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FINTECH

Emerging Trends, Future Directions

Steve Andriole
Guest Editor

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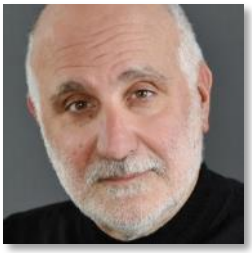

Opening Statement

by Steve Andriole

Though not always in plain view, fintech is everywhere. It is broadly — and quickly — transforming personal and professional transaction processing of all kinds, at all levels. The list of fintech methods, tools, and techniques includes artificial intelligence (AI), machine learning (ML), cryptography, cryptocurrency, blockchain, insurtech, smart contracts, regtech, robo-advisors, cybersecurity, open banking, and underbanked services. AI/ML, blockchain, and cryptography are fundamentally changing how money is exchanged and even the form of money itself. There's a race to adopt fintech for competitive advantage. We ignore it at our own risk.

Fintech is not just another technological revolution. It's different because it's technologically so broad and because its application potential is so great. It's a combinatorial technology where the whole is much bigger than the sum of its parts. It's also focused on every kind of transaction processing. Consumers, corporations, and governments all benefit from fintech, and they benefit from the unpreventable fintech explosion. It's one of those technological cases where inevitability meets benefit, where technology adoption will happen regardless of how consumers, corporations, and governments react (even as their lives improve due to the convenience and seamlessness of fintech-enabled transactions).

This issue of *Cutter Business Technology Journal (CBTJ)* describes the range of methods, tools, techniques, and applications of the fintech revolution. The articles demonstrate fintech's importance and explore the different levels of fintech technologies, experimentation, and applications. While many questions remain, fintech is unstoppable. Institutions, companies, and whole countries are adopting it for financial, political, and even military purposes. Make no mistake: *fintech is a game-changer*.

The range of potential fintech applications includes all the vertical industries and nearly every business model and process that enables them. No industry or process is safe from the disruptive impact that fintech will have in the next five years. Keep in mind that fintech will integrate across business and technology architectures, platforms, databases, and applications.

The application range of *blockchain technology*, for example, is much broader than originally forecast. There are already compelling indicators of extensibility. Prototype platforms and applications have already deployed, venture capitalists are investing in blockchain's applied potential, applications platforms are in development, and consortia have been formed. Blockchain as a service (BaaS) is no longer aspirational. The major cloud providers are offering suites of blockchain products and services, as well as other fintech offerings. In fact, there's competition among BaaS providers to grab as much market share as possible as adoption skyrockets.[1]

Fintech is not just another technological revolution. It's different because it's technologically so broad and because its application potential is so great.

All this interest is the result of conceptual and actual applications and the possibilities around transaction seamlessness enabled by blockchain (and other fintech technologies). The ready blockchain domains include *at least* the following (there are more in queue):[2] financial *services* (asset management, insurance, payments), *smart property* (unconventional money lenders/hard money lending, car/smartphone, blockchain Internet of Things), and *smart contracts* (blockchain healthcare, blockchain music, blockchain government, public value/community, vested responsibility, blockchain identity). In addition, we can expect an evolving blockchain architecture that includes other fintech technologies, especially AI/ML. Intelligent transaction validation — necessary for blockchain scalability — is well under-

way. In an excellent overview, Karin Flieswasser helps us think about the natural and growing relationship between AI/ML and blockchain: "the combination of AI and blockchain is fueling the onset of the 'Fourth Industrial Revolution' by reinventing economics and information exchange. From healthcare to government, the potent combination of both AI and blockchain is slowly but surely transforming industries."[3]

AI/ML provides intelligent search and analytics, and blockchain provides the secure transaction platform. While fintech is most often associated with financial services, many fintech technologies — like blockchain and AI/ML — are already disrupting other industries.

This extensibility is important to understand. Fintech is a basket of technologies targeted primarily at financial transaction processing. Many of the technologies have their origins elsewhere and have been working in the trenches for years. Fintech has commandeered the technologies, added a few purely from the financial domain, and adapted the technologies for their own (broadly defined) transaction processing purposes. But there are important questions: Where does transaction processing begin and end? Which vertical industries *do not* depend upon fast, flexible, and secure transaction processing? The application range of "fintech" will continue to grow dramatically, well beyond its initial focus on *financial* transaction processing.

In This Issue

This installment of *CBTJ* presents a broad look at fintech technologies, the issues surrounding their development and application, and the applications clearly within their range. It's an objective look at fintech's reality and potential. Upon reading the articles in this issue, researchers and practitioners will have a solid understanding of fintech technologies and where consumer and professional transaction behavior will be impacted.

The first article, by Salvatore Moccia, Katia Passerini, and Igor Tomic, focuses primarily on the financial services industry, noting the importance of connectivity, digital assets, and regulation. The authors recognize the opportunities *and* disruptions that fintech creates. They look at how incumbents must respond opportunistically *and* defensively to fintech adoption. A key observation is the tension between "stability and innovation," where change — regardless of how important or impactful — threatens existing processes, platforms, and regulations. The regulatory challenges are especially important since many of the new technologies — particularly blockchain and cryptocurrency — are uncharted and unregulated. Regulations will emerge that will challenge and enable fintech, and technology providers and those who adopt fintech should prepare for alternative regulatory scenarios.

The next article, by Keng Siau, Michael Hilgers, Langtao Chen, Steve Liu, Fiona Nah, Richard Hall, and Barry Flachsbart, looks at data science and AI/ML. These are two of the foundational technologies that empower fintech. They're foundational because they're universally applicable and therefore ever-growing. The authors look at data's role in all fintech transactions. They describe AI and ML as enablers and amplifiers. The financial institutions that adopt emerging fintech technologies (like AI and ML) have a competitive advantage, though there are adoption challenges for even the most adventurous companies. The authors take a detailed look at fintech and marketing and how big data, analytics, marketing, and financial services can be leveraged.

