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ARTICLE

Sustainability, FinTech and Financial Inclusion

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Abstract
We argue financial technology (FinTech) is the key driver for financial inclusion, which in turn underlies sustainable balanced development, as embodied in the UN Sustainable Development Goals (SDGs). The full potential of FinTech to support the SDGs may be realized with a progressive approach to the development of underlying infrastructure to support digital financial transformation. Our research suggests that the best way to think about such a strategy is to focus on four primary pillars. The first pillar requires the building of digital identity, simplified account opening and e-KYC systems, supported by the second pillar of open interoperable electronic payments systems. The third pillar involves using the infrastructure of the first and second pillars to underpin electronic provision of government services and payments. The fourth pillar—design of digital financial markets and systems—supports broader access to finance and investment. Implementing the four pillars is a major journey for any economy, but one which has tremendous potential to transform not only finance but economies and societies, through FinTech, financial inclusion and sustainable balanced development.

Keywords Sustainable investment · Sustainable development goals · FinTech · Financial inclusion · RegTech · Sustainability · e-KYC · Electronic payment infrastructure

1 Introduction

Sustainable development is one of the most important shared objectives globally. In looking at this issue, the focus today increasingly centres on the United Nations Sustainable Development Goals (UN SDGs), with the UN SDGs providing a framework of detailed objectives and criteria in pursuing sustainable development.

Central banks and financial regulators around the world are likewise considering how they can enhance sustainable development and the UN SDGs in the context of

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their wider mandates for financial and economic development. Central banks and financial regulators however have to also balance their other objectives, including monetary stability, financial stability, financial integrity and consumer protection with these developmental objectives.

Today, there are three major approaches emerging among financial regulatory policymakers to sustainability and the UN SDGs.

The first approach views climate change and the other UN SDGs from the standpoint of the traditional financial services focus on risk and related disclosure: as an example, the Financial Stability Board has led the development of a new set of climate change related disclosures. Similar frameworks are being adopted by others, particularly around environmental, social and corporate governance (ESG). Going forward, using the UN SDGs as the core framework for defining, monitoring and evaluating ESG investment has great potential to redirect existing resources towards achieving the SDGs.

The second approach views the UN SDGs (particularly climate change but also biodiversity and poverty reduction) as relating to new sources of potential risk which must be addressed: for example, climate change is now identified by the global insurance industry, its major regulators and related international regulatory organizations (such as the International Association of Insurance Supervisors) as perhaps the greatest risk facing the industry going forward. This is resulting in policy and regulatory changes and significant research into risk modelling, management and mitigation, all resulting in substantial redirection of resources to support the SDGs. InsurTech is a particular focus of R&D efforts. Likewise, the core focus of the Financial Stability Board is identifying new risks, thus providing a potentially significant opportunity for policy and regulatory focus.

The third approach—which is in its very early stages—involves thinking about how to restructure or even redesign the financial system to support the UN SDGs. This is the focus of this article: How can we support the transformation of finance to support the UN SDGs? In answering this question we turn to two other leading foci for central banks and financial regulators: financial inclusion and financial technology.

As the increasing focus on sustainability and the UN SDGs has emerged, so has a related focus on financial inclusion, bringing finance to all parts of societies in order to maximise benefits. Financial inclusion focuses on sustainable balanced development: making sure that the benefits extend to all.

In addition, over the past decade, central banks and financial regulators have had to face yet another challenge: the digital transformation of finance and financial systems around the world. Financial technology or FinTech is a new term for the interlinkage of finance and technology.[1] The interlinkage of finance and technology has a long history, but the most recent waves of its development pose new regulatory challenges because of an unprecedented speed of technological development including BigData, Artificial Intelligence, enhanced connectivity and storage technologies

[1] See on the evolution of the FinTech sector and FinTech in general Arner et al. (2016), p 1275, Arner et al. (2017), pp 377–378.

such as Blockchain and cloudservices.[2] FinTech brings with it not only major opportunities to transform finance positively but also major new risks which potentially impact regulatory objectives.

Sustainable Finance and *FinTech* are now major policy focuses of most national governments and regulators, as demonstrated by (1) a range of initiatives promoted by the European Commission[3] and some of the EU Member States,[4] and (2) an abundant stream of research on both sustainability[5] and FinTech.[6] Yet few have linked the two fields. In particular, the European Commission's Sustainable Finance Action Plan is silent on FinTech.

This article undertakes to link the two topics, using a third as catalyst: *Financial Inclusion*. Similar to sustainable finance and FinTech, financial inclusion is at the centre of current global policy attention, driven e.g. by the G20,[7] the World Bank[8] and major development organizations.[9]

Thus, in seeking to redesign finance to support sustainability through the UN SDGs, we focus on one significant avenue: digital financial transformation in support of financial inclusion and financial development. Strategies focusing on digital financial transformation support financial inclusion, the generation of new financial resources and the direct achievement of the SDGs, for instance through a combination of digital identification systems, simplified account opening processes, interoperable electronic payment systems, and government-to-citizen services delivered through this core financial infrastructure. The new Central Banks and Bank Supervisors Network for Greening of the Financial System and the new Sustainability

[2] See Zetzsche et al. (2018b); Arner et al. (2017), p 373.

[3] See *on FinTech* European Commission (2018a). On *sustainable finance* see European Commission (2018b).

[4] Regarding *sustainable finance*, most notably, the Grand Duchy of Luxembourg has launched a Green Finance initiative, inspired by the ambition to claim market leadership in Green Finance financial products. Other prominent EU examples include the sustainability agendas of France, the Netherlands and Germany, which seek to steer capital flows into sustainable financial products.

[5] See e.g. Delimatsis (2016) (arguing that a 'discomfort with the functioning, working methods and certain rigidities of the global standardizing bodies such as the ISO led to a mushrooming of a new generation of private standard-setters at the transnational level'). In return, the European Commission has started work on an own taxonomy, see European Commission (2018b), work programme in Annex II and III; see also Schanzenbach and Sitkoff (2019) (arguing that ESG investing is only possible for trusts if the trustee reasonably concludes and solely acts because of the fact that the ESG investment will be directly beneficial for the beneficiary by improving risk-adjusted return); Sjafjell and Bruner (2019) (the contributions in the edited volume discuss the mismatch between global markets and territorially rooted national sustainability regulation).

[6] Rather than referring to the large volume of legal work in this field (including our own), we instead refer to some key economic research, including Biais et al. (2019) (analysing economics of Blockchain technology); Hornuf and Schwienbacher (2017a); Buchak et al. (2018) (measuring the impact of technologies); Bacache et al. (2015) (as example for related topics such as taxation of the digital economy).

