

Disruptive Technologies in the Credit Information Sharing Industry: Developments and Implications



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Abbreviations and Acronyms

AI	Artificial Intelligence
Banxico	Bank of Mexico
BIS	Bank for International Settlements
CBRC	China Banking Regulatory Commission
CGAP	Consultative Group to Assist the Poor
CIITO	China Internet Information Technology Office
CIRC	China Insurance Regulatory Commission
CIS	Credit Information Systems
CNBV	National Banking and Securities Commission
CRS	Credit Reporting System
CRSP	Credit Reporting Service Provider
DLT	Distributed Ledger Technology
EFL	Entrepreneurial Finance Lab
EMEA	Europe, Middle East and Africa
EU	European Union
FINMA	Swiss Financial Market Supervisory Authority
FSB	Financial Stability Board
GP	General Principle (for Credit Reporting)
GPFI	Global Partnership for Financial Inclusion
GPS	Global Positioning System
GCRP	Global Credit Reporting Program
ICCR	International Committee on Credit Reporting

IDC	International Data Corporation
IFC	International Finance Corporation
IMF	International Monetary Fund
MIGA	Multilateral Investment Guarantee Agency
ML	Machine Learning
MSME	Micro, Small and Medium Enterprise
ODP	Open Data Platform
PBOC	People’s Bank of China
QR	Quick Response
SECO	Swiss State Secretariat for Economic Affairs
SHCP	Secretaría de Hacienda y Crédito Público
SME	Small Medium Enterprise
SMS	Short Message Service
WBG	World Bank Group



Executive Summary

Financial inclusion is now widely recognized, in the international development community and by policy makers in developed and developing economies, as important to development. An estimated 2 billion adults globally do not have access to a transaction account that can be used to receive payments and make deposits.¹ Research shows that low-income and financially excluded populations have active financial lives and need a range of financial services to take advantage of economic opportunities and manage and mitigate risks. Small and medium enterprises (SMEs) generate the greatest number of new jobs and employ the largest number of people in aggregate; thus they are important for job creation and economic growth. And yet, according to the World Bank Group's SME Finance Forum,² 65 million or 40 percent of formal micro, small, and medium enterprises (MSMEs) in developing countries have unmet financing needs. The MSME finance gap in developing countries is estimated to be \$5.2 trillion or approximately 1.4 times the current level of MSME lending, and women-owned businesses comprise 28 percent of MSMEs and account for 32 percent of the MSME finance gap.

Improving access to financial services plays an important role in reducing the world's poverty levels and increasing shared prosperity. Financial inclusion is aligned with the World Bank Group (WBG) commitment to reduce poverty, increase shared prosperity, and promote sustainable development. Recognizing the transformational potential of financial inclusion for economic development, WBG and partners put forward an ambitious goal of universal financial access by 2020.³

Credit information systems (CIS) help ensure financial stability by enabling responsible access to finance. They also can play an instrumental role in expanding access to credit and other services on credit to the underserved and unbanked. CIS facilitate lending processes by providing objective information that enables lenders to reduce their portfolio risk, reduce transaction costs, and expand their lending portfolios. By doing so, credit reporting systems enable lenders to expand access to credit to creditworthy borrowers, including individuals with thin credit history, microentrepreneurs, and SMEs.⁴

The world is becoming increasingly digitized, and that development has led to an explosion in the different types of data, technologies, and products available. From artificial intelligence to cryptography, rapid advances in digital technology are transforming the financial services landscape, creating opportunities and challenges

for consumers, service providers, and regulators alike. The Bali Fintech Agenda developed by the International Monetary Fund (IMF) and World Bank defines fintech as “the advances in technology that have the potential to transform the provision of financial services spurring the development of new business models, applications, processes, and products.”⁵

These fintech developments also have implications for the credit reporting industry. The industry itself, the product of years of evolution in response to market needs, has already been gradually adapting and leveraging these new developments to better serve market needs and enable greater financial inclusion. The use of alternative data and the digitalization of consumer and SME finance represent a large opportunity to expand access to finance to unserved and underserved market segments.⁶ A rapidly growing crop of technology-focused consumer and SME lenders and analytics providers (“fintechs”) are putting the use of consumer and SME digital data, customer needs, and advanced analytics at the center of their business models, setting forth new blueprints for disrupting conventional consumer and SME lending. The credit reporting industry has always provided cutting-edge technology, and innovation remains at the core of its business. Most of the traditional providers of credit reporting systems are in fact listed as top-ranking fintechs. Yet the spread of new credit providers and the proliferation

of potentially credit-relevant data from nontraditional sources put pressure on this ability to innovate as well as on the core business model of aggregating credit data from financial service providers.

Principle 4 of the G20 High-Level Principles on Digital Financial Inclusion recognizes the role that financial information infrastructure and services play in expanding the safe, reliable, and low-cost provision of digital financial services, particularly for underserved rural areas. Specifically, it advocates for the establishment and responsible use of flexible, dynamic credit reporting systems modeled on best practices as outlined by the International Committee on Credit Reporting (ICCR). It also encourages the use of innovative data sources in CISs, such as data on utility payments, mobile airtime purchases, data on digital wallet or e-money accounts, and e-commerce transactions, keeping in mind consumer data protection and privacy rules as well as consumer identification systems.⁷

Within this context, this note analyzes the evolution of CISs, including the emergence of new technologies that use alternative data in credit decisioning and the opportunities and risks associated with these trends. This paper also predicts the potential development effect of these disruptive technologies and proposes a role for the World Bank Group in leveraging these technologies to promote inclusion and stability.

1.

Overview of Credit Information Systems



Introduction

Well-functioning financial markets contribute to sustainable growth and economic development, because they typically provide an efficient mechanism for evaluating risk and return to investment, and then managing and allocating risk. Financial infrastructure is a core part of all financial systems. The quality of financial infrastructure determines the efficiency of intermediation—the ability of lenders to evaluate risk and of consumers to obtain credit, insurance, and other financial products at competitive terms. Credit reporting is a vital part of a country’s financial infrastructure and is an activity of public interest.⁸ Comprehensive credit reporting systems contribute to increased financial inclusion, responsible finance, and financial stability.

Credit reporting addresses a fundamental problem of credit markets: asymmetric information between borrowers and lenders, which may lead to adverse selection, credit rationing, and moral hazard problems. Regulators and financial market participants therefore increasingly recognize the value of credit reporting systems (CRSs) to improve credit risk evaluation and overall credit portfolio management, to enhance financial supervision and financial sector stability, and as a tool to enhance access to credit.

According to the World Bank’s *Doing Business 2018*,⁹ approximately 134 countries of 183 countries surveyed had either a credit bureau or a credit registry at the end of 2016. The credit reporting industry has experienced unprecedented growth since 2000, especially in emerging markets. This growth was driven by several factors:

- **High growth of retail credit in emerging markets.** Between 1985 and 1995, unfavorable macroeconomic environments and structural restrictions in credit markets in emerging economies constrained credit growth. With the rapid increase in the provision of credit as well as entrance of new types of lenders in the retail credit market, the need for credit information and for streamlining lending processes grew, leading to the establishment of CRSs and greater demand for these types of reforms.
- **Broad reforms stemming from the financial crisis.** The 2008 financial crisis provided major impetus for broad reform efforts at the national level as authorities in developed and emerging markets realized the need for strengthening and improving financial infrastructure, including CRSs. The introduction and rollout of the Basel III accords, which raised the capital provisioning requirements for

banks, also underlined the need for more stringent risk assessment and management frameworks. That need, in turn, has motivated an interest in developing or reforming credit registries to collect credit data that can support both micro and macro prudential supervision and regulation.

- **Innovation in the credit reporting space.** Since they first emerged, credit bureaus have always leveraged new technologies and innovations to improve efficiency, lower the cost of financing, increase the speed of service, and improve the quality of the information provided to the users of these services. In other words, the credit information sharing space is no stranger to disruption. The earliest disruption in credit markets can be traced to the 1950s, with the introduction of credit scoring and the automation of workflow and credit underwriting processes by CRS providers. During the 1970s, the industry harnessed the power of mainframe computers and databases to process, organize, and report on credit data and realized tremendous operating efficiencies that enabled them to process data faster and attract more business.
- **Automated lending solutions.** Given the volume of decisions often required to manage a typical credit retail portfolio (such as grant or reject facility, over-limit authorization, cross-sell or up-sell strategies, and past due action required), lenders in developed credit markets have turned to automation to maintain efficiency. However, raw data in the form of a credit report can be extremely difficult to integrate into such systems. For more than 30 years, credit bureaus have been providing automated lending solutions that eliminate the need for tedious manual sorting of paper and electronic files and that reduce the costs associated with such processing.
- **Hub-and-spoke solutions.** Another key innovation in the credit reporting space was the development of hub-and-spoke solutions. With the improvements in database management software and the decreasing costs of storing and processing data—as well as the decreasing costs of hardware—credit information service providers introduced hub and spoke models, which leveraged economies of scale and increased the

level of security in using a single solution to serve multiple markets. Markets with small populations or small credit markets and markets with a great deal of regional integration and movement of jobs, people, and credit across borders stand to benefit from hub-and-spoke solutions.

- **Credit bureau as a portal.** Another example of innovation that credit bureaus introduced was a portal or “one-stop shop,” which facilitates online links to other relevant data sources, such as company registers, vehicle registry, voter rolls, land title registers, and so on. The bureaus evolved beyond being an aggregator of lenders’ credit information to include information needed to verify applicants, check ownership of assets, check encumbrances, provide property valuations, and so on.

Credit Reporting Ecosystem

- At their core, CRSs consist of databases of information on debtors, together with the institutional, technological, and legal framework that supports the efficient functioning of such databases. The information stored in these systems can relate to individuals, legal entities, or both. The “Credit Reporting Systems” are broadly classified as credit bureaus, credit registries, and commercial credit reporting companies based on the core functions they serve.¹⁰
- Credit bureaus collect information from creditors and available public sources on a borrower’s credit history. The bureau compiles information on individuals and small firms, such as data in credit repayment records, court judgments, and bankruptcies, and then creates a comprehensive credit report that is sold to creditors. Some of the more prominent consumer credit bureaus that have a global presence include Experian, Equifax, TransUnion, CreditInfo, CRIF, and Compuscan.
- Credit registries collect and compile information from regulated financial institutions and are generally used to support the financial system supervision function of most central banks. Generally, information is collected on large credit exposures that represent systemic risk exposures in a given market. Credit registries also provide

credit reports that show aggregate loan exposures to the regulated financial institutions that submit data to the credit registry.

- Commercial credit reporting companies are entities that collect information solely on businesses, including sole proprietorships, partnerships, and corporations, for credit risk assessment, for credit scoring, or for other business purposes such as the extension of trade credit. These entities collect credit data from banks, other regulated financial institutions, nonfinancial lenders, and other sources, and they generally target the lending market segments serving medium and large companies.¹¹ Credit bureaus also collect information on small and medium-size businesses; however, unlike commercial credit reporting companies that focus solely on businesses, the primary focus of credit bureaus is on the information of individuals.

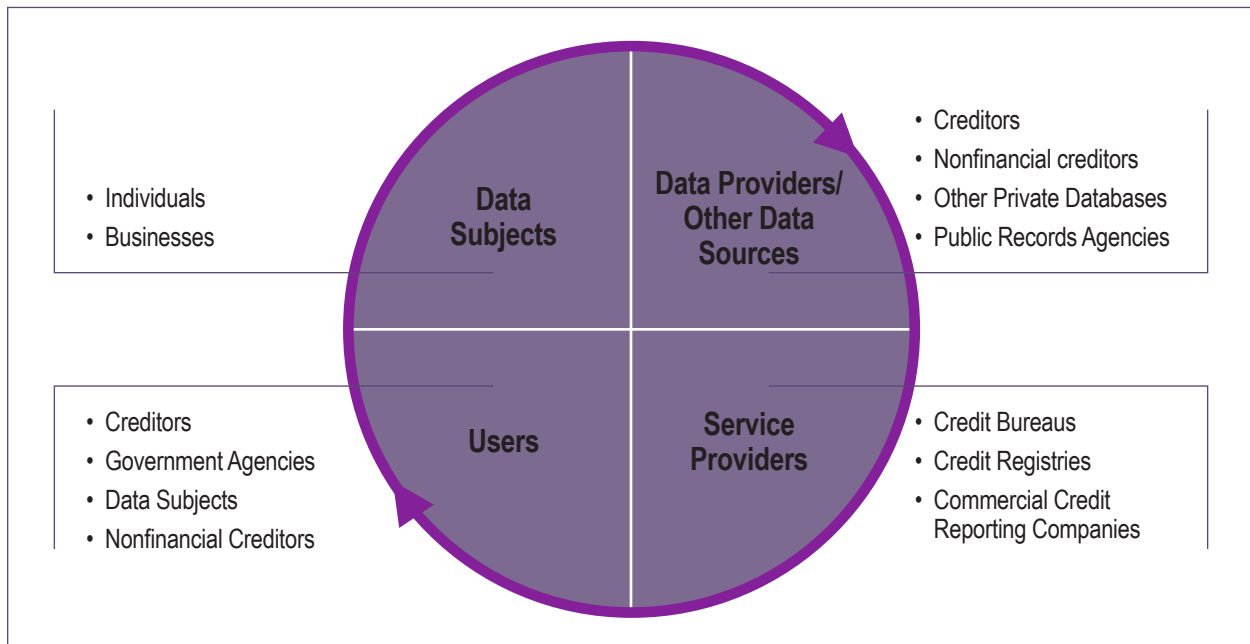
Whereas different models and structures of credit reporting exist throughout the world, each of them involves a large number of actors that intervene at one or more points throughout the cycle of producing, collecting, storing, processing, distributing, and, finally, using information to support credit-granting decisions

and financial supervision. Figure 1 identifies the key participants involved in each step.¹²

Benefits of Credit Information Sharing

When comprehensive credit information is shared and when safe, efficient, and reliable infrastructures are available, the cost of financial intermediation falls and financial products and services become accessible to greater numbers of borrowers; further, lenders and investors have greater confidence in their ability to evaluate and price risk. Credit bureaus and commercial credit reporting companies help address the fundamental issue of “information asymmetry,” whereby the borrower knows the odds of repaying his or her debts much better than the lender does. The inability of the lender to accurately assess the creditworthiness of the borrower contributes to lower acceptance rates for loan applications and to higher interest and default rates, and it affects the profitability of the financial institution. Credit registries provide a useful tool by which financial system supervisors and regulators can monitor systemic risk levels and take appropriate measures to maintain financial stability. See table 1 for a view of these benefits.

