REGTECH FOR REGULATORS ACCELERATOR

An AML SupTech Solution for the Mexican National Banking and Securities Commission (CNBV)

R²A Project Retrospective and Lessons Learned

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The RegTech for Regulators Accelerator (R²A)

The RegTech for Regulators Accelerator (R²A) partners with leading financial sector authorities to pioneer the next generation of tools and techniques for regulation, market supervision, and policy analysis. Accessing new datasets and analyzing available data more effectively allows financial authorities to establish a body of knowledge and evidence to drive smart policy reforms that promote financial inclusion and ensure financial stability, integrity, and consumer protection. R²A accelerates these advances by helping authorities re-imagine how they collect and manage data, and by prototyping new solutions that strengthen their capabilities. Through R²A, partner financial authorities seek to harness technology to improve the speed, quality, and comprehensiveness of information in support of targeted, risk-based decision-making.

Launched in October 2016, R²A has already partnered with the Bangko Sentral ng Pilipinas (BSP) and the Mexican Comisión Nacional Bancaria y de Valores (CNBV) to develop and test next-generation prototypes that can serve as examples for other supervisors and regulators. R²A also engages closely with technology innovators to create structured opportunities for them to propose solutions and collaborate with financial authorities in the design and testing of promising ideas.

Acknowledgements

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"As a result of the partnership with R²A, CNBV has strengthened tech-oriented innovation for market supervision."

Foreword

The presence of financial technology (fintech) is increasingly ubiquitous and today's financial landscape bears little semblance to previous decades. Those regulating and supervising this sector must now contend with traditional financial service providers that adopt new technologies and processes, a rapidly emerging fintech sector, and a greater number of consumers that handle their finances by computer or smartphone. The speed and scale of this evolution is breathtaking, complicating an adequate and timely response from regulatory and supervisory bodies.

How regulatory bodies around the world respond to fintech's rise will have a lasting impact. The perennial challenge of balancing financial stability and innovation has become even more critical as regulators grapple with how to tackle such a disruptive force.

As a leading fintech hub in Latin America, Mexico has recognized the importance of embracing a more digital economy. Last March, we were among the first in the world to pass a fintech law that established a regulatory framework for fintech firms, providing greater clarity around the growth of firms that employ financial technologies. At the Comisión Nacional Bancaria y de Valores (CNBV), we have established two new vice presidencies one in cybersecurity and one in fintech which will oversee the burgeoning fintech sector in Mexico. This will afford CNBV a granular understanding of risks and opportunities presented by new and old actors alike.

Working together over the past two years with the RegTech for Regulators Accelerator (R²A), CNBV has taken concrete steps to be at the forefront of innovation in supervision. I welcome this case study with great optimism for the promise that supervisory technology holds given that an ever-changing digital financial landscape requires regulators to be nimble and adaptable.

New and innovative tools like the prototype developed with R²A, Gestell, and CNBV offer immense potential to not just regulatory bodies' capabilities, but also financial service providers and consumers. This is especially true in anti-money laundering, where our partnership with R²A represents a key step in enhancing our ability to uncover and identify suspicious activities, preserving the integrity of the financial system, and welcoming those who have been financially excluded to participate in this rapidly evolving ecosystem.

Bernardo González Rosas, President CNBV
Mexico City, September 2018

Table of contents

1 Context: Fintech poses new AML challenges

Mexico's financial technology (fintech) ecosystem is flourishing. In 2017 alone, it grew by 55% to become the region's leader in terms of the number of companies operating in this space.[1] Explosive growth is being driven by a combination of deepening mobile penetration and enabling reforms to financial and telecommunication regulation. Building on successive sectoral reforms launched in 2014, Mexican financial authorities introduced a pioneering fintech law in 2018 that seeks to create a level playing field for financial service providers (FSPs) and startups, and bolster consumer protection.[2] Its enactment is likely to underpin continued strong growth in financial innovation going forward.

Financial innovation is unlocking pent-up demand for financial services from a historically underserved population. Despite being the second largest economy in Latin America, Mexico trails many of its regional and Organization for Economic Cooperation and Development (OECD) peers in many measures of financial penetration and inclusion by substantial margins.[3] Persistent financial exclusion is rooted in Mexico's high rates of business informality, sluggish economic growth, high market concentration in financial services and telecommunications, and regulatory burden. Fintech, together with a supportive regulatory environment, promises to remove long-standing barriers to financial access and inject new dynamism into the financial sector.

At the same time, the rise of digital financial products and services poses new challenges for Mexico's financial authorities. Traditional methods and models of capturing and analyzing regulatory data are ill-suited to cope with the surfeit of data being generated by new platforms, products, and customers. The prevalence of manual processes and outmoded technology in anti-money laundering (AML) is a particular concern. The added workload of having to screen vast quantities of digital transactional data for suspicious activity, as well as to audit a host of new providers through on-site inspections, threatens to overwhelm already stretched supervisory resources. Additionally, new fintech potentially opens up more avenues for money laundering and illicit behavior that are harder to uncover.

