Open Banking 2020: The Complete Guide to Tech Innovation

by Mark Palmer, SVP of Data and Analytics, TIBCO

Open Banking for Consumers and Industry Disrupters

For the consumer, open banking promises to provide more choices, better service, and frictionless commerce. For developers, new technology and tech-centric regulations provide the opportunity to make banking systems more agile, intelligent, and automated. And for business, it sets up a level and disruptive playing field.

Introduction

The dream of open banking is to enable innovative banking services anywhere and everywhere by encouraging an all-out technology arms race between traditional banks, startups, and social media behemoths. Hot fintech startups like Stripe, TransferWise, and Zopa aim to disrupt old-school banking styles. Facebook, Amazon, and Alibaba have the pole position on your social banking experience. Traditional banks are reimagining themselves as tech-driven innovators. Payments disruptors like PayPal, Venmo, Apple, and China's Tencent are vying to own the global fabric of payments.

For the consumer, open banking promises to provide more choices, better service, and frictionless commerce. For example, you might want to use Amazon, Paypal, and Facebook to send money or gifts securely to friends with a simple click or swipe. No more logging in to your bank to enter payee details or account numbers; just click "send $200 to Ruby," and you're done. Or, instead of clicking, ask Siri, Alexa, or Cortana.

Risk and compliance used to be portrayed as a thankless and challenging job, replete with legal, technical, and cultural complexity. New technology and tech-centric regulations provide a wind beneath the wings of developers making banking systems more agile, intelligent, and automated—and perhaps for the first time—cool. They even have a cool new name: RegTech.

Here's why open banking matters, how new regulations work, and some case studies that provide an early glimpse into the disruptive effects to come.

Can Open Banking Disrupt Traditional Banking?

Open banking is enabled by a series of technologies, regulations, and services that aim to allow developers to create new banking services, new banking business models, and new commerce capabilities. New technology-centric regulations are an important lubricant for open banking to thrive.

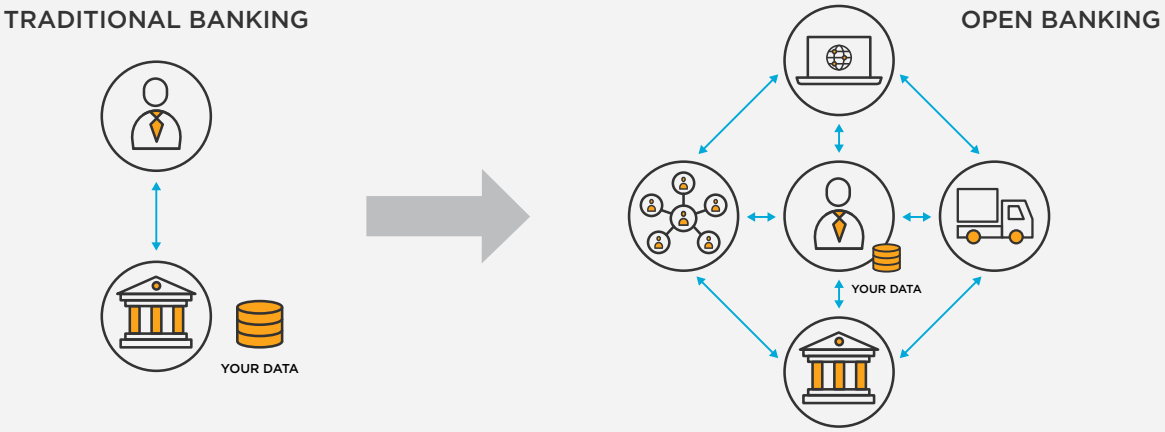

Figure 1: Open vs. Closed Banking, adapted from Deloitte, How to flourish in an uncertain future.[1]

Three forces combine to make the open banking dream possible: changes in banking regulation, changes in culture, and changes in technology. Let's start by exploring the changes in open banking regulation.

New Open Banking Regulations Are Digital, Not Analog

"How many of your companies derive all or most of their revenue from API-driven services or data you provide?" I asked at a fintech conference. Sixty percent (60%) of the audience raised their hands. This is the key distinction of open banking: it's tech-first. The same holds for regulations: they are becoming more technology-centric every day. That is, they're digital, not analog.

1 https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/financial-services/deloitte-uk-open-banking-how-to-flourish-in-an-uncertain-future.pdf

For example, the Payment Services Directive, or PSD2, mandates that banks share data, if the customer gives permission, with trusted third parties through APIs (plug and play software). Bernard Lunn, CEO of Daily FinTech, describes why PSD2 is such a big deal:

> **"PSD2 moves from 'throw the paper rule book at your compliance team of lawyers' to 'send standards docs and application programming interfaces (API) spec to your tech team.'"[2]**

For consumers, regulations like PSD2 promise to make banking services available where and when you want them, and also ensure that the communication among participants is just as secure and trusted as the interactions you've always had with your bank. This can only happen with an agile digital computing fabric, fronted by APIs.

Another marquee example of digital regulation is Australia's Consumer Data Right (CDR)[3] aimed at banking and energy, with telecommunications to follow. The goal of CDR is to help make it easier for consumers to switch between products and services. Fallen out of love with your credit card provider? Switch to a new one with the click of a button, thanks to APIs defined by new standards.

A less tech-centric standard is the Basel Committee on Banking Supervision[4] standard number 239, or BCBS 239. It aims to strengthen risk data aggregation capabilities and internal risk reporting practices and, in turn, makes any firm that provides banking services more secure and regulated in how they handle your data. Although BCBS 239 is more process-centric than service-centric, technology can help ensure the process is well-governed and easy to implement.

