# REGULATORY AND SUPERVISORY TECHNOLOGIES FOR FINANCIAL INCLUSION

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Futuristic high-tech computer network concept with artificial intelligence. (aislan13 /iStock)

# EXECUTIVE SUMMARY

Financial inclusion is one of the primary goals for financial regulators worldwide. As a result, many countries have made considerable strides in increasing access to formal finance to the unserved and underserved populations. However, many remain financially excluded.

But today, digital financial services (DFS), Financial Technologies (FinTechs) and other non-bank entrants are rapidly changing the narrative on financial services access, usage, and quality across all consumer segments, including the financial industry's evolution driven by innovation and great potential to improve financial inclusion.

Nevertheless, these technology-enabled innovators and financial service providers (FSP) come with a set of emerging challenges and concerns for regulators, such as cybersecurity threats, data security, privacy and protection, money laundering/terrorism financing (ML/TF) risks, complexities and inefficiencies around supervision and regulatory compliance or reporting, and particularly the necessity for financial regulators to develop capabilities and adopt tools for effective and efficient regulation compliance, supervision and oversight outcomes.

To address these challenges and solve the capability conundrum, AFI member countries and regulators worldwide are turning to regulatory and supervisory technologies (RegTech and SupTech) powered by different technologies and technological capabilities such as artificial intelligence/machine learning (AI/ML), cloud computing, blockchain technology, data analytics, and adapting these innovations to their local contexts and unique needs to achieve improved regulation compliance methods, efficient supervision processes and effective oversight outcomes — which are necessary pillars to sustain and accelerate financial inclusion.

Based on researches, in-depth analysis and use cases of regulators within the AFI network and beyond already adapting RegTech and SupTech in a number of thematic areas.

This report recommends a five-step policy framework to help regulators adapt these RegTech and SupTech innovative solutions to the specific needs and context of their jurisdictions:

1. Analyzing the local context;
2. Assessing internal capabilities and resources;
3. Engaging and collaborating with relevant demand and supply-side stakeholders;
4. Identifying and designing necessary RegTech and SupTech solutions and processes; and
5. Implementing solutions.

In this report, six key thematic focuses have been identified as proxies for an inclusive regulatory and supervisory regime delivered through technology-enabled innovations.

> **More on page 4**

These themes are explored to establish linkages and opportunities for RegTech and SupTech to add and create value in regulatory reporting and compliance methods, processes, and overall supervision outcomes, hence, contributing to an inclusive and sustainable financial ecosystem.

In conclusion, this framework is anchored on practical insights to help AFI members design, develop, adopt, and adapt SupTech and RegTech initiatives for different and relevant thematic requisite areas to promote financial inclusion. For these to be successful, collaboration and active stakeholder engagement will be of utmost importance.

# TABLE 1: KEY THEMATIC AREAS FOR REGTECH AND SUPTECH FOR FINANCIAL INCLUSION

### CONSUMER PROTECTION AND MARKET CONDUCT

Enhancing the financial regulator's ability, methods, and processes to build and strengthen an inclusive financial ecosystem that exemplifies public confidence, trust, responsible business conduct, fair treatment, and protection of consumers.

### DATA-DRIVEN FINANCIAL SYSTEM STABILITY

Enabling financial authorities, promoting an agile, sound, and efficient financial system to withstand adverse economic cycles, disruption or shocks via data-driven insights, robust sentiment analysis, risk management and technology-enabled innovative forecast and predictions.

### DATA COLLECTION AND MANAGEMENT

Helping identify, collect, standardize data, ensuring dataset fidelity and quality, safety store, analyze, and draw insights for effective decision-making to address challenges with disproportionately excluded segments such as women, older people, forcibly displaced persons (FDPs), or any market segment of interest in real time.

### DETECTION AND PREVENTION OF FINANCIAL CRIMES

Equipping regulators to leapfrog deficiencies in money laundering and terrorism financing (ML/TF) compliance, counter inefficiencies in fraud controls and governance, overcome costly passive and manual processes, address insufficient resources for monitoring and high dependencies on human judgement.
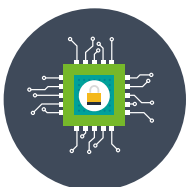
### REMOTE SUPERVISION AND REPORTING

Creating tools, methods and processes that enhance exceptional regulation compliance, comprehensive supervision and oversight outcomes at lower costs, greater efficiency, reduced or eliminated mobility constraints for both regulators and the regulated.

### FINANCIAL INCLUSION FOR DISADVANTAGED GROUPS AND WOMEN

Improving financial stability, customer engagement, and sound regulatory environment by addressing the barriers to financial inclusion for women, older people, youth, internally displaced persons (IDPs) or FDPs and other disproportionately excluded segments.

# INTRODUCTION

The financial services industry is evolving rapidly and has gone through tremendous change in the past decade, with non-bank entrants gaining significant traction globally. As many emerging economies strive to accelerate financial inclusion*, especially for vulnerable groups such as women, youth, micro, small and medium enterprises (MSMEs), FDPs, and those living with a disability, the introduction of digital financial services (DFS) have proven to be a game-changer by helping individuals and businesses access and use financial services with ease.

This paradigm shift in the industry presents new regulatory and supervisory challenges for regulators. For example, they need to comprehend and mitigate prevailing and emergent risks associated with technology such as cybersecurity, anti-money laundering/combating the financing of terrorism (AML/CFT), fraud detection, compliance reporting, outsourcing, and use of third parties. In addition, as the regulators work on their broad mandate to ensure monetary and financial stability, expanding access through responsible usage of DFS for the under and unserved market segments has become imperative.

Regulatory (RegTech*) and Supervisory Technology (SupTech*), though not new ideas, are receiving growing interest from financial regulators across the world — especially from emerging and developing market economies (EDMEs) that make up the Alliance for Financial Inclusion (AFI) network.

Regulators are actively adopting RegTech and SupTech, as regulated financial sector actors such as banks increasingly transform several facets of their operations, delivery, regulatory compliance and reporting through digitization.

It is important to note that many countries, including AFI member institutions in countries such as Ghana, Mexico, Nepal, Nigeria, Philippines, and Rwanda, have piloted RegTech and SupTech solutions to address different challenges or explore various use cases. Our focus in this report is to explore and investigate these pilots and implementations across the globe, with a specific emphasis on AFI member countries.

In the following sections, we will discuss the research objectives and methodology, present the key themes identified and their intersection with financial inclusion, cite relevant country examples and use cases, highlighting how RegTech and SupTech can be an effective response tool and utility during emergencies. Finally, we will discuss policy recommendations through a framework to guide financial regulators on how to adopt and implement RegTech and SupTech solutions, with clear considerations for promoting financial inclusion.

## REGTECH, SUPTECH AND FINANCIAL POLICYMAKING

We start with a RegTech and SupTech analysis and their intersection with financial policymaking to better understand how they can add value at different stages of financial policies and regulation formulation; the lifecycle of policymaking is analyzed through the lens illustrated below.

While RegTech and SupTech play a huge role across the regulatory policymaking process, they can also offer critical value to enhance data collection, its frequency, degree of granularity and quality, and subsequently support the analysis to draw insights for any policy to be inclusive (representative of all segments), actionable and successful.[1]

It is worth noting that this is not a one-time set and forget-it approach. Indeed, financial ecosystems are constantly in flux, thus this framework needs to be regularly reviewed.

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1   Gurung, Nora and Perlman, Leon, Use of Regtech by Central Banks and its impact on financial inclusion (November 16, 2018). Available at: https://ssrn.com/abstract=3285985.

**FIGURE 1:** POLICYMAKING LIFECYCLE (SOURCE: KNILL AND TOLSUN, 2008)[2]



POLICY
ADOPTION

POLICY
FORMULATION

POLICY
IMPLEMENTATION

AGENDA
SETTING

MONITORING AND
EVALUATION

MARKET AND
CONSUMER
DATA COLLECTION,
ANALYSIS
AND INSIGHT

**TABLE 2:** POTENTIAL IMPACT OF REGTECH AND SUPTECH ON THE POLICYMAKING LIFECYCLE

| POLICYMAKING LIFECYCLE STAGE | POTENTIAL IMPACT OF REGTECH AND SUPTECH |
|---|---|
| AGENDA SETTING | The first stage of the policy lifecycle involves the identification of policy problems and the subsequent goal setting for the regulators. As they look to understand the market situation, regulators are increasingly keen to be able to identify industry changes in near-real time. Through the collection and analysis of real-time data, RegTech and SupTech hold the potential to help regulators have a more clear and holistic view of the current market dynamics and predictive capabilities for probable future outcomes. |
| POLICY FORMULATION | Leveraging the big data analysis, insights and potential improvements to processes, methods, and tools through RegTech solutions, regulators are able to have a more proactive policy response to immediate market changes and ensure that policy decisions are inclusive. |
| POLICY ADOPTION | RegTech solutions can help regulators ensure that market participants are compliant with policy changes by lowering compliance and reporting costs, reducing, or eliminating process bottlenecks and introducing efficiencies across the chain. In addition, SupTech can help flag unintended policies and initiatives consequences through the collection of more granular datasets such as sex-disaggregated data, consumer satisfaction rates with DFS, etc. |
| POLICY IMPLEMENTATION | Preliminary evidence of RegTech and SupTech interventions and use cases in consumer protection, complaint handling, and broader redressal mechanisms shows more potential not only improving the implementation of regulations, but also in protecting consumers' interests. This is an indication of the enormous potential of SupTech and RegTech for both micro and macro, online and offline supervision and oversight. |
| MONITORING AND EVALUATION | Monitoring and Evaluation (M&E) is a critical element in any policymaking process. RegTech and SupTech have tremendous potential to improve the evaluation process by automating processes and enabling real-time M&E. |

2   Knill and Tolsun, 2008. The policymaking lifecycle. Available at: https://www.researchgate.net/publication/30014974_Policy_making.

## WHY REGTECH AND SUPTECH FOR FINANCIAL INCLUSION?

Responding to the rapidly evolving demands in the digital age, financial regulation and supervision need to convert from analog to digital design as appropriate and necessary. Accordingly, this report seeks to explore opportunities around RegTech and SupTech as policy interventions to improve financial inclusion and provide policy recommendations and guidance to support and empower financial regulators.

Ultimately, this report is expected to aid financial regulators and policymakers as they explore, consider, adopt, and implement RegTech and SupTech innovations without compromising the integrity, safety, and efficient functioning of their financial systems.

Some of the key questions the report aims to answer include:

> What are RegTech and SupTech solutions? What do they cover?

> How can RegTech and SupTech for financial inclusion be measured? What emerging themes are significant indicators for RegTech and SupTech for financial inclusion?

> How do regulators approach prototyping, testing, and deployment of financial inclusion-focused RegTech and SupTech solutions? What technology options are considered?

> What barriers or challenges do regulators and regulated entities need to overcome to adopt and adapt RegTech and SupTech innovations, technologies, businesses and process models?

  - Identification of specific challenges and risks associated with RegTech and SupTech solutions and their development and deployment, highlighting those around financial inclusion;

  - Implications for regulators and regulated entities.

**IN CONCLUSION,** insights and recommendations drawn from the research will inform the development of a framework of practical insights and approaches anticipated to support AFI member countries design, develop, adopt, and adapt RegTech and SupTech initiatives for different and relevant use cases that contribute to the success of their financial inclusion goals.

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FIGURE 2: RESEARCH METHODOLOGY FOR REPORTING ON REGTECH AND SUPTECH FOR FINANCIAL INCLUSION

TO ACHIEVE THIS OBJECTIVE,
A THREE-STEP RESEARCH PROCESS IS CONSIDERED:
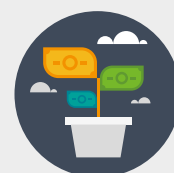
### HISTORICAL AND CURRENT LANDSCAPE DIAGNOSIS

> Literature Reviews
> Case studies
> Identification of emerging trends and use cases

### ANALYSIS FOR FINANCIAL INCLUSION AND DATA VALIDATION

> AFI member interviews
> Developed country interviews
> Strategic industry stakeholder interviews
> Data analysis through the financial inclusion framework
> - key themes

### INSIGHTS AND RECOMMENDATION

Inputs and insights from
> AFI technical team and management unit
> Consulting team

**Source:** Source: AFI and Kapronasia

# REGTECH AND SUPTECH FOR FINANCIAL INCLUSION

## KEY THEMES

According to the World Bank[3], "being able to have access to a transaction account is a first step toward broader financial inclusion since a transaction account allows people to store money, and send and receive payments. A transaction account serves as a gateway to other financial services".

Evidence from AFI's previous research[4] show that there are three key dimensions to a holistic definition of financial inclusion — access representing availability and meaningful access to use the services offered by formal and informal financial institutions; usage, i.e. depth and extent of financial services used; and quality, i.e. how financial services fulfill the needs of the consumers in terms of affordability, fairness, choice, consumer protection, etc.[5]

For more information read the AFI core set policy model.

**> View here**

While the financial services industry has seen many developments in the last two to three decades, the data show varying degrees of financial exclusion across regions and countries. Indeed, close to one-third of adults worldwide remain unbanked.[6]

Moreover, women's financial exclusion (representing the gender gap) has remained stubbornly persistent at around nine percentage points across most parts of Sub-Saharan Africa and varies between five to seven percentage points in South Asia.[7,8]

Accelerating financial inclusion has been top of mind and a strategic imperative for most countries worldwide as well as financial regulators in developing and emerging country representatives of the AFI network. The network's sustained prioritization of financial inclusion can also be attributed to the collective acknowledgement that it serves as an enabler in achieving eight of the seventeen United Nation's Sustainable Development Goals (UN SDGs) by 2030.

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3   World Bank. Financial inclusion. Findex data, 2017. Available at: https://www.worldbank.org/en/topic/financialinclusion/overview.
4   AFI. 2019. The AFI core set policy model. Available at: https://www.afi-global.org/publications/the-afi-core-set-policy-model/.
5   Ibid.
6   World Bank. Financial inclusion. Findex data, 2017. Available at: https://www.worldbank.org/en/topic/financialinclusion/overview.
7   Ibid.
8   CGAP. 2018. Measuring women's financial inclusion: The 2017 Findex story. Available at: https://www.cgap.org/blog/measuring-womens-financial-inclusion-2017-findex-story.

**FIGURE 3:** PERCENTAGE OF GLOBAL POPULATION AGED 15+ WITH A BANK ACCOUNT, %

■ Male  ■ Female

| Region | Male | Female |
|---|---|---|
| Arab world | 48 | 26 |
| East Asia & Pacific | 76 | 71 |
| Europe & Central Asia | 84 | 79 |
| Latin America & Caribbean | 59 | 52 |
| Middle East & North Africa | 57 | 38 |
| South Asia | 75 | 64 |
| Sub-Saharan Africa | 48 | 37 |
| World | 72 | 65 |

**Source:** World Bank Findex 2017

Evidence suggests that DFS alone could benefit millions of people, thereby spurring inclusive growth and adding an additional USD 3.7 trillion to the gross domestic product (GDP) in developing economies.[9]

In this light, and response to the questions presented in the research objectives, we defined how RegTech and SupTech innovations can accelerate and sustain financial inclusion, specifically from the financial regulator's perspective and mandate as follows, see Figure 4.

Hence, within the context and scope of this report, we explore RegTech and SupTech for financial inclusion through the model depicted below, identifying focus areas indicating how RegTech and SupTech innovations can be measured across different thematic areas and collectively present a picture of how financial regulators can leverage this for financial inclusion.

We recognize there could be more thematic areas where RegTech and SupTech innovations can play an important role; however, for the scope of this report, six key themes were selected. They are believed to indicate areas where RegTech and SupTech can contribute, augment, and facilitate effective methods,

processes, tools and actions in creating an inclusive, sustainable, and innovation-ready financial ecosystem for AFI member institutions and other regulators globally.