[7] See Global Partnership for Financial Inclusion (GPFI) (2016).

[8] See The World Bank's financial inclusion policy work at https://www.worldbank.org/en/topic/financialinclusion.

[9] Including the International Monetary Fund, the OECD, and others, NGOs such as the Alliance for Financial Inclusion, The Toronto Centre, and Microfinance Centre, as well as the state-sponsored development banks (EIB, ADB, IDB, FDIC, etc.).

Committee of the International Organization of Securities Commissions are examples of initiatives which seek to combine various policy approaches to support digital financing of the SDGs, while the Alliance for Financial Inclusion's FinTech for Financial Inclusion (FinTech4FI) initiative shows the potential for strategies for digital financial transformation.

Why focus on financial inclusion? We have good reasons to do so: As of 2017, 1.7 billion adults lacked access to a financial or mobile money account, some 31 percent of the world's population.[10] Significantly, though, between 2010 and 2017, 1.2 billion people gained a financial or mobile money account for the first time, with most located in developing countries.[11] Much of this progress came from the impact of technology in finance. For example, mobile money has played a major role in increasing financial inclusion in Kenya and East Africa.[12] China has moved in a very short period of time from an inefficient traditional financial system to perhaps the world's most digitized financial system.[13] India has dramatically increased financial access by building the infrastructure for a new digital economy ('India Stack'), thereby leading to hundreds of millions people gaining accounts.[14] Along with similar developments in Russia, these four places account for the vast majority of the gains in financial inclusion since 2010.

From the legal perspective, linking sustainability, FinTech and financial inclusion is far from obvious. In fact, most research has focused on the three fields as separate, unrelated silos of knowledge. Financial inclusion has become an economic research topic[15]—with a focus in microfinance[16]—but, with few exceptions,[17] much less a legal one. Where legal scholars focus on financial inclusion, they have studied (1) bank access for underprivileged people in developed societies,[18] (2) the regulatory set-up of mobile money service providers,[19] (3) regulatory preconditions for microfinance institutions,[20] and (4)—most recently—the Central Bank's role in financial inclusion.[21] We also note a scarcity of legal work relating to sustainable finance: While a plethora of studies discuss sustainable finance in general, and some research has been devoted to the steering effect of the UN SDGs,[22] with the exception of

[10] Demirguc-Kunt et al. (2018).
[11] See World Bank (2017).
[12] GSMA (2017); Ashenafi et al. (2016).
[13] Chien and Randall (2018); see also Zhou et al. (2015), p 25.
[14] See on the India Stack https://indiastack.org/. For a detailed discussion, see Arner et al. (2019b), pp 55, 64 et seq.
[15] See e.g. Lal and Sachdev (2015).
[16] See e.g. with regard to technology Ashta (2010).
[17] See e.g. Barr (2004a, b, 2012); Lee (2017), as well as the contributions in Barr et al. (2007).
[18] See in particular Barr (2012) and the contributions in Barr et al. (2007), as well as Blank and Barr (2009).
[19] See e.g. Buckley et al. (2015); de Koker et al. (2017); Lal and Sachdev (2015); Winn (2016); Zhou et al. (2015).
[20] See BCBS (2010); Trujillo et al. (2014, 2015); Rosengard (2011).
[21] See Harris and Barr (2019).
[22] See Biermann (2019), pp 52–53; Kanie and Biermann (2017) (with contributions on the governance function and implementation of the UN SDGs).

the impact of climate change on financial institutions[23] few academics have studied the link between *law* and sustainable finance. A lot of attention (including our own[24]) has been devoted to the legal environment governing (and the impact of) certain financial technologies (such as initial coin offerings,[25] artificial intelligence,[26] crowdfunding,[27] blockchain[28] and new payment methods[29]). However, besides furthering competition and innovation, and balancing the former with traditional objectives of financial regulation,[30] little attention has so far been focused on how to ensure financial inclusion as a wider objective of the promotion of FinTech. This is a gap this article seeks to fill.

While, as demonstrated above, our cross-disciplinary analysis is a radical step away from traditional disciplinary boundaries of legal scholarship,[31] we follow the practical approach undertaken by development bodies. *Their* interdisciplinary tendency is demonstrated by widely recognized reports issued e.g. by the G20 and the United Nations.[32]

In line with this approach, this article examines why FinTech is important for sustainable development and how regulators and governments can design a comprehensive strategy to support digital financial transformation, underpinning financial inclusion *and* sustainable balanced development at the same time. Neither FinTech nor financial inclusion are objectives in themselves. Rather, both are *tools* to build a sustainable future.

2 Financial Inclusion and Sustainability: The Long-Term Perspective

While financial inclusion is not included specifically in the UN SDGs, we suggest that it plays a central role in underpinning the SDGs as well as supporting finance in support of their achievement. This section examines FinTech, its relationship with

[23] See the groundbreaking report by Alexander (2014) (assessing the link between systemic environmental risks and financial stability, and offering insights into how some members of the Basel Committee are already acting on these links).

[24] See Zetzsche et al. (2019b); Arner et al. (2019a, b); Buckley et al. (2019); Zetzsche et al. (2018a, b).

[25] See e.g. Chiu (2018).

[26] Cf. Vermeulen et al. (2018).

[27] Cf. Hornuf and Schwienbacher (2017b).

[28] See Paech (2017); Vermeulen and Fenwick (2019); Avgouleas and Kiayias (2019); Finck (2018).

[29] Cf. Chiu (2017).

[30] See Allen (2019); Avgouleas (2018); Brummer (2015); Brummer and Yadav (2019); Chiu (2016); Haddad and Hornuf (2019); Omarova (2019); Magnuson (2018); Ringe and Ruof (2018).

[31] To our knowledge, two exceptions apply. A recent volume edited by representatives of the European Bank for Reconstruction and Development, to which we have contributed, links to our knowledge for the first time sustainable finance to financial technologies *and* inclusion, Zetzsche et al. (2019a). Further, an article by Chiu and Greene proposes using ICO-style fund-raising in order to achieve greater marketization of sustainable and social finance products, see Chiu and Greene (2019).

[32] See e.g. GPFI (2018a), a follow-up to GPFI (2016), as well as GPFI (2018b), endorsed in August 2018. See also UNCDF (2019); World Bank (2019).

financial inclusion, and how FinTech for financial inclusion relates to sustainability, the central objective of the UN SDGs.

