



REGTECH FOR REGULATORS
ACCELERATOR

A Chatbot Application and Complaints Management System for the Bangko Sentral ng Pilipinas (BSP)

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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"RegTech for Regulators Accelerator Project has truly connected us with the possibilities that technology can provide to enhance and further support our work in financial supervision."

Foreword

We were thrilled to begin the relationship between the Bangko Sentral ng Pilipinas (BSP) and RegTech for Regulators Accelerator (R²A). The prospect of being at the forefront of a movement to embrace regulatory technologies, and of expanding our capability to use it, appealed to the BSP. Nearly two years later, our partnership has produced a prototype chatbot for consumer complaints handling. This places the BSP among the first central banks in the world to use such a tool. This is a necessity in an era when consumer information and sentiment can be processed and analyzed with increased speed and accuracy.

Digital, cost-efficient channels of communication are rendering the traditional tools and processes of central banks obsolete. In the Philippines, digitization is expanding financial access for both the unbanked and the underserved communities, slowly but surely transforming the financial landscape. Rather than stifle innovation, we are choosing to embrace it, and standing ready to future-proof our regulatory processes.

A decade ago, the chatbot prototype developed with R²A and the chosen vendor would be unthinkable. In today's connected world, the chatbot has significant potential to bring us closer to consumers than ever before—improving communication, reducing costs, and supporting timely enhancement of policies and enforcement of supervisory actions.

I commend R²A for advancing the RegTech agenda. The BSP welcomes this case study as an example of how RegTech solutions can revolutionize the way we perform central banking functions.

*Nestor A. Espenilla Jr., Governor, Bangko Sentral ng Pilipinas
Manila, September 2018*



Table of contents

1	Context: Rising need for consumer protection	4
2	Diagnosing the pain points of consumer complaints handling	5
3	The R ² A process: Seven steps to building a prototype	7
3.1	Step 1. Inception: Building trust and securing commitment	8
3.2	Step 2. Use case: Value proposition analysis	8
3.3	Step 3. Governance: Defining project parameters	9
3.4	Step 4. Design: Proof of concept	9
3.5	Step 5. Resourcing: Pairing financial authorities with tech providers	9
3.6	Step 6. Prototyping: Iterative testing and development	10
3.7	Step 7. Production: Taking the product to market	10
4	The solution: An AI-based complaints handling system	11
5	Conclusion	14

Context: Rising need for consumer protection

The Philippine banking sector is undergoing a profound transformation. Sustained rapid economic growth, increased competition, and a concerted effort by the government to boost financial inclusion are lifting the country's relatively low levels of financial penetration. Supportive regulation and digitization have helped traditional banks, electronic money issuers (EMIs), micro-finance institutions, and fintechs overcome longstanding physical and financial barriers to access, especially in previously underserved rural and remote areas. These improvements are reflected in measures financial inclusion: according to the World Bank's Global Findex, the portion of the population aged 15 years and over with access to an individual or shared formal financial account grew from 27% in 2011 to 34% in 2014 and 35% in 2017.¹ The trend towards deeper and wider financial penetration is set to continue as more enabling regulation is enacted, digitization permeates more of the financial value chain, and the Philippine fintech industry matures.

Mindful that rapid growth and innovation in financial services can be destabilizing if not appropriately regulated and supervised, the Central Bank of the Philippines (BSP) is seeking to ensure that its frameworks and methods keep pace with market developments. To this end, the Bank has formulated a three-pillared approach building on existing initiatives for (1) risk-based and proportionate regulation (e.g., alignment with Basel III standards on banking supervision), (2) active multi-stakeholder collaboration, and (3) consumer protection.² The last is especially salient in the context of emerging digital financial services where new fintech products and providers tend to have short track records and many first-time users have low financial literacy. These circumstances render consumers – especially low-income – vulnerable to unfair or abusive practices by financial service providers as well as financial frauds and scams. Furthermore, safeguarding consumer protection is crucial to inspiring confidence in digital financial services, and by extension ensuring its continued success in advancing financial inclusion.

While the spreading digital financial ecosystem is increasing the need for effective consumer protection, the capacity of BSP's existing complaints resolution mechanism to deliver that assurance is diminishing. The Bank's Financial Consumer Protection Department (FCPD) currently relies heavily on manual processes and relatively outdated technologies such as direct mail and call centers to field complaints or queries and provide resolution. These make it cumbersome for aggrieved consumers to access and burdensome for the BSP to operate. Furthermore, inadequate analytical tools and data storage capacity limit the actionable insights that can be derived from consumer complaints data.