This report adopts the above analysis frame to guide the structure of the following sections. In the six key themes identified, the report discusses RegTech and SupTech use cases, elaborates on a few case studies and finally discusses the technology choices available for implementation.

Across the themes being considered, the research effort is directed to ensure a balance of perspectives and views on how each RegTech and SupTech use case provides opportunities that will enable regulators to improve oversight, surveillance, and analytical capabilities and generate real-time insights such as risk indicators to support forward-looking, judgment-based regulation, enforcement, supervision, and policymaking.

9   McKinsey Global Institute. 2016. How digital finance could boost growth in emerging economies. Available at: https://www.mckinsey.com/featured-insights/employment-and-growth/how-digital-finance-could-boost-growth-in-emerging-economies.

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**FIGURE 4:** ALIGNING THE FINANCIAL REGULATOR'S MANDATE WITH REGTECH AND SUPTECH DEMAND

| 1 CREATING AND PROMOTING AN ENABLING ECOSYSTEM | 2 ENSURING MONETARY AND FINANCIAL STABILITY | 3 MAINTAINING SAFETY AND REDUCING SYSTEMIC RISK | 4 SUPPORTING A PROPORTIONAL AND BALANCED REGULATORY AND SUPERVISORY REGIME |
|---|---|---|---|

**BROAD MANDATE**

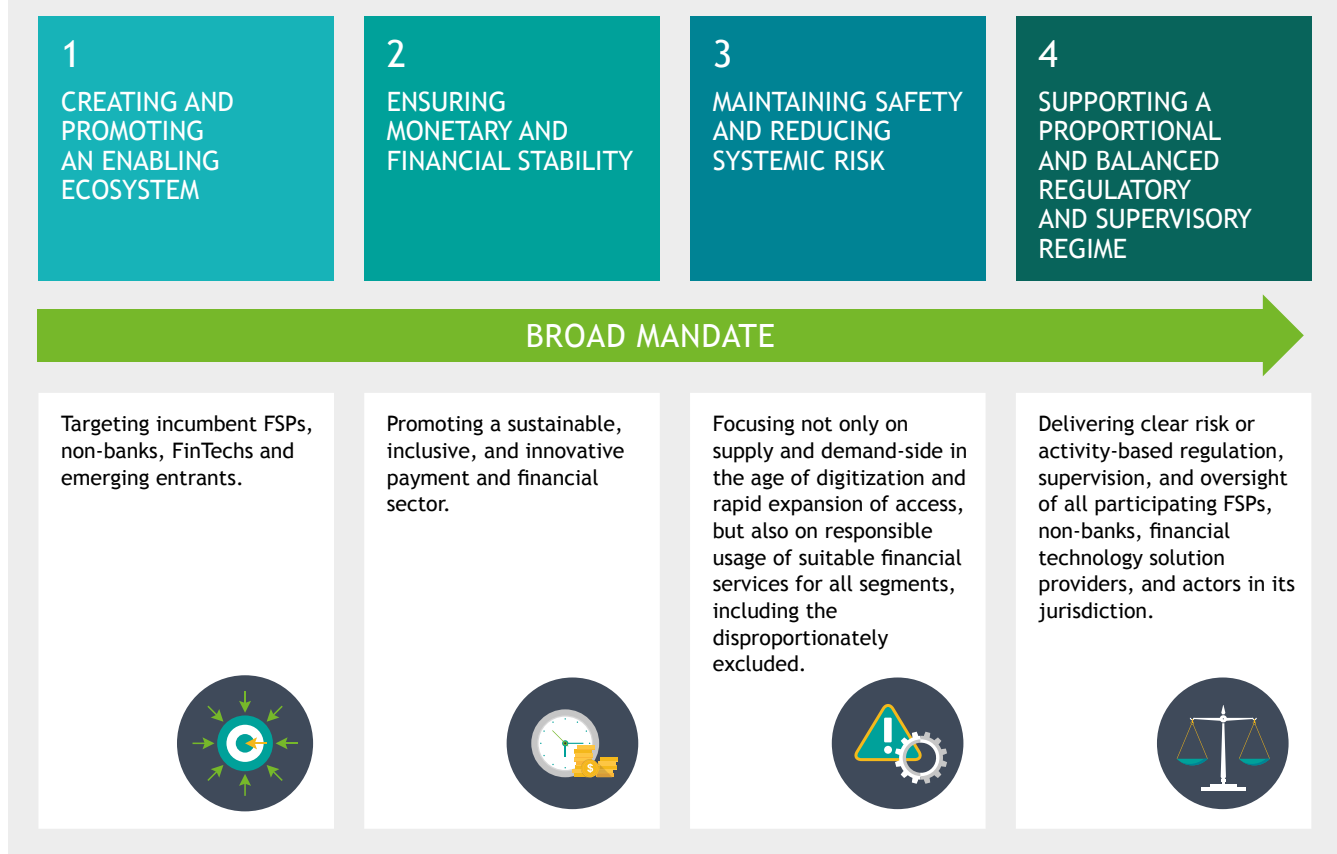| Targeting incumbent FSPs, non-banks, FinTechs and emerging entrants. | Promoting a sustainable, inclusive, and innovative payment and financial sector. | Focusing not only on supply and demand-side in the age of digitization and rapid expansion of access, but also on responsible usage of suitable financial services for all segments, including the disproportionately excluded. | Delivering clear risk or activity-based regulation, supervision, and oversight of all participating FSPs, non-banks, financial technology solution providers, and actors in its jurisdiction. |
|---|---|---|---|

**FIGURE 5:** KEY THEMES — REGTECH AND SUPTECH FOR FINANCIAL INCLUSION

## THEMATIC APPROACH
## TO REGTECH AND SUPTECH FOR FINANCIAL INCLUSION

### 1 REGTECH AND SUPTECH INNOVATION

Technology-enabled tools, methods and processes enhancing exceptional regulation compliance, reporting, comprehensive supervision and oversight outcomes.

### 2 KEY THEMATIC AREAS

1 Consumer protection and market conduct
2 Data-driven financial system stability
3 Data collection and management
4 Detection and prevention of financial crimes
5 Remote supervision and reporting
6 Financial inclusion for disadvantaged groups and women

### 3 DRIVERS AND ENABLERS

1 Technology choices
2 Appropriate use cases
3 Leadership buy-in and support
4 Capability-talent and resources
5 Industry support
6 Multi-stakeholder collaboration
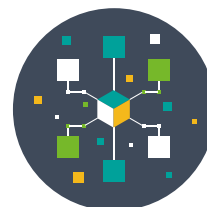
### 4 INCLUSIVE FINANCIAL ECOSYSTEM

Expanded access, responsible usage and appropriate quality of financial services to all segments, particularly the disproportionately excluded ones.

APPLYING TECHNOLOGY-ENABLED INNOVATION TO EXPAND ACCESS, RESPONSIBLE USAGE AND APPROPRIATE QUALITY OF FINANCIAL SERVICES TO ALL SEGMENTS, particularly women, youth, IDPs, FDPs, MSMEs, older people and disadvantaged segments.

# 1.
# CONSUMER PROTECTION AND MARKET CONDUCT

**The rise of digitalized financial services and innovative financial services providers (FSP) brings new opportunities to the financial industry, including innovative ways to approach financial inclusion, especially for vulnerable groups such as women, older and young people.**

Although this is a positive development, there is also an emerging risk that FSP (be it emerging FinTech* companies or other non-bank financial service or financial technology providers) may unintentionally place a greater financial burden and risks on such vulnerable groups in their ambition to provide ground-breaking solutions. As many FinTechs offering DFS target underserved segments of the population, such as those living in rural and remote areas, youth, low-income households, and MSMEs, regulators are mindful of the hidden risks that often accompany this technology-enabled DFS in their delivery channels.

Therefore, deliberate efforts to enhance the financial regulator's abilities, methods, and processes to build and strengthen an inclusive financial ecosystem that exemplifies public confidence, trust, responsible business conduct, fair treatment, and protection of consumers through adoption and adaptation of technologies for reporting, compliance, supervision, and oversight mechanisms should be actively explored.

## REGTECH AND SUPTECH USE CASES

To demonstrate the application and opportunities inherent in RegTech and SupTech in supporting the abilities, methods, and processes to build and strengthen an inclusive and conducive market that exemplifies public confidence, trust, responsible business conduct, fair treatment, reduction or elimination of fraud and effective protection of consumers, the following practical applications can be considered:

## 1. DETECTION AND PREVENTION OF CONSUMER FRAUD

Financial services today have rapidly transitioned to the digital sphere with consumers more likely to have digital accounts serving as their primary store of value, and profiles — basic Know-Your-Customer (KYC) required information, across multiple FSP, be it conventional banks, digital wallets* provider, mobile money (MM)* operators, or integrated TechFin platforms such as Piggyvest, WeChat, Grab, and GoJek.

These factors create an environment where consumers can potentially fall prey to fraud such as identity theft and credit or debit card fraud. Regulators can utilize applicable RegTech and SupTech solutions to enhance their ability to capture and identify relevant datasets, analyze, and draw insights to detect potential fraud patterns, trends, and indicators, as well as act on them to implement more effective fraud prevention measures to guide regulated entities, educate consumers and deter potential criminals.

For example, the Central Bank of Nigeria (CBN)'s Bank Verification Number (BVN) is a RegTech implemented intervention to tackle a large amount of identity theft and fraud using biometric authentication.[10]

*Other biometric technology applications to RegTech and SupTech might include facial and voice recognition.*

Multi-factor authentication (MFA) is also a validated tool or method that can bolster the security of login processes by adding another layer of verification. Starting with the temporary one-time password (OTP) to the more robust two-factor authentication (2FA) for customers. These distinct forms of identity validation can be promoted under a RegTech or SupTech use case where the regulator can validate their adoption or security standards in apps and solutions being deployed and used in their jurisdictions, thereby providing greater security against fraud.

Regulated entities such as financial institutions and DFS providers can also be encouraged to incorporate biometric identification and verification to enable remote onboarding.

10  Gurung, Nora and Perlman, Leon, Use of Regtech by Central Banks and its impact on financial inclusion (November 16, 2018). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3285985.

Moreover, regulators can also use shared utilities to create comprehensive user profiles based on other participating government agencies and data provided explicitly by the user. Implementing shared utilities eliminates the need for users to fill out forms or verify documents, thus streamlining the verification process and removing a potentially vulnerable step in the process that criminals could exploit.

## 2. ENSURING DATA PRIVACY COMPLIANCE WITHIN THE JURISDICTION

The use of consumer data by FSPs presents the risk of customer data exploitation via monetization schemes such as cross-selling to third parties or misuse along customer privacy infringements. RegTech and SupTech solutions leveraging AI/ML tools can be employed by the regulator to improve privacy compliance and data governance proactively.

AI can be used for data classification purposes where data that fall within privacy regulations can be identified by AI performing continual sweeps through data stores, sentiment analysis of social media campaigns, etc. AI bots can also be used to recognize, route, and attend to privacy data requests more efficiently than a human operator, thus acting as a "privacy concierge" for users who wish to communicate with regulators or file a report about data privacy issues.

AFI has published a Guideline Note on Data Privacy for Digital Financial Services[11] which provides non-binding guidance for a comprehensive, risk-based and proportionate policy and regulatory framework for data privacy for digital financial services (DP4DFS).

**> View here**

## IN ACTION – MEXICO AND PHILIPPINES

**BOX 1:** EXAMPLE OF CONSAR MEXICO APPLYING REGTECH TO CONSUMER PROTECTION AND MARKET CONDUCT NEEDS[12]

The Mexican National Commission for the Retirement Savings System (CONSAR) shows how SupTech has been employed to enhance consumer protection and market conduct. The main responsibility of CONSAR is to coordinate, regulate and oversee the Retirement Savings System, which has deployed a platform for digital documents and identities.

In 2013, CONSAR launched an initiative to protect the pension system against emerging fraud risks and promote financial inclusion. The traditional pension supervision model was ill-equipped to handle emerging cybersecurity challenges, and CONSAR responded to the urgent need to address the country's widening pension savings and coverage gap.

By utilizing digital documents and identities, including biometric authentication, CONSAR increased its capacity and capability to monitor compliance and prevent fraud.

In particular, the use of these digital identity verification tools helped them detect and clamp down on widespread mis-selling of pension funds and identity theft by agents.

CONSAR also introduced a mobile application that streamlined the onboarding process for opening an individual savings account and enabled users to perform essential pension planning. This served to attract the previously excluded populations (domestic workers, migrants, self-employees) into the retirement system and incentivized voluntary savings.

Business woman Mexico city. (Light and Vision/Shutterstock)

11 AFI. 2021. Guideline note on data privacy for digital financial services, Guideline Note No. 43. Available at: https://www.afi-global.org/publications/guideline-note-on-data-privacy-for-digital-financial-services/.

12 National Commission for the Retirement Savings System (CONSAR). Available at: https://www.gob.mx/consar.

**BOX 2:** REGTECH IN BANGKO SENTRAL NG PILIPINAS (BSP)'S AI CHATBOT PHILIPPINES[13,14]

In 2018, the Financial Consumer Protection Department (FCPD) of the BSP partnered with RegTech for Regulators Accelerator (R2A) and Sinitic, a provider of AI customer experience solutions, to develop a chatbot and processing utility solution for customer complaints.

The chatbot, named "BOB" for "BSP Online Buddy", went live in late 2020, thus allowing Filipinos to file complaints through their mobile phones via an app or Short Messaging Service (SMS). Using Natural Language Processing (NLP) and AI/ML technology, the chatbot accept complaints in English or a combination of English and Tagalog, and process them by assigning a case number or classifying them.

Following which, the chatbot can either respond directly to the complaint or escalate it to the consumer protection staff to be handled by a human operator. The BSP has a central database that files complaints coming from the chatbot along with those from other sources such as voice calls, emails, and kiosks. Additionally, a reporting and management interface allows consumer protection staff to view analytics for the chatbot and manage the configuration of the chatbot's internal logic.

Before the chatbot, BSP faced challenges with outdated communication channels, an incomplete database of customer complaints, and a lack of analytical tools. Thus, BSP had little understanding of the customer experience which made enforcing the BSP's consumer protection mandate very complicated.

Implementing the chatbot helped democratize consumer protection, amplify the voice of consumers, and detect cases of fraud. Moreover, by delegating mundane and routine tasks to chatbots, human labor is freed up to handle more complex tasks such as analyzing recurrent types of fraud and conducting on-site inspections.



Filipino teenagers using smartphone. (junpinzon/Shutterstock)

# 2.
# DATA-DRIVEN FINANCIAL SYSTEM STABILITY

The business models and playbooks of FinTechs, TechFins[15] and other non-banks provide financial services, such as peer-to-peer (P2P) lending, micro-loans, buy-now-pay-later, payment tokens, virtual assets, etc. are introducing new and unknown risks to the financial system — at a local and regional level.

While there certainly are benefits brought about by such services and providers, the sometimes-opaque nature of their internal processes, models and playbooks can make it difficult to understand, much less to monitor. Moreover, the complexities of the technology algorithms and applications might have various bias unconsciously built in, hence, disproportionately excluding vulnerable segments such as women, older people, IDPs or FDPs, MSMEs and youth.

However, as advances in FinTech propel greater wealth generation and opportunities to advance financial inclusion, regulators are keen to employ technology-enabled innovations inherent in RegTech and SupTech that enable the promotion of an agile, sound, and stable financial system to withstand adverse economic cycles, disruption or shocks via data-driven insights, robust sentiment analysis, risk management and scenario forecasting and predictions.