Finally, there's real time, where the capital markets continue to be the pioneer. The Commodity Futures Trading Commission (CFTC) and the Securities and Exchange Commission (SEC) now aggressively regulate trading activities by mandating as near real-time risk management as possible. As API-driven open banking spreads, all banks will look more like algorithmic trading desks. Therefore, all companies that provide banking services will monitor real-time events that can detect shift, drift, and emerging never-before-seen patterns in financial data streams, consumer preferences, and of course fraud.

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2 Barberis, Janos, Douglas W. Amer, and Ross P. Buckley. The Regtech Book. John Wiley & Sons, August 6, 2019.

3 Neely, Robert and Helen Scott. Consumer Data Right regime is here—what do you need to know? Landers and Rogers, August 8, 2019. Lexology. https://www.lexology.com/library/detail.aspx?g=e34681d7-f03b-4307-b7d5-88f96c7c7c18

4 Basel Committee on Banking Supevision, https://towardsdatascience.com/how-to-query-the-future-a4a5e951d23e?source=friends_link&sk=6f11501cc3c7ad84372cf5b8046f556e

And it all has to work at a global scale: the Financial Industry Regulatory Authority (FINRA) monitors approximately 50 billion market events a day, including stock orders, modifications, cancellations, and trades.[5]

So, payments, internal controls, and consumer data rights are all moving toward digital regulations that are increasingly real time. These trends combine to demand a different kind of culture that's more agile and tech-centric.

The Elements of an Agile Open Banking Culture

It's one thing to declare your company as tech-centric, and an entirely different thing to have the culture operate in a way that's tech-biased. That is:

- Open banking business models are digital, not analog.
- Open banking tech culture is agile, not waterfall-oriented.
- Open banking culture considers data curation a habit, not an after-thought.
- Open banking is real time; not looking only at the past.
- Open banking is built around analytics and automation, not manual processes.

These cultural drivers define the four elements of an agile open banking culture.

Element One: Digital Business Thinking (NOT Analog)

Open banking depends on an open banking culture; a new way of thinking. A good way to think about this is a culture that has an "API-first" mentality. That is, a bias toward thinking about every product and service you provide as an API call—a software service. This must be matched by a data culture that powers those APIs. This is not to say that culture should be digital-only. Human oversight, management, legal implications, and process are all essential elements of an open banking culture. But the digital implications of the business must be considered first and not treated as an afterthought.

Element Two: Data Curation as Habit

You must start with good data. For open banking innovation, its garbage-in, garbage-out; if your data isn't in order, your business isn't in order. Many firms have a federated, unorganized, unstable data fabric and data curation culture. So element two is to tame the data swamp and make governed curation of new data a habit.

The Open Banking Culture

1 Digital (not analog) thinking
2 Data curation as a habit
3 Event-driven bias
4 Data science centric

5 Baig, Murat. Market Surveillance 2020. The RegTech Book, Ibid.

Element Three: A Bias for Event-driven Banking

You can't manage what you can't see, and open banking data is in motion. Building business insights on streaming data gives all stakeholders real-time transparency and awareness of events that impact services, risk, and profitability. Open banking API calls, transactions, market data, and all elements of a digital banking ecosystem, generate events that must be managed and analyzed, often in real time. This event-driven banking way of looking at business is not common, but necessary in an open banking world.

Element Four: Data Science Centricity

AI and data science make the secret sauce of open banking innovation. Algorithms applied to streaming banking data yield smarter banking services, situational awareness for customer engagement, and intelligent pricing. This algorithmic awareness is the pinnacle of digital banking innovation power. But today, it's common to have a data science group that's organizationally disembodied from the business team. For open banking innovation, this barrier must be lowered. Fortunately, if you don't have a data science centric culture, it's not too late. The field is still immature. But hurry up, it's rewarding and fun!

These forces come together to form a culture of digital-centricity and agility. Now, let's explore how to achieve these cultural goals.