Based on findings from a Cutter Consortium survey examining the adoption and application of AI technology, Cutter Consortium Senior Consultant Curt Hall next looks at AI adoption drivers in banking and financial services. He identifies six: (1) competition; (2) the availability of massive data sets; (3) the growing number of commercial AI-based applications; (4) innovation among the players; (5) a growing understanding and appreciation of the potential of AI, ML, and natural language processing (NLP); and (6) increasingly sophisticated user interfaces and customer experience/engagement. His data reveals the primary foci of applications — banking and financial services — and the range of those applications, which extends from "credit approval, compliance, risk management, research and discovery, and document capture and processing to intelligent virtual agents and chatbots employing NLP and ML for automated customer engagement and self-service applications." Predictably, fraud detection, wealth management, and the increased use of bots and virtual assistants of all kinds are major

Upcoming Topic

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targets. The data also reveals the wide deployment of platforms like blockchain into new markets.

Next, Magesh Kasthuri looks at blockchain's impact on fintech. The article delves into the analysis of a specific technology; perhaps one of the most foundational technologies in the fintech basket. Kasthuri discusses the inevitability of BaaS and its security concerns. Most major cloud providers already provide some level of BaaS, but Kasthuri calls for a full blockchain "utility." He anticipates the widespread use of blockchain to enable all kinds of transactions, not just ones tied to the financial services industry.

Diarmuid Lane next looks at text- versus voice-based question answering (QA) systems in financial services. He explores a larger question: how efficient are chatbots, really? While the age of NLP-based QA systems is well underway, there are still hurdles in usability, security, and privacy to address. Lane offers a reality check on some of the supporting technologies that enable transaction processing of all kinds. While we're sometimes a little too eager to adopt new technologies, he reminds us that testing — in this case, usability testing — is a necessary step.

Next, Shivani Raghav, Jari Koivisto, and Frank Michaud raise the digital privacy stakes as they explore how banks could become "identity trust anchors" — and increase revenue as part of the process. Technologies like self-sovereign identity can help with the identity and privacy problem that is ubiquitous on the Web. In fact, KYCaaS ("know your customer" as a service) is a proposed new business model enabled as a new revenue-generating service. This is an interesting look at how fintech technologies, products, and services provide opportunities for companies to profitably commercialize transaction processing.

Markus Warg, Markus Frosch, Peter Weiß, and Andreas Zolnowski next take us into the insurtech platform world and describe how incumbents must adapt their business models and processes to exploit technological opportunities to remain competitive. They suggest that the definition of "platform" can extend from a purely technological definition to a more integrated one, and they explore ways incumbents can benefit from the capabilities insurtech offers.

In the final article, I look at the fintech "arms race," reporting country rankings in several foundational areas. I explore the areas of AI, blockchain, and cryptocurrency, and how countries are faring in the fintech arms race as measured by their investments in, and adoption of, these three fintech baskets. I also look at their national digital infrastructures. For countries to compete, they must invest in these baskets. If they fail to invest and adopt, they cannot compete in the global fintech arms race, and if they fail to compete in the fintech arms race, they will suffer economically, politically, and militarily.

Conclusion

Fintech is here to stay. The message here is that fintech is broad and will continue to disrupt not only the financial services industry but all industries that rely upon transaction processing — *which is all industries*! As the fintech community perfects its methods, tools, and techniques, its applicability will expand. Rather than define itself around specialty technologies or limited domains, fintech will become a platform across industries. BaaS (and other service models) will yield to fintech as a service (FaaS), simply because no industry, product, or service exists without transaction processing. As fintech technologies evolve and the range of applications expands, FaaS will become an enabling platform for all industries.

Endnotes

[1]Patrizio, Andy. "Top 10 Blockchain as a Service Providers." Datamation, 27 March 2018 (https://www.datamation.com/data-center/top-10-blockchain-as-a-service-providers.html).

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ROLL WITH IT

Fintech: Challenges, Drivers, and Future Opportunities

by Salvatore Moccia, Katia Passerini, and Igor Tomic

Financial technologies are experiencing rapid growth and represent the top source of disruption in the financial sector. This article examines the elements of the external environment that are determining this change and the key technologies and trends behind fintech innovation. It also suggests how to leverage future opportunities by rebuilding consumer trust and allowing experimentation within the boundaries of future regulations.

Expanding online access and new technologies allow fintech firms, alone or with partners, to compete with traditional providers in all financial sectors.

The Problem

The financial services industry is experiencing — or, perhaps better said, is *suffering* — an enormous paradigm shift. New technologies, combined with new consumers, are redefining the way financial institutions design products and deliver services. Remaining competitive in this rapidly and constantly changing environment is becoming a complex task. Traditional tools and strategies quickly get supplanted by better ways to meet customer needs. Moreover, traditional players, such as banks or similar financial institutions, face new competitors that more fully understand consumer expectations and are better equipped to meet emerging needs with new technologies. Those competitors use technology to make financial services more efficient. Fintech companies rely, for example, on mobile technology, advanced analytics, artificial intelligence (AI), smartphones, and virtual exchanges and tokens (e.g., cryptocurrencies) to disrupt traditional markets.

Despite these pressures for change, the financial world may seem to be at odds in deciding between stability and innovation. On one hand, we have the US Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 and the Basel III agreements that tightened regulation for the banking sector to improve financial stability after the Great Recession. On the other hand, we have an avalanche of unregulated innovation through myriad financial technologies, such as cryptocurrencies and other blockchain-based applications.

Cryptocurrencies are disrupting our centralized monetary system whose major function is to manage the money supply to provide price stability. This creates tension: regulation for one group (the banking system) and no regulation for the other (the new financial tools by fintech players). Giving up central control of money management after over 100 years of improving it will be an enormous challenge bound to be handled with increasing levels of regulatory interventions and skepticism if not managed effectively.