Money laundering is an especially salient issue for Mexico given the country's relatively high levels of crime and informality, which amplify the risk that illicit proceeds are rechanneled into the formal economy. As the International Monetary Fund (IMF) notes in its 2018 assessment of Mexico's compliance with the Financial Action Task Force (FATF) recommendations: "Mexico has a mature AML/CFT regime, with a correspondingly well-developed legal and institutional framework...It is nonetheless confronted with a significant risk of money laundering stemming principally from activities most often associated with organized crime, such as drug trafficking, extortion, corruption and tax evasion."[4] Several high-profile cases have highlighted the magnitude and pervasiveness of the problem, notably the revelation in 2012 that the local branch of HSBC had laundered over USD 800 million in drug trafficking money.[5] This and other incidents revealed major lapses in internal AML controls and external supervision.

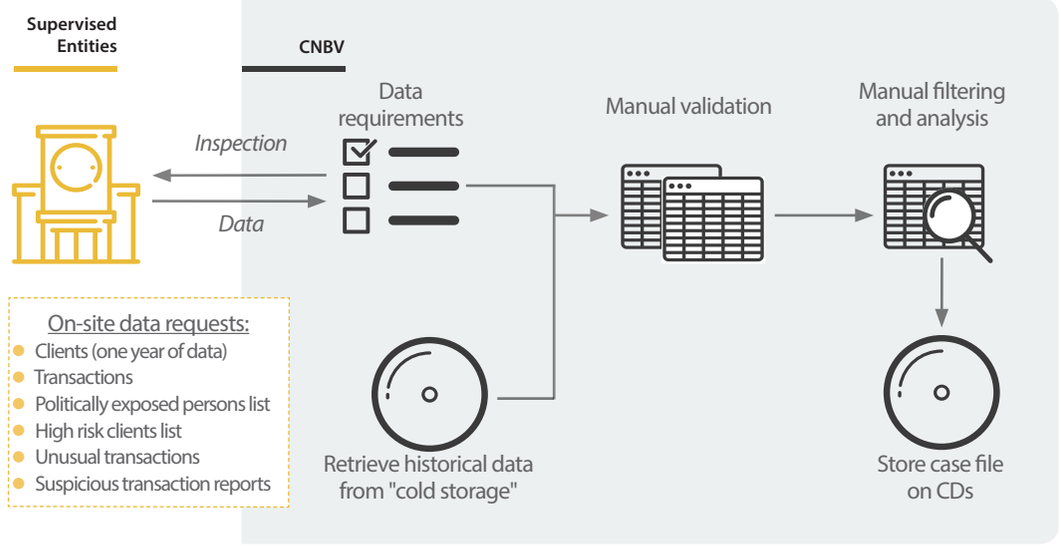
To prevent AML from becoming a regulatory bottleneck and stunting the growth of fintech, Mexican financial authorities are exploring regulatory technology (RegTech for Regulators, RegTech^2) and supervisory technology (SupTech) solutions that leverage the same tools and innovations that are giving rise to fintechs.[6] In this context, the Comisión Nacional Bancaria y de Valores (CNBV) approached the RegTech for Regulators Accelerator (R^{2}A) in 2017 for assistance in developing a market-ready AML solution. The outcome of the engagement consist of a data request and storage platform as well as tools for data-driven metrics and insights. This forms the foundation for a central data warehouse architecture for AML supervision that can accommodate new fintechs while protecting consumers and safeguarding the stability of the financial system.

This case study showcases the prototype developed in collaboration with CNBV and illustrates the co-creation process that took place over the course of fourteen months.

2 Diagnosing CNBV's AML reporting and monitoring pain points

The CNBV's current approach to AML supervision combines (a) off-site assessments based on routine regulatory reporting with (b) a risk-based approach to on-site inspections.[7] The former requires that all supervised FSPs file periodic reports with the CNBV's AML compliance department and the Financial Intelligence Unit (FIU) housed within the Ministry of Finance (SHCP). According to the current data collection process, relevant data is extracted from core banking systems and formatted to meet the specific reporting requirements of the CNBV and FIU. The FIU receives suspicious transaction reports (STR) that are generated by the FSPs' approved internal AML risk models. The CNBV collects customer and transactional statistics and runs them through its risk scoring model.[8] Those scores, in turn, provide the basis for prioritizing FSPs for on-site inspection by CNBV's AML unit. That is, because the CNBV's 82 full-time supervisors (plus 17 temporary staff) cannot possibly visit all 3,300 FSPs they oversee every year, they concentrate on those institutions with risk profiles that indicate a higher vulnerability to money laundering.[9] The inspections entail scrutiny of the FSPs AML processes and models to test their accuracy and effectiveness, and to assess compliance with regulation.

FIGURE 1. CNBV's existing AML workflow



Source: CNBV

CNBV's risk-based approach to AML supervision accords with the best-practice principle of proportionality in that the level of supervisory scrutiny corresponds to FIs' AML risk profiles. However, with around 2,000 FSPs categorized as medium- to high-risk, its strict application would entail many more on-site visits than are feasible with currently available resources. Inefficiencies in the AML data architecture are an added constraint, causing delays and detracting from more productive auditing work. Major pain points can be found in every step of AML supervision:

1. **Data extraction:** Entities do not always fully comply with CNBV's reporting requirements, at times submitting incomplete, erroneous, or improperly formatted AML reports. Furthermore, information is retrieved by supervisors during lengthy on-site visits, but can only be verified upon their return to the CNBV. Fixing errors, emissions, and formatting causes significant delays in the preparation of reports and validation of data submissions.

