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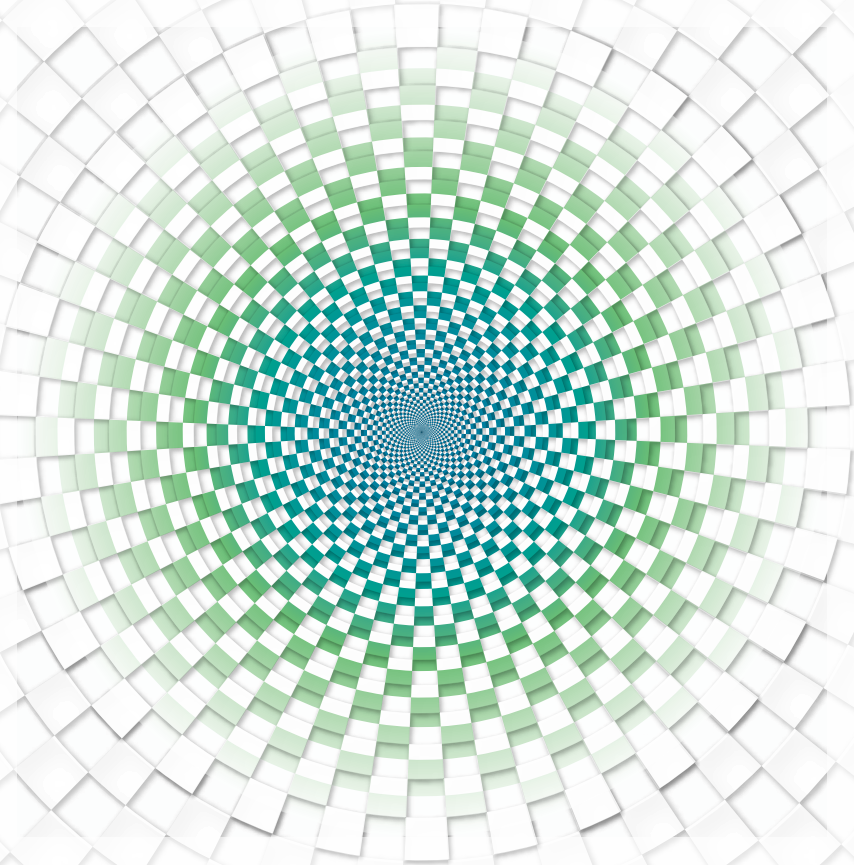
FINTECH AND SUSTAINABLE DEVELOPMENT

ASSESSING THE IMPLICATIONS

SUMMARY



Inquiry: Design of a Sustainable Financial System

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The UNEP Inquiry

The Inquiry into the Design of a Sustainable Financial System has been initiated by the United Nations Environment Programme (UNEP) to advance policy options to improve the financial system's effectiveness in mobilizing capital towards a green and inclusive economy—in other words, sustainable development. Established in January 2014, it published the first edition of *'The Financial System We Need'* in October 2015, with the second edition launched in October 2016. The Inquiry's mandate currently extends to the end of 2017, with work focused on deepening and taking forward its findings.

More information on the Inquiry is available at: *www.unepinquiry.org* and *www.unep.org/inquiry* or from: Ms. Mahenau Agha, Director of Outreach *mahenau.agha@unep.org.*

About this report

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FINTECH AND SUSTAINABLE DEVELOPMENT – ASSESSING THE IMPLICATIONS

Finance is a system in constant flux. At present, the financial system is in both turmoil and transition. The financial crisis and its aftermath caused enormous turmoil and led to an extended period of low growth and instability across the international political economy. Transition of the financial system is in part driven by this turmoil, through policy and regulatory drivers, and heightened the influence of emerging nations in shaping global finance.

