonstrate the growing maturity of decentralized solutions, including discussions of real projects, real challenges, and real opportunities for coming applications.

The multidisciplinary of the challenges and the requirement for cross-pollination of ideas to tackle these challenges are also evident. Technical innovation must go hand in hand with local and national policy development, as well as social innovation if advancements such as CBDCs, global internet

computers, personalized healthcare powered by blockchains, and distributed ledger-based global supply chain ecosystems are to succeed on a mass scale.

With the excitement of BTS '21 now at a close, we await with eager anticipation BTS '22, to be hosted by the University of Calgary. With the pace of innovation in the space of decentralized and distributed technologies, we are confident that the research and developments featured at the next BTS event will demonstrate considerable further advancements, especially if BTS '21 has been successful as a "cross-pollinator" stimulating a "Medici Effect" that creates new connections and networks of innovation among participants.

### Links

[1] BTS '18 presentations can be found at:  
[http://www.fields.utoronto.ca/activities/18-19/blockchain\\_technology](http://www.fields.utoronto.ca/activities/18-19/blockchain_technology)

BTS '20 presentations are available at:  
[http://www.fields.utoronto.ca/activities/19-20/BTS\\_2020](http://www.fields.utoronto.ca/activities/19-20/BTS_2020)

[2] What is self-sovereign identity? Technology and Aging Research Group, 2020.  
[https://youtu.be/0WicIm8x\\_GY](https://youtu.be/0WicIm8x_GY)

[3] For more information:  
<https://extendedlearning.ubc.ca/programs/ubc-microcertificate-blockchain-innovation-implementation>

[4] See, for example,  
<https://www.accounting-degree.org/college-cryptocurrency-blockchain-courses/>

[5] See the BTS'21 schedule, where videos are in the process of being finished editing, then links will be added:  
<https://blockchain.ubc.ca/blockchain-technology-symposium-21-schedule>



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Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark

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## About the Authors

Victoria L. Lemieux, Atefeh Mashatan, Rei Safavi-Naini, and Jeremy Clark served as programme chairs for BTS '21.

Dr. Victoria Lemieux is an Associate Professor of Archival Science at the University of British Columbia's School of Information and Founder and Co-Lead of Blockchain@UBC, a multidisciplinary blockchain research and education cluster at UBC.

Dr. Atefeh (Atty) Mashatan is an Associate Professor of Professor of Information Technology Management and the founder and director of the Cybersecurity Research Lab (CRL) at Ryerson University. She holds the Canada Research Chair (Tier II) in Quality of Security Framework for Internet-of-Things (IoT).

Dr. Rei Safavi-Naini is the NSERC/Telus Industrial Research Chair and Alberta Innovates Strategic Chair in Information Security. She is a co-founder of the Institute for Security, Privacy and Information Assurance at the University of Calgary and served as its Director until January 2019. Her research interests are cryptography and information security.

Dr. Jeremy Clark is an Associate Professor at the Concordia Institute for Information Systems Engineering, where he holds the NSERC/Raymond Chabot Grant Thornton/Catallaxy Industrial Research Chair in Blockchain Technologies.

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