Figure 1: Key Participants in a Credit Reporting System



Source: World Bank, “The General Principles for Credit Reporting,” 2011.

Table 1: Benefits of Credit Information Flow to Different Stakeholders

Stakeholder	Benefits
Lenders, creditors, alternative data providers	<ul style="list-style-type: none"> Stakeholders are able to see the client’s complete range of credit obligations, payments status, and level of indebtedness or overindebtedness. Stakeholders are able to price risk appropriately and provide custom products and services to meet the specific needs of clients. Stakeholders can assess new borrowers with no formal credit histories (specifically low-income groups, women borrowers, small and medium-size enterprises). Stakeholders have tools to proactively manage consumer accounts, such as credit line increases and decreases, payment terms, interest rates, and so on. Stakeholders can proactively manage collections so as to make the collections process more streamlined and to expend effort where needed to maximize collections where recovery rate is highest.
Consumers	<ul style="list-style-type: none"> Credit reporting enables consumers to establish “reputational collateral,” based on credit histories, thus reducing the need for physical collateral. Consumers with on-time payments, no missed payments, and other good borrowing and repayment behavior will stand to benefit and creditors may offer them better terms of credit or higher credit lines. Consumers can benefit from reporting of nontraditional data, such as payments for telephone bills, utilities, and other charges, to the credit bureau. Those consumers that do not have formal relationships with banks and other creditors can show that they meet other payment obligations responsibly and are worthy of credit.
Regulators and supervisors	<ul style="list-style-type: none"> Comprehensive information sharing enables regulators and supervisors to develop appropriate regulatory tools to assist in macro and micro prudential supervision. It provides supervisors with the necessary information to support systemic risk monitoring and prudential supervision.

Credit Information Solutions Offered by the World Bank Group

The World Bank Group emphasizes building the capacity of service providers, authorities, and users to develop and improve credit reporting systems and, ultimately, make them more efficient, safe, and reliable. This holistic approach includes working with governments and all other stakeholders to (a) devise a national strategy for credit information systems (CISs), (b) develop infrastructure, (c) establish legal and regulatory frameworks and determine the role of authorities in the CISs, and (d) improve consumer awareness and protection frameworks. Additional areas of focus include improved availability of digital data from relevant sources to support financial inclusion, financial sector supervision, and regulation and competition in the credit market, along with efforts to ensure the safety and efficiency of the CISs.

The following are areas in which the World Bank’s Credit Reporting Systems team provides technical assistance to diverse client segments:

- Diagnostic Assessments
 - Make assessments against the General Principles for Credit Reporting.
 - Make assessments against the G20 Frameworks.
- Legal and Regulatory Framework
 - Review, develop, and support the amendment of the legal framework that involves CRSs.
 - Support implementation of the law.
- Institutional Framework
 - Develop and enhance credit reporting infrastructure (bureaus, registries).
 - Develop products (such as scoring and other tools).
 - Enhance data (data sources, collection tools, and so on).
- Consumer Protection
 - Design strategy.
 - Design and support awareness campaigns.
 - Develop methodologies for handling consumer complaints.

- Develop methodologies for collaboration between authorities.
- Design financial literacy programs.

Since the Global Credit Reporting Program (GCRP) was launched in 2001, it has supported the development of credit bureaus and registries in about 60 countries globally, and it is currently active in 40 countries. Through technical assistance and advisory services, the GCRP team has supported the development of CRSs in emerging markets where little to no information sharing had existed. The adoption of best practices and the guidance provided have led to creation of a sophisticated credit risk management culture in these markets. Progress has included demand for strengthening methods for systemic risk monitoring and risk prevention and widespread acceptance of the need for strong enabling legal and regulatory frameworks to support the development of these CRSs.

In each of its project countries, the GCRP has supported the reform of the legal and regulatory framework for credit reporting, facilitated the establishment or reform of credit bureaus and registries, conducted extensive outreach and awareness-raising workshops, and built the capacity of key stakeholders. For instance, the GCRP supported the development of a regional credit bureau in Central America, helped set up the first credit bureaus in Cambodia, the Arab Republic of Egypt, Guyana, Jamaica, Lao People’s Democratic Republic, Morocco, and Tajikistan; and worked on the legal and regulatory framework in the Organisation of Eastern Caribbean States, Kenya, and Panama. It continues to assist the development of CRSs in Azerbaijan, India, Liberia, Mongolia, Tanzania, Vietnam, and elsewhere. Since 2002, the World Bank has also been monitoring credit reporting environments in more than 180 countries through the World Bank’s flagship *Doing Business* publications.

The combined coverage of individual borrowers by credit bureaus in these countries as of 2017 is more than 867 million,¹⁴ implying that many people now have a credit history and are able to access credit on the basis of their credit history.

In 2011, the World Bank Group, as a part of an international task force and with the support of the Bank for International Settlements (BIS), led the development of the General Principles for Credit Reporting (GPCR), which represent the only universal set of standards for credit reporting. The GPCR are the only existing set of standards included under the Financial Stability Board (FSB) noncore compendium of standards for the financial sector and is extensively used by regulators, supervisors, and policy makers alike in guiding the reform of credit reporting systems. The GPCR has five principles (see annex A) and describes the respective roles of key stakeholders, accompanying guidelines, and recommendations for effective oversight.

In addition to the individual reform projects in various countries, the World Bank acts as chair to the International Committee on Credit Reporting (ICCR) and hosts its secretariat. The ICCR was formed from the initial task force that developed the GPCR. The ICCR has also produced several reports that provide guidance to the development of CRSs around the world. These include “Assessment Methodology for the General Principles for Credit Reporting,” “Facilitating SME Financing through Improved Credit Reporting,” “The Role of Credit Reporting in Supporting Financial Sector Regulation and Supervision,” and “Use of Alternative Data to Enhance Credit Reporting to Enable Access to Digital Financial Services by Individuals and SMEs operating in the Informal Economy.”¹⁵



2.

Trends and Innovations in Disruptive Technologies



Introduction

Growth in credit information services is being spurred on by an increased appetite for consumer and small and medium enterprise (SME) credit. Some of that demand is well served by traditional lenders, but consumers increasingly seek in financial services the same kind of seamless immediacy and tailored service they have come to expect from other services such as media, transportation, and online and mobile shopping. As a result of the inability of traditional markets to meet customer demand for immediate service and custom and tailored products in a seamless user experience, a range of new lenders and service providers has entered the market, using technology to improve user experience, deliver new products and services directly and efficiently, and embed financial services into day-to-day activities so that payments or credit are delivered “on tap” automatically.

At the same time, hundreds of millions of people have gained access to formal finance for the first time through advances such as digital identity and mobile money systems. When these newcomers to the financial system seek credit, credit reporting service providers (CRSPs) using banking data and formal credit history are not able to provide insights on their potential creditworthiness. Traditional lenders struggle to serve this new customer base—but the very technologies that brought these customers into formal payments networks hold the keys to data on financial and nonfinancial transactions and behavior. Some of the new lenders are focusing on underserved segments, using advances in information technology, computing power, data mining, and analytics to underwrite products and services for customers who might not otherwise have access to credit. Other innovators are leveraging these technologies to provide credit scoring, thus offering a supplement—or alternative—to established CRSPs.

Disruptive technologies encompass the range of new data types (alternative and big data), technologies, and financial and data products that have implications for the credit information sharing space. Disruptive business models include new lenders that use both traditional and new approaches to scoring and underwriting, new data analytics and credit scoring providers, and the application of technology to compliance and supervision.

The proliferation of big data and fintech has disrupted the financial sector and significantly altered the credit reporting ecosystem. Credit reporting is, however, no stranger to

disruption because the systems have always leveraged new technologies and innovations to improve efficiency, lower the cost of financing, increase the speed of service delivery, and upgrade the quality of the information provided to the users of these services. Some of the key innovations and trends, including the proliferation of big data and the emergence of new technologies that have led to alternative lenders and new scoring techniques, are discussed in more detail in the following sections.

Proliferation of Big Data

Data are facts or information—or, more formally, facts and statistics collected for reference or analysis. Traditionally the term referred to structured information that could be classified and grouped and easily subjected to analysis. Structured data lend themselves to being made machine readable and statistically analyzed. But only about 20 percent of information is clearly structured. The rest of the available data are unstructured (figure 2). Unstructured data have always existed: ancient cave writing and tablets show both accounts and storytelling. Advances in computing and data storage have enabled masses of unstructured data to be digitized and analyzed (see box 1). For example, a growing library of world literature is now online, allowing search and analysis. As a result of this digitization and improved search and analytics (including machine learning), unstructured data are increasingly being exploited to better understand trends and patterns in consumer behavior and experiences, and to identify methods to develop products and services that better address consumer needs and provide improved user experience across a range of areas, including financial products and services.¹⁶

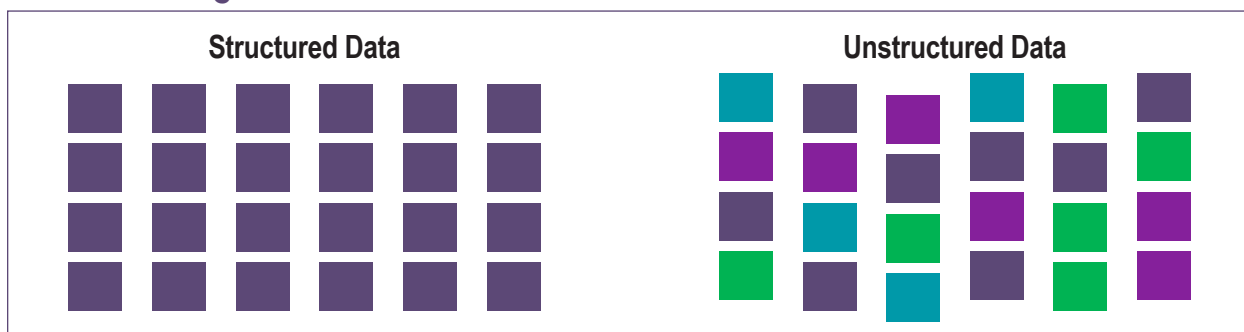
Credit data traditionally focused on specific subsets of available structured data: actual loan repayment

behavior. It also expanded to encompass data from other situations in which credit had been extended (such as post-paid utilities) and linked that information to certain demographic and official data, such as address, date of birth, government identity number, and court records.¹⁷

Transactional data also are structured and comprise a vast quantity of data, but this information was not often used. A bank might look at the balances and movements in the demand deposit accounts of its own customers, but it did not have access to such data from other banks. The structured transactions data created by increased use of electronic payments, e-commerce, pay-as-you-go mobile telephone services, solar panels, and other utilities and services are relatively new and rapidly growing data sets. These transactional data sets can provide objective information on cash flows. They can also be mined for more subjective behavioral information such as what types of products and services are used in what combinations, with whom, and at what times of day, month, or year. This behavioral analysis of structured data is different from personality profiling and psychographics based on questionnaires or analyses of social media profiles and other unstructured data—all of which make up another area of increasing activity.

Mobile devices are generating vast amounts of transactional and other structured data—and in the case of smartphones, information about location—and a broad range of unstructured data from other services used (browsing patterns, social media profiles, and so on). E-money schemes allow for transactions to be easily recorded, and the use of e-money systems worldwide has increased steadily since 2000. Data residing on mobile phones, as well as phone use data made available through mobile network operators, can yield telling information about their owners’

Figure 2: Illustration of Structured and Unstructured Data



Source: Big Data Is the New Black at <http://bigdata.black/infrastructure/storage/unstructured-data/>.

identity, financial health, habits, relationships, and even their personality, all of which are beginning to help traditional and nontraditional lenders assess

creditworthiness. Digital payments made using these devices have the potential to add value to the evaluation of creditworthiness of individuals and legal entities.

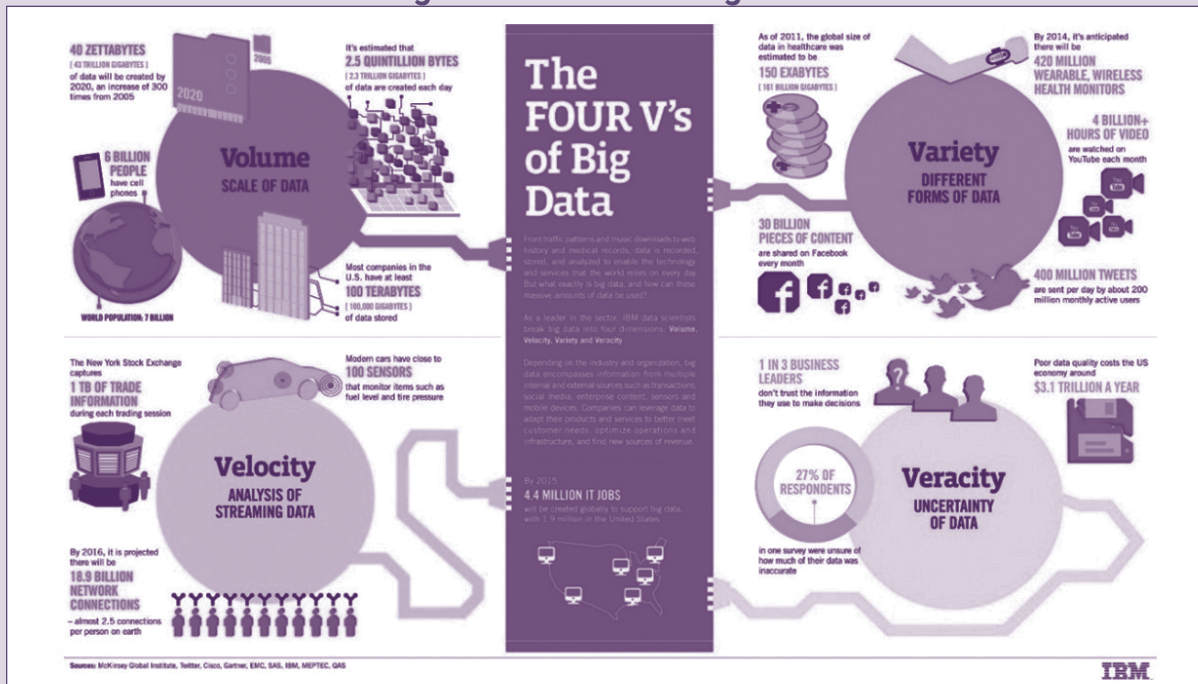
Box 1: What Is Big Data?