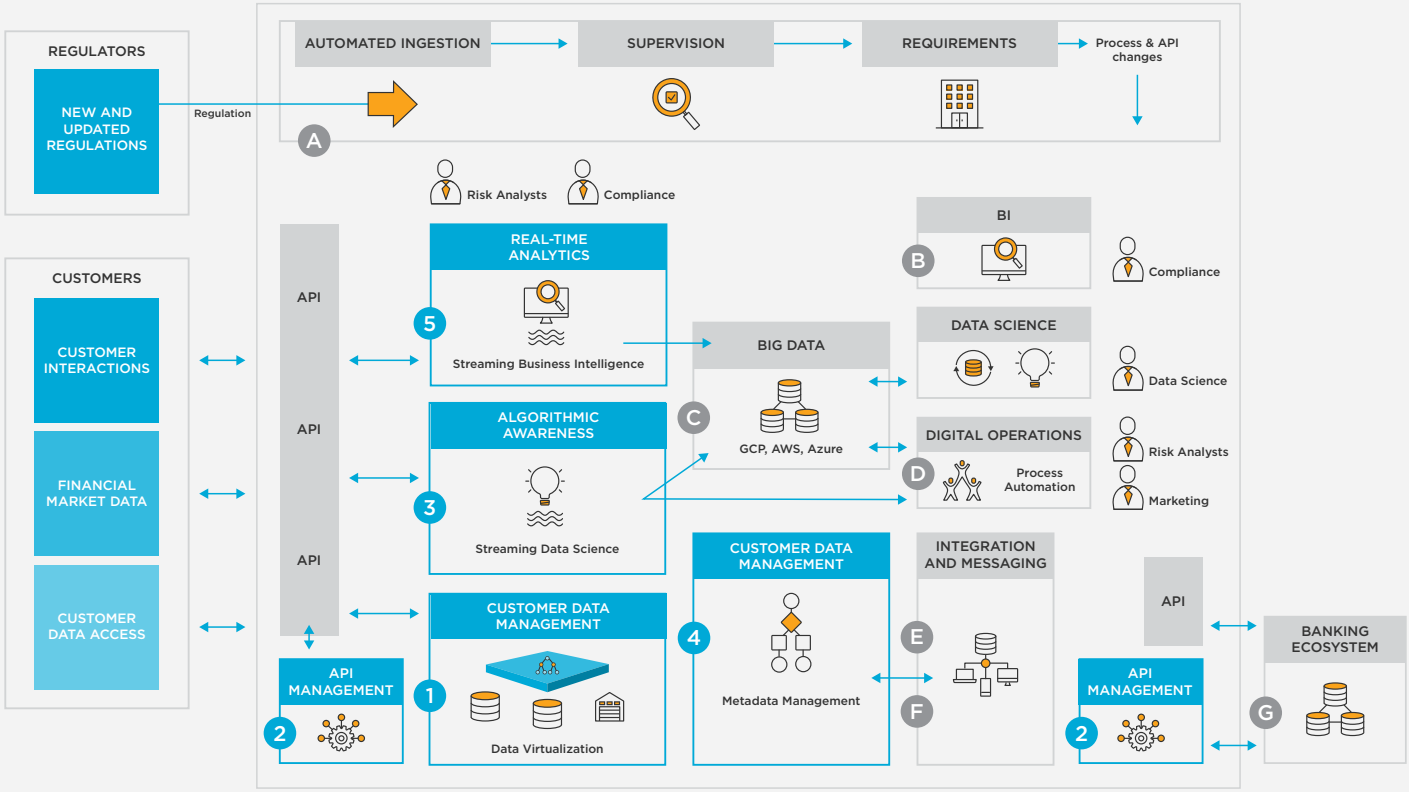
The Open Banking 2020 Blueprint

The Open Banking Technology Blueprint (next page) is described in full in Appendix A. This paper is dedicated to the five most unique areas (numbered) that provide an unfair advantage to banking participants of all types, from fintech unicorns to banking behemoths.

The five game-changing sources of innovation are:

1. Data virtualization for ETL-free, agile access to data for open banking APIs
2. API management to facilitate agile open banking API-driven services
3. Streaming business intelligence for continuous compliance and live risk impact analysis
4. Continuous data curation with metadata management for cultural data governance and increased trust in data
5. Streaming data science for anticipatory surveillance, to automate the earliest discovery of anomalous events in real time

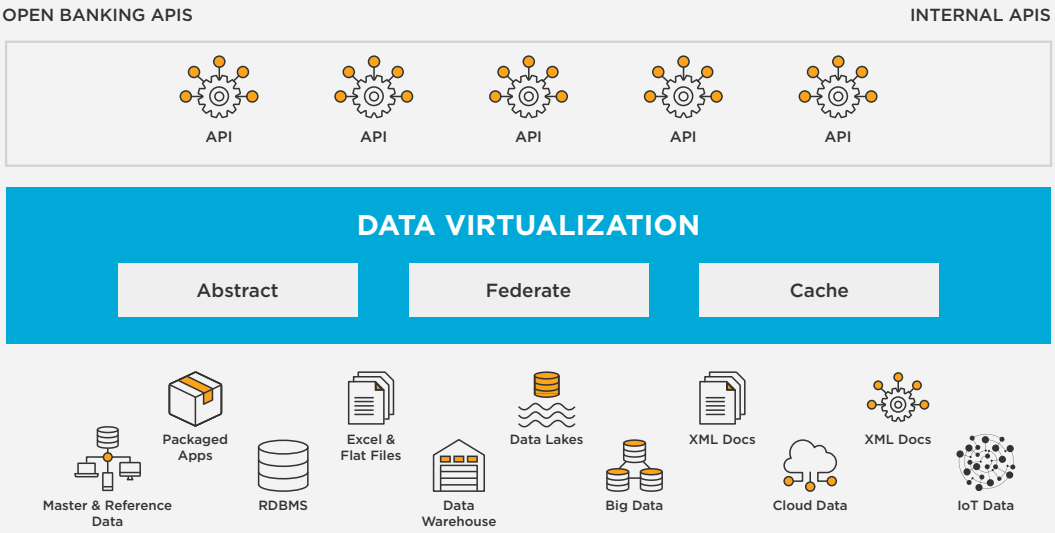
Let's explore each innovation and how it can be applied to achieve a culture of open banking agility.



Open Banking 2020: A technology blueprint

Innovation One: Data Virtualization to Tame the Data Swamp

At the heart of every open banking API call is data, so agile access to data is the first port of call in any innovative system. But although every fintech business wants an agile, efficient, scalable data lake, most have a data swamp: balkanized data sources, a mix of old and new, real-time and streaming data, and a maze of organizational barriers.



"We want a data lake, but we have a data swamp."

Data virtualization is a technology that helps firms tame their data swamp. It allows teams to turn dozens of independent data sources into one virtual data warehouse with nearly the same performance as a single system. So, instead of over-using ETL to create a bigger data swamp for APIs, data virtualization leaves data where it is. This provides a unified interface to customer information as if it was, indeed, a single system.

For API-driven open banking access, data virtualization is an essential way to quickly create APIs that provide secure, high-speed access to customer account information in whatever form is needed by the programming interface. Depending on the size, scale, and organization of data in any given bank, that data may live in dozens of disparate systems, depending on the region, type, and breadth of customers. With data virtualization, the complexity of the back-end architecture is abstracted away.