Transition is driven by broader historic developments, including sustainable development and financial technology innovations. The world is struggling to address growing inequality, the impacts of climate change and widespread deterioration in the natural wealth that sustains communities and underpins the global economy. The current turmoil is driven in part inadequate policy responses to these challenges. This imperative may seem distant from the financial system, but nothing is further from the truth. As the UNEP Inquiry has spelled out in both editions of its global report, "The Financial System We Need", realizing the Sustainable Development Goals (SDGs) and climate commitments agreed in 2015 depends in part on a reset of the global financial system to ensure that private capital is redeployed to finance the transition to an inclusive, green economy.

Financial technology ('fintech') is emerging as a core disruptor of every aspect of today's financial system. Fintech covers everything from mobile payment platforms to high-frequency trading (HFT), and from crowdfunding and virtual currencies to blockchain. In combination, such forceful innovations will threaten the viability of today's financial sector business models, and indeed the effectiveness of current policies, regulations and norms that have shaped modern finance.

The unit cost of intermediation of the last century has been estimated to about 1.5-2%, leading to suggestions that efficiency savings over time in one area of financial services have been largely offset by additional fees in another area. This has attracted new fintech start-ups and their disruptive business models, and with them significant opportunities and risks.

The use of technology in finance is of course not new – but a step change is now expected with the novel application of a number of technologies in combination, notably involving blockchain, the 'Internet of things' (IoT) and artificial intelligence (AI). This novel application of a number of technologies in combination makes the current wave of disruption unlike any we have seen before in finance. Fintech innovations promise a more efficient, accessible and less vulnerable financial system. At the same time, by creating new markets and blurring the boundaries between financial services and adjacent industries like retail and telecom industries, technology-enabled innovations bring a new set of risks to the financial system and may lead to significant unemployment in light of the increase in AI-led automation and the expanded use of robots under way. Minimizing the risks and maximizing opportunities of new innovations is essential to maintaining a healthy financial system that benefits society at large.

Regulatory response to the 2008-09 financial crisis created an opportunity for new start-ups, where they could provide financial services without the same (high) standard of regulation, and hence without the associated costs. With these new regulations, incumbent banks were forced to shift away from non-core assets and unprofitable customers, leaving this space wide open for new entrants.

In this context, the emergence of Bitcoin and its associated ecosystem of blockchains, sidechains and altchains have been described as a disruptive force in the financial sector in opposition to the centralized, trusted and guarded current state model of today's financial transactions. Blockchain may still be an immature technology, but just as earlier disruptive technologies like the World Wide Web and the rise of mobile phones, it holds the potential for a disruptive wave of innovations as it enables transparent interactions of parties through a trusted and secure network that distributes certified and auditable access to data. The blockchain may indeed solve for problems in trust, asymmetry of information and economics of small transactions without the costly and complex risk infrastructures and central intermediaries of today.

The technologies involved are not all new but the combination of them – the speed, the breadth and depth of their disruptive impact across the board – makes fintech unique in the way it may disrupt the system as a whole.

UN Environment commissioned an initial landscape review of the potential for fintech to advance sustainable development. This report is a more detailed companion to the high-level overview of fintech and sustainable development reviewed in the Inquiry's second edition of its report "The Financial System We Need".

Technological innovation is already offering sustainability solutions across the five core functions of the financial system: moving value; storing value; exchanging value; funding value creation; and managing value at risk. In this report, the overarching question is:

How can fintech innovations *help us and/or hinder us in* harnessing the financial system to align financing with sustainable development outcomes?

We focus on deconstructing further this question into the following 'how' questions:

1. How can we unlock much higher *financial inclusion* by significantly reducing the costs for payments and provide suitable access to capital domestically and internationally for the 'unbanked', the 'underbanked' and for small- and medium-sized enterprises (SMEs)?
2. How can we mobilize domestic savings at scale to enable long-term investment directed at long-term sustainability of the real economy through *investment in sustainable development innovations and in resilient and sustainable infrastructures?*
3. How can we disrupt the provision of *financial protection, risk management, risk transfer and risk diversification for vulnerable and exposed communities, real economy assets and infrastructures, and nature's ecosystems?*
4. How can we best *collect, analyse and distribute financial system and real economy information for better economic decision-making, better regulation and better risk management?*
5. How to better *provide effective and efficient financial markets with a level playing field and with market integrity for long term real economy investors* aligned with the sustainable development agenda?
6. How to best *remove barriers for scaling the resulting 'fintech for sustainable development' (FT4SD) innovation portfolio* given their significant impacts if deployed widely and deeply?
7. How to *mitigate the unintended consequences of fintech to obtain a net positive impact* for our FT4SD innovation portfolio?
8. How to *make sense of the complex FT4SD system change required to inform our journey* going forward?