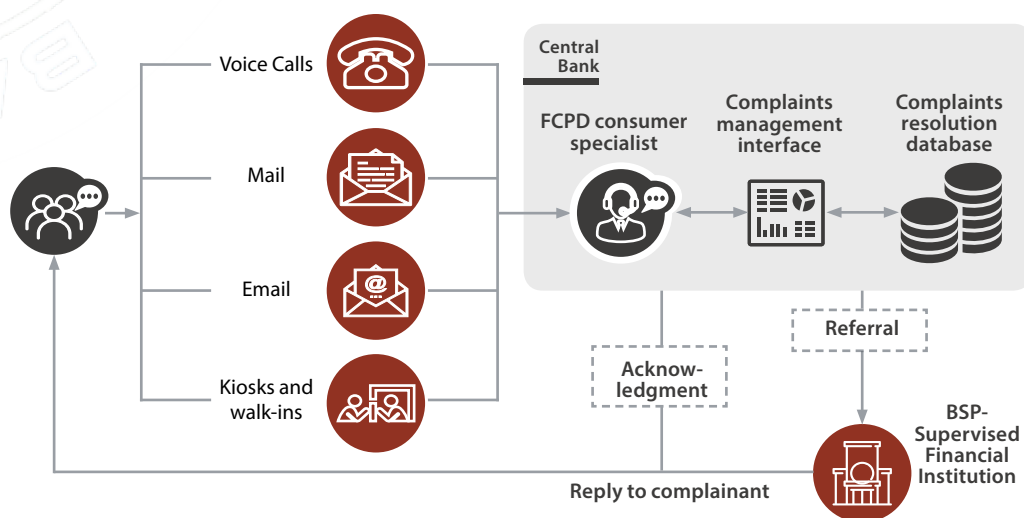
A pioneer in the regulatory and supervisory technology (RegTech for Regulators—RegTech² and SupTech respectively) space, the BSP recognized early that the same technologies that are powering fintech also contain the key to augmenting its consumer complaints management system (CMS).³ The application of Artificial Intelligence (AI) and Big Data to this use-case has the potential to relieve many of the pain points in complaints aggregation, processing, and analysis. By automating many manual processes and optimizing data management, a SupTech solution can unlock significant efficiency gains from the current CMS, reveal previously hidden patterns of consumer and firm behavior to aid ecosystem monitoring, and provide prudential supervisors with a powerful complementary early warning indicator of financial stress. Furthermore, improvements in user experience can encourage more customers to voice their grievances, thereby reinforcing the tool's relevance and effectiveness.

In this context, the BSP approached R²A in early 2018 to develop a prototype chatbot and processing utility solution to handle customer complaints. This case study showcases that solution and demonstrates how it generates significant efficiency gains and analytical insights for BSP.

2 Diagnosing the pain points of consumer complaints handling

The FCPD currently receives customer complaints and queries via voice calls, mail, e-mail, and walk-in kiosks (consumer assistance desks in BSP regional offices and branches). These are processed manually by complaints specialists, which fields incoming questions or complaints, files them digitally into a database, and updates the records as progress is made towards resolution. A complaints management interface, a simple applet that lives on the desktop of the FCPD's computers, is used by the complaints specialists and other team members to administer the complaints data. Finally, all records are stored in a complaints resolution database, including all data from the submission form, name of the representative who received the case, status of the complaint, etc.

FIGURE 1. BSP/FCPD's complaints handling process schema



Source: BSP

The complaints data architecture in its current form has a number of inefficiencies and limitations that cause undue hassle for consumers and impose administrative burdens on FCPD staff. First, the existing communication channels are becoming increasingly outdated in the context of rising mobile and internet penetration in the Philippines. The country is already known as the “texting capital of the world,” and with the rapid spread smartphones, instant-messaging applications are expected to grow in popularity relative to SMS.

Some of the existing channels presuppose a level of literacy (e.g., email) and often require a certain amount of infrastructure (e.g., telephone, post offices, walk-in kiosks, access to internet and email), which places them out of reach of low-income and rural Filipinos. The system therefore has a heavy urban and high-income bias. Hence, the majority of complaints originate within the Metro Manila area, whereas customers outside the capital have far fewer recourse options to address fraud or other issues. Even if more customer had ready access to the consumer assistance mechanism, the laborious nature of case management currently is a binding constraint on the BSP's ability to process large volumes of complaints, impairing its ability provide timely remediation. This can cause frustration and discourage usage of the consumer assistance mechanism.