This tension between stability and disruptive financial innovation that eliminates older financial instruments is not new. Financial services have a history of modernization, where one product is introduced as an innovation and later replaced by another. Years ago, instead of carrying cash while visiting another country, traveler's checks were used. Over time, their usage has all but disappeared as credit cards have made them obsolete. The use of cash is declining as well. For example, in Norway, only 3% of transactions are currently estimated to be made in cash, and that small percentage may also soon disappear.[1]

Since the Great Recession, data usage, the exponential growth of mobile devices with their speed of communication, and the information revolution have challenged traditional business models while opening markets to new consumer segments that did not exist before. For example, mobile micropayments have given access to electronic transactions to clients who might not necessarily have a bank account. Expanding online access and new technologies allow fintech firms, alone or with partners, to compete with traditional providers

in all financial sectors. This competition is succeeding with fast, efficient, and convenient service. The growth of fintech lending, which now represents 36% of all US personal loans (up from under 1% in 2010), makes the scale of success evident.[2] No wonder some fintech firms reach up to 80 million clients.[3]

The Challenges Ahead

Fintech is the biggest disruptor of our time for financial institutions. Moreover, it is experiencing rapid growth at a global level. According to a recent survey, 57% of respondents ranked fintech as the top source of disruption in the financial sector, ahead of growing global regulatory complexity, at 51%.[4] The myriad technology solutions now available or in development are helping to rapidly reinvent the entire value chain of financial services. Such innovations can blur industry boundaries, facilitate disintermediation, revolutionize how existing firms create and deliver products and services, and provide new gateways for entrepreneurship. For example, startups can be financed through cryptocurrencies rather than traditional methods, allowing broader participation beyond established angel investors or venture capitalists. As another example, Bitcoins are entering the (physical) real estate market.

The difference between success and failure in this emerging sector will depend on the ability of any existing or new firm to understand the competitive challenges and their drivers and to responsibly manage emerging innovations by anticipating new regulations and rebuilding consumer trust. Figure 1 illustrates the factors affecting this evolution and its future opportunities.

Drivers of Change

Several factors are leading the fintech revolution and affecting technological innovations. These include cryptocurrencies, tokens, initial coin offerings (ICOs), blockchain, and other security advancements (i.e., multifactor and biometric authentication). The ability of the financial services industry to experiment with these new technologies responsibly is an essential component of their future success and sustainability.

Intangible Assets

Intangible assets are nonmaterial resources that have no physical attributes and thus are invisible, such as culture, knowledge, brand equity, reputation, and intellectual property. Consider Google, the tangible resources (headquarters and server farms) of which are valued at US $16 billion. In contrast, the Google brand, an intangible resource, is valued at roughly $160 billion — 10 times higher than the value of its tangible assets.[5]

Every industry is now part of the intangible economy. The advent of the Internet in the 1990s launched a new economic model based on knowledge and other intangibles. We have been moving from an economy based on raw material processing and manufacturing activities to the processing of information and the development, application, and transfer of new knowledge. Knowledge, as a factor of production, has the unique characteristic of achieving higher value with its repeated use, a phenomenon that has been defined by economists as "increasing returns to scale." In this new economy, intangible resources are not just other resources alongside the traditional factors of production — labor, capital, and land; they have become the most

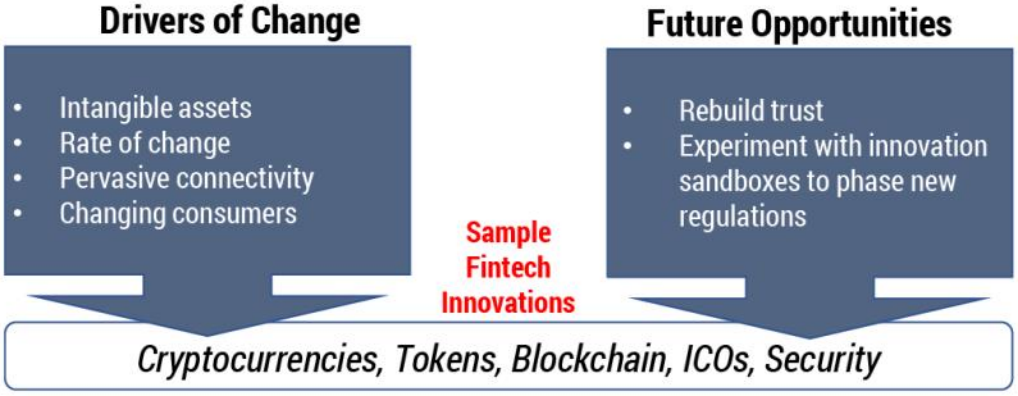

Figure 1 — Fintech innovation: drivers and future opportunities.

critical resources to stimulate growth and achieve increasing returns to scale. Fintech tools may enable increasing returns to scale and the building of intangible assets and capabilities.

> *The Pew Research Center predicts that connectivity and information sharing will become effortlessly interwoven into our daily lives and transparent to users.*

Rate of Change

Another driver of the rapid changes we are experiencing in the financial industry is the accelerating rate of technological change. While there have been many predictions on the technological rate of change (the most famous being those associated with Moore's law of "exponential doubling" in computer transistor growth), it was Ray Kurzweil who linked technological evolution to evolutionary biology, accurately predicting the pace of technological growth across several industries.[6] According to Kurzweil, the speed at which inventions have accelerated in the last two and a half decades is far less representative of the speed of innovation that future accelerations will bring: innovation will likely quadruple, accelerating by an equivalent of 100 years in the next 25 years.[7]

Rather than looking at earlier inventions that have become obsolete (e.g., traveler's checks now replaced by credit cards) as failure points, previous innovations in technology are enablers of feedback loops. Such feedback cycles continuously alert producers to society's shifting needs and tastes and feed the race for the next creative innovation. For example, by observing what happened to traveler's checks and how quickly they were replaced by credit cards, financial institutions can estimate that consumers favor digital transactions over physical financial products, which carry the risk of loss or theft.

Pervasive Connectivity

The disruption affecting innovation in the financial industry is also driven by the pervasive connectivity that characterizes today's telecommunications sector, enabled by the diffusion of Internet access worldwide and the integration of the Internet with other sensor-based technologies, forming the Internet of Things (IoT) infrastructure.

To some extent, asking questions of Alexa, Siri, and AI-like devices has already brought this seamless integration into households. The Pew Research Center predicts that connectivity and information sharing will become effortlessly interwoven into our daily lives and transparent to users.[8] This pervasive integration of technology into any household, achieved through the IoT infrastructure, is making consumers more aware of the advantages of location-based and intelligent technologies, and these consumers may now demand the same level of ubiquitous accessibility and integration from the banking and financial sectors.