Bank of England Governor Mark Carney recently articulated fintech's potential to deliver a great unbundling of banking's core functions, highlighting that the outcomes could be 'bucketed' in one of three potential scenarios – revolution, restoration and reformation. These scenarios could provide benefits to the financial sector including speed of transaction chains, greater capital efficiency and greater operational resilience. More broadly, he argued for leveraging advanced computer science to take a real-time and data-driven approach to monitoring and forecasting the real economy and of the financial system in ways similar to the fusion of advanced physics and computer science to model the earth's atmosphere in long-range climate and short-range meteorological prediction. In fact, he was beginning to connect the two worlds that are the focus of this report: articulating the connections between fintech and sustainable development in a new domain area we term 'fintech for sustainable development' (FT4SD).

Fintech offers the prospect of accelerating the integration of the financial and real economy, enhancing opportunities for shaping greater decentralization in the transition to sustainable development. Turmoil and transition guarantee that tomorrow's financial system will be very different from our current understanding and practices. Indeed, the very distinction between finance and the real economy will become blurred as fintech embeds

finance at the core of an increasingly automated global economy with seamless two-way communication. Change is clearly desirable given the current shortfalls in providing finance for sustainable development.

But what kind of changes can be expected through fintech disruption and how might they impact on sustainable development outcomes?

Just as most DNA molecules consist of two coiled strands that form a double helix – where two DNA strands are composed of simpler units called bases that combine in pre-set ways to generate the genes that code all lifeforms on earth – we will adopt the language of 'double helix of FT4SD' to understand the fundamental attributes (or DNA bases) of fintech and of sustainable development, as drivers of disruption and impact. These two concepts can also "connect" in pre-set ways to enable new sustainable business models. This will help highlight the changes under way and provide a common language to discuss the both positive and negative impacts of FT4SD – effectively providing a first attempt at a *meta-language* for translation across the finance, sustainable development and technology communities.

With this background, we posit some fundamental features, or "DNA" of fintech as including:

- *Increased access and decentralization of the financial system*: whereby advanced technologies are used to enable the inclusion of the unbanked and underbanked community of individuals and SMEs in two complementary roles as both producers and consumers (prosumers).
- *Increased transparency, accountability and collaboration across sectoral boundaries*: where advanced technologies can enable greater transparency, traceability, accountability and information sharing, to regulators, citizens and businesses to work together in the best interests of society.
- *Improved risk management and diversification*: better capture and analysis of citizen, business and financial institution data allow both the private sector and financial regulators to identify, characterize and manage more granular risks through the development of early-warning infrastructure and by better spreading risk across a range of actors in the financial system and in the real economy.
- *Lower costs through improved efficiency, speed and automation*: artificial intelligence (AI) platforms allow for end-to-end automation of processes, reducing costs, increasing reach, tailoring services and increasing the speed of execution of financial system front- and back-end services.
- *Increased competition*: disruption of the competitive landscape by the entry of fintech start-ups and the proliferation of alternative products and business models creates more accessible lower cost choices for all.
- *Redefining how we can better account for (sustainable) value*: by combining advanced technologies, we can create a system of accounting that brings us into the 21st century, migrating away from the reductionist double-entry bookkeeping invented by Pacioli in the 1300s – with an approach that looks beyond numbers in ledgers and utilizes machine learning, multiparty computation and algorithmic representation to redefine "value", particularly sustainable value.