Case Study: Data Virtualization at KBTG

KBTG Bank[6] in Thailand illustrates the value of data virtualization. It services 16 million retail banking customers. Through technology, it competes with non-banking companies for digital banking to fit customer lifestyles.

6 KBTG Creates Digital Lifestyle Banking with Data Virtualization. August 22, 2019 https://www.tibco.com/sites/tibco/files/resources/SS-KBTG-final_0.pdf

"A lot of things you needed a bank for you can now do through 7-Eleven or with wallets. We're competing against non-banks now," said Fred Roteseree, deputy managing director, "so we need to handle a lot more transactions, a lot more activities. Data virtualization brings the business and IT together because we can deliver services in a much more timely manner."

For example, KBTG's "My Portfolio" mobile phone app shows users every banking product and account they have. The data that powers these services is stored in multiple systems—deposit account, credit card, mutual fund. Each API call can require data stored in 12 to 15 databases. By virtualizing its data access, KBTG quickly combines it all.

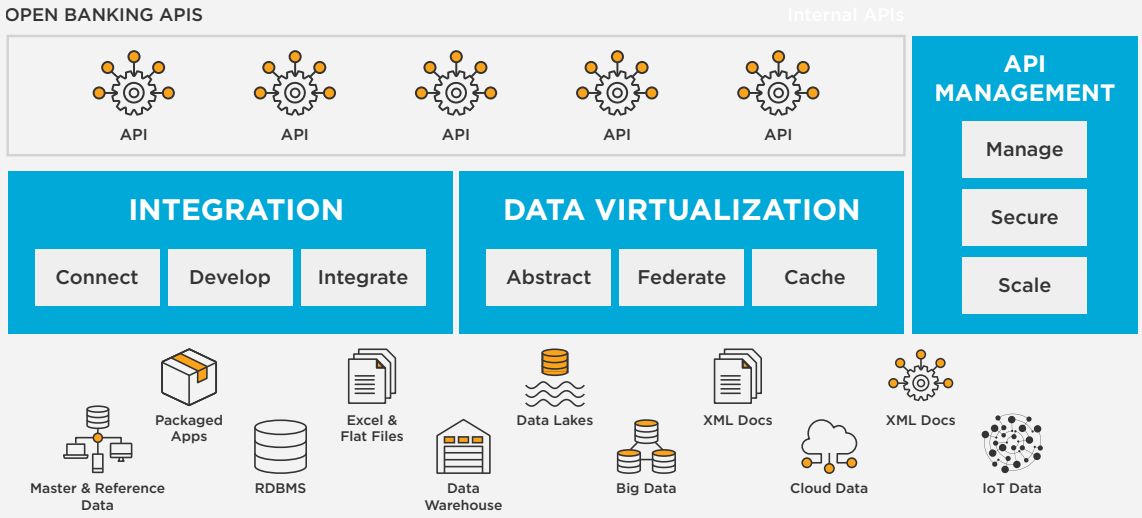
"Now that we use [data virtualization] technology, people start to think about data differently," says Roteseree. "We can create a sandbox environment, add another source of data into the report within days as opposed to six months. We can publish data services in a variety of formats within weeks as opposed to months and deliver them in a standardized format within a single layer. Web services can be built in a few hours."

Innovation Two: API Management for Digital Banking Services

For open banking participants, the API is the product. In a digital world, nothing happens without an API call to supply a service, function, or piece of data. So, how an open banking company manages their APIs is an essential element of innovation and agility.

"The challenge was all the isolated applications and information in our systems. If we didn't resolve these issues, we would not have been able to meet member needs. We would have less robust capabilities to offer, and we would have difficulties getting services to market quickly."

API management technology helps companies create, productize, secure, and analyze APIs as products. Having an effective API management infrastructure and a process to design and deploy APIs is an essential ingredient of success in open banking.



Given the sensitive nature of the customer information accessed through open APIs, PSD2 and open banking stipulate tough rules for secure data protection, including verifying API consumer (developers, financial entities, and end-users) identities through authentication and access management. While API management is purpose-built to meet the rigors of financial-grade security, these platforms also perform a key function with open banking APIs: managing the lifecycle of the API. From design (based on industry standards), to implementation, productization, and performance analytics, managing APIs across their full lifecycle is fundamental to a healthy API program, and an ROI-generating open banking strategy.

Case Study: API Management at MAIF

Fifth in France for auto and home insurance, MAIF[7] wanted to continue the excellent relationship it had with its members and strengthen growth of subsidiaries and affiliates.

"To help the business accomplish its goals, the first thing was to develop agility in our IT systems," said Benoit Louis, middleware consulting and support manager.