“Big data” includes both structured and unstructured data that require cost-effective and innovative forms of information processing to produce actionable insights to aid decision making and automation.^a Big data is used to describe information generated by traditional business activities and extracted from new sources such as electronic payments data from point-of-sale terminals, bank automated teller machines, mobile network operators, utilities, and social media (such as Facebook posts, Twitter tweets, and YouTube videos) and geodemographic data. The analysis of these data points can identify hidden behavior patterns that could be used to better anticipate future performance. Great advances are being made by analytic and processing capabilities, spreading data-driven intelligence across new digital systems at lower transaction costs.

The amount of digital data, a large part of big data, is expected to double every two years through 2020,^b fueled by the phenomenal intersection of and growth in mobile, cloud, big data, electronic payments, and social media.^c It is estimated that by 2020, 60 percent of digital data will come from developing countries.^d

Because much of the volume of big data is unstructured, the veracity of insights derived needs to be carefully gauged. The data may also be rapidly changing—think about the number of electronic payment transactions or Facebook and Twitter updates an active user might make in one day. The IBM Four V’s approach looks at how volume, variety, velocity, and veracity shape the use of big data (figure 3).

Figure 3: Four V’s of Big Data



Source: “The Four V’s of Big Data,” IBM Big Data and Analytics Hub, Infographics and Animations, <http://www.ibmbigdatahub.com/infographic/four-vs-big-data>.

Note: ^a “Gartner IT Glossary: What Is Big Data,” Gartner website, accessed June 21, 2017, <https://www.gartner.com/it-glossary/big-data>.

^b International Data Corporation (IDC), cited in GPFI (Global Partnership for Financial Inclusion), “Alternative Data Transforming SME Finance,” International Finance Corp., Washington, DC, 2017, vii.

^c GPFI, “Alternative Data Transforming SME Finance.”

^d GPFI, “Alternative Data Transforming SME Finance.”

As a result, the range of data that is available, current, and has been shown to be relevant to credit decisions has broadened tremendously. The two principal categories previously used by CRSPs, demographic/official and credit/balance sheet information, can now be supplemented (or even replaced) by noncredit financial information (such as mobile top-up and depletion patterns) and nonfinancial information, including unstructured data, made usable by new analytic techniques.

Emergence of New Technologies

Several new technologies that enable better identification, transacting, networking, sharing, hosting, and other capabilities have emerged and have implications for the credit reporting industry. Six new technologies relevant to the credit reporting industry are described in figure 4 and in the following subsections.

Advanced Computing

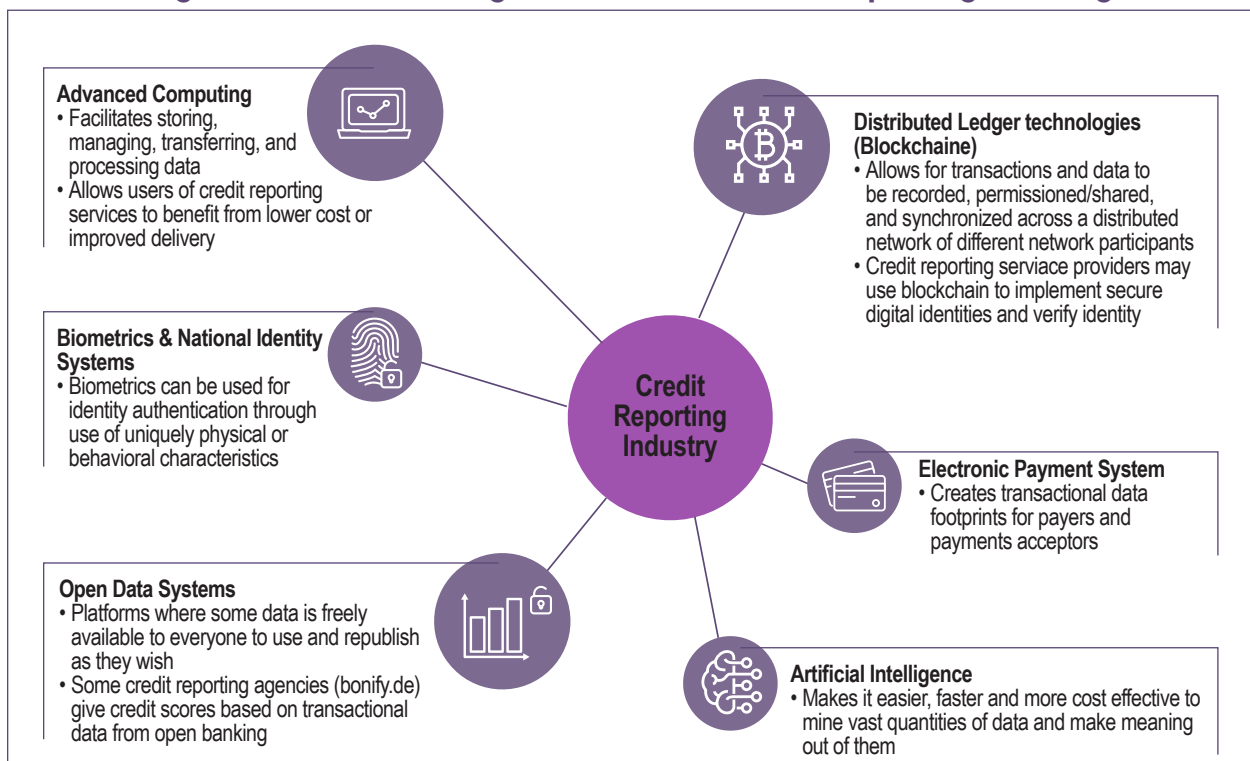
Advanced computing involves a network of remote servers hosted on the Internet that optimize

performance by doing data processing at the edge of the network, taking advantage of underused capacity. The technology includes quantum, cloud, and mobile computing. Advanced computing results in ease of storing, managing, transferring, and processing data. In addition, it reduces the costs of storing and processing data and thus the costs associated with starting a credit reporting service (CRS).

Continuous improvements in database management software and decreasing costs of storing and processing data, as well as decreasing costs of hardware and the ability of several markets to join and use the hub-and-spoke model have reduced the costs of starting up a CRS.

In recent years, CRSPs have been looking to further improve performance and reduce costs by leveraging the availability of cloud computing services. Cloud computing enables companies to avoid or minimize upfront information technology (IT) infrastructure costs. Many CRSPs have already embraced this technology (where the legislation permits) and enable users to benefit from lower costs or improved delivery.

Figure 4: New Technologies Used in the Credit Reporting Industry



Source: World Bank.

Business models that depend on low-cost scalable infrastructure, or on large international data sets for benchmarking, comparison, and scoring, are enabled by cloud computing but could be affected or restricted by regulation. Moving data or processing to remote and possibly distributed cloud infrastructure raises operational and, in some jurisdictions, legal and regulatory risks and issues, particularly with respect to an increasingly complex international landscape of data residency and privacy regulation.

Electronic Payment Platforms

Transaction accounts can help individuals and businesses manage their daily financial affairs. Electronic payment services have been developed by banks and a variety of other payment service providers both to address the limitations of cash as a payment instrument and to provide new opportunities for increased speed, safety, convenience, and other relevant features in a rapidly changing world. They can be classified as (a) electronic funds transfer-based instruments, (b) payment card-based instruments, or (c) e-money-based instruments.¹⁸ Transactions can involve person to person (P2P), person to business (P2B), business to business (B2B), person-to-government, business-to-government, and government-to-government.

Rapidly increasing adoption of electronic payments in developed and developing markets creates transactional data footprints for payers and payment acceptors that can be leveraged to proxy for income, predict cash flows, and analyze behavior.¹⁹ As a result, e-commerce platforms are increasingly becoming prominent in the credit information ecosystem as more and more CRSPs consider alternative data.

Biometrics and National Identity Systems

One of the biggest value propositions of a strong CRSP is its ability to provide accurate match and merge capabilities using available information. Sophisticated algorithms can help credibly identify and validate a borrower's unique identity. The ability to use algorithms to match pieces of data is restricted in emerging markets, where crucial basic data such as names, addresses, and dates of birth are often unreliable or missing. Although biometrics has gained popularity in recent years, the credit reporting industry experimented with the use of this technology decades ago trying to resolve the identification problem.

Distributed Ledger Technologies and Blockchain

Most widely known as the underlying technologies of cryptocurrencies, distributed ledger technologies (DLT) could potentially disrupt the way information is shared and could introduce a greater level of automation, security, and privacy control into several processes. DLT refers to a novel and fast-evolving approach to recording and sharing data across multiple data stores (or ledgers). This technology allows for transactions and data to be recorded, permissioned and shared, and synchronized across a distributed network of different network participants. A "blockchain" is a particular type of data structure, used in some distributed ledgers, that stores and transmits data in packages called "blocks" that are connected to each other in a digital chain.²⁰ Blockchains employ cryptographic and algorithmic methods to record and synchronize data across a network in an immutable manner.²¹

Although blockchain still remains at a "proof-of-concept" stage for all but a few applications, some credit information-sharing systems are experimenting with the use of these technologies. Use case examples of the application of blockchain in financial services include trade finance, payment systems (including cross-border payments), insurance, cross-border data sharing, and "know your customer" systems.

Artificial Intelligence

Advances in artificial intelligence (AI) and machine learning (ML), which use computational power and programming techniques, have made it easier, faster, and more cost-effective to mine vast quantities of data and derive meaning from them. Those techniques already drive new approaches to credit scoring and lending. Notwithstanding the efficiencies of most of these black box approaches, the opaqueness of the algorithms generates concerns about the potential of their being used to discriminate against customers.

As discussed, new data analytics techniques have broadened the range of what can be considered relevant for credit decisions. Some classes of data have always had potential relevance, and data subjects might reasonably expect those to be part of their financial profiles—such as everyday payment data. The sheer volume of such data may have made

the information intractable before AI, but AI was not needed to establish the data's links to credit. However, AI/ML have found patterns even in data and behavior that subjects might not have expected to be relevant to their financial access, such as their social media connections. This capability raises questions about appropriate use and sharing.

Open Data

Open data systems are private and public initiatives for establishing platforms on which some data are freely available to everyone to use and republish as they wish, without restrictions from copyright, patents, or other mechanisms of control. More detail on open data systems will be provided in chapter 3.

Risks, Challenges, and Opportunities

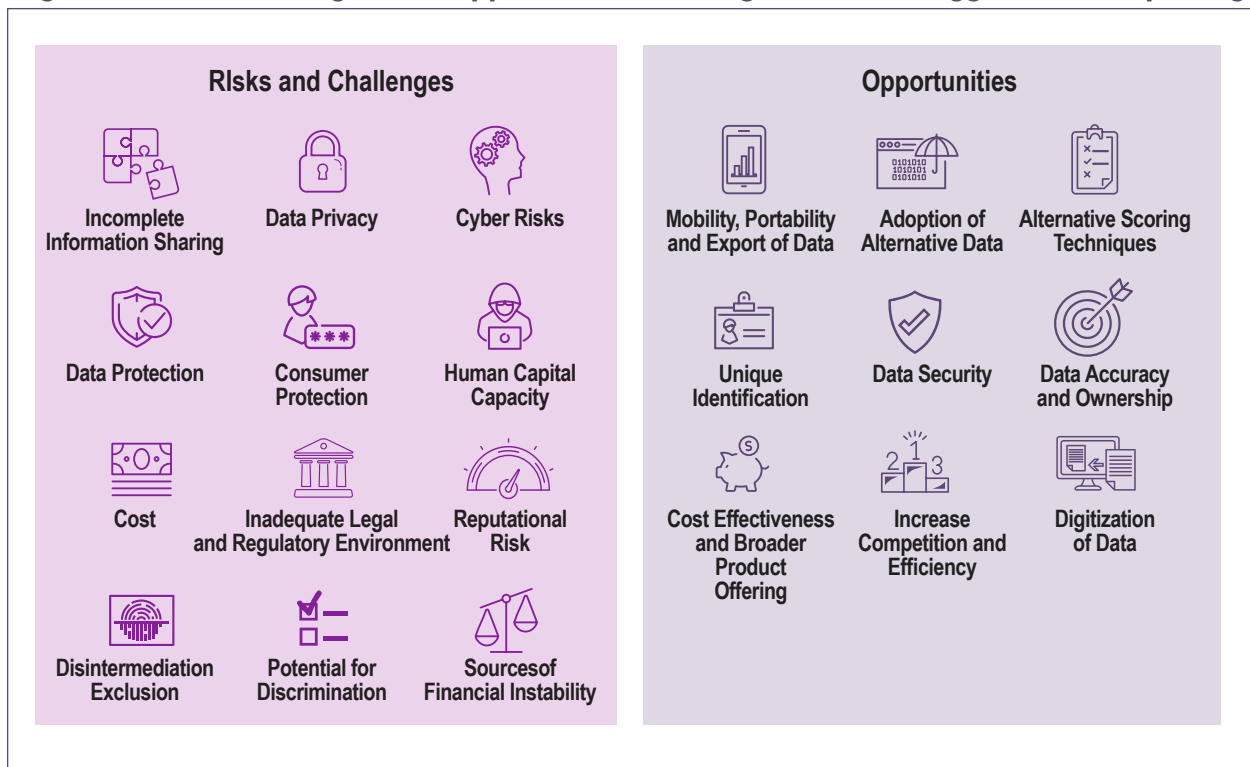
The changing disruptive credit reporting ecosystem brings out new opportunities and additional risks for credit reporting. Figure 5 illustrates risks, challenges, and opportunities.

Risks and Challenges

Several of the new products and technologies and even data being used and rolled out in the markets are still relatively new and untested. The major risk associated with unregulated fintech lenders is that such lenders could become a source of credit bubbles and overindebtedness if data on the credit exposures from these lenders are not collected and shared. Further, some of the online platforms might engage in predatory lending practices, including short-term, high-cost loans akin to payday loans.

Consumer advocates and others have expressed concerns about whether consumers are adequately informed and have consented to having all those data on them collected, and how the data are processed, used, and shared (box 2). Moreover, some key challenges in the widespread use of blockchain technology relate to affordability, aligning incentives, cost-sharing mechanisms, simplification and standardization, security, and [legal and regulatory](#) uncertainty.

Figure 5: Risks, Challenges, and Opportunities of Using New Technology in Credit Reporting



Source: World Bank.