2. **Data transmission:** Transactional data is sent in plain text or spreadsheets via email or CDs from supervised institutions. This limits the size of files that can be sent, as well as being inherently insecure and operationally risky (e.g., a file might mistakenly be sent to the wrong recipient).

3. **Data storage:** Historical records of supervised entities are currently stored in diverse formats and on disjointed databases, including approximately 1,200 CDs and paper files. This makes loading data a largely manual and therefore very time-consuming task. There is no practical way to get a complete historical view of a given supervised entity, or a cross-entity view of a group of supervised entities.

4. **Data analysis:** Following from the prior pain point, loading data from "cold storage" for purposes of analysis can be exceedingly cumbersome. The reliance on Excel is another constraint since the size limits of files and spreadsheets is often less memory than is needed for analysis of granular transactional data, let alone more complex data mining or predictive analysis. It is also limited in the types of statistical models that can be applied and visualizations that can be generated.

The cumulative effect of these pain points is that there is no efficient way to draw deep insights from existing data, to inform onsite visits or otherwise.

The wider repercussions of potential lapses in oversight are more serious. Money laundering enables and reinforces the illicit activities that give rise to it. It amplifies the returns from criminal activity and increases the operational capacity of criminal organizations. It corrupts all areas of the economy, society, and political system that it touches, and complicates the ability of financial authorities to fulfill their mandates. Thus, money laundering distorts and undermines confidence in local financial markets, making it harder to accurately measure systemic risks and preserve financial stability.[10] It is also implicated in the de-risking of cross-border correspondent banking relationships, a relatively recent phenomenon that has disrupted vital remittance flows and encouraged the use of informal banking channels.[11]

On the flipside, tackling money laundering can have large positive spillovers effects, crucially by making it harder to engage in organized crime, corruption, and tax evasion. Fintech, RegTech^2, and SupTech are powerful tools to this end. Digital financial services such as e-commerce and e-payments create digital identities and histories that are more transparent and traceable than cash.[12] They also encourage formalization and financial inclusion by being more ubiquitous, convenient, and affordable than their counterparts. Reducing the size of the informal sector and cash economy brings more transactions and customers into the supervisors' purview. RegTech^2 and SupTech ensure that these digital flows are adequately regulated and supervised, in addition to augmenting regulators and supervisors' money laundering detection capabilities. The following section illustrates how such an AML solution takes shape, and how it can transform the balance of power in the fight against financial crime.

3 The R²A process: Seven steps to building a prototype

The R²A process describes the particular *modus operandi* employed by the R²A team together with its partners for the co-creation of RegTech²/SupTech solutions. It can be broken down into seven steps (see Figure 2). What follows is a short description of how the process was implemented in Mexico.

FIGURE 2. R²A's seven-step project roadmap

1	**INCEPTION** Building Trust and Commitment	• Converge around overarching vision and goals • Demonstrate commitment to data-driven, tech-enabled approach • Formal commitment by the head of the financial authority • Ensure alignment between technical teams and management
2	**USE CASE** Value Proposition Analysis	• Agree on an appropriate RegTech²/SupTech use case • Diagnose "pain points" during in-country workshops • Identify "pain relievers" and set corresponding objectives • Craft solutions (in low fidelity) that can address challenges
3	**GOVERNANCE** Defining Project Parameters	• Define roles and duties of project stakeholders • Delineate project scope • Identify resources and capacity constraints • Agree on a draw project timeline and workplan
4	**DESIGN** Proof of Concept	• Undertake a "design sprint" to agree on key design features • Use dummy data, barebones technology, and mockup visualizations to demonstrate project feasibility • Draft intelligible functional requirement and technical specifications
5	**RESOURCING** Pairing Sponsors with Tech Providers	• Choose vendor selection model that best fits project's need • Provide vetting criteria and/or competent judges to evaluate, select, and contract vendors • Settle legal, contractual, financing questions
6	**PROTOTYPING** Iterative Testing & Development	• Use the "lean" approach to accelerate testing and development • Apply "rapid learnings" from each iteration to progressively refine the project • Frequent check-ins with stakeholders and course corrections
7	**PRODUCTION** Taking the Product to Market	• Decision point on whether to launch the prototype • Learnings and lessons are documented (consent permitting) • Disseminate via conferences, workshops, working groups, webinars