Similarly, the connective fundamentals of sustainable development can be described as:

- *Increased inclusive prosperity for all*: this calls for reducing inequality and ensuring the provision of basic needs for all (water, energy, food, education, health, etc.).
- *Increased solidarity*: solidarity is needed within and across communities in a nation and internationally, particularly in times of disaster.
- *Improved natural resource productivity*: the use of water, energy, food, land and material resources can be improved by drastically reducing environmental externalities and enabling affordable access to all basic natural resources that sustain life and economies.
- *Increased social, economic and environmental resilience*: societies cannot exceed planetary boundaries if they wish to avoid catastrophic and irreversible change; instead they should strive to ensure stability and resilience of communities, of real economy assets and infrastructure, of the financial system and of natural infrastructure and their ecosystem functions.
- *Enhanced circularity:* disruption of whole industries and supply chains where effective flows of materials, energy, labour and information interact with each other and promote by design a restorative, regenerative and more productive economic system.
- *Improved intergenerational decision-making: adopting individual, business, government and collective decision-making to provide a safe and liveable planet for future generations.*

The DNA bases of fintech and of sustainable development connect and interact enabled by a "FT4SD Gearbox". We argue that blockchain coupled with machine learning and artificial intelligence (MLAI) and the Internet of Things (IoT) will lead to revolutionary innovations for building trust, immutability, transparency and traceability in transactions in both the financial system and in the real economy – through entirely new business models such as asset financing models based on real-time accumulated risk versus fixed terms.

Why do we believe that the combination of IoT, blockchain and AI ("FT4SD Gearbox") if deployed correctly, would enable the sustainable development agenda at scale?

Two drivers explain this:

- IoT and AI enable the 'animation of the physical world' – once we bring physical and natural assets, machines, and physical and natural infrastructures to life by interacting with each other and by sensing and responding to each other in real time.
- Blockchain's smart contracts on the immutable distributed ledger allows real economy assets, infrastructures and processes to interact with the financial system in predictable ways and with business models that were unheard of ten years ago. Providing this two-way real-time interoperability between the real economy and the financial system will be disruptive.

The challenge for financial systems is twofold: to mobilize finance for specific sustainable development priorities and to mainstream sustainable development factors across financial decision-making:

- Mobilizing finance**:** Capital needs to be mobilized for *financial inclusion* of underserved groups (e.g. low-income citizens and SMEs), raising *capital for sustainable and resilient infrastructure* (e.g. energy) and *financing critical areas of innovation* (e.g. off-grid energy solutions, smallholder agriculture, sustainable land use, and sustainable fisheries). Estimates suggest that US$5-7 trillion per year is needed to implement the SDGs globally. Developing countries face an annual investment gap of around US$2.5 trillion in areas such as infrastructure, clean energy, water and sanitation, and agriculture.
- Mainstreaming sustainability**:** Sustainability factors are increasingly relevant and material for financial institutions decision-making. This starts with ensuring *market integrity* (e.g. corruption, enabling new common-pool resource markets, efficient markets) and extends to integrating environmental and social factors into *risk management* (e.g. climate-related risk ratings of biological assets, risk transfer in smallholder agriculture and shared assets). Sustainability also needs to be incorporated into the *performance disclosure and reporting* (e.g. immutable registries of property rights and moveable assets) of market actors to guide their decision-making.

To understand how a *FT4SD innovation portfolio* (see summary table) could play a strategic role in addressing the financing challenges of the sustainable development agenda, we examine a representative sample of case studies from the portfolio to understand how they may provide breakthroughs to address the sustainable finance drivers of financial inclusion, capital for infrastructure, financing innovations, market integrity, risk and resilience and reporting and disclosure. The FT4SD innovation portfolio is characterized in terms of applicable geographical contexts, sustainable development goals, sustainable finance drivers, level of maturity and potential for scale. The FT4SD innovation portfolio is balanced across all key dimensions by design so that we can understand its potential systemic impact, the barriers for scaling and the unintended consequences.