13  BFA Global. 2018. Di Castri Simone, Matt Grasser, and Arend Kulenkampf. Financial authorities in the era of data abundance: RegTech for regulators and SupTech solutions. Available at: https://bfaglobal.com/r2a/insights/financial-authorities-in-the-era-of-data-abundance-regtech-for-regulators-and-suptech-solutions/.

14  Primary research interviews with BSP led by the consultant team.

15  This may be tech or e-commerce companies that are already connected to large number of clients and hence contains large data volumes. Summarized from Arner, D, Barberis, J, Buckley, R, et al. (2017), From FinTech to TechFin: The regulatory challenges of data-driven finance. Available at: https://bit.ly/2HgS0bq.

## REGTECH AND SUPTECH USE CASES

### 1. RISK ASSESSMENTS

Risk dashboards are a commonly used tool by regulators to monitor the vital signs of the financial sector and identify early signs of stress. Such dashboards are usually presented as heat maps to highlight potential financial stability issues.

However, in many jurisdictions, data scarcity and lags in reporting make such dashboards cumbersome to use and too static to serve as effective gauges of financial system health. Furthermore, as new FinTech products and players emerge, the set of conceivable stress scenarios will broaden.

Thus, it is inevitable that regulators will need to conduct more frequent early warning stress tests that are highly complex and data-intensive. Advanced data analytics solutions, notably data stacks, and data visualization tools (such as Tableau), can help overcome limitations on available data analysis by feeding regulators' risk dashboards with higher frequency and more granular data sets. To obtain this granular level of data, regulators need API connections between them and the regulated entities. However, these connections are non-existent in many cases.

Additionally, AI/ML tools, such as anomaly detection, can be leveraged to identify outliers in a given data set to enable a more dynamic M&E process. Finally, incorporating AI/ML solutions into risk dashboards can help create richer visualization tools that improve dashboards' prescriptive and predictive ability.

### 2. SENTIMENT ANALYSIS

To better understand current market sentiment and possibly forecast changes in the financial ecosystem, regulators have turned to Natural Language Processing (NLP) tools that scrape information from the web, social media channels and other public available web sources for analysis.

Social media sites, such as Twitter, present regulators with a word stream which can provide uncovered insights using NLP sentiment indicators. With NLP, regulators can scan for words that indicate negative or positive sentiment to forecast financial sector metrics such as retail deposit growth rates.

The interconnectedness between banks can also be measured based on banks mentioned in the same tweet. NLP can also analyze corporate "behavior and culture" by analyzing executive committee meeting minutes or company filings with market supervisory authorities.

It can also show up previously hidden bias such as discrimination against certain groups or genders.

NLP can assess the tonality of such texts and reports by counting negative connotation terms. AI/ML algorithms can then be applied to convert tonality into a risk metric that can help regulators identify firms with possible culture and governance issues that indicate a heightened risk of misconduct.

## IN ACTION – NIGERIA

**BOX 3:** CENTRAL BANK OF NIGERIA (CBN)'S APIS AND DATA STACK

The Central Bank of Nigeria (CBN) and the Nigerian Inter-Bank Settlement System (NIBSS) partnered with BFA Global, a consulting firm, to redesign their data infrastructure for more effective supervision and policy formulation.

At the core, is a data warehouse that stores transactional data which is then used to generate dashboards for CBN to visualize and analyze relevant payments data.

Application programming interfaces (APIs) are used to populate the data warehouse with real-time transactional data from NIBSS as well as compliance data from CBN. The data from CBN and NIBSS form the supply-side core, and additional layers of demand-side data can be stacked to contextualize the transactional data.

The ability to stack demand-side data such as financial inclusion indicators, population statistics, and access point locations on top of the supply-side core facilitates a deeper understanding of the financial ecosystem and ensures more effective and timely response from supervisors.

Importantly, the data stack provides regulators with a real-time view of key risk metrics on a dashboard, serving as a tool for compliance monitoring and early warning system.



Accessing data, Nigeria. (Andrey_Popov/Shutterstock)

# 3.
# DATA COLLECTION
# AND MANAGEMENT

Newer technologies have automated data collection, enabling high-quality data collection, that can be disaggregated by several factors and parameters (such as gender, age, location, etc.), thus significantly improving data storage and sharing capabilities across the board.

As a result, regulators, particularly in developed countries[16], are adopting and adapting appropriate RegTech and SupTech solutions to help identify, collect, standardize, ensure dataset fidelity and quality, safety store, analyze, and draw insights for effective decision making to address challenges with disproportionately excluded segments such as women, older people, FDPs, or any market segment of interest in real-time.

However, due to the individual challenges that each jurisdiction might face, the adoption and adaptation of applicable and appropriate RegTech or SupTech innovations with regards to data collection and management is still not as widespread.[17]

## REGTECH AND SUPTECH USE CASES

### 1. AUTOMATION OF DATA COLLECTION

APIs can be integrated into a central bank's reporting system to help with the automation of disaggregated data collection from financial institutions. Many central banks in the world, such as in Lithuania, Mexico and the Philippines, have increasingly adopted an automated system for regulatory reporting.[18,19]

APIs have been leveraged for regulatory reporting purposes due to their help in reducing compliance costs for financial institutions, helping to ease the burden placed on compliance officers. Many technologies make use of these APIs to automate data collection, particularly in regulatory reporting.

Robotic process automation (RPA) can also be leveraged to automate repetitive manual tasks, which is likely part of the data collection process for regulatory reporting. The traditionally labor-intensive process of data collection for regulatory reporting purposes can thus be automated using the power of RPA.[20]

### 2. DATA VALIDATION, CONSOLIDATION, AND VISUALIZATION

SupTech, based on AI/ML, can help tackle data validation issues by identifying anomalies in the data source. One of the critical technologies that have sprung up is shared utilities[21] for data consolidation.

Similarly, dynamic dashboards are being utilized to read data. These dashboards enable interactive reporting tools to automatically pick up and display data in practical and actionable visualizations, helping users quickly understand the inferences behind the data.[22]

These dashboards help authorities understand developments in the financial ecosystem, such as the impact of financial inclusion initiatives on the under- and unbanked.

In addition, geographic information systems (GIS) enable central banks to use the captured geospatial mapping data to improve financial inclusion by visualizing and pinpointing under- or unbanked regions.

### 3. STACKING DATASETS FOR STORAGE

Data storage is a challenge for all financial market participants. A key issue is the siloed way data are often stored. For example, depending on which department has requested the data, the data may be put into a database belonging solely to that department, thus rendering the data inaccessible to others.

Even a centralized database does not provide the full flexibility of using the stored data until it can store all the data at once, leaving supervisors to work with only a subset of the data at a time. Another problem with fragmented databases is that alternative data sources cannot easily be merged for analysis.[23]

16 Toronto Center. 2017. FinTech, RegTech and SupTech: What they mean for financial supervision. Available at: https://res.torontocentre.org/guidedocs/FinTech%20RegTech%20and%20SupTech%20-%20What%20They%20Mean%20for%20Financial%20Supervision%20FINAL.pdf.

17 CGAP. 2018. RegTech and digital finance supervision: A leap into the future. Available at: https://www.cgap.org/blog/regtech-and-digital-finance-supervision-leap-future.

18 Finextra. 2020. Bank of Lithuania tests API-based RegTech prototype. Available at: https://www.finextra.com/newsarticle/35337/bank-of-lithuania-tests-api-based-regtech-prototype.

19 Gurung, Nora and Perlman, Leon, Use of Regtech by Central Banks and its impact on financial inclusion (November 16, 2018). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3285985.

20 Finextra. 2019. Putting AI to use in regulatory compliance. Available at: https://www.finextra.com/blogposting/17186/putting-ai-to-use-in-regulatory-compliance.

21 Hong Kong Monetary Authority (HKMA). 2021. Regtech adoption practice guide. Issue 1: Cloud-based Regtech solutions. Use case on SaaS regulatory reporting tool. HKMA and KPMG Regtech Adoption Practice Guide. Available at: https://www.hkma.gov.hk/media/eng/doc/key-information/press-release/2021/20210617e5a1.pdf.

22 Ibid.

23 BFA Global. 2018. Financial authorities in the era of data abundance. RegTech for regulators and SupTech solutions. Available at: https://bfaglobal.com/wp-content/uploads/2020/01/R2AWhitePaper.pdf.

Cloud computing provides a solution to data storage and access limitations. It enables on-demand and remote network access to secure databases via remote and shared servers hosted on the internet.[24]

Another possible solution to data management issues is utilizing a data lake. This data warehousing architecture allows for substantially greater scalability than traditional databases. Using data lakes, datasets can be "stacked" and analytically overlaid to uncover new insights.[25]

For example, the Central Bank of Nigeria (CBN) partnered with the Nigeria Inter-Bank Settlement System Plc (NIBSS) to redesign their payments data infrastructure to create a data stack (see Box 3). This is a classic example of how data lake can solve data storage problems.[26]

## 4. DATA QUALITY

Data quality is essential in ensuring valuable data analysis. Typically, issues with data quality arise when non-traditional sources of information are used or when the data source is too big. SupTech can improve data quality for central banks by enabling them to identify anomalies in the data source and collect granular data.

SupTech based on AI/ML can help with tackling data quality issues through a more agile detection of anomalies, while API-based SupTech can collect more granular data for improved data quality. It is important to note that collecting more data in and of itself does not necessarily mean improved data quality. Therefore, simultaneously detecting anomalies while collecting more granular data will be critical.

APIs enable supervisors to manage granular data through "push approaches" or "pull approaches". The "push approach" requires market participants to automatically upload standardized sets of granular data onto a central database using an API.[27]

In the "pull approach", raw data is extracted directly from the market participant's IT systems by the supervisor.[28] By way of illustration, the Central Bank of Austria's (OeNB) Austrian Reporting Services (AuRep) reporting platform bridges the gap between the IT systems of supervised entities and the supervisory agency.[29]

In addition, the data pull approach is demonstrated by the National Bank of Rwanda's (BNR) electronic data warehouse system, which extracts data directly from the IT systems of supervised institutions.[30]

## IN ACTION – NEPAL AND PHILIPPINES

**BOX 4: BANGKO SENTRAL NG PILIPINAS (BSP)'S DATA REPORTING AND VISUALIZATION[31]**

A well-documented case study demonstrating how APIs can automate data collection is the Bangko Sentral ng Pilipinas (BSP)'s API-enabled back-office reporting and visualization software.

RegTech for Regulators Accelerator (R2A) partnered with BSP to produce this RegTech solution prototype. The original manual reporting system required banks to submit reports via email. However, by upgrading the system with API technology, regulators can plug into FI's IT systems to obtain raw, granular data to verify and analyze.

The new system can lower compliance costs for FIs, increase the quality and quantity of data available for regulators, and enable access to almost real-time customizable reports for staff. It has also shown the feasibility of a market-level API-based solution for prudential reporting, encouraging other regulators to upgrade their reporting systems.
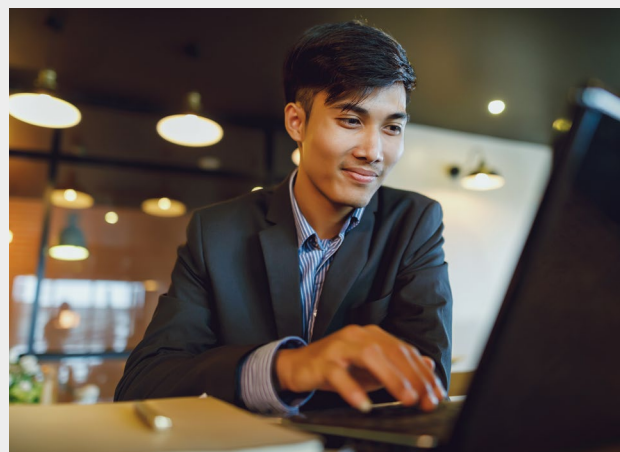


Business man Philippines. (pixfly/Shutterstock)

24  Ibid.

25  Ibid.

26  BFA Global. 2020. Adopting SupTech for anti-money laundering: A diagnostic toolkit. Available at: https://bfaglobal.com/wp-content/uploads/2020/06/R2A-AML-SupTech-Toolkit-04June2020-1.pdf.

27  CGAP. 2017. Denise Dias and Stefan Staschen. Data collection by supervisors of digital financial services. Working paper. Available at: https://www.cgap.org/sites/default/files/Working-Paper-Data-Collection-by-Supervisors-of-DFS-Dec-2017.pdf.

28  Ibid.

29  Financial Stability Institute. 2018. Dirk Broeders and Jermy Prenio. Innovative technology in financial supervision (SupTech) — the experience of early users. FSI Insights on policy implementation No. 9. Available at: https://www.bis.org/fsi/publ/insights9.pdf.

30  Ibid.

31  R2A. Free speech bilingual chatbot and processing utility for customer complaints, Philippines. Available at: https://www.r2accelerator.org/api-visualization-prototype.

**BOX 5:** NEPAL RASTRA BANK (NRB)'S GEOGRAPHIC
INFORMATION SYSTEM (GIS)[32,33,34,35]

In 2017, the Nepal Rastra Bank (NRB) unveiled their upgraded reporting system, which consisted of an e-mapping system based on GIS.

The NRB's Banking and Financial Institutions Regulation Department worked with both the United Nations Capital Development Fund (UNCDF) and the Mobile Money for the Poor (MM4P) program to develop this e-mapping platform. The platform shows all existing physical financial service access points in Nepal, giving the NRB a way to easily collect and analyze data on regions that lack access to financial services.

The financial service access points that are mapped by this platform include users of bank accounts, banks, bank branches, and branchless banking agents. Additionally, the platform provides real-time data on financial access and usage in Nepal, allowing the central bank to track how well any financial inclusion initiatives are being implemented.

In addition, this platform allows for compliance of reporting by licensed banking and financial institutions to be tracked class-, institution-, or reporting category- wise. The timeliness and accuracy of compliance is maintained automatically, ensuring the quality of the data collected. Besides the platform, the NRB also worked with the MM4P and the UNCDF to develop a smartphone app called "NRB Data Collect".

This app allows the NRB to automate data collection from Financial Institutions, who upload their compliance data together with geospatial information of each of their financial service points (branches, ATMs, cash- in/cash-out points, money exchanges, bill payment merchant networks and remittance agent points).



Checking cell phone, Nepal. (gawrav/iStock)

# 4. DETECTION AND PREVENTION OF FINANCIAL CRIMES
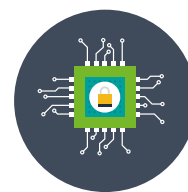
The traditional rules-based approach to detecting money laundering and terrorism financing (ML/TF) involves compliance staff having to scrutinize transactional data and client profiles to look for anomalies that match specific predefined filtering rules. This process is arduous, time-consuming, and highly prone to human error and bias.

The advent of the digital age has made this process more challenging as the large volume, and high frequency of online transactions means that supervisors who rely heavily on manual processes are all but helpless against today's cybercriminals.

Therefore, regulators and supervisors must equip themselves with the necessary and appropriate SupTech solutions to leapfrog deficiencies in ML/TF compliance, counter inefficiencies in fraud controls and governance, overcome costly passive and manual processes, address insufficient resources for monitoring and high dependencies on human judgement.

## REGTECH AND SUPTECH USE CASES

### 1. COMPLIANCE WITH AML/CFT REQUIREMENTS
SupTech tools can be used to increase the regulator's capacity to process substantial amounts of unstructured data, for instance, with the analysis of systemic integrity risk reports submitted by financial institutions.

These reports are self-assessments submitted by banks about their integrity risks and are usually lengthy documents with varied formats. Regulators can utilize a combination of text mining and AI/ML to search for information across a large number of reports and extract relevant data.

32  UNCDF. 2017. Building a backbone for the financial sector in Nepal. Available at: https://mm4p.uncdf.org/article/2483/building-a-backbone- for-the-financial-sector-in-nepal.