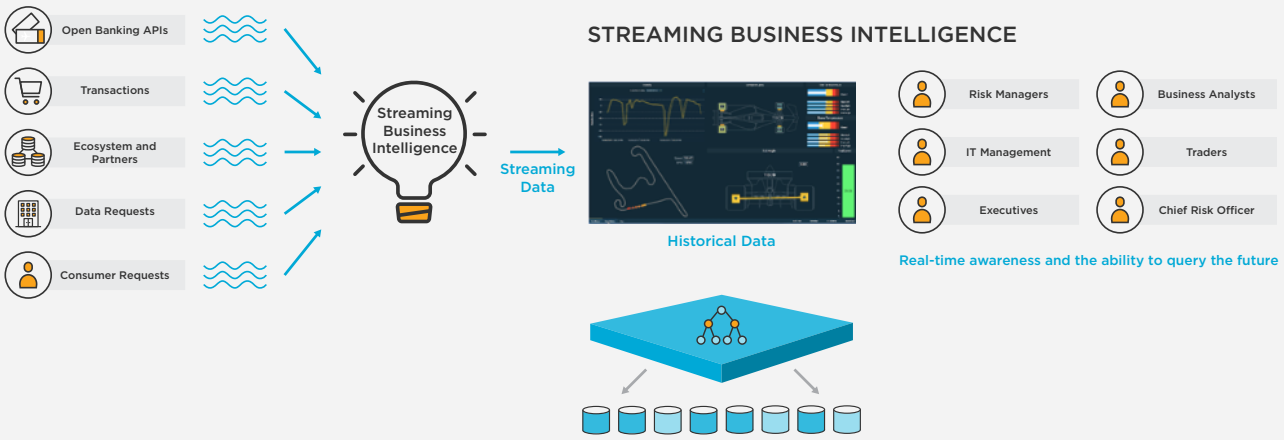
"We also needed an agile, scalable integration platform on which we could develop and reuse web services across all channels and scale information flow as channels were integrated. The significant improvement we made was that 100% of our estimates are producing the same results on all channels. For us, it's a tremendous achievement. We know we will be able to get new, expanded services to market faster to meet member needs.

7 MAIF Insures Member Satisfaction and Partner Channel Performance

"We want to be a leading player in collaborative economics, not just to increase profits, but because of its benefits to society. To have the best connection with partners, we continue to open our systems through IP connections. MAIF's goal is to open the architecture to new digital channels and further improve our agility for an even faster time to market."

Innovation Three: Streaming for Continuous Awareness

Self-service business intelligence tools like Tableau, QlikView, and PowerBI help humans more easily understand their data. But those tools only analyze what has already happened. Analyzing historical data assumes the patterns, anomalies, and mechanisms observed in the past will continue in the future.



In open banking, the standard practice of business intelligence is changing. By combining streaming analytics and self-service visual exploration, banking analysts can now ask and answer questions about the now, and the future. Like the Precrime Division in The Minority Report,[8] this new type of business intelligence can help analysts anticipate future compliance violations, detect them in real time and act to mitigate the problem before it's too late.

This is the field of streaming business intelligence,[9] the fourth, and in some ways, the primary disruptive force in open banking because you can't manage what you can't see, and in the world of financial services, data is in motion and rarely at rest.

8 The Minority Report, https://en.wikipedia.org/wiki/The_Minority_Report

9 Streaming Business Intelligence, https://towardsdatascience.com/how-to-query-the-future-a4a5e951d23e?source=friends_link&sk=6f11501cc3c7ad84372cf5b8046f556e

Case Study: KuveytTurk Bank and streaming analytics

Streaming analytics is used by KuveytTurk Bank in Turkey,[10] an algorithmic trading innovator in the foreign exchange (FX) trading market. As Abdulkerim Ozcan, senior trader, describes, the bank combines real-time data from up to 25 institutions into one real-time big data stream. "With the help of streaming software, we increased FX volume, and we became the first bank in Turkey to provide a gold exchange market," according to Ozcan.

"Our challenges included continuously changing and emerging markets, increasing requirements for pricing, volumes of data and transactions, and speed. And we lacked industry standards. We analyzed these and decided on streaming technology," explained Ozcan.

With visual analytics, firms like KuveytTurk bank can see what's going on in streaming trading systems and better control actions in real time.

Innovation Four: Continuous Metadata Curation

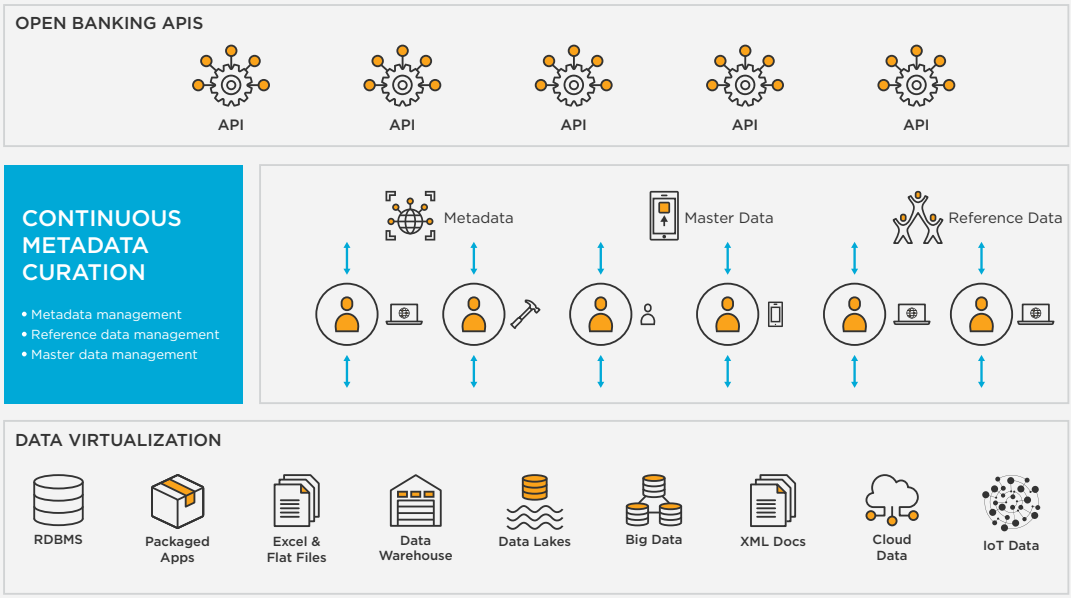
As explained in Banking on Digital Risk,[11] data curation, governance, and metadata management are part of a cultural bias that can't be forced by regulation, provided by technology alone, or outsourced. But technology can facilitate a culture of continuous data curation.