Moreover, increasing computing efficiency is lowering the energy requirements of computer processing, and storage capacity is increasing exponentially, with decreasing storage costs. This pervasive and lower-cost connectivity is bringing more consumers to the forefront of the fintech revolution by enabling many consumers to complete or expect to complete any transaction online. More sophisticated users are actively trading in online investments and cryptocurrency markets. Financial innovations built on technology platforms and standards such as blockchain and cryptocurrencies in their various forms are benefiting from these connectivity and faster processing trends.

Blockchain enables a paradigm shift from a centralized verification *authority* (e.g., the banks) to a user-based verification *system*, whereby the validity of the user transaction is verified through a distributed and interconnected network of computer users. Cryptocurrency miners, who assemble computing power to generate currency units (e.g., Bitcoin) and validate transactions, create and "mint" currency. The seamless network connectivity enables the exploitation of these financial innovations currently operating with little to no government oversight.

Changing Consumers

Ultimately, any innovation, financial or technological, will take hold only if users adopt it en masse. Following the traditional theories of diffusion of innovation, a limited number of early adopters will jump on new opportunities before they reach market potential, and the volume of such early adopters will generally be limited compared to the overall size of the market at its peak.[9] Especially in financial innovations, the need

for higher sophistication of end users generally poses a barrier to fast adoption, thus limiting the number of early adopters to those who are financially and technologically savvy. However, today's new consumers are different. Seamless access to information has made them more sophisticated and able to discern between correct and incorrect information. Pervasive access has increased their confidence in understanding and using technology. Today's users learn from the Internet through powerful and free sites such as the Kahn Academy or thousands of other free websites with verified content. Users are empowered to detect and understand scams through an increasingly reliable network of online reviews and online communities, which are difficult (although not impossible) to manipulate if users undertake due diligence in searching for multiple sources of information. This increased access to information will ultimately increase customer sophistication.

While the risks of opening access to new forms of investment are many, especially due to the anonymity and inability to reverse-engineer cryptocurrency transactions if proof of ownership is lost, the potential opportunities are limitless. As capital begins to be raised for startup entrepreneurship beyond the traditional networks, or physical property starts to be exchanged for cryptocurrency, capital begins circulating much more freely, less subject to constraints and capital gains taxation — at least until new regulation is issued.

Future Opportunities

Now that we have a handle on the challenges and drivers of fintech, let's explore how we can leverage future opportunities by rebuilding trust and experimenting within the boundaries of future regulations.

Rebuilding Trust

Following the 10th anniversary of the 2008 collapse of Lehman Brothers, which triggered the worst global financial crisis since the 1930s — amidst cryptocurrencies, ICOs, AI, unstructured data, and so on — it is important to talk about "old-fashioned" trust. Trust is still a fundamental characteristic of successful business relationships, but it is also the *only* way to be a successful business in the long term. According to recent global public opinion research, trust in global companies, national government, and the official press remains low.[10] Rebuilding this trust is essential.

CEO Thomas Coughlin of Kinesis Monetary System, a recently launched gold-based stablecoin, argued that the financial services industry is in critical need of the restoration of trust to avoid the creation of another "hype" bubble, similar to the one that developed within the housing market in 2008 when borrowers' trust was breached by predatory lending practices.[11]

This is where current financial innovations can help by rebuilding confidence from the bottom up. Paradoxically, despite the current flux and uncertainties surrounding their future and possible nature as another speculative bubble, some financial innovations may in fact allow greater levels of accountability than ever before. The advent of blockchain technology, for instance, allows for the creation of digitized, shared, and trackable sets of data, allowing not only increased visibility but stored, downloadable ledgers for all stakeholders to see. Blockchain technology can provide the trust and transparency the financial services sector needs to ensure complete visibility of transactions by all stakeholders on a micro level, broken down to each second of the day.

The advent of blockchain technology allows for the creation of digitized, shared, and trackable sets of data, allowing not only increased visibility but stored, downloadable ledgers for all stakeholders to see.

The results of Mobile Ecosystem Forum's 2017 "Consumer Trust Study" support the notion that there is a mutually beneficial value exchange when it comes to a trusted digital relationship.[12] In exchange for a richer user experience, customers will end up sharing more data if they can trust what will be done with that data. For example, to access sound investment advice, consumers may be interested in disclosing more information about their current and future needs, their retirement goals, and their financial obligations, which may be distributed across multiple accounts and not held with any single financial institution. If the consumers believe that the data aggregation will ultimately be beneficial to craft an integrated financial strategy, they might be more inclined to facilitate the aggregation of their information from disparate sources. The challenge is assuring that consumers are protected from end to end, across products and services.

Regulation Experimentation: Innovation Sandboxes

Fintech firms are bringing to market a variety of technologies to introduce new products and compete with existing firms. However, the financial markets have a long history of regulation, meant to protect depositors and stakeholders and maintain the safety and soundness of the financial system. Given these concerns, how does one regulate a fintech firm? Should the focus be on each type of technology? Or should regulation be based on broader objectives?

> *Fintech firms are bringing to market a variety of technologies to introduce new products and compete with existing firms.*

These challenges are in the process of being resolved and that will take some time, as it is a two-step progression. First, the industry must create an experimental space (a small market), where technology and its related products can be introduced. In this way, a firm can experiment and improve its offering for some time without regulatory restraints while being observed by the regulators who, in time, can consider any appropriate regulation. This is known as a "sandbox." Second, if a regulation is imposed, it should not be designed to regulate the specific application of a technology but rather to provide a regulatory framework or regulatory objectives. A regulatory objective could be adherence to anti-monopoly and anti-money-laundering, assurance of consumer protection, or maintenance of a sound cybersecurity framework. Another objective could be to provide regulatory certainty, which then encourages new fintech business formation. The Mexico Fintech Law introduced in March 2018 is just for that purpose.[13]

The use of sandboxes has been accepted as a good way to encourage new business formation, as well as for the regulators to learn more about these new businesses. In 2015, the UK Financial Conduct Authority established two such sandboxes, with 18 fintech firms in one cohort and 24 in the second.[14] By the end of 2016, sandboxes were organized in Holland and Denmark and in several Asian countries, including Australia. The state of Arizona was the first in the US to allow the formation of sandboxes starting in March 2018, while the US Department of the Treasury announced recommendations around the following topics:[15]

- Adopt regulatory approaches to support the development of key competitive technology, as well as the use and appropriate sharing of data.
- Combat unnecessary regulatory fragmentation and account for business models enabled by financial technologies.
- Remove outdated activity-specific regulation in the light of technological advances.
- Promote responsible experimentation in the financial sector.