33  Nepal Rastra Bank. Financial inclusion dashboard. Available at: https:// emap.nrb.org.np/.

34  UNCDF. 2018. Nepal Financial Inclusion Portal. Available at: https://www. uncdf.org/article/4158/nepal-financial-inclusion-portal.

35  UNCDF. 2021. Accelerating financial inclusion in Nepal with RegTech — A case study on the Nepal financial inclusion portal. Available at: https:// www.uncdf.org/article/6523/accelerating-financial-inclusion-in-nepal- with-regtech.

The output can then be used to assess whether the financial institution has a sufficient understanding of the risk it is exposed to and whether it has adequate internal controls to handle these risks.[36]

AI/ML can also be applied to assess the risk profile of financial institutions based on the number of unusual transactions that the financial institution has not reported.

The machine is first trained with "manually found" and reported unusual transactions, following which it can scan the entire data set to discover other transactions with similar patterns.

With this tool, supervisors can identify riskier financial institutions as evaluated by the number of unreported unusual transactions and subject these entities to more intensive supervision.

## 2. RISK SCORING FOR SUPERVISED ENTITIES
Advanced data analytics tools enable regulators to incorporate a more comprehensive array of risk factors and other variables to assign a rating to a financial institution, depending on its likelihood of non-compliance with AML/CFT requirements.[37]

For example, these risk factors could be related to an institution's corporate profile, compliance history, and reporting behavior. Determining these risk factors is based on large data volumes from reporting entities and other sources and can cover areas such as wire transfer reports, large cash transactions, and suspicious transaction reports (STRs).

To ensure the model's relevance, a challenger version can be annually developed before being compared with the model in production so that any required updates can be applied to keep the model relevant.

## 3. IDENTIFY NETWORK EXPOSURE OF REGULATED ENTITIES
Network analysis based on transactional data can be used to detect related entities sending funds to the same counterparties in risky countries via different financial institutions.

The outcome is used to assess financial institutions' risk profiles and inform regulators on allocating supervisory resources. Network analysis can also be applied to unstructured data, such as portions of unstructured text in a suspicious activity report (SAR).

This can be done using natural language processing (NLP) to extract information from the text, such as

details regarding the parties' relationship mentioned in the text.

Alternatively, NLP tools can be applied to other data sources such as social media to investigate people or companies reported to be involved in money laundering and potentially uncover the networks they are exposed to.

## IN ACTION – MEXICO

**BOX 6:** MEXICAN COMISIÓN NACIONAL BANCARIA Y DE VALORES (CNBV)'S APIS, DATA INFRASTRUCTURE AND STORAGE

The National Banking and Securities Commission (CNBV) in Mexico, partnered with R2A and tech vendor Gestell to develop a new data infrastructure and data storage platform that can house transactional data submitted by supervised entities through APIs.

The new infrastructure strengthens CNBV's AML supervisory capabilities by increasing the volume, frequency, and granularity of AML-related data available for CNBV to retrieve and analyze. Using AI/ML models and advanced data analytics, the platform can render data in risk dashboards and statistical reports for supervisors to review and analyze. Anomalies in transactional data are highlighted, including risk factors that are not visible to the human eye, and this information can guide supervisors to target on-site visits for further inspection.

CNBV previously lacked an efficient means to extract insights from existing data as supervisors often had to go through the highly inefficient and time-consuming process of loading appropriate data from compact discs and paper files to analyze them in an Excel spreadsheet. With this new solution, CNBV greatly reduces inefficiencies, and is able to generate deeper intelligence making AML supervision more risk-based.

Furthermore, CNBV will now be in a much better position to provide guidance to supervised entities on how to improve their AML compliance systems, which can potentially reduce compliance costs.

36  Deloitte. 2018. Risk powers performance Systematic Integrity Risk Analysis (SIRA) — Clear insight into your integrity risks. Available at: https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/risk/deloitte-nl-risk-sira-clear-insight-into-integrity-risks.pdf.

37  Financial Stability Institute. 2019. Rodrigo Coelho, Marco De Simoni and Jermy Prenio. Suptech applications for anti-money laundering. FSI Insights on policy implementation No. 18. Available at: https://www.bis.org/fsi/publ/insights18.pdf.

# 5. REMOTE SUPERVISION AND REPORTING

The dwindling need for FSP to have or set up physical branches, the ubiquity of the mobile and internet, the rapid digitalization of DFS and more recently, a global emergency like COVID-19 has highlighted the need for authorities and financial institutions to respond swiftly to a fast-changing environment by utilizing the appropriate tools and technology.

With the reducing need for supervisors and regulatory inspectors to visit physical branches and points of services, creating tools, methods and processes that enhance exceptional regulation compliance, comprehensive supervision and oversight outcomes at lower costs, greater efficiency, reduced or eliminated mobility constraints for both regulators and the regulated is a necessity.

This urgent need has motivated not only regulators to accelerate the process of adopting RegTech and SupTech for remote reporting and supervision purposes, but also financial authorities to advance their digital transformation to enable remote supervision.

## REGTECH AND SUPTECH USE CASES

### 1. OVERCOMING MOBILITY CONSTRAINTS

Monitoring and collecting reports from supervised entities located in more rural areas is both time-consuming and costly as it involves regular on-site visits.

SupTech solutions allow supervisors to reach smaller financial institutions cost-effectively, increasing the productivity of supervision teams.

A few different SupTech solutions enable remote supervision of these entities by regulators and remote reporting by these financial institutions. One of the technologies that central banks can utilize is cloud computing to allow access from both sides to a shared online database that allows for on-demand remote supervision and reporting.

As long as the supervised entities located in rural areas of the country have access to the internet, remote supervision is possible with cloud computing.

### 2. ENHANCING SURVEILLANCE AND REMOTE SUPERVISION

SupTech opens the possibility for remote, real-time monitoring of DFS providers, such as mobile money (MM) operators. As a result, there will be better supervision of MM transactions to ensure they are compliant with regulations and have adequate consumer protection.

In addition, SupTech can enable remote monitoring and supervision on a more granular level. For example, supervising agent networks for MM firms, banks, insurance companies, and other financial institutions.

The current approach among regulators is to delegate the monitoring of agent networks to financial institutions and then audit their internal monitoring process. This is done due to both the high cost of supervising thousands of small agents and the lack of information about them, allowing regulators to plan their supervisory work accordingly.

SupTech can enable regulators to access new information from different sources and examine agents remotely.[38]

For instance, regulators could utilize shared utilities for data sharing to extract the data they need to examine agents remotely from the central utility rather than requiring FIs to report the same data to each regulator individually. It could also be done by leveraging APIs to connect regulators to financial institutions to extract these data remotely.

Alternatively, Distributed Ledger Technology (DLT) can leverage a database for identity management to create agent registries and blocklists for remote surveillance.[39]

This will allow more outstanding surveillance capabilities for the central bank. An example of a country that has utilized DLT for identity management is Estonia, which uses blockchain technology for identification purposes.[40]

38  CGAP. 2017. RegTech: Are supervisors ready for the data revolution? Available at: https://www.cgap.org/blog/regtech-are-supervisors-ready-data-revolution.

39  MEDICI Global. 2017. 22 Companies leveraging blockchain for identity management and authentication. Available at: https://gomedici.com/22-companies-leveraging-blockchain-for-identity-management-and-authentication.

40  PwC. 2019. Estonia — the digital republic secured by blockchain. Available at: https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf.

## IN ACTION – RWANDA

**BOX 7:** NATIONAL BANK OF RWANDA (BNR)'S ELECTRONIC DATA WAREHOUSE SYSTEM[41]

In 2017, along with Sunoida Solutions, the National Bank of Rwanda (BNR) developed an electronic data warehouse (EDW) system.

The system automates and streamlines the reporting process by enabling BNR to pull data on a daily basis from financial service providers' systems, opening up the possibility for real-time monitoring.

However, due to Savings and Credit Cooperatives (SACCOs) in Rwanda not having the appropriate IT systems to enable BNR to remotely pull their data, manual reporting via Excel templates is still allowed for those firms.

This new approach by the BNR reduces errors and data quality issues found in manual Excel reporting, whilst also improving the timeliness and reliability of the data collection process.

In addition, the switch to an automated remote reporting process gives BNR the ability to remotely conduct their supervision, thus safeguarding against emergencies where in-person reporting by FSP is not possible.

This is especially evident after the COVID-19 pandemic, where many finance processes had to undergo a shift to digital platforms to mitigate face-to-face contact.



Using digital tablet, Rwanda. (stellalevi/iStock)

# 6.
# FINANCIAL INCLUSION FOR DISADVANTAGED GROUPS AND WOMEN

While there has been general progress in financial inclusion worldwide, with more adults having access to a bank account, the gender gap largely remains unaltered over the last decade.

AFI member countries have adopted the Denarau Action Plan that identifies actions members can take to increase the number of women with access to quality and affordable financial services globally.[42]

**> View here**

Additionally, the AFI's Digital Financial Services Working Group (DFSWG) conducted a comprehensive study to analyze the existing literature and develop a DFS policy framework and implementation plan to assist regulators and financial policymakers in their efforts to reduce or eliminate the financial inclusion gender gap across the AFI network.[43]

A tangible and expected outcome of improved financial stability, customer engagement, and sound regulatory environment is addressing the barriers to financial inclusion for women, older people, youth, IDPs or FDPs, and other disproportionately excluded segments.

Many of the proposed measures and guidelines in some of the knowledge products available on the AFI Publication Hub[44] can be complimented or accelerated by adopting applicable SupTech solutions by regulators and RegTech solutions by FSP.

41  World Bank Blog. 2017. "Leveraging 'suptech' for financial inclusion in Rwanda", June 8. Available at: https://blogs.worldbank.org/psd/leveraging-suptech-financial-inclusion-rwanda.

42  AFI. 2019. Denarau Action Plan: The AFI network commitment to gender and women's financial inclusion. Available at: https://www.afi-global.org/publications/denarau-action-plan-the-afi-network-commitment-to-gender-and-womens-financial-inclusion/.

43  AFI. 2020. Lessons on enhancing women's financial inclusion using digital financial services (DFS). Available at: https://www.afi-global.org/publications/lessons-on-enhancing-womens-financial-inclusion-using-digital-financial-services-dfs/.

44  Available at: https://www.afi-global.org/library/.

## REGTECH AND SUPTECH USE CASES

### 1. IDENTIFYING & ADDRESSING GAPS IN ACCESS AND USAGE

With innovative RegTech and SupTech tools, central banks and regulators can analyze and extract meaning from data on more complex levels, improving their ability to develop and evaluate financial inclusion policies targeted at disadvantaged groups and women.

For instance, RegTech and SupTech tools allow for the collection of age and sex-disaggregated data that enable central banks to paint a clearer picture of the level of access to financial services across genders.

This data can then be used to formulate policies to address the gender gap and develop more targeted financial services or improve the roll-out of financial products to reach across genders more evenly.

AI-driven chatbots offer another potential use case for central banks to improve access to financial services for disadvantaged groups and women, and enhance customer engagement.

For instance, chatbots can be used for educational purposes, such as providing short courses on personal finance and tutorials on accessing and using banking services. Chatbots can also automate and improve customer service functions by giving customers a more convenient way to file complaints or check the balance in their accounts.

This is especially relevant to disadvantaged groups, such as refugees, that face mobility constraints and thus cannot easily access a physical bank outlet.

### 2. IMPROVING THE ONBOARDING PROCESS

One significant barrier to increasing access to financial services for women is the KYC and Customer Due Diligence (CDD)* process, which often requires documents and identification, which financially excluded women do not have and cannot quickly obtain.

FSP are often constrained by KYC and CDD processes that are not commensurate with the customer's level of financial crime risk.

Central banks and market participants can use RegTech tools to identify and filter for low-risk customers, who can then be granted a concession to go through a simplified CDD process.

Such tools can utilize AI/ML models to gather and analyze a broader range of variables that can be used to classify the risk level of potential customers.

Based on this classification, customers can then be assigned to a tiered KYC level and provided with a corresponding bank account whose features accord to AML/CFT guidelines.
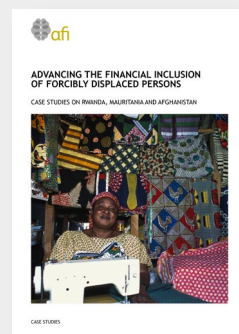
Youth Financial Inclusion Policy Framework

Policy framework for women's financial inclusion using digital financial services

Policy Model for MSME Finance

Advancing the Financial Inclusion of Forcibly Displaced Persons: Case Studies on Rwanda, Mauritania and Afghanistan

## 3. ALGORITHM AUDITS TO ENSURE EQUITY AND FAIRNESS IN DISTRIBUTION OF DFS

AI-driven risk-assessment technology is increasingly becoming widespread in the financial sector as new technology has given firms the ability to run highly complex risk models using a growing array of variables, thus dramatically enhancing the speed and accuracy of credit scoring and insurance underwriting.

However, this development also raises ethical issues as unnoticed errors or biases in algorithms might intentionally or unintentionally discriminate against certain groups.

For example, technology may be gender-neutral when it comes to addressing the gender gap in financial inclusion. Still, the way technology is developed and used is often not, and the biases that the people who create it have, are often transposed into the systems they develop.

Men are the predominant gender in both the technology and finance industry as such.

As a result, factors and variables that affect women may be left out of algorithms because their significance and impact are not understood and recognized. Ironically, more and better-quality data may not be a necessity to move towards more gender-inclusive finance.

The relevant data has already been collected very often but has not been analyzed from a gender perspective, using filters and variables that are gender sensitive.

Therefore, regulators and supervisors need to consider auditing the existing methods that algorithms use to identify potential pitfalls where the gender perspective may have been overlooked.

To achieve this, supervisors can create "robots" that appear as potential financial service clients and are assigned profiles with varying attributes. Then, by analyzing how the algorithms treat these robots, biases in automated processes can be detected and, more importantly, addressed and overcome.

Additionally, a growing toolkit of statistical and machine learning techniques for auditing algorithms is emerging and it would be prudent for regulators to pay attention to this area as it continues to develop.

## IN ACTION - GHANA

**BOX 8:** BANK OF GHANA'S AI/ML AND BIG DATA

In 2019, the Bank of Ghana implemented a fully integrated financial surveillance system from Vizor Software, a provider of SupTech solutions for financial regulators. The system, called ORASS (Online Regulatory and Analytical Surveillance Software), provides a centralized portal to collect prudential data from banks and deposit-taking institutions as well as manage the licensing and authorization of supervised entities.

Compared to the previous system that the Bank of Ghana used, ORASS is able to provide a much more comprehensive data set that captures transactional data from other financial services beyond just payments.

With ORASS, the Bank of Ghana was able to obtain loan application data such as the split between men and women who were granted or denied loans. Data analysis showed that compared to men, women accounted for a smaller share of total loan applicants and generally asked for smaller loan amounts. However the percentage of women denied loans was significantly higher.

Furthermore, ORASS captured data on inbound remittances and identified the types of accounts that the transfer was made to (e.g. e-wallet or bank account) as well as the gender of the receiving account owner. The trend uncovered in the data is that very few women use e-wallets or other digital financial services for remittances.

These two instances demonstrate the power of using comprehensive, granular, and sex-disaggregated data to identify problematic areas that are causing gender exclusion in finance. Observing data trends also helped the Bank of Ghana understand the root causes of the problem, which enables them to improve policy formulation and more effectively address the gender gap in access to financial services.



Online technology, Ghana. (Gerhard Pettersson/iStock)

# TECHNOLOGY CHOICES

To help regulators leverage technology in the above-discussed thematic areas, there are a plethora of options that financial authorities and regulators could choose from, based on specific context and purpose within their institution, industry, jurisdiction or use cases.