Will the alignment of the financial system with sustainable development be a challenge? Global finance is arguably the most complex, dynamically adaptive system ever created. Hundreds of billions of transactions daily enacted by millions of financial institutions and billions of people impact nearly person on the planet. Attempts to simply track these transactions have proved hard to design, let alone implement, as have measures to effectively stabilize the system. Transition drivers like fintech will make policy guidance more difficult in some ways as 'technical code' requires a multidisciplinary approach involving computer scientists, lawyers, cryptographers, scientists, policymakers and domain experts. It will dramatically increase the system's complexity and dynamism, making many current policy instruments less effective or indeed redundant. On the other hand, the combination of blockchain, IoT and AI may offer a basis for new policy instruments and new business models, while others may provide citizens with improved access to, and control over, financial services and related opportunities.

Fintech for Sustainable Development Innovation Portfolio

PORTFOLIO OF FT4SD CASE STUDIES		GEOGRAPHY	FT4SD CASE STUDY CHARACTERISTICS		SCALING POTENTIAL	
		GEO SCOPE	SD GOALS	SUSTAINABLE FINANCE DRIVER	ADOPTION STAGE	SCALING POTENTIAL
1.1	SME collateral management registry	Global	Jobs and growth	Financial inclusion	Conceptual	++
1.2	Welfare conditional transfer	Developing	Poverty	Financial inclusion	Conceptual	+++
1.3	Remittances/accounts for unbanked	Developing	Poverty	Financial inclusion	Pragmatic followers	+++
1.4	Economic identities for refugees	Developing	Peace	Financial inclusion	Early adopters	+++
1.5	International aid smart contracts	Developing	Poverty	Financial inclusion	Early adopters	++
1.6	Smallholder identity and land registry	Developing	Hunger	Financial inclusion	Early adopters	+++
1.7	Participative democracy 2.0	Global	Jobs and growth	Financial inclusion	Conceptual	++
1.8	Enabling microfinance 2.0	Developing	Poverty	Financial inclusion	Conceptual	++
2.1	Pay as you go resource utilities	Developing	Energy	Capital for infrastructure	Pragmatic followers	+++
2.2	Flexible energy supply and demand	Developed	Energy	Capital for infrastructure	Early adopters	+++
2.3	Renewable energy P2P	Developed	Energy	Capital for infrastructure	Early adopters	++
3.1	Smallholder extension services	Developing	Hunger	Financing innovation	Conceptual	++
3.2	Community distributed generation	Developed	Energy	Financing innovation	Early adopters	+++
3.3	SME asset trade finance	Developed	Jobs and growth	Financing innovation	Conceptual	++
3.4	SME smart assets	Developed	Jobs and growth	Financing innovation	Conceptual	+
4.1	Financial markets early warning system	Global	Partnership	Market integrity	Early adopters	++
4.2	Sustainable fintech regulatory sandbox	Developed	Partnership	Market integrity	Early adopters	+
4.3	Biodiversity conservation exchange	Developing	Land-based	Market integrity	Early adopters	++
5.1	Shared asset insurance	Developed	Consumption	Risk and resilience	Early adopters	++
5.2	Smallholder index insurance 2.0	Developing	Food	Risk and resilience	Conceptual	+++
5.3	Basin water rights management	Global	Water	Risk and resilience	Conceptual	+++
5.4	Agricultural credit risk management	Developing	Land-based	Risk and resilience	Conceptual	++
6.1	Water asset registry and ratings	Global	Water	Performance and disclosure	Conceptual	+++
6.2	Fish supply chain traceability	Global	Ocean-based	Performance and disclosure	Early adopters	++
6.3	Climate monitoring reporting verification	Global	Climate	Performance and disclosure	Conceptual	+++

In this context, the path to adoption requires addressing six key dependencies and 11 key barriers.