"Technology has a strong supporting role to play in improving the quality of information provided to a board of directors, expansion of risk assessment frameworks, and disambiguating an organization's accountability lineage. When one considers the Australian Government's response to the Commission's report and recent legislative and regulatory actions, it is increasingly likely that an organization's compliance efforts need to demonstrate adherence to the letter and spirit of the law. Technology

10 KuveyTurk Bank streams to double customers and increase profit. June 20, 2019. TIBCO Software Inc.

11 Banking on Digital Risk, October 26, 2019. TIBCO Software Inc. https://www.tibco.com/resources/whitepaper/banking-digitally-enabled-risk

can help financial institutions not just automate compliance, but demonstrate organizational commitment to the change management process and adherence to the principles of regulations and law."[12]



Open banking participants will access account information, personally sensitive data, consent interactions, and other communications data,[13] which makes metadata management an emerging part of an architectural blueprint, especially as all elements of the architecture (APIs, BI, data science, data virtualization) can interact with that metadata.

12 Lipson, Martin et al. Risk Management and the Board of Directors. Harvard Law School Forum on Corporate Governance, March 20, 2018. https://corpgov.law.harvard.edu/2018/03/20/risk-management-and-the-board-of-directors-5/

13 Perng, B.J. Align Open Banking and Future-Proof RegTech for Regulators and Third-Party Providers to Deliver the Optimal Consumer Convenience and Protection. The RegTech Book, Ibid.

Case Study: Netspend: Governance for better customer experience[14]

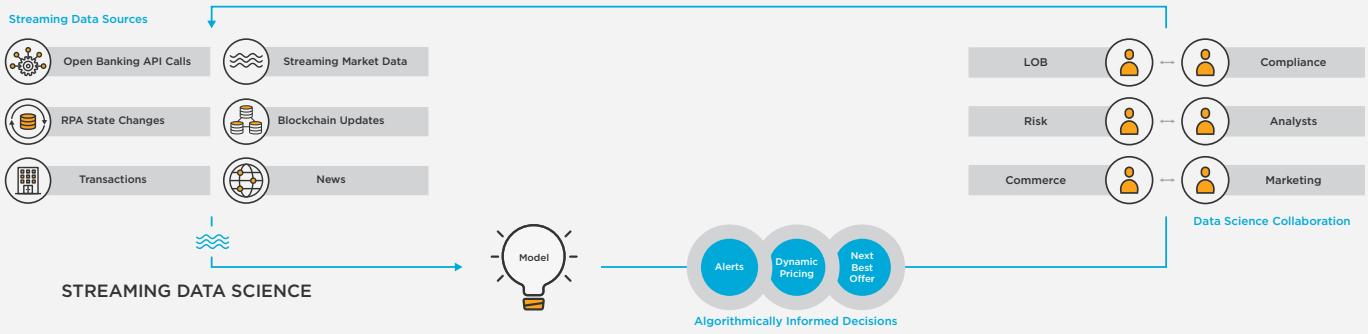
Headquartered in Austin, Texas, NetSpend is a leading provider of general purpose reloadable (GPR) prepaid debit cards, paycards, and related financial services to the estimated 68 million underbanked consumers in the United States who do not have a traditional bank account or rely on alternative financial services.

While originally implemented just for the IT department, TIBCO EBX software has been made available to the entire organization, prompting a huge wave of adoption. "The biggest result is auditability, to be able to know, without a shadow of a doubt, that these are the actual terms the customer is going to see, that single source of truth," says Cuellar. "Streamlining, automating a lot of things to reduce human error. It has really transformed the business."

Accounting and Legal teams are huge evangelists of the software, and compliance teams love using the tool also. "The user base has grown so much that everybody touches it in some way. It started the conversation, "What more can we put in EBX software? What more can we do?"

Innovation Five: Streaming Data Science

Traditional machine learning trains models based on historical data. This approach assumes that the world essentially stays the same — that the same patterns, anomalies, and mechanisms observed in the past will continue into the future. So, predictive analytics is really looking at the past, not the future.



14 How Netspend Unifies Its Business with TIBCO EBX Software. October 31, 2019. TIBCO Software Inc.

Streaming data science takes an alternative approach to machine learning by assuming that the conditions that impact decisions in real time are not stable. For example, the numbers, amounts, and types of credit card charges made by most consumers will follow patterns that are predictable from historical spending data, and any deviations from those patterns can serve as useful triggers for fraud alerts. And, even when the relationships between variables change over time — for example when credit card spending patterns change — efficient model monitoring and automatic updates (referred to as recalibration, or re-basing) of models can yield an effective, accurate, yet adaptive system.

In open banking, each API interaction with consumers, partners, or a blockchain produces streaming data. The speed and volume of data is simply impossible for operational staff to process. Streaming data science helps apply machine learning models to continuously sliding windows of data and discover emerging patterns and new norms, and critical deviations from the norm so action can be taken. These real-time actions are the heart and soul of a real-time open banking system.

Streaming data science development is growing rapidly, and there are open source accelerator frameworks[15] available that ease and speed adoption and share best practices on how to inject and score models based on PMML, PFA, Python, TensorFlow, and other data science implementation tools.

Case Study: AA Ireland and streaming data science for dynamic pricing and risk

The Automobile Association of Ireland uses streaming data science[16,17] to apply models that assess risk and policy pricing against streaming data. Rather than using static predictive models, AA Ireland can ask questions of current conditions, like: "If I increase or decrease discounts, what's the uplift in volume and profitability?"