Box 2: Potential for Discriminatory Lending

For policy makers and regulators, the absence of adequate legal and regulatory frameworks for credit reporting poses a great challenge. Currently, alternative credit scoring systems are treated as protected trade secrets, a situation that raises concerns about privacy and underscores the lack of transparency in how data are collected and used. Furthermore, even where existing laws offer some protections against discriminatory credit scoring, current regimes are likely insufficient to address the unique concerns raised by alternative scoring tools, which usually do not offer clear, if any, comparable standardized pricing policies. Last, there is a concern that alternative scoring tools will be used to identify vulnerable individuals susceptible to predatory loans.

More generally, the implications of big data and fintech on discrimination among customers by the credit providers (or credit reporting service providers) might merit greater emphasis. The use of algorithms may make monitoring discriminatory practices trickier because most of these machine learning models are “black boxes,” and thus understanding the way they are reaching decisions or predictions is not clear.^a Credit scores for consumers from a specific geographical location, race, or gender may be lower, without available explanations from the users of the machine learning algorithms.^b

Nevertheless, there is also some evidence that suggests that discriminatory biases are less serious for the fintech lenders than for traditional mortgage lenders in the United States.^c In any event, a balanced discussion of the potential for discriminatory lending when alternative credit scoring systems are used would be welcome.

Note: ^a Julapa Jagtiani, Larry Wall, and Todd Vermilyea, “The Roles of Big Data and Machine Learning in Bank Supervision,” *Banking Perspectives* (blog), Clearing House, 2018, <https://www.theclearinghouse.org/banking-perspectives/2018/2018-q1-banking-perspectives/articles/big-data-ml-bank-supervision>.

^b Kevin Petrasic, Benjamin Saul, James Greig, and Matthew Bornfreund, “Algorithms and Bias: What Lenders Need to Know,” *JD Supra*, January 23, 2017, <https://www.jdsupra.com/legalnews/algorithms-and-bias-what-lenders-need-67308/>.

^c Robert Bartlett, Adair Morse, Richard Stanton, and Nancy Wallace, “Consumer-Lending Discrimination in the Era of FinTech,” Working Paper, Haas School of Business, University of California, Berkeley, October 2018, <https://faculty.haas.berkeley.edu/morse/research/papers/discrim.pdf>

The disruptive technologies space lacks the experience of more mature and established technologies. Many new technologies and innovations remain at the proof-of-concept stage, and their effectiveness and reliability have not been assessed, nor have any negative consequences been adequately documented or addressed. Further, there is a plethora of ideas and innovations in the marketplace, but no checks and balances are in place to assess whether these new disruptive technologies are creating the positive disruption that they have set out to create, whether negative externalities have been created as a result of these new technologies, and what if any form of control should be set down (box 3). There may be an overlap in ideas, products, and technologies, and not all ideas may come to fruition or continue to exist.

One of the key threats to databases of any kind, is the threat of cyberattacks. Credit information sharing systems are potential targets of such attacks, as was seen in recent breaches at Equifax and TransUnion. Breaches of any kind can have serious consequences

to the image of such a system because these systems are entrusted with the security and integrity of sensitive consumer information. The integration of new data sources with existing systems as well as the leveraging of new technologies all come with similar risks that need to be assessed and carefully managed.

Opportunities

The explosion of new technologies, products, and data creates several opportunities for the World Bank team’s offering (box 4). The biggest opportunity is in enabling greater financial inclusion, particularly for those segments of the borrower population that are consistently marginalized or for whom adequate information is not available.

The introduction of new data sources into credit reporting systems has opened doors for borrowers who did not have formal credit histories or lacked adequate or acceptable forms of collateral to be able to access the credit markets. A key challenge in the credit information sharing market is obtaining data in a digital, ready-to-

Box 3: Risks and Challenges Associated with Big Data and Fintech

- **Incomplete information sharing.** Alternative lenders and other fintech companies currently do not share credit information with credit bureaus because most of them are not subject to regulation.
- **Overindebtedness.** The inability to link and aggregate data from multiple data sources has the potential to result in overindebtedness when the capacity of borrowers to repay is overestimated.
- **Data privacy.** The use of alternative data is a risk, especially in cases in which the data are used for purposes other than that for which they were originally collected and in which confidential information is disclosed to third parties.
- **Cyber risks.** The growth of the credit reporting ecosystem introduces new sources of vulnerability to system security.
- **Data protection.** Inadequate data security can lead to identity theft and fraud.
- **Consumer protection issues.** The opaqueness of the credit scoring techniques and some of the alternative data attributes opens the process to potential discrimination.
- **Human capital capacity.** Most emerging economies have not built adequate capacity to supervise the new platforms and promote innovation within the industry.
- **Cost.** The widespread use of technology in emerging markets can be impeded by its lack of affordability.
- **Inadequate legal and regulatory environment.** Most legal environments in emerging economies have not been reviewed in line with new trends, particularly those related to alternative data and new technologies such as blockchain.
- **Reputational risk.** Endorsing or promoting new technologies and approaches without testing reliability and consistency could harm reputations.
- **Disintermediation/exclusion.** Financial providers might exclude vulnerable customer groups.
- **Potential for discrimination.** Some of the data attributes, such as demographic information, might be used to discriminate against certain classes of society.
- **Sources of financial instability.** Regulatory arbitrage could become a source of instability to the financial sector.
- **Increased fraud and money laundering.** Fake profiles could be created through text messages or social media to hide poor credit or social histories of potential borrowers; the process could be infiltrated by organized crime.

use format. Several fintech companies are now working to collect, cleanse, and aggregate data to then leverage in the development of credit reporting databases in markets where the information sharing infrastructure does not exist or has been weak.

With the creation of unique and reliable forms of identification (IDs) for various marginalized and disenfranchised populations, the opportunity to be a part of the financial system is even greater for women, small businesses, migrant and seasonal workers, refugees and other displaced persons, people lacking formal unique IDs, and others. Drawing these segments into the

financial markets would also enable the formalization of the informal sector and would empower consumers to exert their rights. Some of the new technologies, for example, will enhance the mobility and exportability of consumer information.

Blockchain technology promises to provide more security in the collection and sharing of information by making the information available on multiple servers simultaneously and making it more difficult to hack. The technology also enables consumers to own their information, thus empowering them to proactively manage the collection, sharing, and use of their data.

The introduction of new lending products and the use of new forms of data, along with the application of artificial intelligence to mine through the new data sources and translate them into actionable insights, also

have huge implications for the inclusion of individuals and businesses that have previously been invisible to or underserved by credit markets. They will improve risk management techniques and decision making.

Box 4: Opportunities Associated with Adoption of Big Data and Fintech

- **Mobility, portability, and export of data.** Some new technologies will enhance mobility and exportability of consumer information and thus promote cross-border information sharing.
- **Adoption of alternative/big data.** Adoption of alternative data could promote inclusion of individuals and micro, small, and medium enterprises with thin or no credit files.
- **Alternative scoring techniques.** Use of alternative credit scoring techniques, such as machine learning and algorithms, could assist in the collection and processing of big data to assess creditworthiness.
- **Unique identification.** Fintech has the potential to promote unique and reliable forms of identification for various marginalized and disenfranchised populations.
- **Data security.** Adoption of technologies such as digital ledger (blockchain) has the potential to improve the security, verification, and transmission of data.
- **Data accuracy and ownership.** Blockchain will also enable consumers to own their information, thus empowering them to proactively manage the collection, sharing, and use of their information.
- **Digitization of data.** Businesses and fintech companies are generating vast amounts of digitized data that can enhance credit information sharing, reduce the cost of sharing, and improve transmission speed.
- **Cost-effectiveness and broader product offerings.** Technological innovation and adoption of big data could reduce the cost of business, and those savings could be passed on to customers through broader product offerings.
- **Increase competition and efficiency.** The emergence of new participants will improve competition and promote efficiency.
- **Hyperpersonalization of products.** Through the use of additional data about borrowers, lenders will be able to offer more personalized products.
- **Geographical spread of services.** Through the use of new online technology, consumers from rural locations will be able to access services remotely.
- **Risk-based pricing.** New tools and automation would enable lenders to provide better credit conditions to those borrowers who deserve it.
- **Financial literacy.** The emergence of fintechs provides educational platforms that could increase the financial literacy of consumers through easy and convenient channels such as social media, on which chatbots help clients gain access to services and through which borrowers could be notified about the changes.
- **Cost-effective assessment of small value loans.** In the past, without the use of automation and technology, it has been extremely difficult for lenders to assess low-income groups in the informal sector for loans.



3.

Implications of Disruptive Technologies on Credit Reporting



The proliferation of big data and fintech has significantly altered the traditional financial landscape with the emergence of new financial classes (such as fintech lenders) and new distribution channels and payment platforms. Traditional financial products and services—savings, debt and equity finance, payments, insurance—remain at the core of the new wave of digital offerings. Technology and, in some jurisdictions, regulatory changes have facilitated new processes to create, deliver, and combine components and have enabled a range of nonbank, nonfinancial institutions to offer financial products or components of financial products with improved value propositions to customers.

Evolving Credit Reporting Landscape: Firms

New firms have joined traditional firms both as lenders and as providers of credit reporting information.

Emergence of Alternative Lenders

The sector has witnessed a proliferation of new online platforms that offer alternative models of credit intermediation and have sector-wide consequences. Usually called marketplaces, these platforms provide increasing amounts of credit to consumers. The alternative lenders take many forms—that is, peer to peer (P2P), business to business (B2B) or secured microlending. Most of these lenders leverage the rapidly growing online ecosystems to acquire customers with data footprints from e-commerce. E-commerce platforms, in particular, already touch large customer bases and other types of lenders are growing rapidly in some markets.

The business models of some of these marketplace platforms are carefully designed to avoid coming under regulations that cover deposit-taking institutions or lenders. Instead, the alternative lenders offer services that look similar to those of a bank while avoiding the capital and compliance requirements that increase the cost of banking. The entities are able to offer higher returns to investors and lower interest rates to borrowers because they deploy modern, scalable infrastructure with limited physical overhead, and through an explicit regulatory arbitrage.

The business model for the online platforms is maturing with the passage of time. At inception, the initial wave of P2P lending platforms was premised on the “wisdom of the crowd.” Under this notion, individuals would vote with their wallets which borrowers

should receive funding, thus disintermediating the service provided by CRSPs.

However, to reach the volumes necessary to make a platform profitable, promoters must tap larger pools of capital, whose owners or managers are less likely to know all the small borrowers and are not going to sit at a screen clicking on each small loan. To deploy larger pools of capital programmatically requires some uniform approach to credit screening. As a result, mature platforms use some form of risk rating system that allows investors to select risk and return parameters against which their funds will be deployed. Thus, the platforms are bringing back reliance on CRSPs.

A considerable number of platforms use their own proprietary credit scoring, or base their decisions on proprietary data in addition to a bureau report or conventional credit score. Extensive data analytics powered by sophisticated machine learning algorithms extend credit, disburse, and collect with no need for physical infrastructure or manual, paper processes. Thus, advances in credit analytics and customer servicing capabilities, layered on top of mobile money delivery channels, are enabling credit to go to previously underbanked segments that did not have CRSP coverage.

Another type of lender that is rapidly growing in emerging markets is secured micro-lending against remotely attachable collateral. One example of this method is the pay-as-you-go solar market. A solar

panel fitted with a mobile network-enabled kill switch is sold on an installment basis, with repayments collected through the local mobile money system. The ability to track, recover, or render unusable the hardware in event of prolonged nonpayment enables sales to individuals with no prior credit history. The solar panel companies, which are essentially running a nonbanking financial institution balance sheet that looks like a leasing company, are able to track the performance of their customers and develop a view of their creditworthiness. In a further iteration of this business model, customers who have repaid the initial purchase price are reborrowing against the device on the basis of their established payment track record and the residual collateral value. Over time, the pay-as-you-go solar company will have significant credit data about this customer base.

Although most of the alternative lenders use the services of CRSPs, a majority of them do not report their data to bureaus. As a result, there are growing fears that the traditional credit report information might be based on incomplete data, thus potentially exposing the markets to risks of overindebtedness as the market share of alternative lenders increases. Discussions have ensued on the need of regulating alternative lenders because of their increasing market share and the potential implications on the stability of national financial systems. Examples of alternative lenders are described in box 5.

Box 5: Alternative Lenders: Kabbage, Amazon, M-Shwari, CapitalFloat, and Pay-As-You-Go Solar Markets

Kabbage was an early innovator in the use of online marketplace data to provide credit to marketplace sellers, such as businesses selling on eBay. A marketplace's detailed data on sales, returns, and customer satisfaction can be predictive of the ability of a small business to generate cash flow and repay a loan. Kabbage expanded to offline businesses, using automated onboarding and data gathering processes to collect revenue, accounting, transaction, shipping, and social media data. Its Karrot personal lending product claims to verify 100 percent of a person's income and provides an immediate response to an application with access to funds the next day. According to [Fundera](#),^a Kabbage does not look at business credit scores, and its loans are not reflected on the subject's credit report. Kabbage does, however, look at the personal credit score of the borrower and may report delinquencies. In the United States, Kabbage uses its analytics and customer onboarding and servicing systems to lend by using its own balance sheet. In other markets, Kabbage offers its platform to banks to lend under their own brands. Kabbage platform partners include ING in France, Italy, and Spain and Scotiabank in Canada and Mexico. In both cases, the lender may consult CRSP data, but the use of industry-specific data and proprietary analytics may eventually obviate the need for traditional bureau data.

Amazon Lending has unparalleled proprietary data on the small businesses that sell through Amazon Marketplace—not just on sales, returns, and customer ratings but also on inventory levels. In some cases, Amazon may hold the inventory in its own warehouses, providing a form of security. Amazon Lending has lent billions of dollars since its 2011 launch, and more than half of its borrowers return for another loan. This synergistic business not only earns interest for Amazon but also enables Amazon Marketplace customers to sell more, thus generating additional revenues for the platform. Although this product will doubtless evolve, early reports indicated that loans were offered by invitation only, did not require a credit check, and did not appear on credit reports. Through this lending program, the online retailing giant offers business loans from \$1,000 to \$750,000 for registered Amazon sellers. In June 2017, [CNBC](#) reported that Amazon Lending provided \$1 billion in loans during the previous year alone.^b

CapitalFloat, a digital small and medium enterprise lender in India, focuses on leveraging rapidly growing online ecosystems to acquire customers with data footprints from e-commerce (business to consumer and business to business), point-of-sale transactions, and other activities that could be leveraged for credit scoring.