Source: R²A

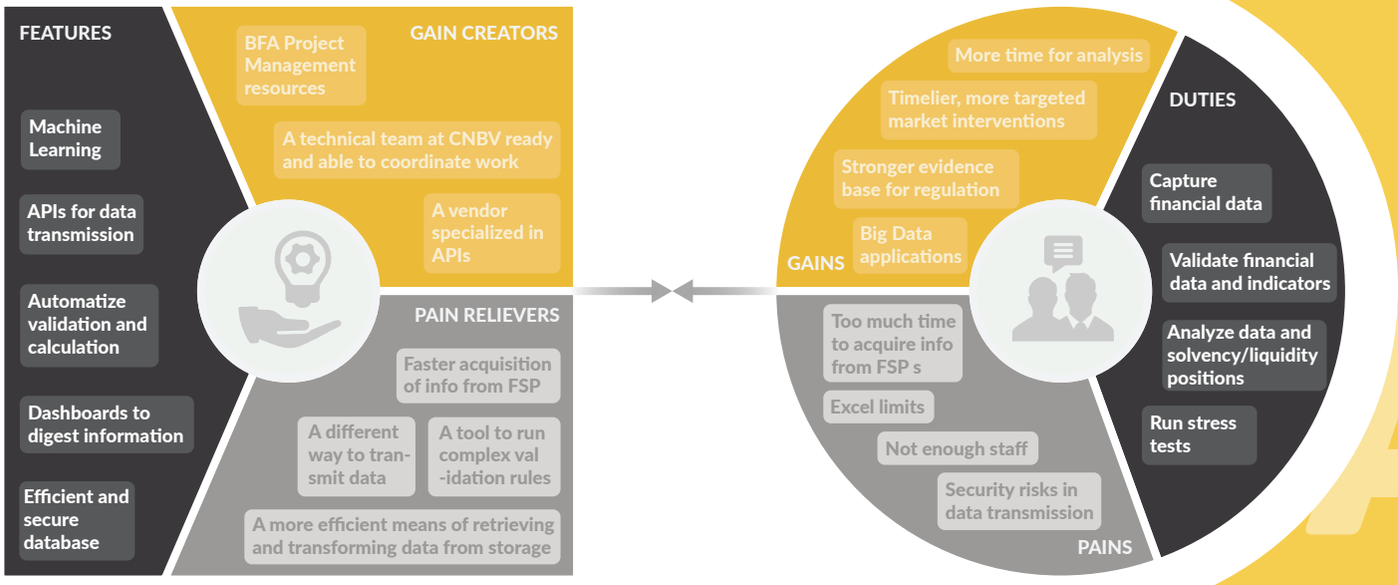
Step 1 Inception: Building trust and securing commitment

The first task of any prospective R²A engagement is to establish a sufficient degree of confidence that the financial authority is open to (a) exploring data-driven and technology-enabled solutions to its supervisory challenges and (b) able to carry the project through to completion. Fortunately, when representatives of the CNBV approached R²A in February of 2017 with an interest in RegTech², the Mexican financial authorities could already point to numerous successful projects and policy initiatives that underscored their commitment, including a financial inclusion strategy, Digital Mexico strategy, and Fintech Law.[13] In particular, CNBV in coordination with the Central Bank (Banxico) introduced a fintech law in 2017 with the aim of enhancing consumer protection and mitigating financial stability risks without unduly burdening the budding Mexican fintech industry. For the CNBV, the prospective RegTech² solution would support its broader mission of fostering the digital financial ecosystem. It accordingly received strong backing from the bank's top leadership. A letter of commitment from former President of CNBV, Jaime González Aguadé, pledged the necessary resources to make the project a priority. Such high-level buy-in was crucial to ensuring the success of the project.

Step 2 Use case: Value proposition analysis

The AML solution was one of several possible RegTech²/SupTech projects under consideration by CNBV and R²A at the outset of the engagement. Other use cases included tools to manage the licensing of financial service providers or to upgrade the existing prudential reporting system. R²A organized a brainstorming session with its technologists, policy experts, and CNBV stakeholders where the different R²A projects were assessed in terms of their expected impact, technical and operational feasibility, and overall strategic fit. An analytical framework widely employed in technology circles helped to articulate the value proposition of the solutions in terms of pain points and corresponding technological "pain relievers" (see Figure 3).[14] On key criteria, the AML solution came out on top. In particular, the efficiency gains from streamlining complaints handling promised to free up significant resources that could be directed to other projects. Furthermore, given its novelty, the AML application would serve to validate and showcase the transformational power of RegTech²/SupTech.

FIGURE 3. Value proposition analysis



Source: R²A, Osterwalder et. al 2015

Step 3 Governance: Defining project parameters

Having secured commitement from all stakeholders and agreed on the use case, the next step was to draft a project charter that delineated the scope of work and leve of effort by the R²A and CNBV teams. In it CNBV and R²A pledged to collaborate on designing, developing, and testing a market-ready AML supervision solution over a fourteen-month period. While a fully-fledged product was not in scope, the prototype would provide a basis for assessing the viability, scalability, and desirability of rolling out the prototype to the wider market.

The charter also assigned roles and responsibilities to project stakeholders. R²A would provide technical specialists to guide design and development, a project manager to ensure effective implementation and facilitate coordinatiovn, and financing for the vendor selection process and award. CNBV, for its part, designated an executive champion to act as the project sponsor to advise on the project's strategic direction and sign off on major milestones. CNBV would also assign a Project Lead to serve as the day-to-day activity manager and liaison with the R²A team and the vendor.

Step 4 Design: Proof of concept

During this step of the process the R²A team typically conducts a "design sprint" with the aim of sketching a rough blueprint for subsequent development work.[15] In this instance, the CNBV had already conceived of a prototype that would use application programming interfaces (APIs) for data gathering and SQL databases for storage — two technologies that are largely standardized and widely regarded as best practice for those purposes. Rather than reinventing the technology, the challenge of this project was to apply them to the Mexican context and to satisfy CNBV's strict security protocols.