2.1 Financial Inclusion: Why It Matters

Financial inclusion involves delivering financial services at affordable cost to all parts of society.[33] It enables people to manage their financial obligations efficiently, reduces poverty and supports wider economic growth.[34] First, it reduces individuals' vulnerability. For instance, facilitating saving allows people to weather shocks and invest in their education, health and micro-businesses. Second, it increases the efficiency of daily life: bills can be paid electronically without time off work. Third, financial inclusion allows the socialization and diversification of peoples' financial risks through the financial system. For instance, breadwinner insurance can prevent people falling back into poverty. Fourth, financial inclusion supports economic growth through increasing financial resources to support real economic activity, particularly for individuals and small and medium enterprises (SMEs).

2.2 Two Sides of the Same Coin

Financial inclusion is crucial to address today's global challenges as outlined in the UN SDGs. Financial access (particularly through FinTech, as will be discussed in more detail below) is one way to reduce the burden of life's challenges, including sickness, crime, poverty, unemployment, age, etc.[35] Financially excluded individuals lack tools to prepare for and manage such risks. For instance, farmers without access to electronic payment systems worry about theft; and may consume more immediately rather than take the risk. Health insurance can secure one's long-term working capacity. Savings can fund children's educations and provide for old age. These are long-term goals. Financial exclusion takes from people the opportunity to think, plan and *act* long-term. Where risks that could be avoided, hedged, or socialized through the financial system materialize we force the excluded to think and act *short*-term, often unsustainably. Financial inclusion and sustainability are two sides of the same coin, aimed at the UN SDG's core objective: promoting prosperity while balancing risks.

The connection between financial inclusion and the UN SDGs, may lead one to expect to find financial inclusion as a UN SDG. While it is not, analysis suggests that financial inclusion underlies success in all the SDGs and therefore should be seen as a key underlying objective in seeking balanced sustainable development (see Table 1).

Financial inclusion can thus be seen to support the broader achievement of the UN SDGs.

[33] FATF (2013), p 12.

[34] CFI (2019).

[35] These are listed as key challenges in the United Nations Sustainable Development Goals, https://www.un.org/sustainabledevelopment.

Table 1 Financial inclusion and the UN SDGs

No.	Goals	Impact Direct = D Indirect = I	How financial inclusion can further goal
1	No poverty	I	Access to finance supports poverty reduction
2	Zero hunger	I	Enhance financial stability; stabilize cash-flows through saving and lending
3	Good health and well-being	I	Provide health insurance and financial stability
4	Quality education	I	Enable financial planning and saving for school fees
5	Gender equality	D	Strengthening female entrepreneurship and financial control
6–7	Clean water and sanitation; affordable and clean energy	I	Financing development and maintenance of infrastructure
8	Decent work and economic growth	D	Availability of finance supports entrepreneurship, SMEs and innovation
9	Industry, Innovation and Infrastructure	D	Provide financing for development and maintenance of infrastructure
10	Reduced inequalities	D	Enable funding of education and savings which provide the best opportunity for greater participation
11	Sustainable cities and communities	I	Finance is key to achieving all the targets; increases the domestic and international resources available to focus on infrastructure development
12	Responsible consumption and production	I	Key to achievement is financing of research and development as well as infrastructure and education; increases resources—domestic and international—available
13	Climate action	D	Identifying and managing both new forms of existing risk as well as new risks and creating systems which expand financial resources available
14	Life below water	I	Providing alternatives to unsustainable production
15	Life on land	I	Providing alternatives to unsustainable production
16	Peace, justice and strong institutions	I	Economic development strengthens peace and civil institutions
17	Partnerships	D	Allows for engagement of private actors, multiplying assistance of public or state-supported actors

2.3 Financial Inclusion: A Developing Country Topic?

It is undebated that financial exclusion, in the formal sense, is less widely spread in developed countries. However, this does not mean that the population in developed countries know how to use their bank access well: As of 2014, the World Bank estimates that only 33% of all adults globally (and only 38% of account-owning adults) are *financially literate* (among them 57% of account owners in major advanced economies, and 30% in major emerging economies).[36] In this context, financial literacy means the ability to manage one's finances independently, without a financial advisor.[37] Assuming that approximately 1/3 of the world's population are children and subtracting the 1.7 billion formally excluded from the financial illiterate *approximately 1.7 billion adults* globally remain that cannot put their financial services access to good use despite access. The EU numbers are equally discouraging. Based on World Bank figures (2014), 53% of the EU's adult population is financially illiterate.

FinTech, if rightly designed and applied (e.g. through robo advisors making recommendations based on clients' interests), could come to the account holders' assistance. However, according to Eurostat, 37% of EU individuals over age 65 have never used the internet.[38] The UK Financial Conduct Authority (as an example of an advanced economy) estimates that 1 in 5 consumers lack the digital skills to use digital financial services.[39] At a time where 1 in 4 bank branches will be closed by 2020,[40] and more bank branches are about to close in poor quarters than in rich[41]—technological exclusion translates into financial exclusion.[42]

Despite many national and EU initiatives,[43] the transposition of findings in specific regulatory and legislative steps aimed at financial inclusion is lagging behind; analysis of how legislation, with the assistance of technology, could respond to financial illiteracy is sorely needed.[44] Multiple regulators seek to draw lessons from (and implement) the UN's digital literacy framework[45]—with Kenya's

[36] See Klapper et al. (2015), p 16.
[37] See Klapper et al. (2015), p 16.
[38] UKFCA (2016), p 13.
[39] UKFCA (2016), p 13.
[40] See report by consultancy firm McKinsey cited in Wallace (2015).
[41] See Brignall (2019).
[42] See Nguyen (2014) (stating that closings have prolonged negative impact on credit supply to local small businesses of − 13% for several years, even after the entry of new banks), as well as Nguyen (2019) (stating that bank branch closings in the USA during the 2000s lead to a persistent decline in local small business lending (fall by 453,000 USD after a closure off a baseline of 4,700,000 USD) for 6 years, while being very localized, dissipating within six miles).
[43] See the overview of the initiatives and discussions on the European Commission's online platform for adult learning, https://epale.ec.europa.eu/en/themes/financial-literacy.
[44] See the recent proposal by Safeguarding Ireland, *Scoping of a Regulatory Framework for Adult Safeguarding Welcomed—Call for Establishment of a National Advocacy Service*, taken from the European Commission's platform for adult learning, https://epale.ec.europa.eu/en/content/scoping-regulatory-framework-adult-safeguarding-welcomed-call-establishment-national.
[45] UNESCO (2018).