A major pain point on the receiving end of the complaints process is the lack of an efficient means to store and retrieve complaints data. This stems in large part because complaints submitted by direct mail, voice calls, or in person must be manually input into the system. Human data entry is inherently error prone and time consuming. Much information is also omitted. As a consequence, the complaints resolution database suffers from some incomplete, inconsistent, and inaccurate information, plus there is often a considerable lag between the filing of complaints and their resolution.

Box 1: Pain points in the consumer complaints process

Consumers' perspective:

- Outdated communication channels
- Logistical difficulties of reaching consumer complaints access points outside of urban centers
- Lack of awareness about consumer complaints system
- Lengthy process of filing complaints and awaiting resolution

BSP's perspective:

- Outdated communication channels
- Urban and high-income bias
- Inefficient storage and retrieval
- Lags in case management
- Limited visibility of customer experience
- Limited insights for supervision or policymaking

Because of sparse and at times unreliable data, BSP supervisors and regulators are not always able to extract meaningful or actionable insights from the customer complaints database. Supervisors have limited visibility of issues that affect customer experience and the type of complaints that customers file with financial institutions. This curtails the ability to contextualize complaints, for instance, in terms of historical levels and trends. Comparing complaints across financial service providers is complicated by biased statistics (e.g., banks concentrated in rural or low-income areas may receive fewer complaints purely for logistical reasons). Data limitations also mean that the CMS may fail to flag potential consumer or market conduct risks. Finally, processing lags and coverage gaps impede the use of consumer complaints as an early warning indicator to complement other methods of prudential oversight (chiefly periodic prudential reporting).

As new digital products and financial service providers enter the ecosystem, the capacity of the existing CMS to provide an effective avenue to voice and resolve grievances will likely diminish. BSP's ability to leverage consumer complaints for purposes of market conduct compliance will become more and more circumscribed. To forestall this outcome, BSP's SupTech solution developed in collaboration with R²A leverages mobile handsets, Big Data and AI to establish a new channel to escalate complaints, streamline the case management process, crowdsource richer complaints data, and enable real time ecosystem monitoring using advanced analytics. Before explaining how it accomplishes these feats, the next section describes the process by which the prototype came into being.



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 the Philippines.

FIGURE 2. R²A's seven-step project roadmap



Source: R²A

Step 1 Inception: Building trust and securing commitment

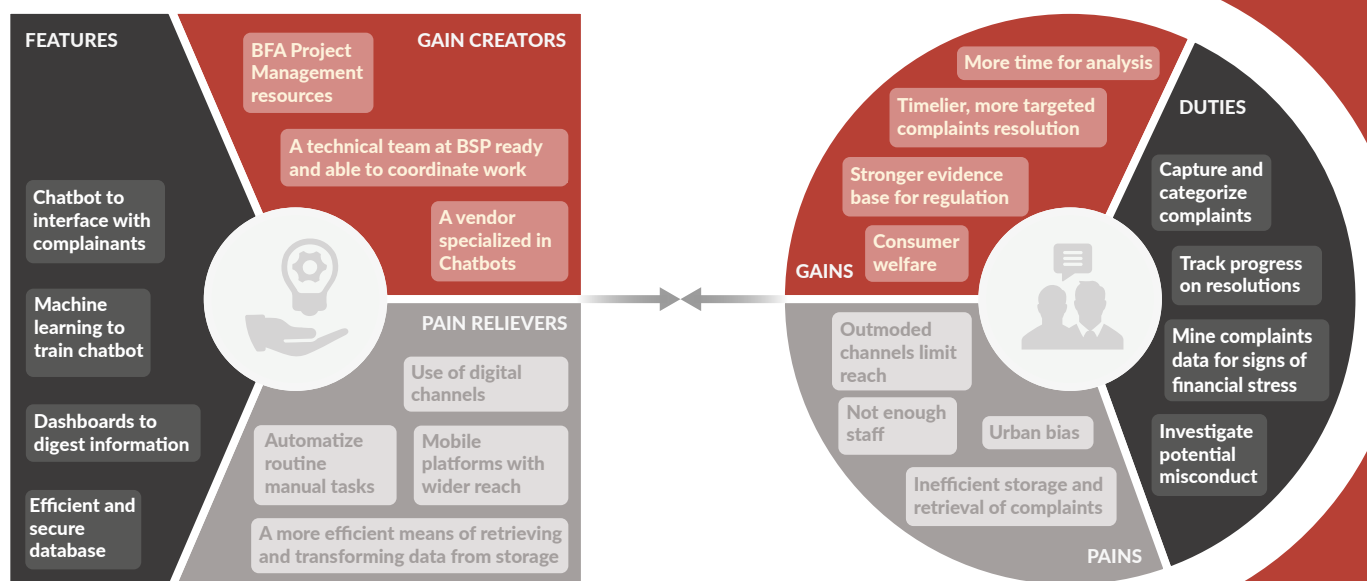
The first step of any prospective R²A engagement is to establish a sufficient degree of confidence that the financial authority is willing to test data-driven and technology-enabled approaches to regulation and supervision and able to carry the project through to completion. Since technological change can elicit skepticism and strong resistance within organizations, effective change management requires openness to experimentation, an alignment of vision among all project stakeholders, and high-level buy-in from executive leadership.