R²A's technologists and policy experts worked closely with the CNBV to translate their needs and desires regarding data architecture, data security, and visualizations into concrete functional and technical specifications that would be intelligible to future developers (selected in Step 5). The core functional requirements were as follows:

i. A central platform to generate standardized, automated requests to supervised entities, and accept the responses via API and feed them into the centralized data store.

ii. A process and mechanism for importing existing historical records from "cold storage" into the central data store.

iii. Cutting-edge analytical tools (e.g. algorithms, notifications, dashboards) to analyze and present key metrics from the centralized data store, focusing on institutional change across time and pan-entity analysis within a group.

In addition to these base components, CNBV and R²A staff explored additional analytical applications that could leverage the trove of data that would be stored in the newly optimized platform. In particular, machine learning models and recommendation engines could augment CNBV staff's capability to detect and monitor suspicious financial activity.

Step 5 Resourcing: Selecting a tech vendor

A crucial role played by the R²A team in the co-creation process involves pairing financial authorities with competent technology vendors capable of delivering a prototype to specification. A variety of matchmaking methods are available for this purpose, including competition prizes, "hackathons," and bootcamps.[16] For CNBV's project, a Request For Proposals (RFP) was deemed appropriate given the relatively strict functional and security requirements of the prospective solution. R²A arranged a global bidding round for a US$ 100,000 grant. This would cover all of the applicants expenses related to the development and testing work, including staff time, hardware, software, travel and all other project-related expenses.

The RFP attracted seven submissions from six different countries (including two local vendors) over the course of one month. During the first round of screening, expert technologists chosen by R²A evaluated applications according to six rank criteria. The first three assessed the applicants in terms of their (1) relevant experience in building large public-facing APIs and Big Data technologies, (2) technical and managerial expertise, and (3) adequacy of staff resources. The second part evaluated the proposals based on their (4) responsiveness to the requirements spelled out in the RFP, (5) the feasibility of the execution plan, and (6) creativity of their proposed RegTech[2] solutions. The top three firms in the ranking were shortlisted for the second round, during which a panel of three reviewers (independent experts chosen by R²A, see Box 2) reviewed the applications and scored them anew. The firm with the highest score was declared the winner — namely local Mexican firm Gestell (see Box 2).[17]

FIGURE 4. R²A's Panel of Judges

Louis De Koker
Professor at La Trobe Law School

Ken Miller
Ex-PayPal Executive

Leisa Reichelt
Head of Research and Insights at Atla`ssian

In order to facilitate contracting, R²A stood in as the intermediary counterparty to both CNBV and the vendor. In other words, the vendor and the CNBV contracted directly with R²A's fiscal sponsor (Rockefeller Philanthropic Advisors), rather than with one another. This effectively "de-risked" the engagement for both parties and enabled a speedier procurement process. During this contracting stage R²A also helped to settle important legal questions regarding data sharing and storage as well as the licensing of intellectual property.

Step 6 Prototyping: Iterative testing and development

With a blueprint in hand and a development team at the ready, the actual work of building a prototype could begin. Gestell selected the appropriate technology components in accordance with the technical and functional specifications elaborated by CNBV and R²A in step 4 and spelled out in the RFP. First the APIs needed to be integrated with client-side software, followed by back-end integration and API stress testing using dummy data. Best practices were followed for the encryption and storage components, as well as for the user experience of the data analytics and visualization dashboards. Once all the parts were assembled, the data streams could be turned on and the machine learning models could be calibrated. After the several iterations and rounds of testing with pilot data from participating financial institutions, the prototype was ready for handover.

Gestell met frequently with the CNBV throughout this period to troubleshoot issues and to ensure that development was proceeding in line with their expectations. As a testament to the power of "lean" production methods upon which the R²A process is based, these check-ins provided invaluable opportunities for course corrections and "rapid learnings." For instance, it was found the solution required many more application programming interfaces (APIs) than initially envisioned, but this meant that they would be easier to amend if data requests changed in the future. Similarly, CNBV evolved in its thinking on data storage and cloud computing during the process as a result of its close collaboration with Gestell. The prototype was delivered in July 2018.

Box 2: Vendor snapshot - Gestell

Location: Mexico
Founded: 2012
Background: Gestell was founded to empower financial institutions and other agencies by utilizing new technologies to create intelligent systems to make financial oversight and operations more efficient and less costly. The company has previously worked with the Mexican Notary Offices and various private-sector clients.

GESTELL

Relevant experience: Gestell staff have over fifteen years of experience working on public-sector information technology projects. Past projects and products include: algorithms to participate in central bank auctions, risk report outsourcing for brokerages and banks, algorithmic trading in shares and forex, and systemic risk models.
Team: Data scientists, data architects, data visualization engineers, project managers, documentation engineers, and subject matter experts.