In a similar way, the 2018 decision by the Basel Committee on Banking Supervision recommended that bank supervisors should review existing supervisory frameworks to consider whether innovative business models can evolve in a manner that has appropriate banking oversight but does not unduly hamper innovation.

Nonetheless, fintech firms may not pose a big challenge to the established banks. Some larger institutions are likely to merge with the new fintech firms if they desire to enter new businesses. For example, in 2014, BBVA of Spain acquired the US-based Simple (an online bank with 100,000 customers). In 2016, BBVA bought Holvi, a Finnish online banking startup. In 2017, BBVA acquired Openpay (a Mexican startup that offers electronic payments for businesses), Madiva (a Spanish big data startup), and solarisBank (a German B2B financial services firm). While some fintech firms will operate on their own, others may be acquired or develop relationships with larger and established institutions.

Conclusion

This article describes a dynamic future for the financial industry. Pushed by changes in the economy that focus on growing intangible assets and by the frenetic pace of technological innovation and pervasive connectivity, consumer needs have evolved, and they are increasingly demanding more sophisticated, efficient, and always accessible financial services. The rise of cryptocurrencies backed by blockchain and other security innovations are just some examples of these emerging trends. Fintech firms — those companies that use financial technologies to create more efficiency and disrupt existing markets — are here to stay.

To avoid another dot-com or housing-like bubble, the long-term sustainability of these firms must be anchored on a key element: the regaining of consumer trust, leading to large-scale adoption. Such trust can be better built through phased and responsible experimentation, such as that described in the sandbox examples in this article. Phasing innovation responsibly will enable sound and principle-based (rather than tech-driven) regulation to follow and will reduce the tension between stability and radical change.

So where are we heading in the near future? Established financial services firms will be engaged with products that assure the safety of consumer deposits and, through mergers, will enter the fintech business, while independent fintech firms will grow in the areas of their specialty. By allowing experimentation, the regulatory focus will be to support the formation of fintech firms while keeping a regulatory eye on them.

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EMBRACE & SURVIVE

Fintech Empowerment: Data Science, AI, and Machine Learning

by Keng Siau, Michael Hilgers, Langtao Chen, Steve Liu, Fiona Nah, Richard Hall, and Barry Flachsbart

As the world becomes increasingly connected through the Internet of Everything, the emergence of fintech is beginning to disrupt the financial world with transformative changes. The unique consumer behavior and banking habits of millennials, coupled with their pro-technology attitude, facilitate the rapidly advancing disruptive revolution of fintech. Banks and financial institutions alike have been adopting innovative technology to cater to the ubiquitous use of mobile devices. As many fintech companies accelerate their presence via online operations — not restricted or constrained by time and place — they can provide their customers with more convenient financial services experiences at much lower costs. According to FinTech Global, the "global fintech sector raised [US] $41.7 [billion] in the first half of 2018, surpassing 2017's record total," and "global fintech investments increased steadily between 2014 and 2017 from $19.9 [billion] to $39.4 [billion] at a [compound annual growth rate] of 18.5%."[1] To stay competitive, traditional banks are now facing the challenge of offering innovative fintech products and services to their clients. If the world's banks cannot find a way to compete with fintech startups, which capitalize on new technologies, they stand to lose $1 trillion in profit.[2]

In this article, we discuss the impact of data science, artificial intelligence (AI), and machine learning (ML) on the revolution and evolution of fintech. We explore the competitive advantages for financial institutions that embrace the latest fintech technologies, challenges they face in adopting these technologies, and future opportunities in fintech with AI and ML.

The Emergence of Fintech

Fintech, a concatenation of finance and technology, refers to technologies used and applied in the financial services sector. Fintech applications cover a wide range of areas addressing the needs of consumers, investors, and regulators. Companies utilizing fintech consist of both startups and established financial and technology conglomerates with the commonality of seeking to replace or enhance the appeal and power of their financial products or services.

Increasingly, fintech has begun to disrupt traditional financial services such as mobile payment, money transfers, loans, fundraising, and asset management. Even currencies are not spared from fintech's onslaught. The use of digital currencies (any currency in a digital rather than physical form), such as Bitcoin, has, in some cases, become an alternative to traditional cash or check payment. One popular form of digital currency is cryptocurrency. Cryptocurrencies are considered reliable because they are based on cryptography.

As the value of 1 Bitcoin rocketed above $19,000 in 2017, the cryptocurrency caught the attention of investors. Built on advanced technologies such as blockchain and distributed ledger, Bitcoin improves transaction speed and reduces service fees. Embedded in a peer-to-peer network, every account in the system has a complete record of history of all transactions, so double postings can be effectively prevented. After the confirmation of each transaction, blockchain nodes spread the transaction throughout the network, and the new record becomes part of the blockchain. Digital currencies, including cryptocurrencies such as Bitcoin, Litecoin, and Ethereum, could potentially transform the financial industry.

Empowering Fintech with Data Science: Big Data and Analytics

Fintech is driving financial services innovation, with big data and analytics as two key enablers. Big data has been a ubiquitous term in business and IT news for more than a decade. One of the fundamental issues facing fintech today is how to manage big data and, more important, how to capitalize on data science. To see how fintech affects the business process of marketing, see sidebar, "The Evolution of Marketing."