There was little doubt about BSP's receptiveness to digital transformation or its commitment to technological innovation when it approached R²A with an interest in upgrading its consumer complaints system. The Bank had made digital innovation and consumer protection major thrusts of its financial inclusion strategy and implemented numerous policy initiatives to those ends, including a Financial Consumer Protection framework for regulated financial institutions launched in 2014.⁴ The chatbot project was therefore consistent with the Bank's supervisory approach and aligned with its strategic vision. It accordingly received strong backing from the bank's top leadership. A letter of commitment from Governor Nestor A. Espenilla Jr. pledged the necessary internal 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 chatbot application was one of several possible RegTech²/SupTech use cases under consideration by BSP and R²A at the outset of the engagement. Others included an API-based prudential reporting system and the use of geographic information systems (GIS) to improve disaster response. R²A organized a brainstorming session with its technologists, technical experts, and BSP stakeholders where the relative value of the prospective R²A projects were assessed according to their expected impact, technical and operational feasibility, and overall strategic fit. An analytical framework widely employed in technology consulting helped to articulate the value proposition of the solutions in terms of pain points and corresponding technological "pain relievers" (see Figure 3). On key criteria, the chatbot solution came out on top (the API-based prudential reporting system was also selected as a separate project).⁵ In particular, the efficiency gains from streamlining complaints handling promised to free up significant resources that could be dedicated to other projects. Furthermore, given its novelty, the chatbot application would also serve to validate the transformational power of RegTech²/SupTech.

FIGURE 3. Value proposition analysis⁶



Source: R²A

Step 3 Governance: Defining project parameters

Having secured commitment from all stakeholders and agreed on the use case, the next step was to draft a project charter that delineated the scope of work. In it, the BSP and R²A pledged to collaborate on designing, developing, and testing a prototype AML supervision solution over a eight-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 solution 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 coordination, and financing for the vendor selection process and award. BSP, 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. BSP 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 conducts a "design sprint" with the aim of sketching a rough blueprint for subsequent development work.⁷ R²A's technologists and subject matter experts worked closely with the BSP to translate their needs and desires regarding case management, data security, and visualization into concrete functional and technical specifications that would be intelligible to future developers selected in Step 5. The challenge was to craft a solution that could be managed and maintained by FCPD staff and that would be readily adopted and trusted by consumers. Based on these consultations, analysis of available complaints data, and research about similar complaint management solutions in other sectors and jurisdictions, the solution was deemed to be feasible from a technical and functional standpoint. The core functional requirements would be as follows:

- Enable financial consumers to file complaints through their mobile handsets (both feature phone and smart phone) via an app or SMS.
- Enable the BSP to address queries and complaints through the chatbot; manage the structure and flow of automated conversations based on expertise and historical data; and use data and insights gathered through the chatbot for oversight and policy development purposes.

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.⁸ For the BSP chatbot project, a challenge prize was deemed most appropriate given the relatively novel application of chatbots and artificial intelligence to regulatory and supervisory use cases. In a challenge prize, participants propose a solution to a specific problem and are rewarded if they deliver it within a certain timeframe — in this case, the award was US\$100,000 for a functioning chatbot prototype and complaints management system within four months.

