Our Digital Future:
from the Internet to the Interledger

Invited contribution to UN at 100 book

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During drafting of the Sustainable Development Goals I was part of the UN Secretary General's "data revolution" team.   It was clear that digital systems were proving to be a fundamental revolution in human development, and so it was important that the power of data and data analytics (including AI) be incorporated into the SDGs [1]. In the subsequent years this revolution has not stopped or even slowed down. The world is becoming ever more digital.

Today this revolution is no longer proceeding application by application and nation by nation. Instead we are seeing a convergence from separate digital systems for each application and each nation to unified, all-purpose digital ledgers that handle finance, commerce, capital, and tax transactions across the globe.   These new ledgers are also a natural home for and extension of Central Bank Digital Currencies (CBDC), and are being promoted by trade countries such as Singapore, Switzerland, and China as a safer and cheaper way to conduct business [2, 3, 4].

While the combination of many different types of transaction on government-sponsored platforms allows greater security and real-time auditing for fraud detection and instabilities, it also raises questions around governance and control. Consequently, there is an urgent need to achieve international consensus on standards and principles of governance, and this will be a critical issue for the UN and other multilateral organizations to address; we need a "digital Bretton Woods" accord to establish the rules of international digital interaction.   My hope is that the 2030 UN development goals will incorporate universal deployment of such rules, and that by 2045 the digital world will have a safe, inclusive, accountable and balanced ecology of data and AI for everything from trade and financel to medical services and government.

Evolution of Internet from a Communication to a Transaction Medium

Digital technologies are making it cheaper, easier, and safer to do business with anyone anywhere anytime.   The current tidal wave of new digital technologies and social disruptions are symptoms of a much bigger change: the very Internet itself is being transformed, evolving from a loosely structured communications medium to a trusted execution medium. Instead of the inter*net,* allowing seamless, inexpensive communication of data everywhere, we are seeing the emergence of the inter*ledger* which allows seamless inexpensive transactions of all sorts, everywhere and with everyone.

To accelerate this trend trading nations are introducing a new "transaction layer" on top of the existing internet has the potential to finally allow both companies and citizens to safely and

securely do business with each other - to let each party know who they are dealing with, confirm the interaction is not fraudulent, and to have the outcomes easily enforceable.

The impact of transition from separate and competing "rails" for different types of transactions to a uniform, unified digital platform is difficult to overstate. It offers the possibility of AI-driven continuous audit of a type much deeper and more complete than current audits, of vastly increased fraud detection abilities, and of course much lower cost and greater safety. It is conceivable that this new technology will eventually be seen as important as the invention of double-entry accounting.

With the insight that the internet is evolving to the interledger, we can put the emergence of technologies like blockchain and AI in context. They are a consequence of the limitations of the internet and a logical extension of the technology evolution we have been witnessing for the past 50 years, certainly since the first personal computers were invented and the early days of the ARPANET. The people who built the ARPANET designed it as a way to ensure reliable military communication in case of a nuclear attack. The system was later extended to keep municipalities and universities connected as well as protect important information. But it failed to provide adequate security and auditability, and so has never developed the trusted systems we need for commerce and government.

AI and blockchain are part of a set of evolving global software platforms. legal protocols, and economic structures that are better suited for a connected world. A key development that is driving this evolution is the deployment of "trust chain" systems by trading nations such as China, Singapore, and Switzerland (which we helped engineer). These new systems combine open alliance legal agreements ("trust agreements"), distributed ledger technology ("blockchains"), and end-to-end encryption to allow businesses to monitor transactions from anywhere on the planet and be confident that they are secure, that data was used only as we expected, and the transactions are irrefutable.

The Interledger

National "trust chains" (a contraction of "trust agreements" and "blockchains") are new all-inclusive distributed ledger platforms for smart cities, commerce, government, and finance that are being deployed by governments and national champions within countries such as China, US, Singapore, Switzerland, and others. Through interoperability agreements, they form the emerging interledger. In addition to considerations of security and efficiency, deployment of trust chain platforms is being driven by the rush to issue national digital currencies, which use these same technologies to facilitate payments and tax collection.