Some of the technologies powering RegTech and SupTech innovations found across both developing and developed countries are highlighted below:

| S/N | TECHNOLOGY OPTIONS | | DESCRIPTION | CORRESPONDING |
|---|---|---|---|---|
| 1 | AI/ML | | > Tracks, monitors, uses predictive analytics to inform regulators.<br>> Assists in the automation of sex- and age-disaggregated data collection and in improving data quality.<br>> Incorporates a broader range of analysis variables to catch more complex money laundering techniques.<br>> Enables easy remote supervision and reporting.<br>> Helps extract meaning from diverse data sets to assess the extent of exclusion from the financial ecosystem. | > Consumer protection and market conduct<br>> Data-driven financial system stability<br>> Data collection and management (e.g. sex- and age-disaggregated)<br>> Detection and prevention of financial crimes<br>> Remote supervision and reporting<br>> Financial inclusion for disadvantaged groups and women |
| 2 | BIOMETRICS | | > Provide robust methods for identity verification such as improving KYC/CDD processes. | > Consumer protection and market conduct<br>> Detection and prevention of financial crimes |
| 3 | APIs | | > Help regulators gather data from financial institutions and other regulated entities.<br>> Allow regulators to obtain raw data from FIs' IT systems and enhance data quality for supervisory and policy development purposes.<br>> Allow for supervised entities to digitally submit information for AML compliance, enabling supervisors to validate new SARs efficiently. | > Consumer protection and market conduct<br>> Data collection and management (e.g. sex- and age-disaggregated)<br>> Detection and prevention of financial crimes<br>> Remote supervision and reporting |
| 4 | SHARED UTILITIES | | > Reduce CDD data duplication.<br>> Help in the input of reporting data into a central utility and can be used for remote analysis by regulators for supervision purposes.<br>> Provide an online profile for identification and verification, resulting in reduced burden for customer onboarding, allowing vulnerable groups and women more access to financial services. | > Consumer protection and market conduct<br>> Remote supervision and reporting<br>> Financial inclusion for disadvantaged groups and women |
| 5 | BIG DATA ANALYTICS | | > Help in extracting and analyzing vast volumes of data.<br>> Aid the use of dashboards for visualization to understand developments in the financial landscape.<br>> Used to analyze transaction trends and identify any anomalies.<br>> Used to generate forecasts of trends on income and savings and inform central banks, helping them to address the region-specific challenges. | > Data-driven financial system stability<br>> Data collection and management (e.g. sex- and age-disaggregated)<br>> Detection and prevention of financial crimes<br>> Financial inclusion for disadvantaged groups and women |

| S/N | TECHNOLOGY OPTIONS | | DESCRIPTION | CORRESPONDING |
|---|---|---|---|---|
| 6 | NLP | | > Uncovers insights from online sources such as social media and research articles, and provide feedback on market sentiment for forecasting.<br><br>> Used to extract information from unstructured text to help identify people or companies engaging in money laundering activities. | > Data-driven financial system stability<br><br>> Detection and prevention of financial crimes |
| 7 | CLOUD COMPUTING | | > Enables flexible storage and the ability to process large data volumes.<br><br>> Lowers costs and increases storage capacity for supervisory agencies.[45]<br><br>> Enables on-demand and remote network access to the data, facilitating remote supervision and reporting.[46] | > Data collection and management (e.g. sex- and age-disaggregated)<br><br>> Remote supervision and reporting |
| 8 | DATA LAKE | | > Ensures capability to consolidate data into a single source from multiple source systems.[47] | > Data collection and management |
| 9 | DISTRIBUTED LEDGER TECHNOLOGY (DLT) | | > A distributed database that enables remote real-time client data sharing through verified data that has been saved and encrypted.[48] | > Remote supervision and reporting |

45  Financial Stability Institute. 2018. Dirk Broeders and Jermy Prenio. Innovative technology in financial supervision (SupTech) — the experience of early users. FSI Insights on policy implementation No. 9. Available at: https://www.bis.org/fsi/publ/insights9.pdf.

46  Toronto Centre. 2017. FinTech, RegTech and SupTech: What they mean for financial supervision. Available at: https://res.torontocentre.org/guidedocs/FinTech%20RegTech%20and%20SupTech%20-%20What%20They%20Mean%20for%20Financial%20Supervision%20FINAL.pdf.

47  Ernst & Young. 2019. Regulatory technology (RegTech) Navigating the right technology to manage the evolving regulatory environment. Available at: https://assets.ey.com/content/dam/ey-sites/ey-com/en_us/topics/financial-services/ey-regulatory-technology-regtech.pdf?download.

48  Gurung, Nora and Perlman, Leon, Use of Regtech by Central Banks and its impact on financial inclusion (November 16, 2018). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3285985.

## ROLE OF INNOVATIVE REGULATORY APPROACHES

As technology options, implications and application might not be a direct capability for policymakers and regulators, its influence and impact on current and future market scenarios and outcomes cannot be denied.

The paradigm shift that is increasingly growing with more technology adoption by the market, industry and regulator presents challenges that might extend to financial stability, consumer protection and the risk of financial exclusion.

For financial regulators to take a balanced approach to innovation, encouraging the adoption and use while ensuring none of the tenets of its mandate is ignored, several innovative regulatory approaches can be explored.

AFI's recent publication Innovative Regulatory Approaches Toolkit[49] highlights some of these approaches including, but not limited to, regulatory sandboxes.

**> View here**

The regulatory sandbox allows regulators to test, observe, and analyze the impact of products or services created, delivered or improved using digitization to see if these are safe for the market. It also enables regulators to consider any regulatory actions or frameworks that need to be implemented to control risk.

These sandboxes become especially useful in scenarios where technologies or platforms have the potential to introduce significant risk into the ecosystem. One example of the usage of sandboxes in the RegTech space is given by the European Union.

## IN ACTION – EUROPEAN FORUM FOR INNOVATION FACILITATORS' SANDBOX

**BOX 9:** EUROPEAN FORUM FOR INNOVATION FACILITATORS (EFIF)' SANDBOX[50]

The European Supervisory Authorities (ESAs) established the European Forum for Innovation Facilitators (EFIF) in April 2019.

The EFIF provides a platform for European supervisors to meet regularly to share experiences from engagement with firms through innovation facilitators (regulatory sandboxes and innovation hubs), to share technological expertise, and to reach common views on the regulatory treatment of innovative products, services, and business models, overall boosting bilateral and multilateral coordination.

The EFIF is a relatively new organization but will provide the basis for more effective and engaged cross-border collaboration within the European Union. More specifically, the EFIF is designed to answer:

**1)** How can a particular technology or set of technologies be used?

**2)** Where do supervisors see current or potential issues in the use of a technology?

**3)** Are there obstacles to the adoption and use of the technology?

One of the use cases that may prove to be an important value-add of the EFIF, is cross-border collaboration especially when it comes to cross-border usage and functionality. The EFIF provides a centralized point of coordination where individual country solutions can be tested with either the same country's data or potentially regional data.

This allows the member country to effectively test its own solutions and allows other countries to benefit from the same testing.
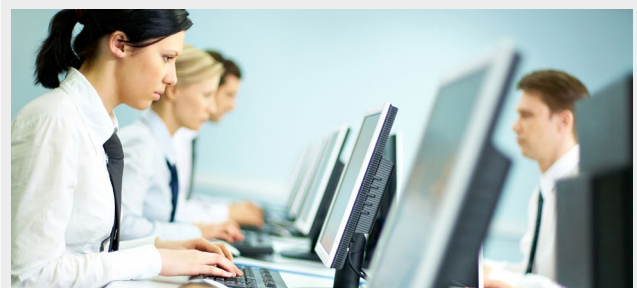
Technology testing. (Pressmaster/Shutterstock)

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49  AFI. 2021. Innovative regulatory approaches toolkit. Available at: https://www.afi-global.org/publications/innovative-regulatory-approaches-toolkit/.

50  Joint Committee of the European Supervisory Authorities (ESAs). European Forum for Innovation Facilitators (EFIF). Available at: https://esas-joint-committee.europa.eu/Pages/Activities/European-Forum-for-Innovation-Facilitators-(EFIF).aspx.

# POLICY FRAMEWORK ON REGTECH FOR FINANCIAL INCLUSION

As we expect the fast-developing technological landscape to continue, especially around RegTech and SupTech innovation and adoption, it is essential to have a framework developed based on insights drawn across several countries within the AFI network and beyond, to serve as guidance for regulators seeking to adopt, adapt, experiment, or improve their RegTech and SupTech policies, interventions, projects, or frameworks.

The framework is intended to present policy guidance, practical steps and approaches that will help AFI members design, develop, adopt, and adapt RegTech and SupTech initiatives for different and relevant thematic areas, as well as, promote financial inclusion.

It is worth noting that although technological enabled advances in RegTech and SupTech innovation might be growing and applicable to several regulatory use cases and supervisory scenarios, maintaining the right balance between automation, technology and human judgement is key — regardless how advanced AI is coming along, certain areas are better handled by humans until all risks elements identified are not exacerbated by technology and can appropriately be mitigated in a Regtech or SupTech regime.

The policy framework follows a process and lifecycle approach for RegTech adoption — from analyzing the local contexts to engaging stakeholders to implementation.

Each stage builds upon the outcomes of the previous one, and the framework incorporates concepts of design thinking and agile methodology for project management.

However, it must be noted that while the roadmap and solutions put forward in this paper are broadly relevant for emerging economies, these are not homogenous.

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**FIGURE 6:** POLICY FRAMEWORK FOR REGTECH FOR FINANCIAL INCLUSION

## THE FIVE-STEP POLICY FRAMEWORK FOR REGTECH FOR FINANCIAL INCLUSION IS AS DEPICTED BELOW:

| 1 ANALYSIS OF LOCAL CONTEXT | 2 ASSESS CAPABILITIES | 3 ENGAGE STAKEHOLDERS | 4 DESIGN | 5 IMPLEMENT |
|---|---|---|---|---|

**REGTECH AND SUPTECH GOALS**

| | | | | |
|---|---|---|---|---|
| Plan and execute a comprehensive diagnosis of the market, industry and regulatory landscape to discover needs, gaps and challenges. | Perform a candid appraisal of internal and external (industry) capabilities for talent, resources, process and systems. | Adopt a bottom-up approach to engagement, cooperation and collaboration with stakeholders to ensure buy-in. | Design for purpose, choosing appropriate technologies and aligning to industry and jurisdiction needs, and financial inclusion targets. | Employ an appropriate (phase, experimental, etc.) implementation approach fit for your context, use case and NFIS targets. |
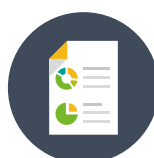
# STEP 1: ANALYZE THE LOCAL CONTEXT

The comprehensive diagnosis is the foundation for achieving an actionable, inclusive, and appropriate RegTech and SupTech framework or intervention that supports and contributes to the fulfilment of national financial inclusion objectives.

Building a policy framework for the adoption of RegTech that supports financial inclusion is complex and requires a number of steps and processes. The first one is to conduct a thorough diagnosis of the local context — demand, supply, and regulatory/policy side.

## OUTCOME CHECKLIST

Upon completing the comprehensive diagnosis and analysis of the local context, identifying, and achieving outcomes with the following elements are recommended.

**TABLE 4:** INDICATIVE OUTCOME CHECKLIST FOR A LANDSCAPE DIAGNOSIS FOR REGTECH AND SUPTECH

| CHECKLIST CRITERIA | APPLICABILITY | SUGGESTED INSIGHTS/CONSIDERATIONS |
|---|---|---|
| 1 DIGITAL INFRASTRUCTURE | Jurisdiction (Regulator) | 1 Determination of the availability, rate of access and affordability of stable internet on a national level. |
| | | 2 Presence and impact of strategically and systemically important financial system or payments infrastructure. |
| | | 3 Level of interoperability and digital integration within the jurisdiction and industry. |
| | | 4 Presence and adequacy of policies, frameworks and guidelines on data protection and privacy, cybersecurity, or cyber hygiene, outsourcing of digital services, open data/API/banking/finance, FinTech regulation or supervision framework, etc. |
| | | 5 Access and growth in cloud computing, storage, and data storage facilities. |
| | | 6 Existing standardization level within industry covering payment systems, data sharing, reporting and regulatory compliance. |
| | | 7 Through a proportionality and inclusion lens, classify the types, number and distribution of regulated entities, including traditional commercial banks, micro-finance institutions, electronic-money issuers, digital wallet providers, digital banks, TechFins, FinTechs, financial and payment technology service providers, etc. |
| | | 8 Feasibility and dependency assessment of potential use cases. |
| | Industry (FSP) | 1 Clear understanding of the regulatory reporting and compliance requirements. |
| | | 2 Compliance with all existing and future policies, regulation and mandates. |
| | | 3 Level of digital transformation within legacy systems and capacity to integrate with newer systems. |
| | | 4 APIs, data sharing and exchange standardization levels within bilateral and multi-lateral relationships. |
| | | 5 Current and potential gaps in process, methods and ability to adequately capture disaggregated and granular data on financial inclusion indicators. |
| | | 6 State of adoption of cloud storage and computing. |
| | | 7 Capability level with regards to skills, talents, resources needed to adopt and adapt technology enabled innovation. |
| | Market (Customer) | 1 Affordable and accessible internet and digital devices. |
| | | 2 Appraisal of digital and financial literacy with regards to DFS. |
| | | 3 Adequate policies to protect consumers and market with regards to cyber hygiene, data protection and privacy, use of data, outsourcing and third parties, etc. |

# THE FOLLOWING FIVE MUST-HAVE CONSIDERATIONS MAY BE ADOPTED TO CONDUCT A THOROUGH LANDSCAPE DIAGNOSTICS AND ANALYSIS.

## 1

### IDENTIFY AND DEFINE THE PROBLEMS AND GAPS

Use necessary quantitative and qualitative tools and methods, including surveys, interviews, observations, focus group discussion, stakeholder engagement and feedback to identify existing and potential problem(s) and gaps with industry or regulator's ability, methods, and processes towards the adoption or implementation of a RegTech or SupTech innovation for financial inclusion.

## 2

### PRIORITIZE THE PAIN-POINTS AND OPPORTUNITIES

While there might be several gaps, the next step will be to consider the impact, likely use cases, cost, capability and ascribe weights to each evaluated gap that need improvement and prioritize pain points that need to be addressed.

Apply the appropriate inclusion lens (e.g. gender) early and also consider a vital factor in estimating impact and priority weights.

## 3

### RECOGNIZE APPROPRIATE AND APPLICABLE USE CASES

While current use cases of RegTech and SupTech implementation might defer across countries and even within the same jurisdiction for both regulators and industry players, recognize the best applicable use cases and scenarios that deliver maximum value of broad buy-in, lower cost, simplified implementation, greater efficiency to process, methods and applications, alignment with internal and external capabilities and ultimately contribute or accelerate maximum impact for financial inclusion.

## 4

### ACHIEVE CONSENSUS ON OVERARCHING VISION AND OBJECTIVES

It is important to achieve consensus on the compelling direction, vision and goals for the RegTech or SupTech intervention that is agreeable to all parties and stakeholders including leadership, other regulators or supervisors, industry, regulated entities and internal stakeholders.

## 5

### COMMIT TO A DATA-DRIVEN AND PRACTICAL APPROACH

Based on the outcome of the landscape assessment, adopt a robust data-driven mindset towards decisions and actions going forward.