The RFA received nine submissions from seven 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 ranking criteria. The first three assessed the applicants in terms of their (1) relevant experience in building large public-facing chatbots, (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 request for applications, (5) the feasibility of the execution plan, and (6) innovativeness of their proposed RegTech solutions. The top three firms in the ranking were shortlisted for the second round, where a panel of six reviewers (independent experts chosen by R²A, see Figure 4) would blindly review the applications and score them anew. The firm with the highest score was declared the winner, namely Sinitic (see Box 2).

FIGURE 4. R²A's panel of judges



Mariya Yao
*Chief Technology and
Product Officer of
Metamaven and Editor-
in-Chief of TOPBOTS*



John Won
*Independent
Consultant; Founder
of the Financial Health
Program at Ideo.org*



Rafael Mazer
*Founder of MazeCo
Limited*



**Pia Bernadette
Roman Tayag**
*Managing Director,
Inclusive Finance
Advocacy Office and
Concurrent Head, FCPD,
BSP*

In order to facilitate contracting, R²A stood in as the intermediary counterparty to both BSP and Sinitic. In other words, the vendor and the BSP 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 critical legal questions regarding data sharing and storage as well as 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. Sinitic obtained historical data from BSP in the form of email chat history and a "data dump" from the existing complaints management system with which to build and train a basic chatbot. This presented some challenges as the information was often too "noisy" for effective machine learning; that is, it contained vast amounts of irrelevant and duplicate information.

As a solution, Sinitic used structured chat history from conversations with the chatbot during prototyping in order to refine the machine-learning models. It also relied upon feedback from BSP and R²A on user experience provided during frequent consultations and successive rounds of testing.

Once the chatbot demonstrated a sufficient degree of proficiency in both English and Tagalog, it could be connected to a new complaint management database as well as an SMS gateway through which text messages are channeled. The latter had to be procured from a local third-party vendor, Globe Telecom. Finally, Sinitic's proprietary CaseManager™ software provided analytics and reporting platform that could be tailored to BSP's wishes and needs, and could serve as the interface for banks to track their caseload.

Step 7 Production: Taking the product to market

Once an R²A prototype has been developed to the satisfaction of the partner institutions, a decision is made between the vendor and the regulator on whether to launch the product full-scale. In the case of the Philippines, repeated testing with live data had clearly demonstrated the chatbot solution's feasibility. Furthermore, an additional goal of any R²A project is to build the capacity of the partner financial authority so that they can operate and maintain the product post-delivery, though a longer-term service agreement with the vendor might still be required. In this case, BSP staff received training from Sinitic and R²A on the inner workings of the CMS and also retained Sinitic to service the chatbot. After sufficient quality assurance testing and training of the machine learning model, the BSP was able to formally launch the solution into the market.

Box 2: Vendor Snapshot - Sinitic

Location: Canada

Background: Sinitic automates multilingual customer support with a vertically-integrated product suite and proprietary natural language processing



sinitic

(NLP) engine for non-English languages. Sinitic solutions are powered by deep-learning algorithms for mixed-language understanding and raw data structuring.

Technical and managerial expertise: Sinitic is led by NLP engineers and software-as-a-service (SaaS) business professionals with a track record of building highly-scalable solutions within digital transformation and AI-adoption projects for public and private sector customers.

Relevant experience: Sinitic has worked on a RegTech project in the EU, automating the delivery of regulatory information via a chatbot to clients of over 200 banks. Sinitic is a member of the Creative Destruction Lab at the University of Toronto, and a graduate of the NextAI accelerator program in Canada.

Products: SiniticNLP™ is the natural language processing engine with extreme adaptability for new languages.