Streaming data science helps explain opportunities and risks that exist in the market now rather than depending on forecasts based on market conditions gone by. Continuous awareness helps inform decisions with situational awareness of current conditions as the market and customer interactions gyrate.

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15 Hoskins, Glenn. The Risk Management Accelerator. TIBCO Software Inc.

16 Closed Loop Continuous Learning with TIBCO. September 20, 2019. TIBCO Software Inc.

17 AA Ireland Transforms Itself and Insures Predictable Success. June 10, 2019. TIBCO Software Inc.

AA Ireland's chief analytics officer, Colm Carey, explains the ability to gain instant awareness in real time, rather than months: "Insurance has always had predictive models, but we would build something, and in three months, update it. Using streaming analytics, data comes in and goes out to models seamlessly without disruption, basically providing real-time predictability."

Carey continues: "And then, you can ask: What should I do differently? How should my pricing change? How should I facilitate that in the call center? You can understand it all—plus segmentation, fraud modeling, underwriter profit. We're going to use it for long-term predictability of call center capacity and CRM modeling, campaigns, and return on investment from them, and how to price a product."

The Unfair Open Banking Advantage: Making it Work

Open source technologies, like Hadoop, Spark, Kafka, and open source data science, are the building blocks of the Open Banking 2020 Blueprint. But innovation comes from embracing those building blocks and empowering business users with agility, self-service access, and enterprise scale.

Agility

An agile culture of continuous metadata curation can now be achieved by deploying new, simpler tooling for business users in TIBCO EBX software. Legacy MDM tools like Informatica were designed for IT departments, but EBX software brings data governance to anyone and everyone that touches critical banking data. Data stewards set up metadata and procedures aligned with GDPR and BCBS 239, then everyone plays a role in developing trust and accuracy in information with easy-to-use web apps and the native EBX Go app for mobile phones.

Self-service

Self-service BI is another innovation driver in open banking. Now, for the first time, self-service BI is possible on streaming data. Real-time visualizations that used to take 6 to 12 months of custom coding can now be created in minutes by a business analyst with TIBCO Spotfire and TIBCO Spotfire Data Streams software. This empowers risk analysts, trade surveillance teams, and compliance teams that monitor API access to gain continuous awareness, apply data science, and query the future, a feat previously not possible.

Enterprise Scale

Finally, enterprise scale comes from tools designed for the enterprise. For example, data virtualization is commonly used to provide virtualized views of data in open source Azure Synapse Analytics, Cloudera, Google Big Query, MySQL, Oracle, Snowflake, and Teradata, all at the same time, with similar performance and scale, as if just one data backend was being queried. For example, KBTG combines 12 to 15 disparate data sources, and it's common in a larger bank to have 100 sources of data in one virtual data warehousing view to service BCBS 239 risk reporting.

Agility, self-service, and scale are what make the open banking blueprint a recipe for unfair advantage and help open banking participants unlock the secret sauce in their unique banking business models.

Conclusion

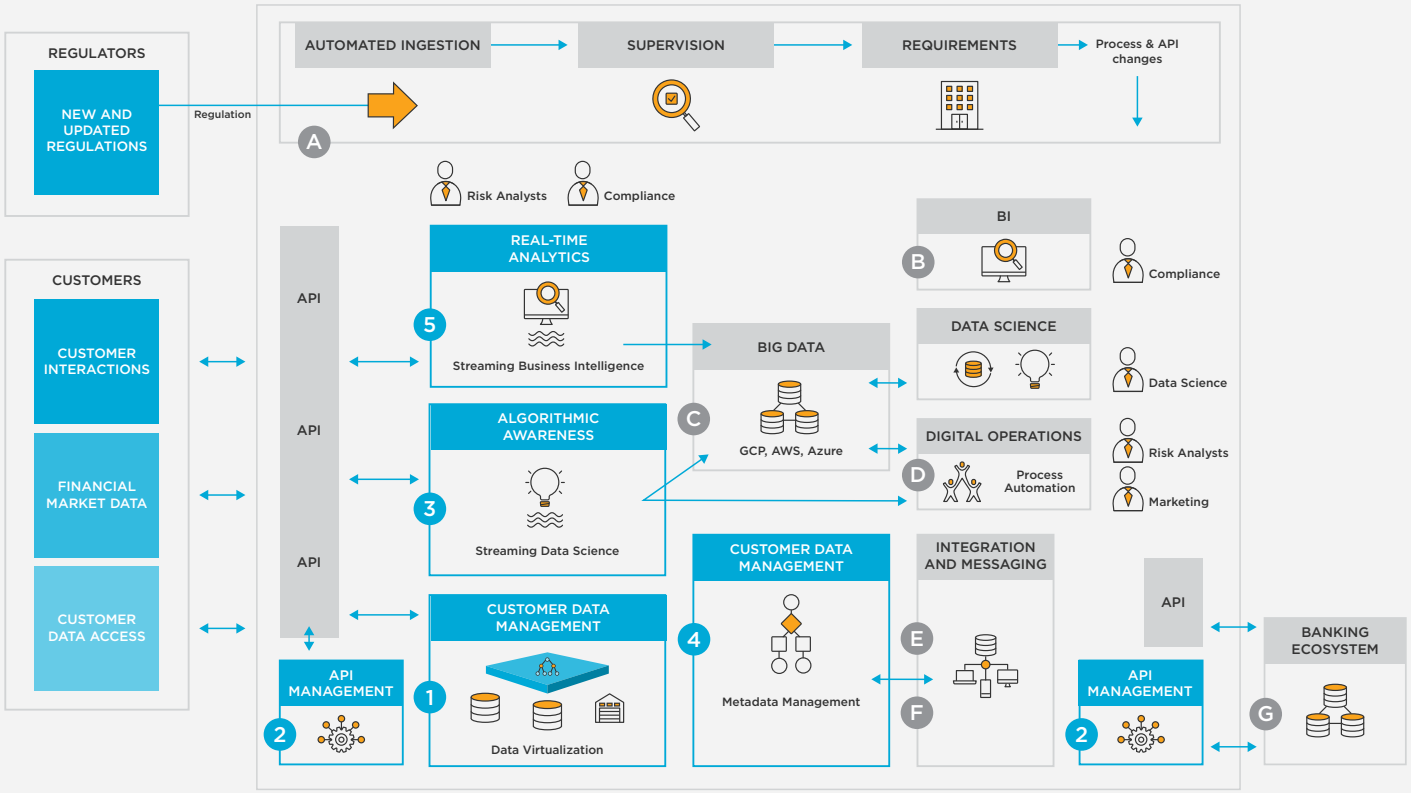
The open banking market is buzzing with disruptive potential. But despite the hype, it's anyone's game to win. The Open Banking 2020 Blueprint provides a roadmap of tools to enable better collaboration, empower business users with self-service, and curate trusted data as a cultural habit.