An example of these new government-backed interledger platforms is the Ubin project sponsored by Singapore's Monetary Authority and Temasek Sovereign Wealth Fund. The Chinese systems are more developed but less well documented, while the Swiss Trust Chain is at an earlier stage of development.

The Singapore assessment of the Ubin platform is that it demonstrated successful development of a domestic multi-currency payments network, and showed that the model can be implemented as an international settlement model, which could bring about cheaper, faster and safer cross-border payments.

In order to determine the commercial viability and value of this blockchain-based payments network, they brought together a broad ecosystem of financial players and non-financial services companies. Their conclusion was that the platform demonstrated the applicability of blockchain technology beyond capital markets and trade finance.

The project is also explored the additional functionalities that can be provided by deploying "smart contracts" on the Ubin network. Smart contracts enable the codification of business rules or logic as a set of programming codes that will execute fairly and faithfully without the need for a trusted third party.

The flexibility provided by smart contracts enables rapid prototyping, testing and the deployment of additional functionalities such as Payment Commitments, Request to-Pay and Pull Payments. The Ubin project team piloted more than a dozen use cases beyond payments, broadly categorized into four areas: capital markets, trade and supply chain finance, insurance, and general transaction contracts beyond financial services.

These new digital platforms offer greatly enhanced ability to address the world's challenges, but they create their own dangers. Transition to more digital infrastructure risks unhealthy concentration of power, and threats to community and national values and norms. The deployment of new data and transaction/AI platforms risks creating a "cold war" between technology blocks, leaving less developed nations at the mercy of a few powerful governments and generally degrading the ability of the world to deal with global challenges.

Driving Forces

Perhaps the main force driving the deployment of interledger technologiy is the need to repair the world's tattered finances, coupled with the emergence of China as a major international power. Current levels of public debt are at levels not seen since World War II, and simultaneously national economies are in disarray. Many nations are feeling that the time to act is *now.*

Another game-changing and accelerating development has been that of national digital currencies in central bank digital currencies (CBDC). China has released their digital currency, Singapore has piloted multi-digital CBDC capabilities, and small states such as Bermuda have released a CBDC for social support and financial inclusion purposes (our MIT group helped with the design). A community of over 40 central banks, international organizations, academic researchers and financial institutions have begun to create frameworks to help central banks evaluate, design and potentially deploy CBDCs. Their deployment in China, Southeast Asia and soon in the EU provides greater efficiency, effectiveness and inclusion at global scale.

However, which standards, norms, laws, and currencies will govern these new transaction platforms? The deployment of these new digital trade platforms will provide nations with possibilities for re-arranging the dynamics of trade and influencing other nations in ways that are far less visible than implied by official policy or treaty.

This suggests that a new "Bretton Woods" multilateral effort is required, with the goal of establishing interfaces, methods, and exchange standards for digital transaction platforms such as those developed by China, Singapore, and Switzerland. Unlike the World War II Bretton Woods effort, such coordination must not only be centered around just banking and finance, but must be intimately dependent on digital technical standards for trade and the unified risk science needed to measure and forecast interactions between finance, sustainability, and social factors.

The Challenges

The digitization of everything means that society faces an unprecedented set of challenges and opportunities. These challenges are perhaps most apparent in these new transaction platforms because they bring together all types of transactions, touch every aspect of society, and affect every organization and citizen in a direct, fine-grained manner. The issues digitalization presents are complex, emergent and demand new approaches which deliver impact at both the global and local level. Along with the challenges of complexity and uncertainty of digitalization, is the speed at which change occurs. Shared understandings and collective decisions need to be made in shorter time periods than ever before.

The complexity involved in digital transformation demands that the various "layers" of the challenge be understood and acted upon in a coordinated and holistic manner. From a technology perspective, data needs to be made more accessible and standardized in a more coherent and interoperable manner, while at the same time protecting private and proprietary data. The data infrastructure needs to be made more ubiquitous, affordable and most importantly more secure to address the times-ten increase in cyberattacks that is anticipated to accompany the roll-out of 5G and the Internet of Things. Technologies such as Federated AI, distributed ledgers, open legal alliances, and business models such as data exchanges are making this possible

In addition to the complexity of the transition to digitalization, another dimension which society needs to attend to is the overall velocity of change. Driven by the exponential increase in networked technologies, the velocity of change within the geopolitical and social context is unprecedented. Likewise, the rate of change within the private sector has accelerated as new transformative and highly collaborative business models are emerging. All of this demands that leaders have a more holistic and globally systemic view of how digitalization is impacting entire ecosystems.