Three-Step-System of (1) familiarizing, (2) using, and (3) creating and programming software providing a particularly active example.[46] But despite all these efforts, due to the enormous dimensions of the problem both digital and financial illiteracy is here to stay—financial law has to accept wide-spread illiteracy as a given regulatory precondition. In light of this, ensuring FinTech for Financial Inclusion is a crucial intermediate goal on the road towards a long-term, sustainable, yet prosperous world.

3 FinTech, Financial Inclusion and Sustainability

Increasing financial inclusion is being seen—correctly in our view—not as an end in itself but as one fundamental support for achieving broader sustainable development objectives, including the UN SDGs.

If financial inclusion is beneficial for sustainability in terms of underpinning the achievement of the UN SDGs, what is the role of FinTech?

3.1 FinTech and Financial Inclusion

The 2008 financial crisis prompted sweeping regulatory responses coordinated by the G20 aimed at building a resilient global financial system. This led to the establishment of the Financial Inclusion Experts Group ('FIEG'),[47] Global Partnership for Financial Inclusion ('GPFI') and the endorsement of the first Financial Inclusion Action Plan ('FIAP') by G20 leaders in 2010, which has been revised in 2014 and 2017.[48]

The GPFI formally recognized digital financial solutions as critical to facilitate global financial inclusion in 2016[49] and introduced the G20 High Level Principles for Digital Financial Inclusion (HLPs).[50] Alongside the Recommendations for Responsible Finance[51] and the ID4D,[52] the HLPs aim to encourage and guide governments to embrace digital approaches to financial inclusion. In 2017, the FIAP was updated to reflect the pivotal role of digitization.[53]

The Alliance for Financial Inclusion (AFI) was established in 2008 by the central banks of developing countries, with an exclusive focus on financial inclusion. In 2012, its members signed the historic Maya Declaration on Financial Inclusion,

[46] See Kenyan Digital Literacy Programme by the Ministry of Information, Communications and Technology (ICT): http://icta.go.ke/update-on-the-digital-literacy-programme-being-implemented-by-the-ict-authority/.

[47] G20 Financial Inclusion Experts Group (2010); GPFI (2010).

[48] For the latest version see GPFI (2017); Buckley (2014), p 63.

[49] GPFI (2013).

[50] GPFI (2016).

[51] See Responsible Finance Forum (2011).

[52] See World Bank, *Identification for Development*: http://www.worldbank.org/en/programs/id4d.

[53] Timmermann and Gmehling (2017).

by which developing countries committed to financial inclusion targets and national policy changes and other agreements have followed.[54]

The UN also established the Task Force on Digital Financing in November 2018 in an effort to develop strategies that promote financial technology to advance the SDGs. Recognizing that FinTech for financial inclusion requires nothing less than an overhaul of the entire financial system, the UN's Task Force is committed to 'put people at the centre', i.e. it supports the view expressed herein that FinTech is an important, possibly the most important, single accelerator for attainment of the SDGs.[55]

There is thus strong support for the idea that FinTech does play an important role in financial inclusion. What role can FinTech play in sustainability more broadly?

3.2 FinTech and Sustainability

Digital finance and FinTech play three core roles in relation to achieving the SDGs.

The first is enhancing the allocation of existing financial resources to support sustainable development. This takes place through business models, incentives, policies and regulations to redirect financial resources globally and in individual countries to provide SDG-related finance. Examples include ESG (environmental, social and governance) and Green investment strategies, and the rapid growth in the EU, China and Japan in particular in ESG-related financing.

The second involves the expansion of resources in the financial system generally which can in turn support the SDGs. This takes place through financial inclusion and financial sector development, which together can increase the amount of financial resources available globally and particularly in developing countries and by which savings, investment and inclusion increases result in potentially large amounts of new money available. China's digital financial transformation is perhaps the best example of this.

The third involves the use of digital finance and FinTech to directly achieve the SDGs themselves. This occurs through the use of new technologies and of regulatory technology (RegTech) to design better financial and regulatory systems to achieve policy objectives, with the India Stack strategy showing the dramatic potential on offer.

Table 2[56] presents how FinTech contributes directly or indirectly to the UN SDGs.

If financial markets are sufficiently mature, providing payment services, long-term financing, insurance services and savings/investment products, supporting financial inclusion—particularly through FinTech—contribute to *all* 17 UN SDGs.

[54] AFI (2017a, b).

[55] UNSG (2018).

[56] The Table draws on the authors' own research and experience. That digital financial services support the UN SDGs is very broadly accepted: see United Nations, Digital Finance and the SDGs, http://www.uncdf.org/mm4p/dfs-and-the-sdgs.

Table 2 How FT4FI could further the UN SDGs

No.	Goals	Impact Direct = D Indirect = I	How FT4FI can further goal
1	No poverty	I	Allow for online financing, including credit and crowdfunding; create new income opportunities through online markets and payments; reduce impact of disasters with local impact
2	Zero hunger	I	Enhance financial stability; stabilize cash-flows through saving and lending
3	Good health and well-being	I	Provide health insurance and financial stability
4	Quality education	I	Provide financial planning and savings for school fees
5	Gender equality	D	Strengthening female entrepreneurship and financial controls
6	Clean water and sanitation	I	Provide financing for development and maintenance of infrastructure; further education for local sustainability expertise
7	Affordable and clean energy	I	Provide financing for development and maintenance of infrastructure; further education for local sustainability expertise
8	Decent work and economic growth	D	Allow for online financing, including credit and crowdfunding; create new (online) income opportunities; ensure funding and use symmetry (long-term for long-term projects, short-term for short-term projects)
9	Industry, Innovation and Infrastructure	D	Provide financing for development and maintenance of infrastructure
10	Reduced inequalities	D	See on gender at UN SDG 5. Re regional, economic and educational equality, education and savings provide the best opportunity for greater participation for most societies; both are furthered by FT4FI
11	Sustainable cities and communities	I	FT4FI assists the development of and investment in sustainable technology and transformation
12	Responsible production and consumption	I	FT4FI assists the development of and investment in sustainable technology and transformation
13	Climate action	I	FT4FI assists the development of and investment in sustainable technology and transformation
14	Life below water	I	FT4FI assists the development of and investment in sustainable technology and transformation
15	Life on land	I	FT4FI assists the development of and investment in sustainable technology and transformation
16	Peace, justice and strong institutions	I	Robust economic development strengthens peace and civil institutions
17	Partnerships	D	FT4FI allows for engagement of private actors, multiplying assistance by public or state supported actors

Table 2 makes evident that financial inclusion through FinTech is perhaps *the most important* intermediate step economies must take on their journey to the UN SDGs. Economies should develop strategies for digital financial transformation, focusing on FinTech's role in financial inclusion, as a response to the most important and difficult question: How should economies approach achieving the UN SDGs?