M-Shwari, a product launched by Commercial Bank of Africa in Kenya in 2012, offers deposits and loans through the M-Pesa mobile money system. Credit scoring leverages M-Pesa and phone account data. There are now dozens of mobile phone lending companies, most of them nonbank technology-based companies, operating in East Africa and globally. M-Shwari reports its clients to the country's credit bureau. This practice has led not only to an extension of credit bureau coverage, but also to a phenomenon of negative credit bureau records for individuals who defaulted on small amounts taken out through these new loan channels. In turn, the central bank has been reviewing the responses of the credit reference bureaus to positive and negative data.

Note:

^a See Fundera's website at <https://www.fundera.com/business-loans/guides/kabbage-competitors>.

^b "Amazon Loaned \$1 Billion to Merchants to Boost Sales on Its Marketplace," CNBC, <https://www.cnbc.com/2017/06/08/amazon-loaned-1-billion-to-merchants-to-boost-sales-on-its-marketplace.html>.

Emergence of New Scorers and Lending Enablers

Disruptive technologies have also resulted in the emergence of alternative credit scoring providers, competing directly with traditional credit bureaus. These companies are largely targeting the marginalized sectors of the society and as such their coverage of unbanked or underbanked customers tends to be much broader than that of credit bureaus, enabling broader access to finance. Advances in artificial intelligence (AI) and machine learning (ML) are providing these companies fast, efficient, and cost-effective techniques to mine vast quantities of data and make meaning out of them.

Most of the alternative scoring companies are leveraging nontraditional credit data (alternative data), such as social media footprints, psychometrics, online behavior data, and telecommunications data, including top-up patterns (for prepaid customers), mobile money use, and even calling patterns and contacts. Others are using advanced analytics and ML to process a range of data pulled out of users' phones, including not only telephone use data but also messaging content, browser data, and GPS location

data. A few of these companies combine traditional and alternative data to determine their scores (box 6).

The widespread use of alternative scoring, however, is being slowed by privacy concerns, data residency questions, and attempts by local governments to regulate these approached through supervisory mechanisms. Additionally, post-causality black box approaches have often raised questions about the potential for discrimination. Notwithstanding, alternative scoring companies can in the interim play an important role in facilitating the integration of previously marginalized groups by promoting initial access to the credit market.

Evolving Credit Reporting Landscape: Models, Data Types, Sources, Ownership, and Privacy

The explosion of fintech and the adoption of big data have opened the credit reporting market and have exposed traditional players to intense competition from new players and a changing landscape. Credit reporting firms such as banks and other incumbent lenders are recognizing the need to do things differently to compete

Box 6: Alternative Scoring Companies

Alternative scoring companies employ different methodologies and use a variety of data to assess credit risk.

Lenddo and FriendlyScore, for instance, leverage social media footprints to develop credit scores for potential borrowers. However, Facebook has recently blocked third parties from gaining access to its data for credit risk assessments.

FirstAccess, Tiixa, and Trusting Social use telecommunications data, including top-up patterns, mobile money use, and patterns and contacts.

CreditVidya uses advanced analytics and machine learning to process a range of data pulled out of users' phones. The data include telephone use information, messaging content, browser data, and GPS location data.

Verde International creates credit assessment models for banks using a combination of credit bureau data and alternative data sources. Some business-to-business companies customize their underwriting technology to fit the needs of particular types of lenders or borrowers and might combine processing alongside scoring.

AMP Credit Technologies and OnDeck Capital enable banks to lend to small businesses by leveraging payments and other information, and they help the banks streamline the onboarding and servicing of small business loans.

with new fintech lenders—and to potentially leverage new fintech service providers. Competition in the credit reporting services (CRSs) industry is driving providers to develop creative solutions, products, and services to meet consumer expectations.

As margins are squeezed, the credit reporting industry has offered a range of responses. Some firms have innovated new methods and improved existing operational processes to cut costs, whereas others deal with different processes as commodities that can be monetized and outsourced and others form partnerships. As a result, the traditional CRSPs have had to respond to innovation and the proliferation of big data by adopting new technologies and alternative data, changing business models, and establishing smart partnerships with fintechs.²²

The proliferation of big data and fintech has revolutionized the volume and variety of data available for assessing creditworthiness. With the increasing amount of data, the veracity of the data and their sources are also being brought into question. The use of broad sets of data is also having serious ramifications on the privacy of data subjects.

Rising Sources of Alternative Data

Credit data have traditionally focused on specific subsets of available data: actual loan repayment

behavior, which was linked to certain demographic and official data, such as address, date of birth, and government identity number. In certain instances, the information expanded to encompass data from other nonconventional credit such as post-paid utilities and court records.

The adoption of digital platforms and technologies by individuals and businesses alike has increased the sources of data to include unstructured data. Every time individuals, micro enterprises, and small and medium-size enterprises (SMEs) and their customers use cloud-based services, conduct banking transactions, make or accept digital payments, browse the Internet, use their mobile phones, engage in social media, buy or sell electronically, ship packages, or manage their receivables, payables, and recordkeeping online, they create digital footprints.

This real-time and verified data are increasingly being exploited to better understand trends and patterns in consumer behavior and experiences. The data also help firms identify methods to develop products and services that better address consumer needs and provide an improved user experience across a range of areas, including financial products and services. Specifically, this alternative data set can be mined to determine both consumers' capacity and willingness to repay loans.²³

As a result, the range of data that are available and current and that have been shown to be relevant to credit decisions has broadened tremendously (figure 6). The two principal categories previously used by CRSPs, demographic/official and credit/balance sheet information, can now be supplemented (or even replaced) by noncredit financial information (such as top-up and depletion patterns for pay-as-you-go mobile phones) and nonfinancial information, including unstructured data, made usable by new analytic techniques.

These new data categories include information that credit subjects might reasonably expect to be taken into consideration for a credit decision, such as bank and card transactions and payments. But the categories also include information that many credit subjects might not expect to be part of their credit profile—such as whom they are linked to in social media. Some of these data are not only unrelated to the subject’s financial activities but may even be incidental to their intended activities—such as search records, website navigation, or changes in a font on the subject’s computer.²⁴

CRSPs worldwide increasingly use such alternative data. For example, in Kenya mobile lenders are now obligated to provide data to the credit bureau. The number of borrowers in the country with a credit footprint has been significantly increased by this reform. In Guyana, regulatory provisions have been made to provide utility data to the credit bureau, a change that has greatly

increased financial inclusion for previously excluded segments. In the United Kingdom, data on payments for house rent are now captured by credit bureaus.

Some of the sources of alternative data that CRSPs now use are detailed in the following subsections.

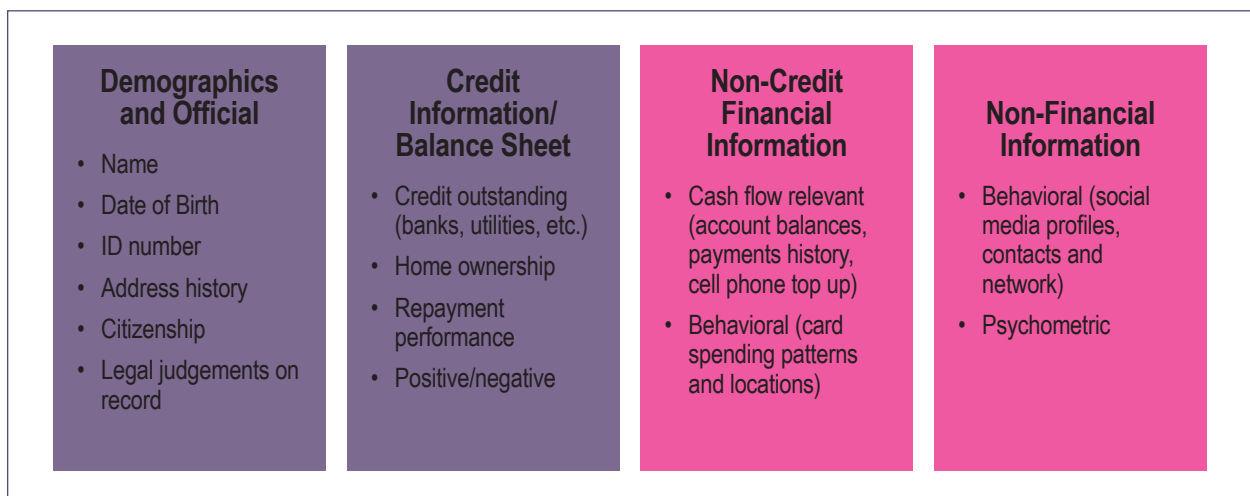
Transaction platforms

Structured transaction data created by the use of electronic payments, e-commerce, pay-as-you-go mobile telephone services, solar panels, and other utilities and services are relatively new and rapidly growing data sets. These transactional data sets come from payments for utilities, mobile phones, rent, taxes, and other obligations and can provide objective information on cash flow and payment behavior. These data can also be mined for more subjective behavioral information such as what types of products and services are used in what combinations, with whom, and at what times of day, month, or year. The behavioral analysis of structured data is different from personality profiling and psychographics that are based on questionnaires or from analyses of social media profiles and other unstructured data, another area of increasing activity.

Mobile devices

Mobile devices generate vast amounts of transactional and other structured data (and in the case of smartphones, information about location) and a broad range of unstructured data from other services used, including

Figure 6: Types of Data Used for Credit Reporting



Note: Violet denotes traditional data and magenta denotes nontraditional data.

browsing patterns, social media profiles, and so on. E-money schemes allow for transactions to be easily recorded, and the use of e-money systems worldwide has increased steadily since 2000. Data residing on mobile phones, as well as phone use data made available through mobile network operators, can yield telling information about their owners' identity, financial health, habits, relationships, and even their personality, all of which are beginning to help traditional and nontraditional lenders assess creditworthiness. Digital payments made using these devices have the potential to add value to the evaluation of creditworthiness of individuals and legal entities. Summary scores based on such data can be integrated in credit bureaus.

Social media

Social media networks are repositories for huge amounts of data that can be used for assessing an applicant's creditworthiness. Social media data contain abundant social parameters such as trust, interaction intensity between the users, and social groupings, all of which can be used to capture qualitative aspects of willingness and capacity to repay. Data from social media can also be a good indicator of spending patterns. Check-ins and posts or tweets can contain valuable information of how data subjects spend their incomes. Some social media channels are also useful for validating education or employment history.

CRSPs are mining social media data and processing them into forms that can be used to analyze creditworthiness.

Bureaus that have started incorporating social media data to enrich traditional credit histories include Kreditech and Creditinfo. Although the use of social media data has largely promoted access to credit for clients with no credit files, concerns have been raised about the discriminatory potential of using such information.

Psychometric tests

Psychometrics, which seek to measure and score a subject's personality and predict behavior, is a growing area of data collection and analysis. Psychometric data can be gathered as part of a credit application. The subject may offer it actively by answering a questionnaire. As with other alternative data, psychometrics can score people that currently lie outside the formal financial markets or enhance their current credit profile to receive personalized services. One of the more prominent psychometrics providers collects data using tests administered through digital means (SMS), through web-based applications, or through phone interviews to assess a potential borrower's willingness to pay. The tests assess not only how the applicants answer the actual questions, but how they physically respond, such as how long it takes to answer. These data can be used to generate an alternative credit score or they can be used in combination with other data, including traditional bureau data, where available. Results from working with a commercial lender in Kenya indicate that psychometric scoring has the ability to increase acceptance rates by 20 percent when combined with the lender's own internal behavioral score (box 7).

Box 7: Psychometric Tests—Entrepreneurial Finance Lab and Creditinfo

Entrepreneurial Finance Lab (EFL) and Creditinfo (Coremetrix) collect psychometric data in several ways, including by using tests administered by digital means (SMS), web-based applications, or phone interviews. These tests help assess potential borrowers' willingness to pay their obligations. The tests assess not only how the applicants answer questions but how they respond physically—for example, by measuring how long the applicant takes to answer a question.

EFL uses psychometric data for customers with “thin credit files” by combining data generated from psychometric test results and traditional credit history from a bureau, where available. In countries such as Kenya, the use of psychometric data has increased loan application acceptance rates by 20 percent. EFL's scoring methodology has been adopted and marketed by FICO as part of the FICO Financial Inclusion Initiative.

Coremetrix is a personality-based credit assessment that was launched by Creditinfo. The assessment uses psychometric results that are based on personality and self-reported information. The data are then used to complement traditional credit data, thus promoting broader access to finance. In South Africa, Coremetrix has partnered with Compuscan.

Open data systems

As noted earlier, open data systems are private and public initiatives that provide data that are freely available to everyone to use. Some examples of open data initiatives include Data.gov, Data.gov.uk and Data.gov.in, open banking, and Open Data Platform (ODP). ODP (opendatapatform.org) is a private sector initiative by tech companies to promote open source-based big data technologies and standards for enterprises that are building data-driven applications. Parties use application programming interface to access and share data on the platform.

Open data platforms promote access to information and foster competition in markets, thus they benefit consumers. In addition, they are a potential reliable source of traditional and alternative data (box 8). Nevertheless, open data systems introduce new challenges in the form of cybersecurity concerns, potential for fraud, and data privacy and protection issues. The reliability of open data platforms depends on the quality and timeliness of the data that are collected and stored on these platforms. Thus, there is a need to ensure that the process of collecting and processing data enhances the quality of the data stored. There is also a need to ensure the ethical use of data that are accessed from the platforms.

Implications on Data Ownership and Dissemination Models

The traditional credit reporting model is based on the need for an intermediary such as a credit bureau to perform the role of collecting, aggregating, and transmitting data that can be used to assess creditworthiness. That model was premised on the notion that borrowers were less likely to accurately disseminate and maintain a trail of their credit standing because they lacked the capacity or willingness to do so.

The proliferation of technological advancements, especially distributed ledger technology (DLT), challenges that notion (box 9). One pertinent application of DLT in credit reporting is its ability to enable customers to control their own data while having the data validated by credit providers. A distributed ledger structure could enable data subjects to control the storage and dissemination of their data and permission inquiries, while the subjects assure the inquirer that they have not altered the data. This technology will also help data subjects to control the access and transfer of their data. The immutability feature of DLT will aid in increasing the reliance on customer-centric data transmission models.