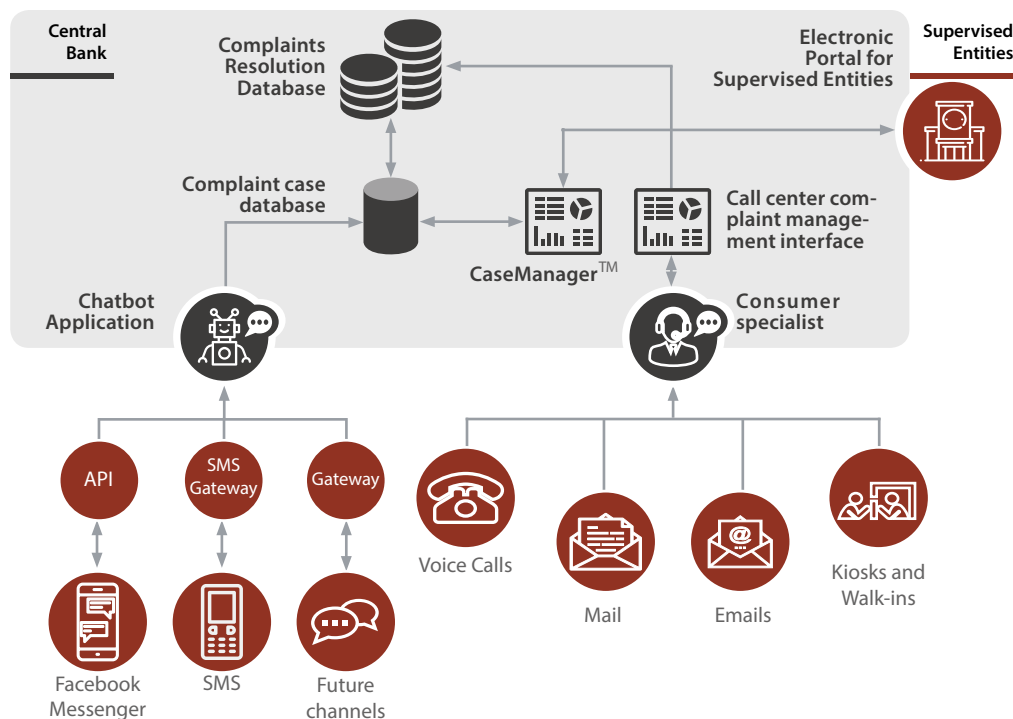
Staff resources: 14 at offices in Toronto and Taipei.

4

The solution: An AI-based complaints handling system

The prototype that emerged from R²A's design and development process represented a fundamental re-engineering of BSP's consumer complaints handling system. The solution consisted of a mix of relatively cost-effective, best-in-class technologies targeted at the various pain points of the existing reporting system. Together they formed a coherent and streamlined architecture for the (1) capture, (2) classification, (3) storage, and (4) analysis of consumer complaints. 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 collection and analysis process.

FIGURE 5. BSP financial consumer complaints data architecture



Source: BSP

1 Customer complaints interface

The customer complaints platform provides multiple communication channels compatible with both smart and feature phones. The solution uses a variety of popular communication channels – Facebook Messenger, SMS, webchat – to receive complaints and interpret them, via Sinitic's cross-lingual natural language processing (NLP) technology, in Tagalog and English. Any user visiting the Facebook page of BSP can select the button "Send Message" and then talk to the chatbot. For complaints submitted via SMS, the solution has enlisted GlobeLabs to provide SMS-based APIs that can send and receive SMS notification to and from subscribers on all local mobile networks in the Philippines. Finally, the solution can embed a webchat on an institution's website, which when opened, launches a conversational interface for end-users to communicate with the BSP chatbot.

By reducing the need to appear in person, the solution effectively removes one of the main hurdles to access to the recourse mechanisms provided by BSP. By creating a ubiquitous chatbot solution, customers of all financial service providers all over the Philippines are able to access the same type of assistance. And by adding a feature phone channel, a much wider user-base can be accessed than if the solution were solely smartphone enabled—in 2017, around 40% of mobile phone users were still using 2G.⁹

2 BSP chatbot

Once received, the chatbot uses either English or Tagalog NLP engine, depending on the language selection of the user, to interpret messages and then follow the pre-defined conversation flow to return suitable responses. A supervised machine learning model continuously teaches the chatbot to correctly interpret end-user "intents" and classify complaints into one of the ten categories, such that the chatbot's accuracy and fluency improves over time as the database of logged intents/complaints grows with use. In addition, Sinitic's BotEditor™ technology allows BSP to directly control the dialogue, logic, channels, and integration without consultant support. This ensures that the chatbot does not go "rogue."

FIGURE 6. Screenshots of smart and feature phone SMS interfaces



Source: Sinitic

3 Database

The complaints and follow-up resolutions are stored in a revamped complaints resolution database, together with data needed to configure and administer the chatbot itself. It is updated automatically by the chatbot and manually by consumer specialists/administrative staff (for those complaints that cannot be handled by the chatbot). Furthermore, all past complaints are imported to the database in order to deepen the historical record for machine learning.