4 Sustainability through FinTech and Financial Inclusion: Four Pillars of Digital Financial Transformation

For these reasons, an ever-increasing range of international development organizations are focusing on the role of FinTech and digital financial transformation in supporting broader developmental objectives today, including the United Nations Secretary-General's Task Force on Digital Financing of the Sustainable Development Goals,[57] the Alliance for Financial Inclusion,[58] the World Bank and Consultative Group to Assist the Poor (CGAP),[59] and many regional development banks.[60]

Given the many partly competing, partly complementary initiatives it is crucial to avoid the mistakes of the past. This section addresses two questions: what lessons have we learned; and what types of FinTech are most likely to advance balanced sustainable growth and financial inclusion?[61]

FinTech today encompasses technologies such as the application of artificial intelligence to big data.[62] Which among these innovations are most likely to facilitate financial inclusion and the UN SDGs?

The immediate answer is mobile money—the provision of e-money on mobile phones—of which the paradigmatic example is M-Pesa in Kenya. The longer-term answer is more complex. The real opportunity FinTech affords is developing an entire infrastructure for a digital financial ecosystem underpinning the SDGs and financial development, inclusion, stability and integrity.

Lessons can be taken from India's FinTech strategy, India Stack, implemented over the last decade. India Stack is a set of APIs which form a digital infrastructure used by the government, businesses and other entities to provide paperless and cashless services.[63] India Stack involves four main levels.[64] First is a national biometric identification system. Second is the establishment of bank accounts to deliver national services. Third is a common payment API. Fourth is a series of electronic

[57] See UN Secretary-General's Task Force on Digital Financing of the Sustainable Development Goals, https://digitalfinancingtaskforce.org/.

[58] See the AFI special report by lead authors Arner et al. (2018).

[59] World Bank, Fintech and Financial Inclusion, http://pubdocs.worldbank.org/en/877721478111918039/breakout-DigiFinance-McConaghy-Fintech.pdf.

[60] We know of FinTech initiatives by the Asian Development Bank, the Islamic Development Bank, the European Investment Bank, and the Financial Development Corporation.

[61] GPFI (2018a).

[62] See on data-driven financial services Zetzsche et al. (2018b).

[63] *What Is IndiaStack?*, https://indiastack.org/about/.

[64] Bose (2016). To learn more about India Stack, see https://indiastack.org/about/.

KYC initiatives allowing individuals to provide their financial details to financial services and other providers. These eKYC utility platforms show how RegTech—regulatory technology—can improve the integrity of financial markets and reduce risks.

Based on India's experience and other successful examples including Kenya, China and Russia, we argued in our major study for AFI that economies must focus on four pillars of digital financial infrastructure to support digital financial transformation.[65] These four pillars are:

- Pillar I: Digital ID and eKYC for identification and simplified account opening
- Pillar II: Open electronic payment systems, infrastructure and an enabling regulatory and policy environment that facilitates the digital flow of funds from traditional financial intermediaries and new market entrants
- Pillar III: Account opening initiatives and electronic provision of government services, providing vital tools to access services and save
- Pillar IV: Design of digital financial market infrastructure and systems that support value-added financial services and deepen access, usage and stability.

These four pillars are examined below.

4.1 Pillar I: Digital ID and eKYC—Establishing the Foundation

Experience indicates that digital identity is central to the transformation process. This is particular challenging in developing countries where substantial numbers of people often lack formal identification documents.[66]

India's Aadhaar system is the first level of India Stack and involves issuing a 12-digit randomized number to all residents for access to government and other services.[67] Difficulties in implementation should not detract from the potential of a national biometrically-based identification system to underpin a digital financial ecosystem. Digital ID is necessary for subsequent parts of the digital financial ecosystem to rest upon a solid foundation.

The experiences of the UN and Jordan with developing a digital identity solution for refugees illustrates good system design and synergistic development.[68] IrisGuard is iris recognition technology that converts an iris image into a unique code which is then used to identify the individual.[69] Since 2016, IrisGuard's EyePay platform has been used by the UN to deliver financial aid. The technology provides sufficient digital identity for beneficiaries to receive food vouchers, withdraw cash and transfer funds without a bank account. EyePay, in conjunction with the Ethereum blockchain, is now used to promote financial inclusion of Syrian refugees in Jordan by

[65] Arner et al. (2018).
[66] See for an extensive analysis of ID techniques and respective regulation Arner et al. (2019b).
[67] *About Aadhaar*, Unique Identification Authority of India, http://bit.ly/2HsyzJd.
[68] See https://www.irisguard.com/node/39.
[69] Ibid.

processing supermarket and ATM transactions in real-time. More than 2.3 million Syrian refugees in the region are registered in the system so far.[70]

In the European Union, the 2014 eIDAS Regulation was adopted to provide mutually recognized digital identity for cross-border interactions between European citizens, companies and government institutions. Once member states notify the European Commission of their eID, other member states must recognize it and individuals can use their eID in other member states.[71]

Base digital ID needs to extend as broadly as possible to maximize efficiencies. While base identity can be developed from multiple sources, including business-specific e-identities,[72] base identity provides the fundamental element of the KYC process. Particularly when linked electronically with other golden source data (such as tax information), it provides the basis of a simple eKYC system. The core objective is to make opening accounts for most people and entities simple and cheap, thereby allowing resources to be focused on higher risk customers and protection of market integrity.

Technology enables the reconsideration of existing systems so as to balance market integrity, financial inclusion and economic growth while meeting international financial standards.

For instance, as part of its Aadhaar system, India has developed a paperless eKYC service, to instantly establish the identity of prospective customers.[73] The digitization of identity authentication streamlines account opening and allows easy access to both digital and traditional financial services. Axis Bank was the first Indian bank to offer an eKYC facility in 2013, reducing the turnaround time for opening bank accounts from 7 to 10 days to just 1 day.[74] Today, many traditional banks and licensed payments banks in India offer accounts which can be opened and used instantly with eKYC.[75]

The European eIDAS system is intended to be the starting point for a similar system, making it 'possible to open a bank account on-line while meeting the strong requirements for customer identity'.[76] This includes accepting electronic identification for meeting customer due diligence (CDD) requirements.