Key dependencies for scaling:

- Need for industry-wide standards and network interoperability
- System and process integration challenge across institutional borders
- System-wide coordination barriers
- Migration away from IT infrastructure legacy
- Broadband connectivity requirements
- Enabling (pseudo)-anonymity

Key barriers for scaling:

- Regulatory barriers
- High energy bitcoin network consensus cost
- Requirement of a validation network
- Scalability of blockchain and technology robustness
- Operational transition risks
- Immutability barriers
- Incumbent business model risks
- Security, privacy and resilience against cyber-attacks
- Cost sharing across the network
- Governance of the network
- Legality of smart contracts

There is a range of both transitional and more structural unintended consequences, however, with potential downside risks for sustainable development. The rapid development of fintech has raised policy questions about proper regulation and supervision. But typically financial system regulators concentrate their efforts on financial stability and not around fintech's many unintended consequences spanning various areas, which are often the purview of other sectoral regulators in the telecom/IT and in the natural resources arenas.

In this report, we discuss 15 unintended consequences that can be grouped into eight structural and seven transitional types.

Structural consequences:

- Cryptocurrency outsized energy footprint
- Ownership and governance of use of data
- Cashless society provides backdoors to privacy and control
- Too high a granular risk may make high-risk communities uninsurable
- Provisioning cognitive layer of robo-advisers with unintended value system
- Fintech commoditization destroying relationships
- Know Your Customer (KYC)/Anti-Money Laundering (AML) compliance on the blockchain may aid state surveillance efforts
- Blockchain's immutability and the right to forget

Transitional consequences:

- Alternative sources of finance with unmanaged risks
- Increasing several fold the cyber security risks of going fully digital
- Fintech AI-driven automation will create significant unemployment
- Unintended killer apps for mobile money/bitcoin exchanges
- Accelerating regulatory knowledge gaps
- Capital markets level playing field
- Rapid obsolescence of mission-critical digital technology through ownership lifecycle

Shaping a financial system that can meet the needs of the 21st century requires a focus on its underlying purpose and resilience, not just on measures to cope with today's sources of turmoil. Dangers associated with the current turmoil encourage us to focus attention and policy measures on stabilizing a system that is fundamentally no longer fit for purpose. Continued misalignment with sustainable development will ferment further instability across economies, nations and ecologies. This will in turn undermine the stability of the financial system and its effectiveness in allocating capital for private gain. Key, then, is to place more focus on transition drivers such as fintech, which offer an opportunity by blending market, technology and policy innovation to align the financial system with sustainable development.

As part of the UNEP Inquiry report on the 'Financial System We Need', a number of scenario vectors were developed including one termed 'Technology Edges', which to a large extent is the lens of this report. In the "Technology Edges" scenario, our end-state vision considers that (to leverage advanced technologies) mainstreaming sustainable development in the financial system requires developing and understanding the levers of the 'real economy-financial systems graph'. This graph is analogous in nature to Facebook's "social graph" or LinkedIn's "economic graph". But in our case, we have an interest of mapping the interactions and the positive and negative feedback loops between the four (excluding the social network) foundational

networks linking the real economy with the financial system: natural resources and infrastructures, physical infrastructures, supply chains and the financial system networks. We believe that this "system of systems approach" will allow us in time to model the complex world we live in with advanced computer science disciplines in AI and network science. If we can do this in time, it will allow us to understand the overall system interactions, the positive and negative feedback loops, the vulnerabilities, the overall dynamics – and chart our future with more confidence. Becoming the "cartographers of FT4SD systems change" then becomes a high priority for ensuring net positive outcomes.

Broad technological change enabled by fintech can redefine the systems constraints and thus the location of the equilibrium points. Shocks of various origins (regulatory, novel technology ecosystems, standardization, risk instabilities, etc.) can force the equilibrium points to move over time. Thus we expect the dynamics of the system originating from a level of equilibrium, followed by a shock, followed by a new level of temporary equilibrium. Another important characteristic of this type of system fully complies with the first and second laws of thermodynamics. The nature of this system change is complex, in that sometimes it is in a stable pseudo-equilibrium state but it can also be subject to complex unpredictable exponential growth and collapse – where all economic activities and financial activities are firmly grounded in the real physical world of things, physical assets and infrastructures, natural resources and natural infrastructures. In another words, attaining sustainable development outcomes will to a large extent require complying with the fundamental laws of thermodynamics.