4 Case manager interface

A new complaints management interface allows the FCPD staff to view analytics for the chatbot, configure its internal logic, and display the complaints for further handling and tracking. BSP team can view, edit, and export all complaint cases. They can also add notes or upload attachment files. CaseManager™ also offers manual case creation in order to provide a unified case management across all communication sources that may not be using the chatbot.

More sophisticated predictive analytics, for instance, to identify probable trends in financial consumer threats, were envisioned for after the prototyping phase once the core functionality had been proven viable. Similarly, an interface for BSP-supervised financial institutions to access the CMS would be made available once the prototype was sufficiently robust.

5 Conclusion

Digitization is fundamentally reshaping the Philippine financial sector. New digital providers, products, and platforms are driving down costs and raising the speed, efficiency, and convenience of financial services. Mobile technology is taking them to previously underserved or inaccessible parts of the country. With the pace of financial innovation and mobile penetration projected to remain robust and a regulatory environment that is progressively more attuned to financial inclusion, the Philippine financial ecosystem will continue to grow in breadth, depth, and complexity.

Yet the rapid expansion of digital financial services also presents risks. Without proper scrutiny and transparency, financial customers, especially financially illiterate first-time users, are at a heightened vulnerability to unfair or abusive practices by financial service providers as well as financial frauds and scams. With growing usage, the risks would not be limited to the users of the services but may spread and affect the wider financial system. The failure to protect consumers from these risks also threatens to undermine confidence in financial technology, which in turn could stifle the growth of the budding indigenous fintech industry. Financial consumer protection is therefore closely entwined with financial inclusion and financial stability.

The BSP is pursuing a balanced approach to risk and growth of digital financial services by keeping pace with the latest developments in financial innovation, addressing consumer protection issues and managing financial stability risks while promoting innovation. To this end, it is revamping key components of its regulatory framework and supervisory data architecture using advanced RegTech² and SupTech applications. The chatbot and processing utility solution for customer complaints is only one example of BSP's proactive position on RegTech²/SupTech; others include a prudential regulatory reporting system using APIs (also in collaboration with R²A) and an openness for fintech experimentation through its test and learn approach.

The chatbot and complaints management system developed in the context of R²A relieves many of the pain points embedded in the current system. It enables BSP to address queries and complaints automatically, manage the structure and flow of conversations based on expertise and historical data, and use data and insights gathered from the chatbot for oversight and policy formulation. Compared to current channels of communication (phone calls, direct mail, walk-in kiosks, etc.), the digital platforms employed by the prototype (i.e., online messaging and texting) capture more data than before, have a wider reach, and a faster turnaround time. They are also more cost effective since fewer manual workarounds are required. Also, using popular and ubiquitous platforms can improve the user experience, encouraging more customer to voice their grievances.

The BSP chatbot project further served to validate R²A's model of collaborative co-creation through "lean" design and development. This iterative approach allowed the developers and project managers 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 market.

Endnotes

- ¹ See: <https://globalindex.worldbank.org/>.
- ² Bangko Sentral ng Pilipinas, "[2017 Annual Report: Sustaining the Growth Momentum](#)."
- ³ RegTech for Regulators, RegTech², is distinguished from RegTech for supervised entities. See Simone di Castri, Matt Grasser, and Arend Kulemkanpff, "[Financial Authorities in the Era of Data Abundance: RegTech for Regulators and SupTech Solutions](#)," RegTech for Regulators (R²A) white paper, August 2018.
- ⁴ See: BSP, "[MB Approves Financial Consumer Protection Framework](#)," May 14, 2014
- ⁵ See: Simone di Castri, Arend Kulemkanpff, and Matt Grasser, "[An API-based Prudential Reporting System for the Bangko Sentral ng Pilipinas \(BSP\): R2A Project Retrospective and Lessons Learned](#)," September 2018
- ⁶ Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, and Alan Smith, "[Value Proposition Design: How to Create Products and Services Customer Want](#)," John Wiley & Sons, January 26, 2015.
- ⁷ Design sprints are short (typically five days) but intense workshops aimed at answering critical questions through rapid prototyping and user testing.
- ⁸ For more information on selection models, see: Simone di Castri, Matt Grasser, and Arend Kulemkanpff, "[The RegTech for Regulators Accelerator \(R²A\) Process: Giving Financial Authorities Superpowers](#)," RegTech for Regulators (R²A) paper, August 2018.
- ⁹ GSMA, "[The Mobile Economy: Asia Pacific 2018](#)," June 2018.



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