Such systems—while technically feasible—may not be politically feasible everywhere.[77] Systems of optional digital identity, separate from sovereign identification systems, may hold the greatest transformative potential.[78]

[70] Ibid.
[71] Arner et al. (2019b), section 4.3.
[72] Ibid., at section 4.4.2.
[73] Desai and Jasuja (2016).
[74] India Infoline News Service (2014).
[75] For example, AXIS Bank (https://www.axisbank.com/accounts/savings-account/axis-asap/axis_ASAP.html) and RBL Bank (https://abacus.rblbank.com/).
[76] European Commission (2017), pp 13–14.
[77] See Arner et al. (2019b), p 58.
[78] Arner et al. (2019b), section 4.4.2.

4.2 Pillar II: Open, Interoperable Electronic Payment Systems—Building Connectivity

Payments systems provide the fundamental infrastructure for money to flow through any economy. They are foundational to financial inclusion, financial development and the functioning of the real economy. A mobile money ecosystem is one way FinTech can help. Technology enables developing countries to leapfrog bricks-and-mortar bank branches with a seamless digital financial system. Even poorer members of society and SMEs can then have accounts and access the services they need to flourish.

4.2.1 Mobile Money

Mobile money enables mobile phones to be used to pay bills, remit funds, deposit cash, make withdrawals and save, using e-money, sometimes issued by banks but mostly issued by telecommunication companies ('telcos'). The service currently exists in over 89 developing countries and is growing rapidly.[79] E-money is typically defined as a stored value instrument or product that: (1) is issued on receipt of funds; (2) consists of electronically recorded value stored on a device such as a mobile phone; (3) may be accepted as a means of payment by parties other than the issuer; and (4) is convertible back into cash.[80]

M-Pesa is a major success in providing financial services to a sizable proportion of the Kenyan population.[81] However, mobile money success has not been consistent across countries. This is due to the differing needs of consumers in different countries, the inability of service providers to adapt to different markets,[82] a tendency of central banks to over-regulate these services,[83] a lack of trained payments professionals in many markets,[84] and cultural and anthropological reasons.

Mobile money services, especially those offered by telcos, are key to defeating financial exclusion in poorer countries, but pose real regulatory challenges. Such services often do not initially pose systemic stability concerns and at least initially do not in many cases require, traditional levels of banking regulation.[85] At the same time, such services have the potential to grow rapidly, particularly when introduced by a dominant mobile telecoms provider, meaning that risks and the consequent need for regulation can develop very quickly in some cases. Service providers

[79] Scharwatt et al. (2015).

[80] AFI Mobile Financial Services Working Group (2014).

[81] In 2016, through embracing M-Pesa and other digital payment networks, over 75% of adults in Kenya had access to formal financial services, a 26.7% increase from a decade earlier, Ndung'u (2017).

[82] Buckley and Webster (2016), p 151.

[83] For example, the Central Bank of Kenya applied a 'light-touch' approach from the outset, which many believe assisted the provision of these services.

[84] Buckley and Mas (2016), p 71.

[85] Arner et al. (2018), p 12. For the impact on financial stability also see the in-depth analysis by GSMA (2019), pp 20 et seq.

benefit from a central bank that encourages innovation and understands local customer needs: a major shift from the traditional role of central banks.

4.2.2 Designing Regulatory Infrastructure for an Open Electronic Payments System

In China, Alipay and WeChat Pay show the power of facilitating new entrants and the digitization of the traditional payments system among banks.

Alibaba established Alipay in 2004 as a payment method for its ecommerce business. It is now the second largest mobile wallet provider in the world, behind PayPal.[86] The Yu'e Bao money market fund was established with Alipay in 2013, providing the opportunity to make small investments, and is now the world's largest money market fund.[87]

WeChat was established as a messaging platform by Tencent in 2011. In 2013, the WeChat Wallet was introduced, allowing users to make mobile payments in WeChat games. Cash transfers and in-store cashless payments became possible in 2014,[88] and by 2017, 92 percent of survey respondents were using mobile payment systems like this for retail payments.[89]

The People's Bank of China ('PBoC') has since 2017 subjected mobile wallet services to increasing regulation.[90] Mobile payment institutions are now required to channel payments through a new centralized clearing house, the China Nets Union Clearing Corporation.[91] The PBoC has also raised payment platforms' reserve funds ratio to 50 percent from 20 percent, gradually increasing to 100 percent over time, to further protect consumers.[92] Payment institutions must now also obtain permits to offer barcode payments.[93]

These Chinese experiences highlight how payments providers should be subject to appropriate proportional regulation to address risks and provide a level playing field.

Increasingly, interoperability to bring together traditional and new forms of payments are central to making such systems attractive. As such, governments are increasingly mandating interoperability as a licensing condition for payments providers; in many cases, governments are even involved in the development of switches to provide the supporting infrastructure for such interoperability across different systems.

The combination of digital ID/eKYC with open electronic payments provides the fundamental infrastructure. The greatest digital transformation can be achieved by combining these with Pillar III.

[86] Bushell-Embling (2018).
[87] Mu (2014).
[88] Millward (2018).
[89] China Tech Insights (2017).
[90] See for an overview of China's financial sector regulation Zhou et al. (2015), pp 28 et seq. ('discussing China's last mover advantage').
[91] Hong (2017).
[92] Wang (2018).
[93] Xinhua (2017).

4.3 Pillar III: Electronic Government Provision of Services—Expanding Usage

While various governments have experimented with electronic provision of services and mandatory account approaches, their effect is often limited unless built upon Pillar I and II infrastructure. This combination has underpinned the third element of India Stack, namely providing government salaries and services electronically through bank accounts.

Such systems support financial inclusion, empowerment and savings and may also dramatically reduce leakage, facilitating and supporting all aspects of achieving the UN SDGs. Such systems have the potential to improve tax collection, as SMEs grow within the formal financial system instead of outside. The Pillar I-II-III infrastructure can also support national pension systems, which enhance the financial safety net and provide additional financial resources to support growth.

4.3.1 Electronic Payment: Government Salaries and Transfers

For the poor, state support payments are often important. Digital financial transformation polices focused on government payments—particularly to the poor—achieve three beneficial outcomes. First, digital payments enable governments to shift from in-kind assistance (food, water supply) to inexpensive cash transfers.[94] Second, accounts established for support payments can be used for non-government payments. Third, the need to use the technology to receive government payments can break down cultural attachment to cash.