Best yet, these technologies are readily available now, where previously they were either extremely expensive or required an army of developers. The barriers have been lowered. For example, the cost of Streaming BI is similar to traditional BI tools, and many innovative data science libraries are open source and practically free.

This brings down the cost of innovation dramatically, frees up management time, and enhances not only compliance, but the possibility to create differentiated services delivered in an agile manner to address quickly changing consumer demands. The only thing standing in the way of banking disruption is creativity and the right blueprint. Now you have a plan, and the technology is available, so get creative and start building your unfair advantage.

Appendix A: Open Banking 2020: The Big Picture

Putting it all together into one blueprint, the modern open banking infrastructure:



This paper argues that the four sources of greatest innovation are:

1. Open banking standards, like PSD2 market surveillance and customer data protection regulations, require an agile data fabric to create new APIs and enrich data more quickly than ever before. As KBTG Bank in Thailand illustrates, a virtualization layer can help launch new APIs in hours that used to take six months.
2. Streaming business data science provides continuous algorithmic insight into operations and can predict not only better customer engagement strategies but also check for emerging never-before-seen patterns and norms, as well as non-compliant behaviors that must be flagged and stopped.

3. Continuous curation is achieved by business-user tools to organize, authorize, and validate data with a modern master, meta, and reference data system. By continuously curating data as it's created, with regulation-compliant processes and procedures, a firm can ensure it has provided data not just quickly, but accurately.
4. Finally, streaming business intelligence pulls both streaming and historical data into one view of the market and internal systems. Streaming BI is a new technology that has broadened the applicability of visual exploration to business analysts and line-of-business personnel.

Other essential areas of the Open Banking 2020 Blueprint include:

A. Modern FSI regulation automation is more and more tech-driven, with APIs and digital representation. Being digital affords the chance to automate the ingestion of new regulations and updates to create a more agile process of assessing the implications of change and implementing those changes via APIs.

B. Traditional business intelligence. These tools are useful and ubiquitous, albeit most (Domo, Microstrategy, Power BI, QlikView, Tableau, Thoughtspot, etc.) are restricted to backwards-looking data exploration. Although advances abound in the BI market, most companies have a well developed use of BI, so this is not a technology area of disruption. The notable exception is streaming BI, which is addressed above.

C. Big Data. Deployment of Hadoop and Spark infrastructure on-premises and in the cloud is used primarily to power traditional data science and business intelligence.

D. Traditional data science for predictive analytics based on historical data and analysis of stable market conditions (that is, not streaming).

E. Robotic Process Automation is a rising technology that helps automate previously manual tasks. This may be considered innovative for some applications, and, if we were to cover a fifth factor in this paper, RPA would have been it.

F. Integration Platform as a Service (iPaaS) for enterprise integration is a foundational component of open banking architecture. It allows banking institutions to simplify the complexity of their hybrid architecture, connect disparate systems, and align information across the business in an API-led fashion, and at scale.

G APIs are also critical technology for inter-bank and partner ecosystem communication. Most emerging banking standards are centered on APIs, their design, and their function in the broader financial ecosystem.

H Blockchain usage continues to be explored for a shared, trusted ledger for certain aspects of open banking. For example, the Australian Stock Exchange has adopted blockchain technology for clearing, settlement, asset registration, and other post trade services that are critical to the orderly functioning of the market.[18]

I API Management platforms turn APIs into products and maximize the security of digital assets, and as such, are an important part of the open banking ecosystem. As an internal management framework for APIs, they are an essential and effective ingredient of success.

About the Author

Mark Palmer has more than 20 years of experience working in the financial technology industry, with expertise in algorithmic trading applications and automated trading architecture development. He has spoken at numerous industry events and is frequently quoted in leading publications, including the Wall Street Journal, Time Magazine, the Financial Times, and CNBC. Under his leadership, TIBCO StreamBase software was honored by the World Economic Forum with one of the most prestigious awards in technology innovation, Technology Pioneers. In 2010-2013, Institutional Investor named Mark one of "The Top Executives and Innovators in Financial Technology." In 2005, he won an InfoWorld Innovator award and was named to the InfoWorld Media Group's Innovators Hall of Fame for his achievement in event processing.

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Global Headquarters
3307 Hillview Avenue
Palo Alto, CA 94304
+1 650-846-1000 TEL
+1 800-420-8450
+1 650-846-1005 FAX
www.tibco.com

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