A case in point are the feedback loops between the financial system and the real economy, whereby accelerating climate change increases the amplitude and frequency of weather extremes, thereby impacting financial assets negatively either through a correction or elimination of the underlying financial value. These weather extremes can also disrupt the real underlying economic activities of assets and infrastructures through higher temperatures, changed patterns of precipitation, droughts, floods, landslides or public health disasters. Dietz et al.[1] estimate that under unabated climate change, there is a 1% chance that at least US$24 trillion will be lost.

Irrespective of the massive complexity involved as discussed in the prior section what can we say about the system change ahead? The first blockchain applications emerged out of eroded trust in traditional institutions, and yet eight years later, more than 60% of the global financial system has entered into a consortium to apply blockchain to remove cost and create efficiency in their businesses. In addition, the World Economic Forum Deep Shift research estimates that 10% of global gross domestic product (GDP) will be stored on blockchain technology by 2025. However, the notion that a novel fintech start-up can capture the bulk of the global financial market settlement and become the Google, Apple or Facebook of global finance, while transforming post-trade operations and earning massive profits is overly simplistic and probably just plain wrong.

Reality is distorted by the near daily announcements of new developments, new partnerships, new consortiums, new standard battles, new world-changing proofs of concept, new start-ups – all promising to change the world for the better, as well as a steady stream of news on technological improvements and their potential scalability. Ignoring the current media hype, we can safely say that all developments are nascent. Furthermore, there are no commonly accepted standards for a number of practical areas, and with multiple efforts being undertaken in the space, resolution will take time. While talk of the next big disruption and a blockchain revolution (or two) suggests that wide-scale adoption is imminent, the facts suggest otherwise. In reality, this may take longer than expected but the results will be more profound once the change is finally under way. As Bill Gates clearly articulated: "We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction."

Governments often play a key role as inventors and/or funders at the infrastructure-building stage of new transformational innovations like the Internet (US DARPA). The end-to-end open standards principle adopted for the Internet allows for innovation at the network's edges where the tinkerers, innovators and start-up disruptors reside. By unbundling the transportation of bits from the provision of applications, innovations can be developed without permission – this is precisely what we need to reinvent our future in terms of sustainable development. Let 'thousands of FT4SD flowers bloom' is without a doubt the best strategy possible.

Government's mission-oriented policies drawing on frontier knowledge for great impact leveraging "big science deployed to meet big problems" makes a huge difference. The market creation and support

mechanisms that governments deploy in the future will set the odds for good, bad or even ugly scenarios. This is a major challenge that will determine the probabilities of success or failure.

If we can engineer a similar outcome for the blockchain and associated technologies as per the Internet example, we have yet to imagine the limits of what is possible. If not, then positive innovations and disruptions will be stifled and history books may see the 'FT4SD Gearbox' as a failed innovation platform. To get this right, we need to seriously consider how to govern the public-private and citizen's interests to achieve the best possible outcome for all.

With this hindsight, we can envisage that the road ahead will involve one or multiple 'standards battles' that take us back to the famous operating system wars, the browser wars, the Betamax and VHS wars and so many other standard wars where the most common outcome is that the "winner takes all".

The FT4SD revolution calls for addressing these design principles in the next 3-5 years. The questions we need to address are how best to take advantage of this short window of opportunity and what are the policies required to enabling scaling and mitigate the impacts of the unintended consequences?

The net impact of the FT4SD revolution will also depend on a number of policy and regulatory innovations that enable scaling and minimize fintech's unintended consequences in the areas of:

- Enabling 'technical code'
- Enabling open data policies
- Policies Enabling Trust and Interoperability
- Enabling policies of embracing blockchain regulatory co-benefits
- Public sector taking a leadership role
- Enabling 'hands-off regulatory approach' to market creation and innovation

We envisage three implementation pathways: FT4SD start-up pathways; FT4SD multi-stakeholder partnership pathways; and top-down FT4SD policy-mandated innovation pathways.