Insight drawn from the diagnostics must inform next steps, e.g. should a phased adoption and implementation be considered? Will an innovative regulatory approach such as a sandbox be expedient? This approach will also simplify monitoring, project management and documentation.
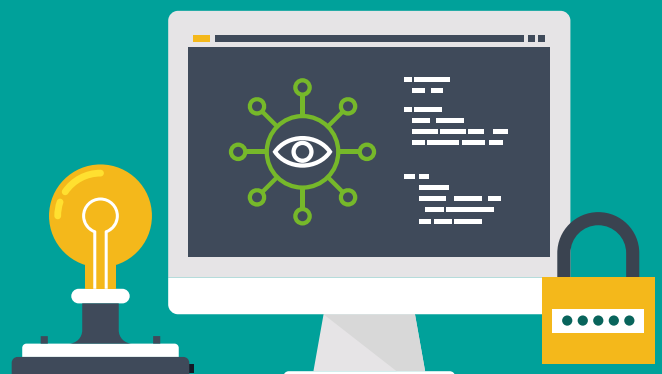
**TABLE 4:** *continued*

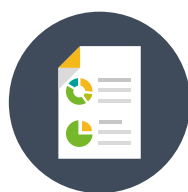| CHECKLIST CRITERIA | APPLICABILITY | SUGGESTED INSIGHTS/CONSIDERATIONS |
|---|---|---|
| 2 USER PREPAREDNESS | Jurisdiction (Regulator) | 1 Consider requirements and need to upskill, train and build capacity internally for data collection, visualization, analysis, management.<br><br>2 Consider gender-sensitive training and capacity building on recognizing bias, concerns and spurious relationships within dataset.<br><br>3 Consider frequently scheduled appreciation workshops on emerging technologies, digital tools and capability to understand and appreciate RegTech tools for compliance reporting and SupTech for supervisory oversight including AI/ML, NLPs, chatbots, etc.<br><br>4 Consider experimenting a RegTech module to create an industry-wide alignment and foster talent development in the space. |
|  | Industry (FSP) | 1 Consider gender-sensitive training and capacity building on recognizing bias and spurious relationships within dataset captured by RegTech tools.<br><br>2 Consider frequently scheduled appreciation workshops on emerging technologies, digital tools, and capability to understand and appreciate RegTech tools for compliance reporting and SupTech for supervisory oversight.<br><br>3 Evaluate impact of emerging technology implementation on consumer protection, data privacy and cyber hygiene and contribution to adequate consumer digital and financial literacy with tools such as chatbots, digital IDs, e-KYC, and remote onboarding will be critical. Other variables to consider include literacy. |
| 3 REGULATORY LEADERSHIP AND COMMUNICATION | Jurisdiction (Regulator) | 1 Aim to influence the industry via regulatory leadership with RegTech and SupTech initiatives to ensure rapid uptake by the industry.<br><br>2 Leverage open dialogues and discussion to build clear understanding and garner support.<br><br>3 Lead in the identification of apparent problems, gaps and inefficiencies in regulatory reporting, compliance or supervision processes, methods and tools and work with the industry to prioritize areas fit for immediate resolutions.<br><br>4 Lead in the recruiting of specialized teams to take up the implementation of RegTech and SupTech interventions and commit to upskilling of existing staff.<br><br>5 Devote funds, investment and resources to industry level capacity building, technical appreciation, and grants to support, incubate and accelerate adoption and use of relevant RegTech solutions for identified and approved use cases.<br><br>6 Regulators could also introduce a RegTech skills framework to identify the skills required for different roles to accelerate the adoption of RegTech. Such a framework could then be disseminated to FIs to develop training internally or share it with external service providers. |
| 4 COLLABORATION | Jurisdiction (Regulator) and industry (FSP) | 1 Lead and provide an appropriate channel for market participants and industry to discuss and collaborate.<br><br>2 Successful implementations will require buy-in from everyone early in the development process.<br><br>3 Establish appropriate channels for market participants to voice their concerns and share suggestions.<br><br>4 Review RegTech and SupTech initiatives periodically following legitimate concerns and feedback received on cybersecurity, data privacy, or third-party dependencies, using a bottom-up approach. |

# STEP 2: ASSESS CAPABILITIES

Assessing existing capabilities to undertake and successfully implement a RegTech or SupTech intervention is an important step — as this not only enables regulators to map out existing resources and gaps, but also helps them to understand and estimate future capability requirements and work towards achieving those.

Therefore, starting with the RegTech or SupTech journey, identifying and assessing capabilities needs under each stage of the lifecycle is imperative.

### STAGES OF TYPICAL SUPTECH OR REGTECH JOURNEY

As part of the capabilities assessment process, regulators and ecosystem players need to also measure where they are in their SupTech journey and where they need to go next.

Furthermore, the following process is suggested to assess capabilities even from a holistic perspective:

1) Undertake a cost-benefit analysis for regulators to understand the capital investment, operational costs, potential labor and resources, and efficiency gains for either or both Regtech and SupTech initiatives.

2) Identify resources and capacity constraints for internal development (at regulator and industry level).

3) Assess the need for an external vendor and align on an appropriate vendor selection model, if required.

4) Establish vetting criteria and a committee assigned to evaluate, nominate and contract vendors.

The Capabilities Assessment framework consists of two components, i.e. "Internal capabilities" and "External stakeholders". Central banks and regulators can use this framework to analyze their internal and external environment to identify resources and constraints for implementing RegTech and SupTech solutions.

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**FIGURE 7:** TYPICAL STAGES OF REGTECH AND SUPTECH



MANUAL PROCESSES

BASIC AUTOMATION

BIG DATA ARCHITECTURE

AI-DRIVEN PROCESSES

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**TABLE 6:** EXAMPLES OF INTERNAL CAPABILITIES AND EXTERNAL STAKEHOLDERS

| INTERNAL CAPABILITIES | EXTERNAL STAKEHOLDERS |
|---|---|
| Capital costs | Technology solution providers (TSPs) |
| Operational costs | Donors |
| Set-up time | Market participants |
| Management time | |

Source: Kapronasia

**TABLE 5:** INSIGHTS INTO STAGES OF REGTECH AND SUPTECH

| STAGE | | INSIGHTS |
|---|---|---|
| 1 MANUAL PROCESSES | | The first stage of SupTech or RegTech is the beginning point for most supervisors and industry, where data management workflows are heavily manual, and the type of analytics done is primarily descriptive. At this stage of RegTech or SupTech development, data collection is typically received/sent via email or hardcopy documents and is often restricted by limited file sizes and data security issues.[51]<br><br>Data management is relatively simple, with data visualization accomplished through static reports and data validation conducted manually through "spot checks" or automated checks via macros on spreadsheets.[52]<br><br>**The transfer of data collected to data storage for more profound analysis is also done manually.** |
| 2 BASIC AUTOMATION | | When supervisors and industry progress to the second stage of RegTech or SupTech (as applicable), data collection has evolved to allow for basic automation through web-based portals or bulk uploads. These sharing and collection tools are typically integrated with automated validation checks built into the upload protocol.[53]<br><br>**Data storage in this stage of RegTech or SupTech is made more centralized and less fragmented through utilizing data warehouses.** |
| 3 BIG DATA ARCHITECTURE | | In adopting significant data architecture for their IT systems, supervisors and the industry are able to incorporate RegTech or SupTech that involves using technology stacks that support data of higher granularity, diversity, and frequency.[54]<br><br>The use of APIs and RPA in RegTech or SupTech at this stage allows for data collection/sharing and consolidation to become fully automated.<br><br>Additionally, the use of APIs gives regulators/industry the ability to integrate their SupTech (or RegTech) systems into market participants'(or regulator's) IT systems, enabling the collection (or sharing) of real-time data. Data storage and computation are enhanced in significant data architecture using cloud storage and data lakes.<br><br>**This allows for advanced statistical modeling that enables supervisors to conduct predictive analytics.[55]** |
| 4 AI-DRIVEN PROCESSES | | Generally, AI-enabled SupTech necessitates an underlying significant data architecture since most AI models require substantial data volumes and considerable computing power for valuable results.[56]<br><br>Therefore, this would be the last stage of SupTech development for supervisors. AI/ML-based SupTech tools can improve data validation via identifying anomalies in the data source.<br><br>Additionally, these SupTech solutions can enable further real-time monitoring by supervisors via chatbots that carry out supervisory tasks previously performed by humans, such as responding to and resolving customer complaints.[57]<br><br>Moreover, the use of AI and machine learning in SupTech solutions to drive data analytics enables prescriptive analysis to be carried out by supervisors, which could be used to evaluate, formulate, or tweak policies. Specific policies that can be impacted through prescriptive analytics include those targeting financial inclusion.<br><br>**In addition, the emergence of blockchain and distributed ledger technology can also be applied in SupTech to further the benefits supervisors can gain from SupTech solutions and tools.** |

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51 Financial Stability Institute. 2019. Simone di Castri, Stefan Hohl, Arend Kulenkampff and Jermy Prenio. The SupTech generations. FSI Insights on policy implementation No. 19. Available at: https://www.bis.org/fsi/publ/insights19.pdf.

52 Ibid.

53 Ibid.

54 Ibid.

55 Ibid.

56 Ibid.

57 RegTech for Regulators Accelerator (R2A). Case study: Chatbot prototype. Available at: https://www.r2accelerator.org/chatbot-prototype-1.

It should be noted that there should be a greater degree of alignment in terms of focus between internal and external considerations, without neglecting one for another. However, external parties can play an essential role in enabling the successful development and implementation of RegTech and SupTech solutions.

External technology solutions vendors, with their vast knowledge of IT and SupTech systems, can be instrumental in helping a regulator deal with rapid changes in technology and overcoming limited in-house technical skills and resources.

Strategic partners often provide financial resources and technical assistance to promote awareness and implementation efforts related to RegTech, SupTech and financial inclusion, especially in developing countries with few well-developed success stories.

Moreover, through their constant contact with regulators, donors can be influential in obtaining buy-in and support from regulators and market participants.

# STEP 3: ENGAGE STAKEHOLDERS

Implementing RegTech or SupTech solutions is most effective when financial policymakers and regulators can involve other regulators, and even market participants, in the early stages of identifying areas of improvement, all the way through the development and launch of the end product.

Collaboration with other regulators and departments within the central bank can be achieved using a consultative approach to managing the various steps in the framework above.

For instance, a steering committee can be set up to include representatives from all supervisory departments so that the development of the solution will be more inclusive of different regulatory perspectives and concerns.

Preferably, potential managers and users of the system can be brought on early in the process to be involved with the design of the solution. To improve collaboration with supervised entities, it is essential to have open dialogue and discussion channels with the central bank and regulators. The formation of an advisory group with representatives from supervised entities can be an effective way for regulators to receive feedback and recommendations, and communicate policy goals and the planned action steps to reach them.

It will also be important to conduct stakeholder interviews with organizations working on Gender Inclusive Finance (GIF), inclusion of disproportionately excluded segments including youth, older people, MSMEs, FDPs, etc. to understand opportunities to address the peculiar gaps and financial exclusion instances for these segments.

# STEP 4: DESIGN

Design will be an essential part of the overall process, and there are a few important considerations to keep in mind, primarily to ensure that technical specifications are well-specified and feasible to implement:

1) Engage in a design sprint to decide on key design features.
2) Craft a mock-up with limited functionality to determine if the concept will work as envisioned.
3) Use dummy data and basic barebones technology to demonstrate the concept feasibility.
4) Draft intelligible functional requirements and technical specifications.

Adopting an agile and thorough design process will lessen the chances of failure in implementation to a considerable extent.

# STEP 5: IMPLEMENT

The potential of RegTech and SupTech to be useful and adequate in fulfilling the needs under the key thematic areas examined demonstrates the abundance of opportunities available for regulators, supervisors and the industry.

However, moving from an initial idea to a finished ready-for-deployment product is often complicated and challenging, even for experienced regulators. Therefore, forming an implementation team to provide business and technology-related support and guidance is highly recommended.

The following considerations will be critical in this final stage:

a) Adopt an agile approach to speed up testing and development.

b) Set up a whole implementation team with a balance of tech professionals and regulatory officers.
c) Have frequent check-ins with stakeholders and make adjustments as necessary.
d) Communicate intended solution goals and impact on stakeholders and users.
e) Determine and balance the need for in-house versus third-party providers, including developing new solutions internally or by contracting an external Technology Service Provider (TSP).
f) Document key lessons and apply "rapid learnings" from each iteration to progressively refine the project; establish a change management strategy to optimize the benefits of the solution for end-users.
g) Decide how to take the RegTech or SupTech solution to market.

Successful deployment requires planning, early and frequent communication, training, capability building, change management, and adequate deployment support.

Therefore, tracking, documenting, and publicizing benefits where appropriate (e.g. cost savings, person-hours reduced, reduced fraud) to highlight the solution's impact will be necessary to generate continued interest and support from other government agencies and market players.

To successfully implement these solutions, continuous monitoring, evaluation, and learning (ME&L) will be essential. ME&L should be compulsorily included as part of the implementation process to ensure the desired outcome is achieved and continuously learn what works and what does not, and improve the processes accordingly. This will ensure that the framework adopted is both well-rounded and agile.

# RECOMMENDATION: ENACT GENDER-TRANSFORMATIVE APPROACHES

Apart from stakeholder engagement and communication, a gender-sensitive or gender-transformative* analysis must be taken into account at every stage for RegTech or SupTech solutions to have the desired positive impact on financial inclusion.

Any solution needs to be gender-sensitive or gender-transformative, whose design and development must consider how women interact with the end-product.

The format of the solution needs to be accessible to women, and additional attention must be given to avoid unintentionally excluding women simply by the channels through which the solution is available.

Moreover, it is essential to set up feedback channels where women can have their voices heard and potentially improve the system. Adjustments and modifications also have to be made when interacting with women users; for instance, with chatbots, efforts can be made to use words that derive greater engagement by being more attuned to the way women communicate.

A combination of remote, digital and in-person communication channels must be available to enable women to choose the most appropriate and accessible method for their situation.

# USE OF REGTECH AND SUPTECH DURING EMERGENCIES

## The COVID-19 pandemic has raised significant concerns among regulators about practical actions and priorities for financial system supervision, especially during emergencies.

To understand the impact COVID-19 has had on the markets, industries, and sectors they regulate, regulators must have access to good quality data to make informed decisions within the context of the pandemic. There are several dimensions determining the quality of data gathered: accuracy, preciseness, legitimation, reliability, consistency, relevance, comprehensiveness, accessibility, and granularity.

According to a recent survey by the Financial Stability Board, the pandemic has led to a significant increase in the number of authorities considering SupTech as their strategic priority.[58]

In addition, a joint report by the World Bank and the Cambridge Centre for Alternative Finance titled "The 2020 Global COVID-19 FinTech Regulatory Rapid Assessment Study" found that 80 percent of regulatory innovation initiatives have been impacted in some way by COVID-19, typically, but not always, resulting in the acceleration of these initiatives.[59]

## 58%

According to the report, 58 percent of respondents have either accelerated or introduced RegTech or SupTech initiatives.

During such emergencies, important areas of focus by Central Banks and other financial regulatory authorities could be threatened. These include:

> Financial stability
> Liquidity management
> Business continuity (e.g. bank branches and Automated Teller Machines or ATMs)
> Monitoring of financial crimes
> Maintenance of personal data and privacy standards
> Regulatory compliance reporting

The potential impact around a few of these focus areas and how Regtech and SupTech could play a role in mitigating these risks are briefly discussed below.

**BOX 10:** DE NEDERLANDSCHE BANK (DNB)'S REGTECH USE CASE DURING EMERGENCIES[60]

De Nederlandsche Bank (DNB) is currently developing an interactive reporting dashboard to provide insight for supervisors on COVID-19 related risks. Although still in the early phases of development, the dashboard is intended to provide the regulator with different data views such as benchmarking, over time, and single bank overviews.

While the dashboard is not yet live, there are already plans for future improvements, which include incorporating public COVID-19 information and analyzing comment fields with text analysis.