Box 8: Use of Open Data Platforms—Bonify

Credit reporting service providers, such as Bonify in Germany, are using transactional data (debit and credit movements on accounts, liquidity levels, and historical changes) from open banking platforms to create a creditworthiness score that is quite different from the static approach of the past. Instead of looking only at long-term statistics, Bonify maintains a score that is always up to date and is based on both historical and current transactional data

Box 9 Distributed Ledger Technologies and Biometrics in Credit Reporting

Credit bureaus such as Nova Credit and Creditinfo have developed consumer-driven data sharing platforms—that is, “credit passports”—using distributed ledger technologies that promote cross-border information sharing while safeguarding immutability. Driven primarily by the need to provide credit data portability for individuals and firms that have credit histories but are unable to use the data across borders, the credit passport enables users to take their credit history from one country to another. The use case also could be expanded beyond cross-border information sharing.

A mobile application will be used to download the user’s credit history and identification (ID) data from the country of origin using biometrics, and then the information can be shared with overseas financial institutions via QR (quick response) codes and encrypted using blockchain technology. Credit passports have been piloted and launched in Africa, Europe, and North America.

Implications on Data Privacy and Consumer Protection

Beyond the impact on institutional arrangements that have underpinned the social benefits of credit information sharing among lenders, the use of ever-growing data sets introduces a range of social and privacy issues. A large volume and variety of information are being considered relevant to credit reporting. The information then changes with high velocity, and it is being processed using techniques that reach conclusions whose veracity may not be readily ascertained.

The use of alternative data for credit reporting brings to the fore additional risks, including unlawful transmission of and access to personal information, lack of transparency of algorithms and processes, the potential for exclusion through discrimination, and multiple fragmented data sources.²⁵ Additionally, the use of digital platforms heightens the potential that cyber risks, fraud, and identity theft could have systemic implications on the stability of the financial system. As a result, authorities should balance promoting the benefits of the expanded use of alternative data with ensuring that inherent risks are managed.

Implications for Integrity of Credit Reporting Systems

Improved ability to uniquely identify data subjects

One of the biggest value propositions of having a strong CRSP is its ability to provide accurate match and merge capabilities by using available information and sophisticated algorithms to credibly identify and

validate a borrower's unique identity. The ability to use algorithms to match pieces of data is restricted in emerging markets, where crucial basic data such as names, addresses, and dates of birth are often unreliable or missing.

The credit reporting industry has increasingly adopted digital identity techniques in recent years, in an effort to resolve the identification problem (box 10). Biometrics can be used to authenticate identities using unique physical or behavioral characteristics. The development of biometrics is, however, costly and time consuming, and it requires more stakeholders than does the work of a traditional credit bureau.

Enhanced security and data privacy

Distributed ledger technologies could potentially disrupt the way information is shared and could introduce a greater level of automation, security, and privacy control into several credit information sharing processes. This technology allows for transactions and data to be recorded, permissioned or shared, and synchronized across a distributed network of different network participants. Blockchains employ cryptographic and algorithmic methods to record and synchronize data across a network in an immutable manner.²⁶

Implications for Business Models

With the explosion of fintech and big data; credit reporting players, such as lenders and credit bureaus, are recognizing the need to review their business models and value propositions so as to be able to withstand

Box 10: Biometrics —Uganda and India

In Uganda, with the support of the regulator, the credit bureau developed a financial identification (ID) card based on biometrics as a means to identify borrowers in the system and enhance the effectiveness of the credit bureau. Whether to use biometrics is still unresolved because of the sensitivities involved in collecting such personal information. Further, the development of biometrics is costly and time consuming, and it involves more stakeholders than does the work of a traditional credit bureau.

The Unique Identification Authority of India's Aadhaar program, or universal identification program, has provided more than 1 billion residents with unique IDs, demonstrating that it is possible to roll out a national identity system at an unprecedented scale. Aadhaar has also demonstrated how a reliable identity system can increase financial inclusion and more effectively target and deliver to beneficiaries access to key government social programs and subsidy programs. Given that identification is critical to the development of credit reporting systems, the Global Credit Reporting Program has been closely working with the World Bank's Identification for Development (ID4D) initiative to undertake country assessments to identify problems, design solutions, and implement new systems to increase the number of people with official identification. Those efforts also are beneficial to the overall development of credit reporting systems.

competition from emerging players and to potentially leverage new fintech service providers. Responses by the credit reporting players range from innovating and improving existing operational processes to outsourcing and creating smart partnerships.²⁷

Improved products and services

Increased competition has compelled traditional credit bureaus to leverage disruptive technologies to develop creative solutions, products, and services to meet consumer expectations. For example, a new credit passport promotes cross-border information sharing using data subject-centric dissemination methods. CRSPs are also tapping into new markets such as SMEs and clients with thin or no files by incorporating psychometric profiles, SME financials, and smartphone data into usable risk assessment models that enable credit decisions.

Other innovation solutions include mobile scoring, social scoring, and digital identification, and automated decision-making tools for advanced agri-finance. As a result, over the past three years, major credit bureaus and bureau-related services continue to be among the Top 100 of International Data Corporation (IDC) Financial Insights Fintech Ranking List (table 2).

Implications for business operations

One example of an innovative business is Credit2B, a cloud-based platform that combines third-party credit information with a network of thousands of credit professionals and credit grantors that have a common interest in acquiring better credit information about their trading partners. The platform enables businesses to quickly obtain business and credit information with more than 25 million businesses in the United States and Canada, including large, small, and privately owned firms.²⁸

Moving data, processing data, or both to a remote and possibly distributed cloud infrastructure raises operational and, in some jurisdictions, legal and regulatory risks and issues, particularly with respect to an increasingly complex international landscape of data residency and privacy regulation. Business models that depend on low-cost scalable infrastructure or on developing large international data sets for benchmarking, comparison, and scoring are enabled by cloud computing but could be affected or restricted by regulation.

Nevertheless, given strong interest and investments being made by banks and other CRSP clients, it is possible that CRSPs will be pulled into adopting

Table 2: IDC Financial Insights Fintech Ranking List

Company	Company Profile	Ranking		
		2014	2016	2017
CRIF	<ul style="list-style-type: none"> • Credit Reporting Service Provider • Presence in 22 countries since 1990 	46	54	33
Equifax	<ul style="list-style-type: none"> • Credit Reporting Service Provider • Presence in 14 countries 	16	16	17
Experian Group	<ul style="list-style-type: none"> • Credit Reporting Service Provider • With 32 credit bureaus around the world 	26	42	45
FICO	<ul style="list-style-type: none"> • Leading analytics software company • Presence in 90+ countries 	25	30	27
TransUnion	<ul style="list-style-type: none"> • Credit Reporting Service Provider • Presence internationally for over 30 years in 30 countries 	-	35	42

Source: International Data Corporation (IDC), "IDC FinTech Rankings: Top 100 and Enterprise 25," https://www.idc.com/prodserv/insights/#financial-fintech_rankings.

Note: -- = not ranked.

blockchain solutions by their clients even if they would prefer to wait and see how the technology develops. Equifax and TransUnion have recently joined trials of an experimental Canadian identity network to facilitate sharing of sensitive consumer data over the Internet via blockchain technology.²⁹

Kreditech is an example of a CRSP using artificial intelligence and machine learning. The company uses proprietary credit scoring technology to process up to 20,000 data points per application, the majority of which are drawn from social media to estimate human behavior. CreditVidya uses advanced analytics and ML to process a range of data pulled out of users' phones, including telephone use data, messaging content, browser data, and GPS locational data.

Rise of smart partnerships

The increasing competition in the sector has also necessitated collaboration among providers. Some traditional CRSPs are partnering with emerging fintech companies, and the new entrants are also partnering among themselves. For instance, FICO, the world leader in credit scoring technologies, has partnered with Electronica Finance Limited (EFL) to integrate alternative data into its scoring platforms.³⁰ EFL itself recently merged with Lenndo to provide a combined platform that will leverage different sources of alternative data to develop credit scoring and identity verification products and services.³¹

Traditional banks are also increasingly partnering with fintech and mobile companies to provide services. For example, the Commercial Bank of Africa in Kenya launched M-Shwari, a product that offers deposits and loans through the M-Pesa mobile money system. Credit scoring leverages M-Pesa and phone account data. Dozens of mobile phone lending companies, most of them nonbank technology-based companies, now operate in East Africa and globally.

Evolving Credit Reporting Landscape: Development

The adoption of fintech and alternative data for credit reporting will also have macroeconomic implications on financial inclusion, financial stability, and job creation (table 3). Some of the macroeconomic implications are the following:

- **Financial inclusion.** By creating digital identities, leveraging new data to create credit histories, and using new technologies to increase financial literacy and responsible access to, and use of, financial services, fintech will expand the economic participation of marginalized segments, including women, SME borrowers, informal workers, migrant or seasonal workers, agricultural workers, refugees, and people in fragile and conflict-affected environments with low infrastructure capabilities.
- **Job creation.** Expanding financial access to SMEs supports job creation because SMEs contribute up to 45 percent of employment and up to 33 percent of gross national product in developing economies. The technologies can be particularly beneficial in providing access to finance for underserved small enterprises.
- **Financial stability.** New technology can provide regulators with tools and data to undertake systemic monitoring and supervision that will ensure that the flow of credit information effectively mitigates systemic risk and overindebtedness.
- **Privacy and security.** The technologies can empower consumers to own their digital financial footprints and be aware of how the new data and technologies can be both beneficial and risky to them.

Table 3: Potential Development Impact of New Data Technologies, Products, and Models

Categories	Purpose/Scope	Impact			
		Financial Inclusion	Privacy & Security	Financial Stability	Job Creation
New Data	<ul style="list-style-type: none"> New data sources 	✓	✓		✓
New Technologies	<ul style="list-style-type: none"> Blockchain/distributed ledger technology (credit information sharing system, ID, trade suppliers, commercial registries) 		✓		✓
	<ul style="list-style-type: none"> Payment transactions (retail, remittance, small and medium-size enterprise [SME], and government payments) 			✓	✓
	<ul style="list-style-type: none"> Cloud computing 				
	<ul style="list-style-type: none"> Biometric technologies 	✓			
	<ul style="list-style-type: none"> Artificial intelligence/machine learning 	✓			
New Business Models	<ul style="list-style-type: none"> Lending (crowdfunding, peer-to-peer lending, online lenders, SME lending) 	✓	✓	✓	✓
	<ul style="list-style-type: none"> Risk management techniques (development of scoring models and fraud detection to provide financing or lending) 	✓	✓	✓	✓
	<ul style="list-style-type: none"> Regtech and suptech (to support compliance and supervision) 			✓	



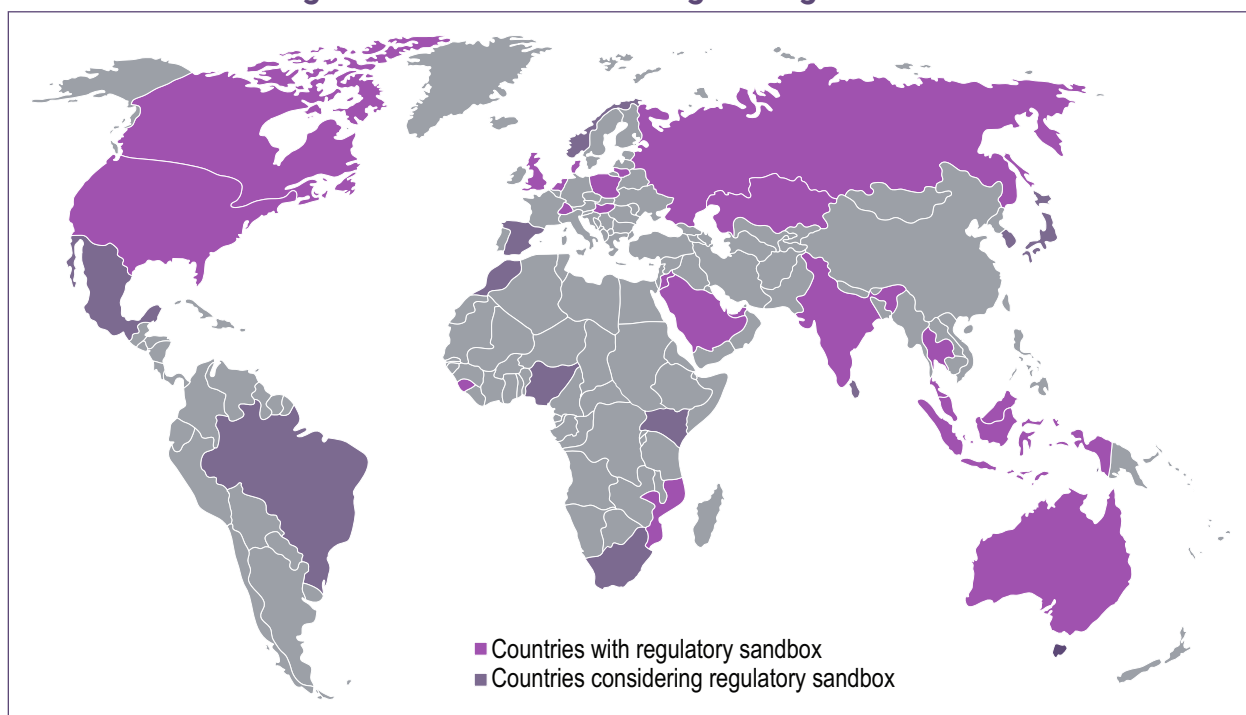
4. Regulatory and Supervisory Approaches to Fintech



The rapid growth in the use of fintech and adoption of alternative data pose new regulatory challenges for the integrity, safety, and soundness of the financial system. Despite this realization, regulatory response has largely been varied across markets as standard setters and most regulators grapple with striking a fine balance between promoting innovation and maintaining the stability of financial systems.

As they consider the regulation of and legal framework for new fintech firms, a number of countries have used the sandbox approach, in which fintech start-ups are spared from regulation that otherwise could severely impede their development. As stated in the *World Bank's Global Financial Development Report (2018)*: “The regulators are developing regulatory sandboxes to manage the transition to a new landscape—

Figure 7: Countries with Regulatory Sandboxes



Source: CGAP, accurate as of July 31, 2018.

allowing for the live testing of Fintech services with a low level of regulation for a defined period, helping to understand the risks that the new products might entail in a controlled environment. This way, the sandbox enables regulators to work with Fintech companies to ensure that appropriate consumer protection safeguards are built into their new products and services before these reach a mass market (Financial Conduct Authority, 2015).

The relative newness of alternative data poses its own challenges for financial institutions and policy makers. For financial institutions, because using alternative data for credit reporting is in its infancy, practitioners are not yet skilled or experienced in aggregating diverse data to derive meaningful insights. They may therefore lack the expertise to determine which data are meaningful, what level of detail is optimal, and what combinations of data are most effective. Furthermore, regulatory requirements and privacy laws may prohibit lenders from gaining access to certain types of information. Last, many new financial service providers have not made sufficient investments in data protection and cybersecurity.