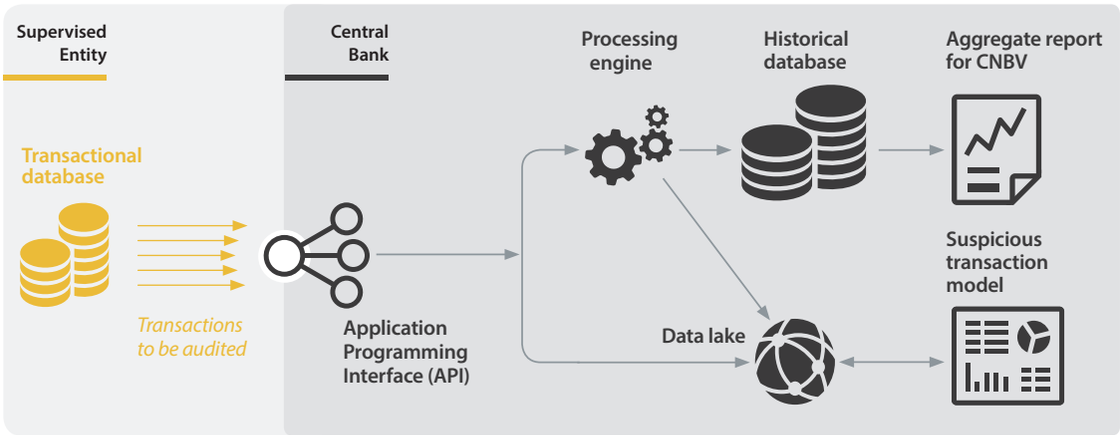
Step 7 Production: Taking the product to market

Once an R^2A prototype has been developed to the satisfaction of all stakeholders, a decision is made between the vendor and the financial authority on whether to adopt the product at scale. In the case of Mexico, repeated testing with live data had clearly demonstrated the AML solution's feasibility and value add, and CNBV began exploring how to roll out the solution country-wide.

4 The solution: An API-based AML data architecture and AI-driven analytics tool

The prototype that emerged from R²A's design and development process represented a fundamental re-engineering of CNBV's approach to AML supervision. It consisted of a mix of open-source, cost-effective (i.e., no licensing requirements), best-in-class technologies targeted at the various pain points of the existing reporting system. Together they formed a coherent, streamlined architecture for the (1) transmission, (2) processing, (3) warehousing, and (4) analysis of banks' transactional data. This section provides some color on each of these technical layers, and highlights the efficiency gains that are reaped by rationalizing and automating key aspects of the reporting process.

FIGURE 5. R²A/CNBV AML data architecture



Source: CNBV

1 Application programming interface (API)

The API establishes a secure, direct line of machine-to-machine data transmission between the supervised institutions' transactional databases and CNBV's processing engine. Raw data is "pushed" or "pulled" directly to CNBV's systems, providing the supervisor with the raw data as well as select suspicious transactions, and obviating the need for manually-populated spreadsheet templates, insecure email transmissions, or time-consuming CD submissions. What had previously taken days and weeks to collect could now be achieved in mere seconds (see Figure 6).