There are many notable examples of Government-to-Person ('G2P') payment programmes aiming at financially including the unbanked as well as enhancing the efficiency and effectiveness of government services, transfers and payments. At least 19 G2P programmes operate in developing countries.[95] However, most of these projects are at best half-digital. In the case of *Bolsa Familia* in Brazil, *Familias* in Colombia, and *Benazir* in Pakistan, a debit card is provided to recipients who may withdraw cash. However, further digitalizing these projects faces real challenges. According to CGAP, '31 percent of accounts in low-income countries […] [are] used for only one or two withdrawals per month'.[96] CGAP has identified potential reasons for this, including use limitations of accounts and insufficient recipient and agent training.[97]

The Center for Financial Inclusion highlights the need for payment processes to 'align with customer life patterns'.[98] For instance, in a Pakistani G2P women's programme, only 53% of transactions were initiated by women; the rest were by male representatives.[99] Consequently, the Pakistan government adopted biometric

[94] CGAP, *Govt. to Person Payments*, http://www.cgap.org/topics/gov-person-payments; Stewart (2016).
[95] Stewart (2016), p 29 (citing policy reports from PFIP, CGAP, Gates Foundation and others).
[96] CGAP, *Govt. to Person Payments*, http://www.cgap.org/topics/gov-person-payments.
[97] Ibid.
[98] Stewart (2016), p 2.
[99] Ibid., p 19.

technology, ensuring women received cash transfers directly, thereby hopefully empowering them to decide how to use the money.[100]

G2P payments can further financial inclusion and the UN SDGs, *if properly designed*. However, G2P payments frequently have not successfully underpinned a flourishing digital financial ecosystem. In particular, the three following features must be addressed:

1. Government-designed account procedures should facilitate later unrestricted payments.
2. The digital-to-real gap must be bridged well. When digital transaction partners are few, individuals will prefer cash. If merchants cannot do business without accepting e-money, they will provide devices to accept e-money efficiently, with or without incentives. Hence, it all starts with e-liquidity on the customers' side.
3. Functionality must be simple. The learning required to receive government support must enable one to make and receive other transfers. A customized set-up could assist, for instance by providing customers with the account information of their most important recipients.

4.3.2 Electronic Payment and Provision: Other Core Services

The combination of Pillars I, II and III supports many service payments, particularly for utilities and telecommunications, that improve the lives of individuals. The infrastructure for Pillars I, II and III also supports ecommerce, with significant benefits for SMEs.

Governments can support digital transformation by highlighting the advantages of e-money, setting limits for cash transactions in the real economy, and requiring merchants to accept digital payments at low or no cost to customers.

More transformational, integrated strategies integrating Pillars I, II and III have the potential to transform government revenue, delivery of services, and trust and confidence. This combination is very powerful from the standpoint of supporting the achievement of the UN SDGs.

From the mutually reinforcing foundations of Pillars I-III, Pillar IV focuses on other forms of infrastructure to support access to finance more broadly.

4.4 Pillar IV: Design of Financial Market Infrastructure and Systems—Enabling New Activities, Business and Wider Development

Additional forms of digital financial infrastructure, combined with the foundations of Pillars I-III can support access to finance, financial stability and market integrity. Digitized systems for securities trading, clearing and settlement can also provide greater access to investment products and support financial sector development more

[100] Government of Pakistan and BISP (2017), p 12.

broadly, as evidenced through the experiences of China, Kenya and India, among others.

4.4.1 Transforming Credit Provision: From Collateral and Microfinance to Cash-flow

Historically, credit risk analysis was conducted only by specialized banks, making it uncommercial for many individuals and SMEs. The traditional solution was to rely on collateral, which is difficult in developing countries where property rights may be weak or nonexistent.

Digitalization has changed this. Providers with accurate customer data are well placed to price credit through datafication, i.e. the process of analyzing and using data. Superior data may derive from social media services, search engines, e-commerce platforms, and telcos.[101]

The big data approach applied by these firms (referred to as 'TechFins') should improve business decisions by helping form a better picture of a customer's financial position using these superior data sets.

TechFins can thus *'re-personalize' the financial relationship* with clients by adjusting credit rates based on individuals' real risk profiles. This enables financial inclusion by providing 'personalized' services at a much lower cost per client.

The potential benefits are huge but the emergence of such platforms also brings new challenges and risks, some existential from the standpoint of the UN SDGs, meaning approaches to the interaction between data regulation and financial regulation must be considered carefully.

4.4.2 Adding Insurance and Investments to Savings and Credit

While online payments and lending are the core of most financial inclusion strategies, extensions into the investment sector are necessary. Digitalization can increase access and reduce transaction costs. It also may reduce biases in investments and strengthen capital markets through enhanced savings rates. Importantly, it also has the potential to bring new financial resources into the financial system which can in turn support innovation, business development, human capital and infrastructure, as savings rates increase and are redirected through the financial system, thereby underpinning attainment of the UN SDGs.

However, digitalization also brings risks. The main challenge is the uncertainty and complexity which are inherent in investments. Bridging the trust divide—as investors must trust intermediaries to control risk—is at the heart of developing liquid financial markets.

4.4.3 Building Better Financial Infrastructure

Today, cloud, Internet of Things (IoT), blockchain and other technologies are being used to redesign markets and infrastructure, particularly in payment systems,

[101] Zetzsche et al. (2018b), pp 406 et seq.

securities clearing and settlement systems, early stage financing, and trade and agricultural finance. Maximizing this potential requires the foundation of Pillars I-III.

5 Developing a Comprehensive Strategy

5.1 Strategic Approach

The starting point is that the power of these pillars is greatest when all are pursued and become mutually reinforcing. This is the core lesson from India Stack and can be seen in an increasing range of countries which are pursuing integrated strategies to support financial inclusion and digital financial transformation.

5.2 The Challenge of Technology

Any FinTech-based approach must accept that technology is not perfect. Three consequences follow.

First, technology may operate beyond its developers' intentions. Self-learning algorithms may enhance biases existing in the data.[102] Perfect technologies to control this tendency do not yet exist. Hence, providers must constantly test the outcomes of algorithmic data interpretation.

Second, technology may do exactly what the developers intend, and the problem is the developers. Financial history is replete with fraud. Every new technology will be abused by some. A recent example is the use of initial coin offerings for defrauding investors/participants.[103]

Third, ever-accelerating technology facilitates ever more new entrants, making regulators' roles ever more challenging. This will likely require regulators to respond with technology. RegTech includes automation and data-driven analysis of internal control systems and internal and external reporting.