At the heart of big data are significant changes in the cost and capacity of storing information. According to

The Evolution of Marketing[1]

Approximately 70% of big data usage is for marketing applications. To see how fintech intertwines with big data, analytics, marketing, and financial services, let's consider an example.

Suppose that Nancy carries a credit card issued by ABC Credit Corporation (a fictitious financial company). ABC would like Nancy to use the card more often because it generates revenue for ABC in several ways. ABC receives a flat fee from the vendor for the use of the card for a purchase and additional interest if this purchase becomes part of an unpaid balance. The financial institution also has the option to impose an annual fee for the credit card.

Traditional marketing methods begin with mass mailings, which have a fixed cost for each person solicited by the marketing effort. The amount spent on the marketing effort is wasted unless the recipient increases the use of the credit card; hence, it can be expensive, as many people will have no interest in increasing their use of the card and will simply ignore the marketing mails.

With fintech, ABC can reach out to potential customers using electronic mail by sending an email to every card holder at a significantly lower cost than postal mail. Unfortunately, most computer users will never see the marketing offer among the tidal wave of daily spam. According to a 2014 Cyberoam report, an average of 54 billion spam messages were sent out every day.[2] Spam messages accounted for 39.2% of email traffic worldwide in 2017, down from 59.8% in 2016, but still a significant percentage.[3]

ABC finds the email campaign response rate disappointing. The Direct Marketing Association indicates that the average response rate for an email campaign in 2017 was only 0.12%.[4] As the price of memory storage has decreased such that more complete customer information can be captured, ABC is now able to store more data and learn more about its customers, which allows ABC to switch from mass marketing appeals to directed campaigns, sending marketing emails only to those card holders most likely to take advantage of the offers or promotions. The combination of fintech, big data, and analytics allows companies to use mathematical models to predict the likelihood of a purchase. By targeting only those customers predicted to have a higher probability of using the card, overhead costs are reduced while profits increase. The overuse of these targeted advertising appeals, however, has quickly hardened the population of computer-literate users. For example, ads on Web pages, even those directed toward a particular consumer, have been countered by ad blockers.

Business analysts using big data and data science stepped up the game. The next approach has been to target smaller and very similar groups of people. Prediction models now gather an increasing number of client characteristics, processed by ever-more sophisticated modeling techniques and faster computers. Personalized marketing means that Nancy receives advertising designed specifically around her purchasing interests. Marketing algorithms not only work to predict her next purchase but also to recommend that next purchase. Suppose Nancy uses her card to purchase a pair of running shoes. Within seconds of receiving this information, a marketing algorithm predicts (or recommends) that her next purchase will be a pedometer, as she is classified as a middle-income, gadget-oriented consumer who is athletic or fitness-conscious. The algorithm, using data from past purchases captured by fintech, shows that many customers who purchase a pair of running shoes eventually purchase a pedometer. Moments later, thanks to AI and ML, Nancy receives a message that good pedometers are available at Joe's Sports Store just around the corner from her current location. She is given information about Joe's inventory, which happens to include other items also recommended to her. She is given pictures of Joe's along with a video advertisement. The fintech application then offers her 20% off the purchase of the pedometer today if she uses her ABC card.

Think for a moment about the complexity of this situation. ABC receives millions of credit card transactions a second from stores located worldwide offering every type of product or service. Nancy's transaction is instantaneously associated with her personal demographics and purchasing history. Meanwhile, ABC's data science group has utilized AI and ML to mine text reviews, photos, and videos found on social media to identify a cluster of people with buying interests similar to Nancy's. All the information is drawn together to provide an estimate of the probability Nancy might next buy a pedometer.

Moving forward, ABC is further exploring the use of data science, AI, and ML to enhance its market share and innovate new financial services and products for its customers.

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Computerworld, in 1967, the cost of 1 megabyte of hard drive storage was about $1 million. By 2017, "that same megabyte of capacity on a hard disk drive costs about two cents."[3]

A large proportion of new data generated every day is directly or indirectly related to fintech and can be utilized in fintech. Data centers and cloud services developed by Amazon, Google, IBM, Microsoft, and Oracle have facilitated the storage of fintech data. Such cloud computing development has hugely lowered operating costs and enables startup fintech companies to focus their efforts and financial resources on specific applications via the Internet. To be useful, data must be analyzed to extract meaningful information that can be applied to transform business solutions. This transformation is facilitated by increasingly powerful graphical processing units and advanced microprocessors enabling the explosive growth of big data analytics and data science.

The Four Vs of Big Data and Fintech

With the exponential growth of big data in volume, velocity, variety, and veracity (the four Vs),[4] it becomes imperative for the financial industry to efficiently recognize interesting patterns from financial data, enabling business executives to make discoveries from, support decisions with, or provide explanations about patterns, trends, clusters, gaps, and anomalies. Let's look more closely at each of the four Vs:

1. **Volume.** The financial industry sits on a huge amount of data that continues to grow every second. Financial institutions have their data generated from various activities ranging from financial transactions to online consumer reviews. Data volume has been growing from terabytes to petabytes and even zettabytes. With the growth in data availability, a sophisticated team of data scientists and analysts in fintech can do more in-depth and insightful analyses with the data.

2. **Velocity.** Having more data does not necessarily lead to faster and more efficient decision making unless that data is also processed and analyzed. A key element of successful fintech applications is the capability to capture and process significant volumes of information on a millisecond basis. For example, institutions using fintech for credit score management face the challenge of producing credit ratings for their clients on a real-time basis. In general, stream processing involves a computing platform enabling analysis of high-velocity data so that timely responses are possible. Data integrity can be improved by continuously analyzing and transforming information in memory before it is stored in the database. Fraud identification requires real-time actions and immediate responses, making developments in fintech an ideal aid. The quicker a fraud is detected, the greater the chance that losses can be controlled.

3. **Variety.** Powerful insights come from efficiently processing data in both traditional and nontraditional formats. While most data-driven initiatives focus primarily on structured data stored in databases, unstructured data gathered from social networks, weblogs, and/or other sources contains enormous value for financial institutions. For example, textual data collected from social media can be used for sentiment analysis to gauge customers' attitude toward a financial company's products and analyze its product offerings. Fintech needs to be able to combine various data types and sources to yield valuable intelligence from big data and analytics for real-time and effective decision making.