**BOX 11:** MONETARY AUTHORITY OF SINGAPORE (MAS)'S REGTECH USE CASE DURING EMERGENCIES[61]

The Monetary Authority of Singapore (MAS) as part of the national effort to reduce the risk of further local transmission of COVID-19, issued in March 2020 an advisory to all FIs in Singapore to implement safe distancing measures in all aspects of their business operations, especially customer touchpoints.

By using data analytics, the MAS can monitor FIs' implementation of safe distancing measures and inform inspection and enforcement actions. Data on bank branch locations, customer footfall, wait time and peak hours are collected and visualized on a monitoring dashboard.

The results are then used to prompt intervention actions by identifying crowded customer service locations and prioritizing inspections on these FIs to enforce compliance with safe distancing rules.

58  Financial Stability Board. 2020. The use of supervisory and regulatory technology by authorities and regulated institutions. Market developments and financial stability implications. Available at: https://www.fsb.org/wp-content/uploads/P091020.pdf.

59  World Bank and CCAF. 2020. The global Covid-19 FinTech regulatory rapid assessment report, World Bank Group and the University of Cambridge. Available at: https://www.jbs.cam.ac.uk/wp-content/uploads/2020/10/2020-ccaf-report-fintech-regulatory-rapid-assessment.pdf.

60  Financial Stability Board. 2020. The use of supervisory and regulatory technology by authorities and regulated institutions. Market developments and financial stability implications. Available at: https://www.fsb.org/wp-content/uploads/P091020.pdf.

61  Ibid.

**TABLE 7:** EXAMPLES OF POTENTIAL REGTECH AND SUPTECH ROLES DURING EMERGENCIES

| | FOCAL AREA | IMPACT OF EMERGENCY | POTENTIAL ROLES FOR REGTECH AND SUPTECH |
|---|---|---|---|
| 1 | FINANCIAL STABILITY | > Deteriorating financial conditions could affect credit quality, the value of pledged collateral, and minimal/delayed payments on loan balances or outright defaults.<br><br>> In addition, in terms of capital management, FIs could face lower capital adequacy ratios (CARs) and thus higher capital requirements as increased credit risk impacts their risk-weighted assets (RWAs).<br><br>> Likewise, the increase in credit risk resulting from emergencies will also mean that FIs will have to estimate and make provisions for the change in their Current Expected Credit Losses (CECL). | > Both FIs and regulators would benefit from AI/ML to model different scenarios' impact on banks' RWAs, CECL estimates, and other financial/credit risk measures. The latter requires reasonable and supportable forward-looking information that NLP might help with (see Bank of England in Appendix).<br><br>> Determine whether a significant increase in financial and credit risk has occurred, AI/ML can be used to monitor vulnerable sectors to identify potential downgrades and watchlists.<br><br>> APIs can enable regulators to watch FIs in real-time to intervene quickly should prudential risk ratios drop and get a real-time, dynamic overview of the financial sector overall to intervene quickly if conditions deteriorate. |
| 2 | LIQUIDITY MANAGEMENT | > Volatility in the market could lead to big swings in stress testing results and limit/threshold breaches.<br><br>> Ultimately, the result could be increased liquidity tightening with FIs experiencing a lower liquidity buffer in excess of the liquidity coverage ratio (LCR). | > Banks would benefit from RPA and AI/ML to monitor and review daily liquidity stress testing reporting, limit/thresholds, and LCR results.<br><br>> Help monitor market activity against their liquidity stress indicators for triggers that would activate the contingency funding plan (CFP).<br><br>> AI/ML could also help determine the size and impact of any liquidity shortfall against potential future scenarios. |
| 3 | BUSINESS CONTINUITY | > Business continuity could become a massive challenge for FIs during emergencies due to disruption in physical access. For instance, in the COVID-19 pandemic, stay-at-home notices resulted in branch closures and ATMs not being replenished with cash, disrupting individuals and MSMEs. | > Digitalization of FIs' services such as remote onboarding has necessitated robust electronic know your customer (e-KYC) solutions to prevent fraud.<br><br>> An increase in digital payments and remittances has required digital solutions to mitigate the higher risk of money laundering.<br><br>> Real-time data and visualization could highlight geographical location worse impacted and inform best response by the regulator and FSP. |
| 4 | REGULATORY COMPLIANCE REPORTING | > As regulators try to get to grips with the challenges posed by the pandemic, the frequency of regulatory changes has also increased, obtaining the right data and insights remotely might be a challenge. | > The high frequency of regulatory changes has led regulated entities to increase their use of RegTech to stay abreast of their compliance requirements. For example, NLP can be seen to have supported operations to stay updated with the compliance and regulatory policy shifts during this challenging period.<br><br>> In addition, SupTech solutions utilizing APIs to pull machine-readable data from regulated entities in real-time could, in turn, be run through an AI/ML model to help with both macro-and micro-prudential analysis. |

# CONCLUSION

This report has highlighted potential RegTech and SupTech use cases across key thematic areas from a financial inclusion perspective, and herewith some key takeaways:

## 1

**REGTECH AND SUPTECH SOLUTIONS COULD PROMOTE FINANCIAL INCLUSION** through improved monitoring, ease of access (especially in rural communities), lower costs involved, and better targeting of the unbanked population using appropriate technologies per use case, e.g. GIS dataset for DFS access points.

## 2

Some of the **MOST COMMONLY USED TECHNOLOGIES IN REGTECH SOLUTIONS** include AI, ML, data warehousing, NLP, DLT, API, GIS, and shared utilities.

## 3

**WHILE MANY REGULATORS IN EMERGING ECONOMIES HAVE ADOPTED REGTECH SOLUTIONS, THESE ARE STILL IN THEIR NASCENT STAGE.**

Uptake of such solutions are limited by the lack of technological and digital infrastructure, and legal restrictions on technologies with limited reliable use cases of RegTech solutions.

For RegTech adoption to be successful, there are a number of important prerequisites that regulators will have to ensure, including collaboration among different stakeholders in the RegTech landscape.

## 4

**REGULATORS ADOPTING THE FIVE-STEP FRAMEWORK PUT FORWARD IN THIS REPORT WILL BE WELL PLACED TO IMPLEMENT A SUCCESSFUL REGTECH AND SUPTECH INTERVENTION.**

The roadmap includes a coherent process — from analyzing the local context, to assessing internal and external capabilities, design, and implementation.

While the steps in the process may be relevant to emerging economies, they must be tailored to the local context.

Overall, RegTech and SupTech adoption to accelerate financial inclusion is only expected to quicken in the coming years. It will be of great importance for emerging economies to keep pace with the evolving technology and develop relevant skills to reap the maximum benefits from expedited financial inclusion.

# GLOSSARY

Within the context of this report, the following terms shall have the following meaning or definition except where explicitly described or mentioned otherwise in the report.

## GENERAL TERMINOLOGY

**Customer Due Diligence (CDD)** — The assessment of a retail or business customer's risk to the financial provider's business that typically involves obtaining information about the customer and their underlying financial position (e.g. source of funds).

**Digital Financial Services (DFS)** — The provision of financial products and services mainly through a digital channel and without the involvement of an actual person.

**Digital wallet** — An electronic service on either a mobile device or online that holds assets (funds, tokens, vouchers, or cryptocurrencies) on behalf of a user. The same device or system often allows individuals to make electronic transactions.



**Financial inclusion** — The ability of every individual, particularly the low-income poor, productive poor, migrant workers, and people living in remote areas, to have access to a full range of quality financial services in a timely, convenient, informed manner and at an affordable cost. An additional dimension to financial inclusion would be the regular usage of quality financial services by all segments of society.[62]

> **View here**

**Financial Technology (FinTech)** — Technology-enabled transformation in financial services that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions and the provision of financial services.[63]

**Gender Transformative** — An approach that identifies the root causes of gender inequality in the field of financial inclusion, before analyzing and transforming inequitable gender norms and power dynamics into positive outcomes that directly enhance gender equity.

**Mobile money (MM)** — A basic payments system designed for cash-based economies that allow users to transfer digital value between mobile phone handsets.



**Regulatory technology (RegTech)** — Any technology which can include artificial intelligence (AI), machine learning (ML), data science, and more straightforward technology such as databases that is used to enhance processes, methods, and tools for regulatory reporting, compliance, and mandated regulatory objectives.[64]

> **View here**

**Supervisory technology (SupTech)** — The use of technology to specifically support supervisory activities (described as a subset of RegTech in AFI's Inclusive Financial Integrity Toolkit).[65]

62  AFI. 2017. Defining financial inclusion, Guideline Note No. 28. Available at: https://www.afi-global.org/wp-content/uploads/publications/2017-07/FIS_GN_28_AW_digital.pdf.

63  Financial Stability Board (FSB). 2021. FinTech. Available at: https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/fintech/.

64  AFI. 2020. Inclusive Financial Integrity: A toolkit for policymakers. Available at: https://www.afi-global.org/wp-content/uploads/2020/09/AFI_CENFRI_toolkit_AW_digital.pdf.

65  Ibid.

## REGTECH AND SUPTECH TECHNOLOGY TERMINOLOGIES

| TECHNOLOGY | DEFINITIONS | EXAMPLES |
|---|---|---|
| APPLICATION PROGRAMMING INTERFACE (API) | A set of definitions and protocols that allows for the creation of applications. This acts as a software intermediary, allowing two applications to interact with each other. | N/A |
| ARTIFICIAL INTELLIGENCE (AI)/ MACHINE LEARNING (ML) | AI is a technology that performs tasks that typically require human intervention.[66] Machine Learning is a subcategory of AI that learns from data and spots patterns to improve existing algorithms. | Banko Sentral ng Pilipinas (BSP) developed an AI chatbot to simplify and automate the receipt and resolution of customer complaints.[67] |
| BLOCKCHAIN/ DISTRIBUTED LEDGER TECHNOLOGY (DLT)/ CRYPTO | A series of digital transactions grouped into "blocks" of information and shared securely across computers. When a new block is added, it is connected or "chained" to a previous block, making it difficult to change past information. | Bank of Estonia is using DLT for identity management.[68] This helps government to access consumers' data securely, making the processes efficient for consumers to access financial services. |
| CLOUD COMPUTING | The delivery of computing services like storage and analytics over the internet. It reduces capital costs, increases processing speed by provisioning large amounts of computing resources, and provides elastic resources for scalability.[69,70] | Cantilan Bank in the Philippines is using cloud-based banking to reach the unbanked population, especially those living in hard-to-reach areas.[71] |
| DATA LAKE | A centralized repository that allows for storing structured and unstructured data at any magnitude. It saves data in an unstructured way without requiring the data to be processed or analyzed. Additionally, data lakes receive and retain data from all sources, support all data types and schemas are not established when the data is collected.[72] | The Central Bank of Nigeria redesigned their payments data infrastructure using data lake technology to improve data storage and management.[73] |
| DATA WAREHOUSE | It saves data in a defined manner. Data is typically only loaded into the warehouse when an application for the data has been determined. The data structure and schema are established beforehand to optimize for quick SQL queries.[74] | The National Bank of Rwanda (BNR) developed an electronic data warehouse (EDW) system to help automate and streamline the reporting processes.[75] |
| GEOGRAPHIC INFORMATION SYSTEM (GIS) | A technological field that incorporates geographical features with tabular data to map, analyze, and assess real-world problems. | Nepal Rastra Bank developed a GIS-based reporting platform that shows all existing physical financial service access points in Nepal, providing a way to collect and analyze data on financial industry coverage across the country. |
| ROBOTIC PROCESS AUTOMATION (RPA) | A set of software tools used to automate human activities that are manual, rule-based, and repetitive.[76] | N/A |
| SHARED UTILITIES | Technology that makes use of a central repository that enables firms to share services via cloud computing or online platforms.[77] | Aadhar in India is an example of a Know-Your-Customer (KYC) shared utility and has helped millions of Indians to open bank accounts seamlessly, thereby improving financial inclusion.[78] |

66  Stanford Social Innovation Review. 2021. When good algorithms go sexist: Why and how to advance AI gender equity. Available at: https://ssir.org/articles/entry/when_good_algorithms_go_sexist_why_and_how_to_advance_ai_gender_equity.

67  Ibid.

68  Ibid; Ledger Insights. 2020. Estonia launches central bank digital currency project. Available at: https://www.ledgerinsights.com/estonia-launches-central-bank-digital-currency-cbdc-digital-euro-project/.

69  Microsoft Azure. What is cloud computing? A beginner's guide. Available at: https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/.

70  IBM. Cloud computing: A complete guide. Available at: https://www.ibm.com/cloud/learn/cloud-computing-gbl.

71  ADB. 2021. Cloud-based core banking in the Philippines: A rural bank pilot project, September 2021. Available at: https://www.adb.org/publications/cloud-based-banking-philippines-rural-bank-project.

72  Amazon Web Services. What is a data lake? Available at: https://aws.amazon.com/big-data/datalakes-and-analytics/what-is-a-data-lake/.

73  Ibid.

74  Forbes. 2018. What is a data lake? A super-simple explanation for anyone. Available at: https://www.forbes.com/sites/bernardmarr/2018/08/27/what-is-a-data-lake-a-super-simple-explanation-for-anyone/?sh=13c8ced476e0.

75  Ibid.

76  AIIM. What is robotic process automation? Available at: https://www.aiim.org/what-is-robotic-process-automation.

77  Financial Conduct Authority. 2016. Feedback statement. Call for input on supporting the development and adopters of RegTech. Available at: https://www.fca.org.uk/publication/feedback/fs-16-04.pdf.

78  Ibid.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| **2FA** | Two-factor authentication |
| **AI** | Artificial Intelligence |
| **AML** | Anti-money Laundering |
| **API** | Application Programming Interface |
| **ATM** | Automated Teller Machines |
| **AuRep** | Austrian Reporting Services |
| **BNR** | National Bank of Rwanda |
| **BSP** | Bangko Sentral ng Pilipinas |
| **BVN** | Bank Verification Number |
| **CAR** | Capital Adequacy Ratios |
| **CBN** | Central Bank of Nigeria |
| **CDD** | Customer Due Diligence |
| **CECL** | Current Expected Credit Losses |
| **CFT** | Combating the Financing of Terrorism |
| **CNBV** | Comisión Nacional Bancaria y de Valores (Mexico) |
| **CONSAR** | National Commission for the Retirement Savings System |
| **COVID-19** | Coronavirus Disease 2019 |
| **DFS** | Digital Financial Services |
| **DFSWG** | Digital Financial Services Working Group |
| **DLT** | Distributed Ledger Technology |
| **DNB** | De Nederlandsche Bank |
| **DP4DFS** | Data Privacy for digital financial services |
| **EDW** | Electronic Data Warehouse |
| **EFIF** | European Forum for Innovation Facilitators |
| **e-KYC** | Electronic Know Your Customer |
| **ESAs** | European Supervisory Authorities |
| **FCPD** | Financial Consumer Protection Department |
| **FDPs** | Forcibly Displaced Persons |
| **FI** | Financial Institution |
| **FinTech** | Financial Technologies |
| **FSP** | Financial service provider |
| **GDP** | Gross Domestic Product |
| **GIF** | Gender Inclusive Finance |
| **GIS** | Geographic Information System |
| **IDPs** | Internally Displaced Persons |
| **IT** | Information Technology |
| **KYC** | Know Your Customer |
| **LCR** | Liquidity Coverage Ratio |
| **MAS** | Monetary Authority of Singapore |
| **ME&L** | Monitoring, Evaluation, and Learning |
| **ML** | Machine Learning |
| **ML/TF** | Money Laundering/Terrorism financing |
| **MM** | Mobile Money |
| **MSMEs** | Micro, Small and Medium Entrepreneurs |
| **NIBSS** | Nigeria Inter-Bank Settlement System Plc |
| **NLP** | Natural Language Processing |
| **NRB** | Nepal Rastra Bank |
| **OeNB** | Central Bank of Austria |
| **ORASS** | Online Regulatory and Analytical Surveillance Software |
| **OTP** | One-time password |
| **P2P** | Peer-to-peer |
| **R2A** | RegTech for Regulators Accelerator |
| **RegTech** | Regulatory technology |
| **RPA** | Robotic Process Automation |
| **RWA** | Risk-weighted Assets |
| **SACCOs** | Savings and Credit Cooperatives |
| **SAR** | Suspicious Activity Report |
| **SDGs** | Sustainable Development Goals |
| **SMS** | Short Messaging Service |
| **STR** | Suspicious Transaction Report |
| **SupTech** | Supervisory technology |
| **TSP** | Technology Service Provider |
| **UNCDF** | United Nations Capital Development Fund |
| **USD** | US Dollar |

# REFERENCES

## AFI PUBLICATIONS

**AFI. 2017.** Defining financial inclusion, Guideline Note No. 28. Available at: https://www.afi-global.org/wp-content/uploads/publications/2017-07/FIS_GN_28_AW_digital.pdf.