Coordination and cooperation are helping the world address these several interlinked digitialization challenges. From a data perspective, one of the most hopeful points of progress

during the COVID-19 pandemic is the increasing support from fortune 500 enterprises, standards bodies, investors, NGOs and international organizations in the adoption Environmental, Social and Governance (ESG) metrics and financial disclosures.

The Need for International Standards and Governance

There are two main areas where international agreement and transnational initiatives could make important difference in the evolution and emergence of the interledger. These are (1) digital transaction auditing and standards enforcement, and (2) governance. These two topics will be discussed in more detail below.

It must be kept in mind that any framework will inevitably include both international treaty, national and local law and regulation, as well as technical standards. There are many initiatives currently underway, but they lack overall coordination. It must be recognized that complete uniformity is impossible due to differing norms and local conditions. Instead, discussions should focus on establishing norms of interaction, auditing, accountability, and governance between communities. Payments and some other types of financial transactions are examples of such systems.

The basis of good governance is reliable and comparable data, which means that data metrics must be reliable uniform, frequent and sufficiently fine-grain to allow visibility required for security and regulation. Private companies must contribute to and participate in these systems, but this should not be at a burdensome cost or endanger their competitive position.

Security and Privacy: digital transaction auditing and enforcement

Foundational to the digital transformation of nations will be the need for strengthened multilateral cooperation to ensure the privacy of citizens and the security of both public and private data systems (e.g., government systems but also financial systems, health systems, etc). A strengthened commitment to multilateral digital trade security is a natural topic for the UN and its members, and is increasingly urgent.

As 5G and Internet of Things technology are more widely deployed in the coming years, many nations will face increasingly disruptive cyberattacks. Current estimates is that the frequency of such attacks could be an order of magnitude greater that today, and would threaten basic government, health, food, power, financial systems. Similarly, the impending deployment of national digital currencies may pose an even greater danger. Not only could "hacks" of a national digital currency cause immense real-world damage, but such systems can potentially allow tracking every purchase of every person. Such individual-level financial tracking poses privacy risks that dwarf current concerns.

Coordinated multinational and national systems that allow unified and agile response is required. The need for technologies such as secure, privacy-preserving digital ID, accurate records of cross-border trade, and real-time sharing of health data are becoming urgent. There

are of course many relevant initiatives underway, but there is no overarching vision and so gaps and contradictions are everywhere. The technology to build effective systems exists, and industry is willing to lead the way in deployment, and now governments need to enable effective, coordinated detection of attacks, fraud, and rules for proportional response.

Governance for digital platforms

Modernizing and digitizing governance of national, international, and commercial interactions to become more efficient, transparent, and inclusive is a key global priority, and dozens of efforts to already underway. However, current efforts are mostly piecemeal and incremental. This is therefore a natural topic for the UN and its members.

Governance of digital platforms has become unexpectedly urgent with the pilot deployment of nationally-backed digital platforms that provide a uniform framework for not only finance but trade and logistics, authentication, fraud detection and analytics (e.g., AI). China, for instance, is moving existing Silk Road investments onto Chinese digital systems that are dramatically more agile and cheaper than Western systems.   Singapore has developed a similar digital trade and logistics infrastructure for investments within its Temasek Sovereign Wealth fund, and Switzerland has recently deployed the Swiss Trust Chain.   Finally, most major economies have either deployed or are seriously considering deployment of national digital currencies.

These systems are poised to integrate the majority of the world's trade into efficient, unified frameworks that seamlessly interoperate across sovereign and institutional borders. However, their accountability, inclusiveness and governance may not satisfy many nations, perhaps particularly Western nations. It is imperative to develop standards specifications for these new digital governance systems, making this topic a natural one for members of the UN.

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