4. **Veracity.** Understanding the importance of data veracity is the first step in differentiating the signal from the noise when it comes to big data. Along with opportunities, the huge amount of data poses many challenges for data credibility and quality. For example, using input with bad quality and low accuracy is likely to result in unreliable predictions in financial models. IBM estimated that poor data quality cost companies $3.1 trillion in 2016.[5] Ensuring data reliability and quality, and transforming big data into useful information, are the prerequisites for turning mega data into value-adding "smart" data in fintech.

Descriptive, Predictive, and Prescriptive Analytics in Fintech

Obtaining a competitive advantage is what businesses hope to achieve with big data. As discussed above, to be useful, data must be transformed into practical and useful information via business analytics. Analytics strives to provide insight into the business relevancy of data. Analytics is not useful in and of itself unless the analysis yields actionable insight based on the appropriate performance/value measurement, which can be accomplished via a combination of descriptive, predictive, and prescriptive analytics:[6]

- **Descriptive analytics in a fintech context provides a summary view of an institution's financial health based on past financial data.** It presents historical data in an easily digestible format for the benefit of business and financial executives. Primary analytical methods include data aggregation and data mining. Information visualization is especially important, particularly as the dimension and size of data sets increase. Visualization of financial data (e.g., sales expenses, profit margins, and net income over time) is an example of descriptive analytics. The ease of comprehension and accurate representation of data analytics results enable their efficient and effective utilization for timely decision making.

- **Predictive analytics focuses on predicting the future with available data.** Many financial institutions have widely used time series, regression, and advanced ML methods to predict outcomes of interest. Deep learning, an advanced form of ML, is particularly important for prediction with large-scale or streaming data, which usually includes a very large sample size and/or a very high dimensionality (i.e., a large number of variables or features). Making financial forecasts based on past trends is an example of predictive analytics in the fintech context.

- **Prescriptive analytics goes beyond predictive analytics and evaluates new ways to conduct business.** Optimization, simulation, and decision-modeling approaches are used to assess possible business scenarios and to find ways to achieve more desirable outcomes. Prescriptive analytics is one of the newest and least fully explored areas in fintech. Although business analytics has been vastly developed and many tools and platforms for analysis are readily available and accessible for free (e.g., R and Python), companies are confronted with the challenge of translating analysis into actionable insights that can be applied to improve competitiveness and drive business value creation.[7] The use of AI and ML to automate financial decision making is an emerging area in prescriptive analytics within fintech.

Challenges and Opportunities of Data Science in Fintech

Big data and analytics present tremendous opportunities for fintech to innovate existing products and services. However, many challenges come along with the opportunities.

Data Quality

Data quality is paramount in analytics. "Garbage in, garbage out" is to be avoided at all costs. Data capture and cleansing are essential and are the most time-consuming parts of a fintech analytics project, especially when big data is involved. Raw financial data can be extremely messy, noisy, and dirty, as it may be obtained from different sources, some of which are ill-structured and untrusted. A well-designed system architecture can enhance the accuracy, reliability, and efficiency of the data-capturing and cleansing process. As the fintech industry moves to real-time analytical processing, data quality becomes an ever-more challenging issue. In fintech applications, big data platforms such as Hadoop can be used as a data hub that integrates data from various sources and provides a single data environment for descriptive, predictive, and prescriptive analytics.

Data capture and cleansing are essential and are the most time-consuming parts of a fintech analytics project, especially when big data is involved.

Textual and Sentiment Analytics in Fintech

Given that a large percentage of business-relevant data is stored in a textual format, textual and sentiment analytics are essential for fintech data analysis. A nontrivial exploration of textual data (e.g., Twitter feeds, online customer reviews, and news) requires an appropriate way of representing texts as numbers, which are mandatory when using most advanced analytics methods. Text mining applies a set of algorithms to quantify unstructured text as structured data and then uses quantitative methods to analyze the structured data.

"Bag of words"[8] is a popular approach to quantify textual data by treating a document simply as a collection of words. A general text quantification used in the financial industry, it involves the preprocessing of textual data, such as tokenization, part-of-speech parsing, stemming, and stop-words filtering, followed by representing the text by term count, term-by-document matrix, and other techniques. However, as bag of words ignores the meaning, syntax, and context of the text, the results from this approach could be less satisfactory than that of the natural language processing

approach. Advanced text analytics methods (e.g., word cloud visualization, text classification, and sentiment analysis) can be conducted to gain insight into the contextual polarity of emotional reaction to certain financial services, products, and/or processes.

Information Visualization in Fintech

Fintech requires creative approaches to the visualization of financial information for descriptive, predictive, and prescriptive analytics. Visualization can expand human working memory and amplify human cognitive capability. Visual communication has been regarded as "a must-have skill for all managers."[9] Information visualization is still a challenge in fintech, and more research is needed to ensure effective representation of information for fast and accurate interpretation — especially in the case of multidimensional data and data of multiple types and structures.

Understanding Investor Risk Tolerance and Mitigating Risk Exposure

Fintech, far from being a silver bullet, neither resolves all the woes of the financial industry nor is it a panacea for financial investors. Fintech companies still need to understand and consider investor risk tolerance and educate investors on risk exposure. Ignorance can be very costly, making education and training necessary for financial institutions and investors. The evolution of fintech products needs to be closely monitored and controlled, as fintech companies may be compelled, given the fierce competition in the fintech market, to accelerate and roll out the development of products without thorough conceptualization and testing.

Fintech Governance and Regulation

Governance and regulations typically advance more slowly than the pace of technology advancement. Fintech is no different, meaning that governance and regulatory bodies need to catch up with the rapid developments in fintech. Some organizations that have been enhancing or further refining fintech regulations include:

- **The US Financial Crimes Enforcement Network (FinCEN)** — part of the USA Patriot Act that addresses issues such as money laundering.
- **The US Federal Reserve's Comprehensive Capital Analysis and Review (CCAR)** — a framework for preventing financial institutions from being undercapitalized.
- **The US Financial Industry Regulatory Authority (FINRA)** — provides a set of rules regarding the transparency and validity of transactions.
- **The US Office of the Comptroller of Currency (OCC)** — regulates fair access to banking and enforces the US Bank Security Act.