**AFI. 2019.** Denarau Action Plan: The AFI network commitment to gender and women's financial inclusion. Available at: https://www.afi-global.org/publications/denarau-action-plan-the-afi-network-commitment-to-gender-and-womens-financial-inclusion/.

**AFI. 2019.** The AFI core set policy model. Available at: https://www.afi-global.org/publications/the-afi-core-set-policy-model/.

**AFI. 2020.** Inclusive financial integrity: A toolkit for policymakers. Available at: https://www.afi-global.org/wp-content/uploads/2020/09/AFI_CENFRI_toolkit_AW_digital.pdf.

**AFI. 2020.** Lessons on enhancing women's financial inclusion using digital financial services (DFS). Available at: https://www.afi-global.org/publications/lessons-on-enhancing-womens-financial-inclusion-using-digital-financial-services-dfs/.

**AFI. 2021.** Guideline note on data privacy for digital financial services, Guideline Note No. 43. Available at: https://www.afi-global.org/publications/guideline-note-on-data-privacy-for-digital-financial-services/.

**AFI. 2021.** Innovative regulatory approaches toolkit. Available at: https://www.afi-global.org/publications/innovative-regulatory-approaches-toolkit/.

## ARTICLES

**BFA Global. 2018.** Di Castri Simone, Matt Grasser, and Arend Kulenkampf. Financial authorities in the era of data abundance: RegTech for regulators and SupTech solutions. Available at: https://bfaglobal.com/r2a/insights/financial-authorities-in-the-era-of-data-abundance-regtech-for-regulators-and-suptech-solutions/.

**Central banking. 2020.** The winners of the 2020 FinTech and RegTech global awards. Available at: https://www.centralbanking.com/awards/7703456/the-winners-of-the-2020-fintech-and-regtech-global-awards.

**CGAP. 2017.** RegTech: Are supervisors ready for the data revolution? Available at: https://www.cgap.org/blog/regtech-are-supervisors-ready-data-revolution.

**CGAP. 2018.** Measuring women's financial inclusion: The 2017 Findex story. Available at: https://www.cgap.org/blog/measuring-womens-financial-inclusion-2017-findex-story.

**CGAP. 2018.** RegTech and digital finance supervision: A leap into the future. Available at: https://www.cgap.org/blog/regtech-and-digital-finance-supervision-leap-future.

**Finextra. 2019.** Putting AI to use in regulatory compliance. Available at: https://www.finextra.com/blogposting/17186/putting-ai-to-use-in-regulatory-compliance.

**Finextra. 2020.** Bank of Lithuania tests API-based RegTech prototype. Available at: https://www.finextra.com/newsarticle/35337/bank-of-lithuania-tests-api-based-regtech-prototype.

**Ledger Insights. 2020.** Estonia launches central bank digital currency project. Available at: https://www.ledgerinsights.com/estonia-launches-central-bank-digital-currency-cbdc-digital-euro-project/.

**McKinsey Global Institute. 2016.** How digital finance could boost growth in emerging economies. Available at: https://www.mckinsey.com/featured-insights/employment-and-growth/how-digital-finance-could-boost-growth-in-emerging-economies.

**MEDICI Global. 2017.** 22 Companies leveraging blockchain for identity management and authentication. Available at: https://gomedici.com/22-companies-leveraging-blockchain-for-identity-management-and-authentication.

**Stanford Social Innovation Review. 2021.** When good algorithms go sexist: Why and how to advance AI gender equity. Available at: https://ssir.org/articles/entry/when_good_algorithms_go_sexist_why_and_how_to_advance_ai_gender_equity.

**UNCDF. 2017.** Building a backbone for the financial sector in Nepal. Available at: https://mm4p.uncdf.org/article/2483/building-a-backbone-for-the-financial-sector-in-nepal.

**UNCDF. 2021.** Accelerating financial inclusion in Nepal with RegTech — A case study on the Nepal financial inclusion portal. Available at: https://www.uncdf.org/

article/6523/accelerating-financial-inclusion-in-nepal-with-regtech.

**World Bank Blog. 2017.** "Leveraging 'suptech' for financial inclusion in Rwanda", June 8. Available at: https://blogs.worldbank.org/psd/leveraging-suptech-financial-inclusion-rwanda.

## CENTRAL BANK DOCUMENTS

**Bank of England. 2020.** Eleni Kalamara, Arthur Turrell, Chris Redl, George Kapetanios and Sujit Kapadia. Staff Working Paper No. 865. Making text count: economic forecasting using newspaper text. Available at: https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2020/making-text-count-economic-forecasting-using-newspaper-text.pdf?la=en&hash=E81EC91956CEA4FC6F63C4DC5942F0E9D4580558

**Central Bank of Nigeria. 2017.** Bank verification number (BVN) enrollment for customers. Available at: https://www.cbn.gov.ng/Out/2017/OFISD/CIRCULAR%20ON%20BVN%20OF%20OFIs0001%20(3).pdf.

**Central Bank of Nigeria. 2017.** The regulatory framework for bank verification number (BVN) operations and watch-list for the Nigerian financial system. Available at: https://www.cbn.gov.ng/Out/2017/BPSD/Circular%20on%20the%20Regulatory%20Framework%20for%20BVN%20%20Watchlist%20for%20Nigerian%20Financial%20System.pdf.

## DATA PORTALS

**Nepal Rastra Bank.** Financial inclusion dashboard. Available at: https://emap.nrb.org.np/.

**UNCDF. 2018.** Nepal financial inclusion portal. Available at: https://www.uncdf.org/article/4158/nepal-financial-inclusion-portal.

**World Bank.** Financial inclusion. Findex Data, 2017. Available at: https://www.worldbank.org/en/topic/financialinclusion/overview.

## FACT SHEETS

**AIIM.** What is robotic process automation? Available at: https://www.aiim.org/what-is-robotic-process-automation.

**Amazon Web Services.** What is a data lake? Available at: https://aws.amazon.com/big-data/datalakes-and-analytics/what-is-a-data-lake/.

**Forbes. 2018.** Bernard Marr. What Is a data lake? A super-simple explanation for anyone. Available at: https://www.forbes.com/sites/bernardmarr/2018/08/27/what-is-a-data-lake-a-super-simple-explanation-for-anyone/?sh=13c8ced476e0.

**IBM.** Cloud computing: A complete guide. Available at: https://www.ibm.com/cloud/learn/cloud-computing-gbl.

**Microsoft Azure.** What is cloud computing? A beginner's guide. Available at: https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/.

## FINANCIAL AUTHORITIES

**Financial Stability Board (FSB). 2021.** FinTech. Available at: https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/fintech/.

**Joint Committee of the European Supervisory Authorities (ESAs).** European Forum for Innovation Facilitators (EFIF). Available at: https://esas-joint-committee.europa.eu/Pages/Activities/European-Forum-for-Innovation-Facilitators-(EFIF).aspx.

## REPORTS AND STUDIES

**ADB. 2021.** Cloud-based core banking in the Philippines: A rural bank pilot project, September 2021. Available at: https://www.adb.org/publications/cloud-based-banking-philippines-rural-bank-project.

**BFA Global. 2018.** Financial authorities in the era of data abundance RegTech for regulators and SupTech solutions. Available at: https://bfaglobal.com/wp-content/uploads/2020/01/R2AWhitePaper.pdf.

**BFA Global. 2020.** Adopting SupTech for anti-money laundering: A diagnostic toolkit. Available at: https://bfaglobal.com/wp-content/uploads/2020/06/R2A-AML-SupTech-Toolkit-04June2020-1.pdf.

**CGAP. 2017.** Denise Dias and Stefan Staschen. Data collection by supervisors of digital financial services. Working paper. Available at: https://www.cgap.org/sites/default/files/Working-Paper-Data-Collection-by-Supervisors-of-DFS-Dec-2017.pdf.

**Deloitte. 2018.** Risk powers performance Systematic Integrity Risk Analysis (SIRA) — Clear insight into your integrity risks. Available at: https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/risk/deloitte-nl-risk-sira-clear-insight-into-integrity-risks.pdf.

**Ernst & Young. 2019.** Regulatory technology (RegTech) Navigating the right technology to manage the evolving regulatory environment. Available at: https://assets. ey.com/content/dam/ey-sites/ey-com/en_us/topics/ financial-services/ey-regulatory-technology-regtech. pdf?download.

**Financial Conduct Authority. 2016.** Feedback statement. Call for input on supporting the development and adopters of RegTech. Available at: https://www.fca.org.uk/publication/feedback/fs-16-04.pdf.

**Financial Stability Board. 2020.** The use of supervisory and regulatory technology by authorities and regulated institutions. Market developments and financial stability implications. Available at: https://www.fsb.org/wp-content/uploads/P091020.pdf.

**Financial Stability Institute. 2018.** Dirk Broeders and Jermy Prenio. Innovative technology in financial supervision (SupTech) — the experience of early users. FSI Insights on policy implementation No. 9. Available at: https://www.bis.org/fsi/publ/insights9.pdf.

**Financial Stability Institute. 2019.** Rodrigo Coelho, Marco De Simoni and Jermy Prenio. SupTech applications for anti-money laundering. FSI insights on policy implementation No. 18. Available at: https:// www.bis.org/fsi/publ/insights18.pdf.

**Financial Stability Institute. 2019.** Simone di Castri, Stefan Hohl, Arend Kulenkampff and Jermy Prenio. The SupTech generations. FSI insights on policy implementation No. 19. Available at: https://www.bis. org/fsi/publ/insights19.pdf.

**Gurung, Nora and Perlman, Leon,** Use of Regtech by Central Banks and its impact on financial inclusion (November 16, 2018). Available at: https://papers.ssrn. com/sol3/papers.cfm?abstract_id=3285985.

**Knill and Tolsun, 2008.** The policymaking lifecycle. Available at: https://www.researchgate.net/ publication/30014974_Policy_making.

**PwC. 2019.** Estonia — the digital republic secured by blockchain. Available at: https://www.pwc.com/gx/en/ services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf.

**RegTech for Regulators Accelerator (R2A).** Case study: Chatbot prototype. Available at: https://www. r2accelerator.org/chatbot-prototype-1.

**Toronto Centre. 2017.** FinTech, RegTech and SupTech: What they mean for financial supervision. Available at: https://res.torontocentre.org/guidedocs/FinTech%20 RegTech%20and%20SupTech%20-%20What%20They%20 Mean%20for%20Financial%20Supervision%20FINAL.pdf.

**World Bank and CCAF. 2020.** The global Covid-19 FinTech regulatory rapid assessment report, World Bank Group and the University of Cambridge. Available at: https://www.jbs.cam.ac.uk/wp-content/ uploads/2020/10/2020-ccaf-report-fintech-regulatory-rapid-assessment.pdf.

# APPENDIX

## LIST OF ORGANIZATIONS INTERVIEWED

> Bangko Sentral ng Pilipinas, Philippines

> Bank of Ghana

> Bill & Melinda Gates Foundation

> CNBV Mexico

> European Banking Authority

> Monetary Authority of Singapore

> Nepal Rastra Bank

## SUMMARY OF SELECTED CASE STUDIES

| COUNTRY | IMPLEMENTING ACTOR | DESCRIPTION | TECHNOLOGIES INVOLVED | CORRESPONDING THEME(S) |
|---|---|---|---|---|
| GHANA | Bank of Ghana | Implemented an integrated financial surveillance system to track loans taken by women and men. | AI, ML, big data | Women's financial inclusion. |
| INDIA | Unique Identification Authority of India (UIDAI) | Provides a unique identity number to residents of India, and resident's Aadhaar number is linked to their demographic and biometric information, which is stored in a centralized system. | KYC utility | Data collection, usage and management. |
| MEXICO | The National Banking and Securities Commission in Mexico | Partnered with R2A and tech vendor Gestell to develop new data infrastructure and a data storage platform that can house transactional data submitted by supervised entities through APIs. | API, data warehouse | Detection and prevention of financial crime. |
| NEPAL | Nepal Rastra Bank | Helps track financial progress in the country through a financial inclusion portal. | GIS | Data collection, usage and management. |
| NIGERIA[79,80] | Central Bank of Nigeria | Assigned users Bank Verification Numbers (BVN), a unique identification number that can be used to track bank transactions and identify theft and fraud. Created a centralized database of fraud data for banks to verify watch-listed individuals. | API, data warehouse, biometrics | Data collection, usage and management. Prevention of financial crimes. |
| PHILIPPINES | BSP | Chatbot commissioned NLP and AI/ML to help enable consumer protection in the Philippines. | API, NLP, AI, ML | Consumer protection and market conduct. |
| RWANDA | National Bank of Rwanda (BNR) | BNR developed an electronic data warehouse (EDW system) for automating and streamlining reporting processes. | Data warehouse | Data collection and management. Remote supervision and reporting. |
| UNITED KINGDOM [81] | Bank of England[82] | Published a paper that showed how machine learning tools could be used to extract timely economic signals from newspaper text. The report found that "these improvements are most pronounced during periods of economic stress when, arguably, forecasts matter most".[83] | NLP, ML | Emergencies and crises. |

79  Central Bank of Nigeria. 2017. The regulatory framework for bank verification number (BVN) operations and watch-list for the nigerian financial system. Available at: https://www.cbn.gov.ng/Out/2017/BPSD/Circular%20on%20the%20Regulatory%20Framework%20for%20BVN%20%20Watchlist%20for%20 Nigerian%20Financial%20System.pdf.

80  Central Bank of Nigeria. Bank verification number (BVN) enrollment for customers. Available at: https://www.cbn.gov.ng/Out/2017/OFISD/CIRCULAR%20 ON%20BVN%20OF%20OFIs0001%20(3).pdf.

81  Bank of England. 2020. Eleni Kalamara, Arthur Turrell, Chris Redl, George Kapetanios and Sujit Kapadia. Staff working paper No. 865. Making text count: economic forecasting using newspaper text. Available at: https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2020/making-text-count-economic-forecasting-using-newspaper-text.pdf?la=en&hash=E81EC91956CEA4FC6F63C4DC5942F0E9D4580558.

82  Central banking. 2020. The winners of the 2020 FinTech and RegTech global awards. Available at: https://www.centralbanking.com/awards/7703456/the-winners-of-the-2020-fintech-and-regtech-global-awards.

83  Bank of England. 2020. Eleni Kalamara, Arthur Turrell, Chris Redl, George Kapetanios and Sujit Kapadia. Staff working paper No. 865. Making text count: economic forecasting using newspaper text. Available at: https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2020/making-text-count-economic-forecasting-using-newspaper-text.pdf?la=en&hash=E81EC91956CEA4FC6F63C4DC5942F0E9D4580558.