5.3 Building Innovation Ecosystems: Regulatory Sandboxes, Piloting and Test-and-Learn Approaches, and RegTech

Probably most important is the need for policymakers and regulators to develop methods to understand new technologies and the related risks and opportunities combined with the increasing necessity for regulators to consider how they can better use technology in redesigning their systems for the regulation of digital finance and FinTech.

One recent development to potentially assist digital financial transformation is regulatory sandboxes.[104] The sandbox creates an environment for businesses to test

[102] See e.g. Uber's use of machine learning, Reese (2016).
[103] Zetzsche et al. (2019b).
[104] Zetzsche et al. (2017).

products without having to meet the full panoply of regulation. In return, regulators require appropriate safeguards. The main advantages of sandboxes extend beyond the regulator's exemption. A sandbox sends a market message that the regulator is open to innovation and provides learning opportunities for regulators. The main risks of sandboxes are the potential to jeopardise regulatory priorities and supervisory 'over-friendliness' due to capture or corruption.

We note, however, that 'no two regulatory sandboxes are alike': most regulators practice, under the sandbox label, something we find more akin to an innovation hub, i.e. a structured way of communication with innovative firms that results in guidance to the firm and mutual learning, but no regulatory privilege is automatically granted to the innovative firms; further, while innovation hubs require resources and the involvement of seasoned supervisors, they often function without substantial changes to legislation.[105]

Other ways to respond to innovation include more structured approaches to waivers, no-action letters, piloting and testing, and small business exemptions.

Another way resulting in increased regulatory technology expertise is to actually *use* technology: Regulators could require supervised firms to report digitally to supervisors, and supervisors to receive and process reported information by digital means, resulting in a RegTech cycle that will propel both supervised firms and supervisors into the digital age. Successful examples in this regard can be drawn from the European Union.[106] This use of technology by regulators is the truly transformative potential of RegTech and integrated systems design of the sort we advocate.

5.4 Balancing Inclusion with Client Protection

Client protection is key for not only digital financial inclusion but digital financial transformation more broadly. One promising option is regulation-by-design: regulatory restrictions embedded technologically in the product. These restrictions would reflect client exposure and ability to bear risks and would substitute for today's restrictions on access to financial services.

A reasonable approach will never aim at full access for all of society to all financial services. To protect clients, any policy must be partially exclusive: restricting access to products too risky for people with low financial literacy. The result will be an asymmetric paternalistic system in which people with greater financial sophistication have access to wider ranges of financial products. We envisage that clients will be assessed by income, education, experience and wealth and categorized in classes. Depending on the class, access to risky products will be controlled. This approach also allows preferred ethical restrictions. For instance, clients who wish to avoid leverage for religious reasons (e.g. Islamic finance) will be able to do so.

[105] For a detailed analysis for regulatory sandboxes around the globe, see Buckley et al. (2020).

[106] See Buckley et al. (2019), pp 1–11.

The FinTech aspect of this new legal, rather than de facto, segregation, is that criteria can be set, reviewed and adjusted day-to-day, as its application follows data-driven rules, and its outcome can be supervised using RegTech.

Going forward, such principles-based, rather than rules-based, approaches are key to successful regulatory development.

6 Towards Inclusive *and* Balanced Sustainable Growth

Digital financial transformation is *one* important answer to how regulators and government can support achievement of the UN SDGs, and thus result in a balanced, sustainable development. Digital financial transformation supports achievement of the UN SDGs in three key ways: first, by potentially generating additional financial resources; second, by more efficiently using existing (as well as new) financial resources; and third in some cases by directly supporting achievement.

What sorts of approaches work? A comprehensive digital financial transformation strategy based on four pillars, including digital ID, open interoperable payment systems, FinTech for G2P programmes, and long-term development of sophisticated financial market infrastructure, is key.

From the standpoint of transforming all aspects of society and development, the most powerful technology which has emerged is the mobile phone, particularly the smartphone when combined with internet access. Research shows the transformative potential in terms of all of the SDGs as well as for financial sector development, inclusion and deepening. The development of inexpensive smartphones combined with new business models which rely less on network charges or handset sales and more on generating data which in turn support commercial applications means that smartphones are ever more available in many countries. Policies supporting smartphone and internet development are among the most important that can be pursued and form the basis of many aspects of digital finance to support the SDGs. Major barriers remain though, particularly in the context of the last mile but also in the context of much of Africa where feature phones still prevail and internet access is mixed. Because of their foundational effect, this is a core area for focus in seeking rapid transformation going forward.

Another transformational technology not only in digital finance but in empowerment more generally is digital identification. Formal identification is an element of the SDGs and because of its significance, is the subject of a major World Bank led initiative: ID4D. The experience of India's Aadhaar system, through which over a billion people have received digital biometric identification has been transformative: it has shown the power of such systems for achieving the SDGs directly as well as increasing financial resources available but, at the same time, has highlighted the potential dangers in data protection and other abuses. Once again, digital identification projects if designed and implemented effectively have the potential to support foundational transformations in directly achieving the SDGs as well as in supporting financial development supporting wider societal transformation.

These foundational technologies offer the potential for other interventions, of which mobile payments have been among the most important from the standpoint

of achieving the SDGs, with the example of M-Pesa in Kenya being the best known. Central to their impact is interoperability, with an increasing range of governments mandating this in order to maximize developmental benefits.

Combining these allows governments, businesses and others to provide better services to people, with important successes in the context of displaced persons through the UNHCR's use of digital delivery of aid. Going forward, these sorts of systems are likely to be increasingly important as migration and other forms of displacement increase. Other examples of mitigation and development include forms of digital crop insurance, pooled digital insurance for catastrophes.

As digital financial transformation proceeds, digital finance increasingly enables individuals to invest small amounts of money, with customer acquisition costs made viable through foundational technologies of the sorts described here. This bring new money to achieve the SDGs, potentially as billions of people join the financial system and are empowered to make investments which support wider social objectives.

Looking forward, the power of digital finance is greatest in those countries which are furthest behind but through policy choices to support foundational technologies are able to leapfrog to higher levels of development. This strategy of digital financial infrastructure development rests fundamentally on availability of communications' infrastructure. It offers the greatest potential in countries with high smart phone penetration rates and inefficient old-fashioned financial systems. While financial inclusion remains a challenge in many countries, the cost of smart phones is falling rapidly, while construction of related infrastructure is proceeding apace in most markets. While this strategy will not solve all challenges—for instance, we may face a new digital divide between the technologically able and others—it does provide the core elements of an enabling framework to support the achievement of the UN SDGs.

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