Challengers (FT4SD start-ups)

FT4SD start-ups will need strong focus to increase market adoption, based on reducing customers' costs, risks, or capital consumption by at least a factor of 10-100. Anything less than this performance threshold will not overcome the main obstacle for start-ups: inertia and status quo. This is particularly challenging in a networked business such as the financial system, where the business case for any participant depends on adoption by several of its counterparties creating 'network effects'. Start-ups have a significant role to play in demonstrating the real possibilities of disruption, as they have no legacy or business model to defend or no revenues. Incumbents need to learn from their 'take no prisoners' approach at high speed, with a motto than can be characterized as iterations of *'do, fix, learn'* versus the more classical *'meet, discuss, plan and meet again to refine'* of incumbents.

Multi-stakeholder FT4SD Partnerships (including incumbents, FT4SD start-ups, regulators, policymakers, real economy and philanthropic players)

The multi-stakeholder approach relates to adoption by stakeholders from the public, private and public purpose sectors. Achieving consensus on the joint outcome is very time-consuming, given the different languages of the different communities (finance, technology, real economy, sustainable development, policy and philanthropy), their contribution and power in the value chain, and the benefits and costs that the partners experiment in technical, business, policy and regulatory model types.

Top-Down Mandated or Policy-driven FT4SD Innovation

In the blockchain-enabled FT4SD universe, top-down regulatory mandates are unlikely to achieve the positive impact we need. These, however, will be necessary to create the enabling environments for blockchain-enabled value propositions that can be prototyped and proven at scale. In the short term, innovative central bank innovators are planning to provide regulatory grade data to incubate RegTech start-up hubs for their own purpose. This is a good move from leading-edge regulators that prefer to co-develop innovations and explore the possibilities (both good and bad), rather than wait to see what evolves and then try to regulate the innovations.

Policy interventions can be active on both the fintech supply-side and on the manner in which financial system development is aligned to sustainable development. Some key steps in the FT4SD innovation journey could include:

1. Convening the multi-stakeholder platform to jointly develop the standards required
2. Co-developing the multiple FT4SD ecosystem-wide pathways for system-wide change
3. Envisioning and co-designing FT4SD innovations
4. Rapidly developing FT4SD prototypes and embracing agile "do, fix, learn" cycles
5. Bringing VC performance management rigour to FT4SD start-ups and multi-stakeholder initiatives alike

In this context, there are at least three potentially complementary "how to" models to accelerate the development of FT4SD innovations:

- Step 1 : **Creating a FT4SD challenge fund** – this challenge fund would be similar in nature to the Longitude and X-Prizes that seek a select number of jurisdictions or initiatives that are either piloting pioneering initiatives or are ready to embark on the FT4SD journey. The fund would provide them with the design, technical support and funding to develop implementable pilot plans. It would also create a global community of purpose that can pilot and create investment-grade, replicable partnerships and solutions. This is an area where a visionary philanthropic foundation can shape a catalytic system change.
- Step 2: **Setting up regional FT4SD innovation incubators for multi-stakeholder partnerships** – these would use design-centric rapid prototyping methodologies developed in social innovation labs and in technology start-ups around the world. Governments, international development partners, NGOs, scientific organizations, private sector companies, central bank regulators, FT4SD start-ups, philanthropic organizations and incumbent financial institutions can convene place-specific and time-bound "co-creation labs" with the objective of designing the specific FT4SD capabilities needed on the ground across different regional realities.
- Step 3: **Raising FT4SD VC and social impact funds** – FT4SD VC and social impact funds can bring on board the high impact multi-stakeholder partnerships incubated in Step 2 above to fund the scaling of FT4SD innovations by selecting jurisdictions for deploying their resources. They would then recover the initial investments through participation in successful FT4SD start-ups and/or initiatives. A VC-type model of performance based funding will be at the core of the design to insure impact and scalability.

1. Dietz, S., Bowen, A., Dixon, C. and Gradwell, P. (2016). 'Climate value at risk' of global financial assets. Nature Climate Change. *http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2972.html*

Inquiry: Design of a Sustainable Financial System

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