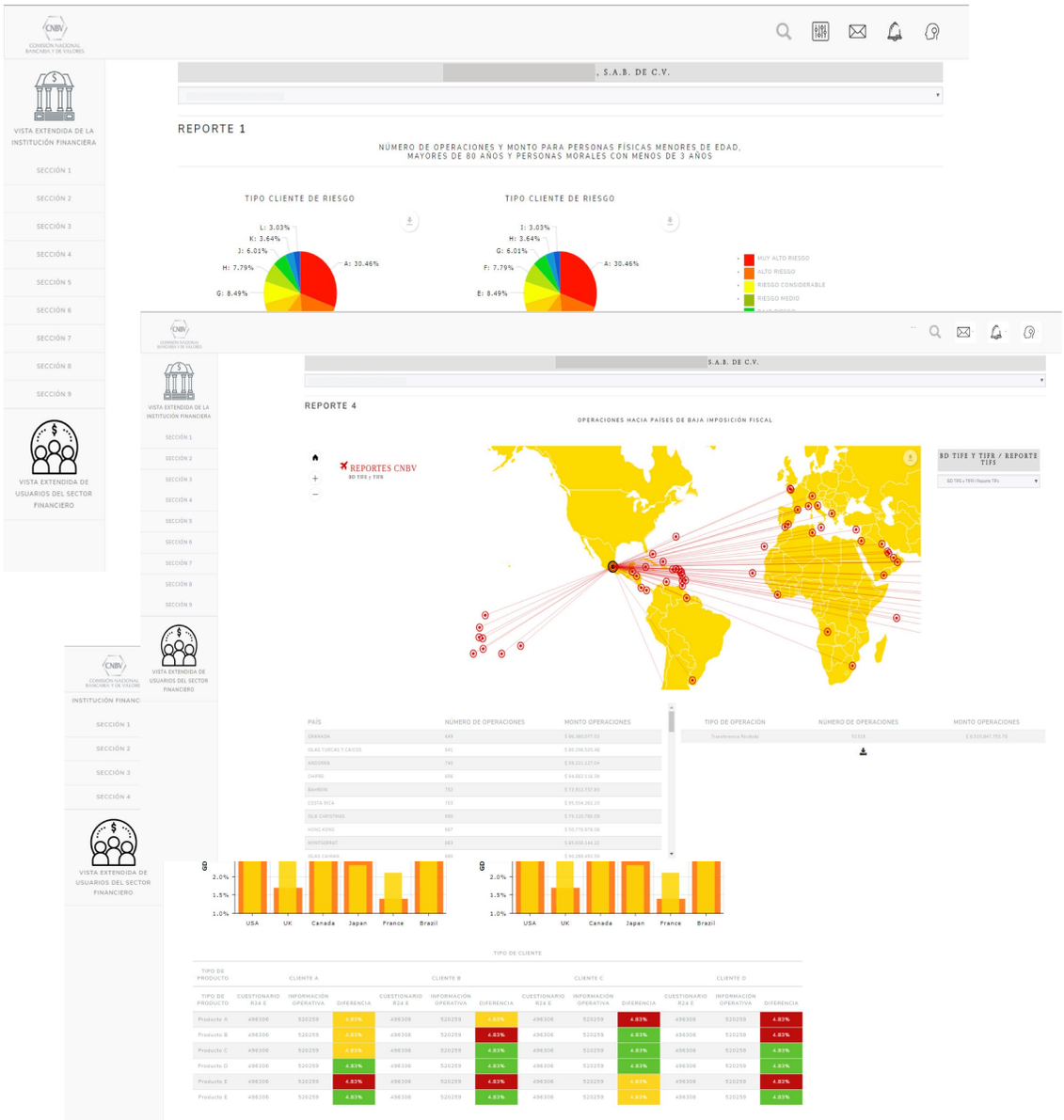
2 Processing engine

A processing engine receives the data and instantly runs validation tests in order to verify the quality, content, and structure of the reports. Incorrect or incomplete reports are automatically rejected. Having a single processing engine ensures that all tests are run uniformly, rather than on separate spreadsheets whose formulas may be inconsistent, broken, or out of date. It also allows for more complex number crunching than might be possible in Excel, and significantly cuts down on processing times.

3 Database

The processed data are funneled into a "data lake" for storage together with the original raw data and the AML model output data. Retaining all of the information that is streaming through the CNBV's platform ensures that all transformations can be traced back to the original source.[18] The lake also serves as a staging area for the historical data warehouse, the postgreSQL database where the "treated" data is stored for reporting and analysis. Whereas the old system housed the data in disjointed databases and physical filing cabinets, this architecture consolidates them into a single, access-controlled storage platform. The flow of data throughout the platform is controlled automatically through edge computing formulae, which cuts out manual workarounds and further enhances the efficiency of the solution.

FIGURE 6. Snapshot of CNBV's AML dashboard (proof of concept)



Source: Gestell (with mock up data)

4 Analytical tools

A centralized warehouse vastly expands the array of analytical and visualization tools that can be leveraged for AML. Those employed by this solution include:

1. **Dashboards** to visualize each FSPs AML risk exposure by type of client, product, and transaction. The dashboard reports are updated automatically as new information arrives, giving the CNBV a near real-time view of the AML risk landscape and an ability to drill-down into — and export — the underlying data.

2. **Artificial intelligence (AI)** to detect suspicious transactions using predictive analytics and machine learning techniques such as clustering, neural networks, logistic regression, and random forests. This enables the CNBV to find patterns and relationships that are invisible to the human eye, and potentially stop money laundering before it takes place.

3. **A machine learning model** that can recommend AML procedures/alerts based on the underlying risk exposures of FIs. For example, if a credit union is running the same AML risk as a commercial bank, then its AML models and procedures should be adapted accordingly. Early data mining results yielded 12 new transaction alerts that could be added to the current list.

4. **A watchlist tracker** that automatically cross-references FSP clients with individuals on watchlists (e.g., politically exposed persons, individuals sanctioned by the Office of Foreign Assets Control, etc.).

FIGURE 7. Key performance metrics

Prior reporting system	R^2A Prototype
Identifying transactions to low taxation jurisdictions	
1.5 working week	**0.01 seconds**
Identifying transactions by minors, adults older than 80 years old, and companies under 3 years of incorporation	
1 working week	**3 minutes**
Calculating lags between detection date and alert day	
3 working weeks	**15 seconds**
Identifying alerts that were not submitted to committee	
4 working days	**0.03 seconds**
Number of suspicious transaction alerts	
45 alerts	**57 alerts**

Source: Gestell

5 Conclusion

RegTech[2] and SupTech are poised to effect a paradigm shift in the fight against money laundering. RegTech[2]/SupTech-based data architectures that combine advanced data transmission, storage, and analytical technologies have the potential to dramatically enhance the accuracy, efficiency, and predictive power of traditional AML approaches, or supplant them altogether. In addition to automating many of the manual tasks in traditional methods, such as painstakingly reconciling FIs' suspicious activity reports, supervisors can now leverage Big Data applications to scrutinize the raw transactional and customer data themselves drawing on historical and real time data. Cutting down on preparation and travel time for data collection frees up time and resources for deeper off-site analysis and more frequent on-site inspections. Dynamic and interactive dashboards helps supervisors visualize data in novel ways and draw insights that might have been previously hidden, which also helps to make investigations more targeted. Similarly, innovative machine learning models allows regulators and supervisors to identify new patterns of suspicious activities not detectable by manual analysis.