Standards for Fintech and Alt Data

International standard setters have been working to determine the effects of fintech and alternative data on the operations of their regulated entities and on financial systems.

Alternative Data Standards

The International Committee on Credit Reporting (ICCR) recently released a policy guide, which outlines policy recommendations for how regulatory authorities and government can promote and harness the use of alternative data for credit reporting.³² The policy defines and outlines categories and sources of alternative data. It also identifies the risks and challenges that impede the adoption of alternative data for credit reporting. The challenges include (a) lack of an enabling legal and regulatory environment; (b) difficulties in verifying the identity of data subjects; (c) multiplicity and fragmentation of data sources, which often result in inaccurate or incomplete information; and (d) the opaqueness of alternative scoring methodologies. The guide also noted that the use of alternative data in emerging markets is hampered by low levels of

digitization. Some of the risks associated with use of alternative data include inaccuracies in the data, use of data that are based on uninformed consumer consent, the potential for discrimination, and heightened exposure to cyber risks.

The ICCR guidance note provides 21 policy recommendations that countries and regulatory authorities should consider when promoting the adoption of alternative data in credit reporting. Among the policy recommendations, the ICCR considers aspects related to data privacy, consumer protection, and cybersecurity.

Fintech Standards

Although considerable efforts have been made to analyze the risks, challenges, and opportunities of fintech for their constituency bodies, international bodies have not agreed to worldwide financial regulatory standards or policies. There is no guidance that considers the broad spectrum of fintech and its implications on financial markets in general and for credit reporting in particular.

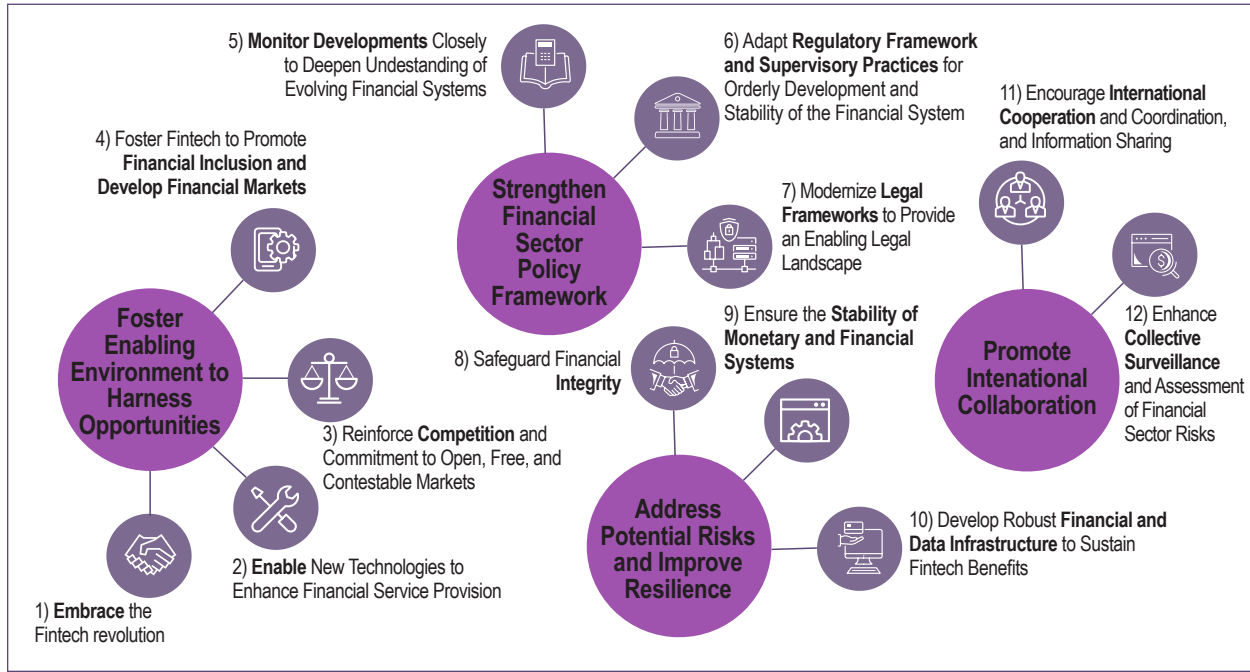
Financial Stability Board and Bank for International Settlements

In 2017, the Financial Stability Board (FSB) produced a report that considered the implications of fintech credit on market structure, business models, and financial stability.³³ Moreover, the Bank for International Settlements (BIS) produced a report that assessed the impact of fintech on the banking industry and the activities of supervisors and offered broader guidance.³⁴ The document highlights the importance of balancing innovation and financial stability and elevates the importance of cooperation among supervisory agencies across sectors and borders. The guidance also highlights the need for training and capacity building for supervisors and identifies potential use cases of fintech for supervisory and regulatory purposes. The document further identifies the regulatory frameworks for and approaches to dealing with fintech across jurisdictions.

The Bali Fintech Agenda Paper

The World Bank and the International Monetary Fund (IMF) jointly released a paper intended to guide policy makers around the world in their handling of the rise of fintech. The paper, called the “Bali Fintech Agenda,”³⁵ outlines 12 considerations that the IMF,

Figure 8: Guidelines for Policy Makers and Regulators to Address FinTech from the Bali Fintech Agenda



the World Bank, and governments can keep in mind when designing policies and regulations to maximize the benefits of fintech while keeping financial systems sound (figure 8). Those considerations include using fintech to promote financial inclusion, allowing new technology players to have a level playing field with existing companies, and having countries work together to protect the global financial system.

Two types of fintech legal frameworks are currently in use: fragmented and consolidated (box 11). Under the fragmented regulatory framework, a wide array of laws, regulations, and directives are applied to fintech companies and activities. This model is based on the understanding that fintech cuts across various sectors such as banks, insurance, and capital markets. Thus fintech companies are regulated by the regulatory framework relevant to their business models and activities. A fragmented regulatory framework is used in the European Union and Switzerland.

However, a few countries, including China and Mexico, have adopted the consolidated regulatory framework model. Within the model, a single fintech legal framework is developed that addresses the various

fintech models and activities. The success of this model depends on the effectiveness of the cooperation and collaboration of agencies across multiple sectors.

Suptech and Regtech

Disruptive technologies also have applications in businesses that seek to help financial institutions comply with regulations and supervisory reporting (“regtech”) and to help supervisors oversee activity (“suptech”). These applications tend to be combinations of rules engines and machine learning (ML) that enable compliance and monitoring within regulated institutions, open banking interfaces that improve the efficiency and accuracy of data exchange and reporting, and big data analytics and ML that assist supervisory monitoring of activities. For example, automated data exchange may help aggregate data across different financial institutions locally or globally. Blockchain or cryptographic tools could be applied to preserve the confidentiality and security of underlying information. Applications of ML and artificial intelligence are being explored to assist in reading and analyzing large amounts of structured and unstructured data relevant to risk supervision and to improve modeling, forecasting,

and stress testing of the financial sector.³⁶ Suptech is currently found in two areas: data collection and data analytics. Applications are used for supervisory reporting, data management, and virtual assistance. Examples include the ability to pull data directly from

banks' information technology systems, automated data validation and consolidation, and chatbots to answer consumer complaints while collecting information that could signal potential areas of concern (box 12).³⁷

Box 11: Fintech Laws and Regulatory Framework in the European Union, Switzerland, China, and Mexico

European Union

The regulatory framework for fintech in the European Union (EU) is highly fragmented with a wide range of directives and regulations applying to Fintech business models. Some of regulations and directives include the E-Money Directive and the Payment Services Directive 2, which cover digital money, mobile and online payments, and EU-wide single markets. Certain provisions of the Anti-Money Laundering Directive are also applied to fintech companies.

Switzerland

The Swiss fintech regulation is fragmented and dependent on specific business models of fintech operators. The major statutes that are applied are the Banking Act (acceptance of deposits from the public), the Anti-Money Laundering Act (discretionary asset management, payment services, or lending), the Stock Exchange Act (securities broker-dealer activities), the Collective Investment Schemes Act (issuing or managing investment funds), the Consumer Credit Act (if granting or intermediating loans to consumers), or the Financial Market Infrastructure Act (financial market infrastructure function). The established industry practice of self-regulation also extends to certain activities of fintech activities. The effectiveness of the Swiss model depends on the fact that the Financial Market Supervisory Authority (FINMA) is the body responsible for regulating the financial institutions, thus ensuring a consistent regulatory approach.

Mexico

Mexico enacted a consolidated fintech law in 2018 that categories fintech companies into three types: crowdfunding, cryptocurrency firms, and other. The law mandates open data systems—that is, open banking platforms on which financial institutions can share data through application programming interfaces. The law also provides a framework of regulating sandbox ecosystems.

The law provides for the enactment of secondary regulations that will cover an interinstitutional committee, technological risk and business continuity plans, cash limits, autocorrection plans, sandbox sign-ups, payment claimant behavior, and other provisions.

The administration of the fintech law takes a multiagency approach. The authorities in charge of the fintech law in Mexico are SHCP (Secretaría de Hacienda y Crédito Público), the National Banking and Securities Commission (CNBV), and the Bank of Mexico (Banxico).

China

Fintech regulation in China is governed by the Guiding Opinions and Administrative Measures/Rules. The Guiding Opinions on Promoting the Healthy Development of Internet Finance (Guiding Opinions) was jointly issued in July 2015 by the Ministry of Industry and Information Technology, the People's Bank of China (PBOC), and eight other regulatory authorities, including the China Banking Regulatory Commission (CBRC), the China Insurance Regulatory Commission (CIRC), and the China Internet Information Technology Office (CIITO). According to the Guiding Opinions, the PBOC regulates online payments, the CBRC regulates equity crowdfunding and online fund sales, and the CIRC regulates online insurance.

In 2016, the CBRC and three other ministries jointly issued the Provisional Rules for the Administration of the Business Activities of Online Lending Information Intermediary Institutions (Provisional Rules). Regulatory agencies have issued rules from time to time elaborating the regulation of activities under their purview.

Box 12: Automated Data Collection in Austria and Rwanda

Supervisory authorities in Austria and Rwanda have developed supotech solutions for automated data collection that can be leveraged for market conduct. The Austrian example represents a data-input approach, whereas the Rwanda example represents a data-pull approach.

Austria

The Austrian central bank, in collaboration with Austrian banks, has developed an innovative data-input regulatory reporting platform that provides a direct interface between the information technology systems of the central bank and banks. The platform allows banks to upload data in a standardized format, according to Austrian central bank requirements and specifications. The central bank can then transform the data into “smart cubes,” or data sets, that contain specific data and information relevant for different departments within the Austrian central bank. This new model ensures more consistent and higher-quality data, relieves banks from having to prepare different reports for different supervisory departments, and allows cost sharing of compliance between the supervisor and industry.

Rwanda

An automated data-pull system developed by the National Bank of Rwanda enables supervisors to access raw data from the systems of supervised financial service providers and then to process the data into reports using the bank’s own software. The system comprises an electronic data warehouse to automate and streamline the reporting processes that inform and facilitate supervision. The data warehouse permits the bank to automatically “pull” data from the systems of supervised entities, reducing the need for manually produced reports and improving the accuracy and consistency of data. The electronic data warehouse also facilitates daily automated data pulls for certain types of data. This approach does, however, generate new concerns and challenges, including those related to data privacy, operational risk, and reputational risk.



5.

The Role of the World Bank Group



As an independent, objective, and neutral third-party provider of advisory services, the World Bank Group (WBG) primarily works with each of the stakeholders in the credit information sharing space to raise awareness about the new opportunities and potential risks; to identify ways in which to integrate new opportunities to enhance the effectiveness of existing credit reporting systems or develop new systems in a more efficient manner; and to educate the various parties about their roles and responsibilities in working with new types of data, technologies, and products. All of the activities and guidance provided would be aligned with the World Bank's general principles for credit reporting.

Since the beginning of its work on CRSs, the World Bank team has always leveraged and embedded various new data sources, technologies, and products into its portfolio of existing projects. Many of the markets that the program works on are characterized by low levels of information technology infrastructure, connectivity, and relevant skills, and those markets may not support the adoption of rapidly evolving disruptions at this stage of their maturity.

However, there may be the possibility to leverage some of the technologies to leapfrog the process of establishing CRSs in many markets. Whereas traditional CRSs evolved from sharing information in the banking sector, there may be an opportunity to leverage technology to aggregate information on credit activity outside the banking sector in a faster and more efficient manner.

There is a real potential for existing CRSPs to be disintermediated by direct-to-source data approaches or by fintechs offering alternative scoring systems. Emerging lenders such as Amazon and Branch already use proprietary data from outside the banking sector. CRSPs need to build their data analytics capabilities; plain data gathering may cease to be a viable business model. The WBG's leadership in aligning these new technologies and models with the global standards and best practices would be the key to direct the effects of innovations toward financial inclusion, stability, and job creation (table 4).

Table 4: World Bank Group’s Role in New Data Technologies

New Data Technologies and Products Models		
Category	Purpose/Scope	World Bank Group’s Role
New Data	<ul style="list-style-type: none"> New data sources 	<ul style="list-style-type: none"> Facilitate data provision and sharing in accordance with GPs 1 and 2 General principles (GPs) create enabling legal and regulatory frameworks and ensure data subject rights are protected (GP 4) Build appropriate capacity of supervisor, oversight framework
New Technologies	<ul style="list-style-type: none"> Blockchain/distributed ledger technology (credit information sharing system, ID, trade suppliers, commercial registries) 	<ul style="list-style-type: none"> Create enabling legal and regulatory frameworks and ensure compliance with GP 4 Build appropriate capacity of supervisor Ensure that the overall legal and regulatory framework for credit reporting is clear, predictable, nondiscriminatory, proportionate, and supportive of data subject and consumer rights Increase security and reliability in compliance with GP 4
	<ul style="list-style-type: none"> Payment transactions (retail, remittance, SME, and government payments) 	<ul style="list-style-type: none"> Facilitate data provision in accordance with GPs 1 and 2 Create enabling legal and regulatory frameworks Build appropriate capacity of supervisor Lead efforts to increase financial inclusion
	<ul style="list-style-type: none"> Cloud computing 	<ul style="list-style-type: none"> Ensure alignment with GPs 2 and 5 Create enabling legal and regulatory frameworks Support supervision and regulatory capacity building
	<ul style="list-style-type: none"> Biometric technologies 	<ul style="list-style-type: none"> Ensure alignment with GPs 1 and 2 Create enabling legal and regulatory frameworks in accordance with GP 4
New Business Models	<ul style="list-style-type: none"> Aggregators Lending (crowdfunding, peer-to-peer lending, online lenders, SME lending) 	<ul style="list-style-type: none"> Ensure alignment with GPs 1 and 2 Create enabling legal and regulatory frameworks For potential new data providers, educate about importance of credit information sharing and relevance of GPs 1 and 2 Assist efforts to provide responsible access to credit and stability Assist efforts to provide adequate consumer protection measures, regulatory oversight
	<ul style="list-style-type: none"> Risk management techniques (development of scoring models and fraud detection to provide financing or lending) 	<ul style="list-style-type: none"> Develop appropriate oversight frameworks and build supervisory capacity Ensure transparency in development of scorecards Ensure consumer awareness and protection of consumer rights
	<ul style="list-style-type: none"> Regtech/suptech (support compliance and supervision) 	<ul style="list-style-type: none"> Support micro and macro prudential supervision function Sensitize and create uptake by regulator Help harmonize international regulatory framework Help enable cross-border information sharing between regulators

6.