CNBV's prototype developed under the auspices of R[2]A largely fulfills this vision. Early testing of the prototype has already demonstrated large efficiency gains that could be reaped from a full-scale roll-out of this solution, particularly in time saved from routine manual work. Data collection and processing that required weeks and days of manual work under the traditional approach can now be completed in minutes and seconds. New analytical models also delivered concrete results that supervisors can already use to improve anomaly detection. With more data mining and machine learning, these models are likely to uncover more illicit activity or even predict money laundering before it happens.

The potential impacts on Mexico's financial system and wider economy are profound. Tackling money laundering can have major knock-on effects on crime-fighting more broadly, chiefly by curtailing the ability of criminals to reinvest the proceeds into their business, or enjoy them otherwise. Cleansing the economy and financial markets of ill-begotten funds can lift confidence of investors and financial consumers. Clamping down on money laundering also benefits financial inclusion as it facilitates the implementation of the risk-based approach, which could lead to lower barriers to access for underserved Mexicans, and mitigates incentives for financial institutions to de-risk their correspondent relationships.

The CNBV AML project further served to validate R[2]A's model of collaborative co-creation through user-centric design and "lean" development. This iterative approach allowed the developers at Gestell and project managers at CNBV and R[2]A to spot potential problems early and make course corrections quickly. As a result, the prototype was delivered to the satisfaction of all stakeholders and within a relatively short timeframe. Furthermore, the emphasis on knowledge sharing and capacity building ensured that the groundwork had been laid for the upcoming roll-out of a full-scale product to the wider market.

Endnotes

[1] See Finnovista 2017, though Brazil recovered the top spot in 2018 (Finnovista 2018).

[2] The number of mobile broadband subscriptions grew by 194% between the second quarter of 2013 and the third quarter of 2017, according to the Instituto Federal de Telecomunicaciones (IFT), the telecoms regulator, covering 65% of the population.

[3] For instance, the percentage of Mexican adults (15 years and older) with a bank account was 36.9% in 2017, compared to an average of 94.7% for members of the Organization for Economic Cooperation and Development (OECD), of which Mexico is a member. The percentage of Mexican adults that borrowed from a financial institution was only 5.8%, compared to average of 19.9% for the OECD. See: Findex.

[4] See: International Monetary Fund, "Mexico: Detailed Assessment Report-Anti-Money Laundering and Combating the Financing of Terrorism," Country Report No. 17/405, January 2018.

[5] See: Reuters, "HSBC draws line under Mexican cartel case after five-years on probation," December 2017.

[6] RegTech for Regulator, RegTech^2, is distinguished from RegTech for supervised entities. See: Simone di Castri, Matt Grasser, and Arend Kulenkampff, "Financial Authorities in the Era of Data Abundance: RegTech for Regulators and SupTech Solutions," RegTech for Regulators Accelerator (R^{2}A) white paper, August 2018.

[7] International Monetary Fund (2018), *cit*.

[8] The CNBV also employs a second AML model that relies on the FIU reports rather than on a specific supervisory reporting framework. Furthermore, all FIs are also required to produce annual AML/CFT audits, undertaken by either their internal or external auditors.

[9] See: International Monetary Fund (2018), *cit*.

[10] SEGOB, SHCP, PGR, Banxico, and Poder Judicial de la Federación, "1ª Evaluación Nacional de Riesgos de Lavado de Dinero y Financiamiento al Terrorismo en México," October 2016.

[11] Michaela Erbenová, Yan Liu, Nadim Kyriakos-Saad, Alejandro López-Mejía, Giancarlo Gasha, Emmanuel Mathias, Mohamed Norat, Francisca Fernando, and Yasmin Almeida, "IMF Staff Discussion Note: The Withdrawal of Correspondent Banking Relationships: A Case for Policy Action," SDN/16/06, une 2016.

[12] Juan Antonio Ketterer, "Digital Finance: New Times, New Challenges, New Opportunities," IDB Discussion Paper IDB-DP-501, March 2017

[13] See: ENIF, Mexico Digital, and FinTech Law.

[14] Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, and Alan Smith, "Value Proposition Design: How to Create Products and Services Customer Want," John Wiley & Sons, January 2015.

[15] Design sprints are short (typically five days) but intense workshops aimed at answering critical questions through rapid prototyping and user testing.

[16] For more information of selection models, see: Simone di Castri, Matt Grasser, and Arend Kulenkampff, "The RegTech for Regulators Accelerator (R^{2}A) Process: Giving Financial Authorities Superpowers," RegTech for Regulators Accelerator (R^{2}A) paper, August 2018.

[17] See: https://gestell.co/.

[18] A data lake is a storage repository that holds a vast amount of raw data in its native format until it is needed. While a hierarchical data warehouse stores data in files or folders, a data lake uses a flat architecture to store data. A data lake shifts the traditional extract, transform, and load (ETL) workflow in data warehousing and analytics to a new extract, load, and transform (ELT) process where "streams" of structured and (crucially) unstructured data from various sources fill the lake without needing to be configured to meet the specific requirements of the platform. See: Roi Avinoam, "ETL vs ELT: The Difference is in the How," 2018.

BFA

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