Conclusions

In the past, financial inclusion was largely hindered by the lack of accessibility to clients and information on which to base decisions. Banks that were traditional providers of finance held valuable data, but they were often not using it effectively. The daily transaction data of consumers and small to medium-size enterprises (SMEs) provides reliable real-time visibility into consumer and SME cash flows and credit capacity. However, most banks lacked the ability and willingness to create innovative lending models from that data. Further, the data inside banks often reside in a patchwork of legacy systems and information silos that make the data difficult and costly to access.

More recently, access to data has become less challenging in lending. New consumer and SME digital data streams are becoming readily available and accessible, and most of them are outside credit reporting service providers (CRSPs). Digital consumer and SME lenders have shown they can lend at scale by leveraging vast and expanding stores of data, including from electronically verifiable, real-time sales, bank account money flows and balances, payments, social media, trading, logistics, business accounting, and CRSPs, as well as from a wide range of other private and public data sources. Although the new streams of data are becoming more and more available, further digitization and structuring of data are required to unleash the information. Despite the availability of technology that could bring fintech players together, most of them work within their organizations, and the individuals and SMEs benefit only partially. This lack of cooperation increases the risk that overindebtedness will lead to systematic risk.

In addition to the new data, the new technologies elaborated on in this paper, as well as the new products developed using new data and technologies, are fast becoming critical for the development of efficient financial infrastructure reform. As with all things new, these digital disruptions come with significant risks and challenges. With the abundance of alternative data, for instance, there are challenges regarding what data to use, how to use them, and how to work responsibly while respecting privacy and other important rights of individuals and SMEs. The available data are also isolated (payment data from mobile data, social media, psychometrics, consumer data, government data, credit information, or utility information, and so on). Logical aggregation of the data can substantially scale up the usefulness and potential benefits of fintech offerings. The new products and technologies are still relatively



untested, and endorsing any of them requires a certain level of confidence in their long-term viability. New entrants bring new complexities, risks, and ways of thinking about financing value, as well as new agenda items for policy makers and regulators, including data privacy and security, pricing transparency, and credit information sharing.

Credit reporting systems (CRSs), such as credit bureaus, have always leveraged new technologies and innovations to improve on efficiency, speed of service, and quality of the information provided to the users of the services. CRSs are part of a credit infrastructure system established on a set of internationally agreed upon principles that ensure transparency and accuracy,

with rigorous standards of reliability and security. This system is currently adapting to the new reality of dispersed sources of credit-relevant data; but there is potential to expand further. At the same time, use of new data types should conform to level-playing-field standards of privacy, reliability, and security.

The role of the World Bank Group's Global Credit Reporting Team in the age of digital disruption is more critical now than ever. The team is best placed to offer a balanced approach to developing or reforming financial infrastructure systems that are tailored to individual client contexts and that leverage these digital innovations while balancing them with responsible applications of sound risk management practices and proportionate policy making.



Annex.

General Principles for Credit Reporting

“The General Principles:”

The General Principles aim at the following **public policy objectives** for credit reporting systems: Credit reporting systems should effectively support the sound and fair extension of credit in an economy as the foundation for robust and competitive credit markets. To this end, credit reporting systems should be safe and efficient, and fully supportive of data subject and consumer rights.

Data

General Principle 1: Credit reporting systems should have relevant, accurate, timely and sufficient data—including positive—collected on a systematic basis from all reliable, appropriate and available sources, and should retain this information for a sufficient amount of time.

Data Processing: Security and Efficiency

General Principle 2: Credit reporting systems should have rigorous standards of security and reliability, and be efficient.

Governance and Risk Management

General Principle 3: The governance arrangements of credit reporting service providers and data providers should ensure accountability, transparency and effectiveness in managing the risks associated with the business and fair access to the information by users.

Legal and Regulatory Environment

General Principle 4: The overall legal and regulatory framework for credit reporting should be clear, predictable, non-discriminatory, proportionate and supportive of data subject and consumer rights.

The legal and regulatory framework should include effective judicial or extrajudicial dispute resolution mechanisms.

Cross-Border Data Flows

General Principle 5: Cross-border credit data transfers should be facilitated, where appropriate, provided that adequate requirements are in place.”

Roles of Key Players

Role A: Data providers should report accurate, timely, and complete data to credit reporting service providers, on an equitable basis.

Role B: Other data sources, in particular public records agencies, should facilitate access to their databases to credit reporting service providers.

Role C: Credit reporting service providers should ensure that data processing is secure and provides high quality and efficient services. All users having either a lending function or a supervisory role should be able to access these services under equitable conditions.

Role D: Users should make proper use of the information available from credit reporting service providers.

Role E: Data subjects should provide truthful and accurate information to data providers and other data sources.

Role F: Authorities should promote a credit reporting system that is efficient and effective in satisfying the needs of the various participants, and supportive of data subject/consumer rights and of the development of a fair and competitive credit market.

Recommendations for Effective Oversight

Recommendation A: Credit reporting systems should be subject to appropriate and effective regulation and oversight by a central bank, a financial supervisor, or other relevant authorities. It is important that one or more authorities exercise the function as primary overseer.

Recommendation B: Central banks, financial supervisors, and other relevant authorities should have the powers and resources to carry out effectively their responsibilities in regulating and overseeing credit reporting systems.

Recommendation C: Central banks, financial supervisors, and other relevant authorities should clearly define and disclose their regulatory and oversight objectives, roles, and major regulations and policies with respect to credit reporting systems.

Recommendation D: Central banks, financial supervisors, and other relevant authorities should adopt, where relevant, the General Principles for credit reporting systems and related roles, and apply them consistently.

Recommendation E: Central banks, financial supervisors, and other relevant authorities, both domestic and international, should cooperate with each other, as appropriate, in promoting the safety and efficiency of credit reporting systems.



Endnotes

1. World Bank Financial Inclusion Initiative website, <http://www.worldbank.org/en/topic/financialinclusion/overview>. Data are based on Global Findex 2014 and the International Monetary Fund (IMF) Financial Access Survey.
2. SME Finance Forum, “MSME Finance Gap,” <http://www.smefinanceforum.org/data-sites/msme-finance-gap>.
3. World Bank, UFA2020: Universal Financial Access by 2020,” <http://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020>.
4. ICCR (International Committee on Credit Reporting), “Credit Reporting Systems Contribution to Financial Inclusion,” ICCR Policy Brief.
5. IMF and World Bank, “Bali Fintech Agenda,” October 2018, <https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/10/11/pp101118-bali-fintech-agenda>.
6. GPMI (Global Partnership for Financial Inclusion), “Alternative Data Transforming SME Finance,” May 2017, <http://www.gpmi.org/sites/default/files/documents/GPMI%20Report%20Alternative%20Data%20Transforming%20SME%20Finance.pdf>.
7. GPMI, “G20 High-Level Principles for Financial Inclusion,” 2016, http://www.gpmi.org/sites/default/files/documents/G20-HLP-Summary_0.pdf.
8. Margaret Miller, Nataliya Mylenko, and Shalini Sankaranarayanan, “Financial Infrastructure: Building Access through Transparent and Stable Financial Systems,” Financial Infrastructure Policy and Research Series, World Bank, Washington DC, 2009.
9. World Bank, *Doing Business 2018* survey data on the “Getting Credit” indicator.
10. World Bank, “General Principles for Credit Reporting,” Financial Infrastructure Series, 2011, <http://documents.worldbank.org/curated/en/662161468147557554/pdf/70193-2014-CR-General-Principles-Web-Ready.pdf>.
11. World Bank, “General Principles for Credit Reporting.”

12. World Bank, "General Principles for Credit Reporting."
13. Miller, Mylenko, and Sankaranarayanan, "Financial Infrastructure," and ICCR, "Credit Reporting Systems Contribution to Financial Inclusion."
14. World Bank, *Doing Business 2018*. Information is based on the number of individual records as reported by private credit bureaus in countries where the program has worked.
15. "Assessment Methodology for the General Principles for Credit Reporting," International Committee on Credit Reporting (ICCR), Financial Infrastructure Series, World Bank, Washington, DC, 2013; "Facilitating SME Financing through Improved Credit Reporting," ICCR, Financial Infrastructure Series, World Bank, Washington, DC, 2014; "The Role of Credit Reporting in Supporting Financial Sector Regulation and Supervision," ICCR, Financial Infrastructure Series, World Bank, Washington, DC, 2016; and ICCR, "Guidance Note: Use of Alternative Data to Enhance Credit Reporting to Enable Access to Digital Financial Services by Individuals and SMEs Operating in the Informal Economy," World Bank, Washington, DC, 2018.
16. Judith Hurwitz et al., "Unstructured Data in a Big Data Environment," Dummies.com, accessed June 20, 2017, <http://www.dummies.com/programming/big-data/engineering/unstructured-data-in-a-big-data-environment/>.
17. The substance of court proceedings tends to be unstructured data, but it could be summarized in a structured format: for example, has the subject been convicted of a felony (yes/no), do court records show any judgments against the subject (yes/no). Such summary analysis, often binary in nature, may not convey the nuances of a situation.
18. There are three types of e-money: (a) e-cash, (b) network money, and (c) access products.
19. World Bank Group and World economic Forum, "Innovation in Electronic Payment Adoption: The Case of Small Retailers," World Bank Group, Washington, DC, 2016, <http://documents.worldbank.org/curated/en/765851467037506667/pdf/106633-WP-PUBLIC-Innovative-Solutions-Accelerate-Adoption-Electronic-Payments-Merchants-report-2016.pdf>.
20. Blockchain is a form of distributed ledger technology in which information is hosted on several servers at the same time, thus eliminating the need for central storage of information and the intermediaries that control such central databases.
21. Harish Natarajan, Solvej Karla Krause, and Helen Luskin Gradstein, "Distributed Ledger Technology (DLT) and Blockchain," FinTech Note 1, World Bank Group, Washington, DC, 2017.
22. International Finance Corporation (IFC), "Digital Financial Services: Challenges and Opportunities for Emerging Market Banks," EMCompass note 42, August 2017.
23. ICCR, "Guidance Note: Use of Alternative Data to Enhance Credit Reporting to Enable Access Digital Financial Services by Individuals and SMEs Operating in the Informal Economy," World Bank, Washington, DC, 2018.
24. James King, "Credit Scoring for the Social Media Generation," *The Banker*, January 10, 2014, <http://ec2-54-72-50-240.eu-west-1.compute.amazonaws.com/Banking-Regulation-Risk/Retail-Banking/Credit-scoring-for-the-social-media-generation?ct=true>.
25. World Bank and Consultative Group to Assist the Poor, "Data Protection and Privacy for Alternative Data," GPFI-FCPL Sub-group Discussion paper draft, May 2018, <https://www.gpfi.org/publications/data-protection-and-privacy-alternative-data>.
26. Blockchain is a form of distributed ledger technology in which information is hosted on several servers at the same time, thus eliminating the need for central storage of information and the intermediaries that control such central databases. See Natarajan, Krause, and Gradstein,

- “Distributed Ledger Technology (DLT) and Blockchain.”
27. IFC, “Digital Financial Services: Challenges and Opportunities for Emerging Market Banks.”
 28. See the Credit2B website, <https://www.credit2b.com/>.
 29. Solarina Ho, “U.S. Credit Agencies Test Canadian Blockchain Identity Network,” Reuters, May 4, 2017, <https://www.reuters.com/article/us-canada-blockchain-credit-idUSKBN1802OR>.
 30. “FICO and EFL Partner to Extend Access to Credit for ‘Unscoreable’ Consumers and Entrepreneurs in Multiple Markets,” FICO website, October 25, 2016, <http://www.fico.com/en/newsroom/fico-and-efl-partner-to-extend-access-to-credit-for-unscoreable-consumers-and-entrepreneurs-in-multiple-markets-10-25-2016>.
 31. “Lenddo and EFL Team Up to Lead Financial Inclusion Revolution,” Cision PRweb, October 17, 2017, <http://www.prweb.com/releases/2017/10/prweb14806664.htm>.
 32. ICCR, “Guidance Note: Use of Alternative Data to Enhance Credit Reporting to Enable Access to Digital Financial Services by Individuals and SMEs Operating in the Informal Economy,” World Bank, Washington, DC, 2018.
 33. Financial Stability Board and Committee on the Global Financial System, “FinTech Credit: Market Structure, Business Models and Financial Stability Implications,” FSB and Bank for International Settlements, May 2017
 34. Basel Committee on Banking Supervision, “Sound Practices: Implications of Fintech Developments for Banks and Bank Supervisors,” Bank for International Settlements, 2017.
 35. International Monetary Fund and World Bank, “The Bali Fintech Agenda: Chapeau Paper (English),” World Bank, Washington, DC, 2018, <http://documents.worldbank.org/curated/en/390701539097118625/The-Bali-Fintech-Agenda-Chapeau-Paper%20>.
 36. Institute of International Finance, “Regtech in Financial Services: Technology Solutions for Compliance and Reporting,” Washington, DC, March 2016, <https://www.iif.com/Publications/ID/1686/Regtech-in-Financial-Services-Solutions-for-Compliance-and-Reporting>.
 37. Dirk Broeders and Jermy Prenio, “Innovative Technology in Financial Supervision (Suptech): The Experience of Early Users,” FSI Insights 9, Financial Stability Institute, BIS, Basel, Switzerland, July 2018.
 38. World Bank, “General Principles for Credit Reporting,” 2011.