Given that cybersecurity and data privacy have been headline news lately (e.g., the Marriott data breach that involved about 500 million guests[10]), government entities also need to expeditiously put in place financial regulations to reduce the occurrences of cybercrime. In addition, regtech, which is emerging as an important solution using innovative information technology to manage the complex array of financial compliance demands, should also be a focus of attention.

Fintech Business Models

It is vital that fintech startups, entrepreneurs, and companies find a successful and profitable fintech business model. Simply adding fintech to an existing business model is not going to work. At best, business as usual can only provide suboptimal outcomes. The business models and processes need to be reengineered to capitalize on the innovations enabled by fintech.

Even for startup funding, fintech entrepreneurs can utilize the innovations enabled by advanced technologies. For example, one popular fintech funding model is crowdfunding. It provides entrepreneurs with a platform to readily raise money at a low cost and from all over the world. Kickstarter, founded in 2009, is a popular crowdfunding platform that focuses on helping people achieve their fundraising goals; the platform has helped fund numerous business ideas such as films, music, comics, video games, and food-related projects. Indiegogo is another crowdfunding platform aiming to help people solicit funds for idea development, charities, or startup businesses. Via these platforms, fintech startups and entrepreneurs can capitalize on using websites for their fintech projects, which they can then publicize through social media such as Facebook, Twitter, and similar platforms. Campaigns that successfully reach their funding targets are assessed fees of a small percentage of the funds raised. For unsuccessful projects, the sites allow campaigners to refund contributors, at no charge, any money raised.

Continuous innovations and adaptations are necessary to survive and excel in fintech, and fintech business models and processes need to evolve as technology advances. Fundrise is a good example.[11] Fundrise is an online investment platform that helps democratize real estate investing. With a minimum investment of $500, Fundrise makes investing in commercial real estate accessible to the masses. An eREIT (electronic real estate investment trust), a Fundrise invention, pools the funds of many individual investors and allows investors to purchase a diversified mix of commercial properties without high capital commitment. By the end of 2017, Fundrise had originated $343.8 million in both equity and debt investment across more than $1.9 billion in real estate property.[12]

Fintech Adoption

The gulf between those who have ready access to computers/mobile devices and the Internet and those who do not poses a challenge to fintech adoption. Another challenge is cultural differences, which should be carefully considered when pushing fintech services from one country or region to another. The generation gap is another stumbling block, with the two main factors being trust in and familiarity with technology.[13] Generations Y and Z readily adopt fintech, while some members of Generation X may face challenges. Moreover, a significant group of pre-Generation Xers may not be fintech adopters. For this group, which includes many wealthy individuals, human touch, rather than fintech automation, may still be necessary.

The Future of Fintech: AI and ML

The use of AI and ML in fintech has mushroomed. For example, robo-advisors are a class of financial advisory services that provide, with minimal human intervention, investors with online automated asset management. Based on a client's risk preference and desired return rate, robo-advisors employ methods such as modern portfolio theory and investment analysis to allocate the client's money among a variety of financial products (e.g., stocks, bonds, futures, commodities). Online delivery and the ability to eliminate human interaction through the application of AI offer a unique customer experience that keeps cost at a low level.

AI and ML are expected to be the next drivers of fintech. Machine learning aims to give computer systems the capability to find patterns in and derive insights from data. ML techniques, such as support vector machine, ensemble, and deep learning (recently becoming popular with the advancement of computation hardware), can be used for classifying financial data and performing predictive analytics.

For instance, these techniques can be easily adapted to a financial setting to predict whether a financial customer is likely to cancel financial services (aka "customer churn analysis") based on the customer's demographic information and past use of services. Such analysis can help financial institutions optimize their resources to prevent customer churn. Another example is fraud detection. With historical data and ML, an analytical solution can be embedded in the operational process and automatically isolate or minimize financial fraud. Using historical transaction data, the algorithm, together with the training process, is expected to automatically differentiate fraudulent activities from legitimate transactions. AI and ML can help fintech companies detect suspicious incidents instantaneously and expedite the time to respond. Risk monitoring, based on real-time big data processing and ML, can capture fraud signals more effectively and efficiently than traditional rules-based systems or manual processes. Unsupervised ML algorithms (in which data is unlabeled), examples of which are association rules and clustering, have also been widely used in applications such as market basket analysis as well as in customer and product segmentation.

Getting more from pattern recognition in fintech will increasingly depend on the use of ML techniques. To utilize these techniques effectively, organizations need to ensure that the data is not only of good quality but is also cleansed and categorized appropriately for data analysis. As with big data and analytics, the processes to examine data and feed it into ML algorithms will be key. At the same time, caution is needed as there is still a lot of hype about AI and ML. Predictions and prescriptions must be validated, and any biases imposed by AI and ML must be offset.

Although AI and ML provide tremendous opportunities to further advance fintech, they are evolving rapidly, and most of the recommendations provided by AI and ML algorithms are not easily understandable or explainable. Research efforts are ongoing to make these "black boxes" transparent or at least translucent.

Conclusion

Combined with data science, AI, and ML, fintech creates a competitive advantage for financial institutions. The

revolutions and evolutions in fintech are accelerating and will continue to drive innovations and create new financial services and products. Financial institutions need to embrace fintech and evolve with it — or be eliminated from the marketplace, passing into history.

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TOP RANKS

AI in Banking and Financial Services:
Current and Future Trends

by Curt Hall

Banking and financial services companies were among the first to apply artificial intelligence (AI) in strategic applications. Initially this took place in the mid- to late 1980s in the form of expert (rules-based) and knowledge-based systems for credit/loan approval and mortgage processing. It continued in the early to mid-1990s, when banking and financial services companies began to deploy neural network–based applications for credit and bank card fraud detection and profitability management.

One of the first comprehensive neural net applications to impress me was Falcon, a commercial credit card fraud detection system developed in the early 1990s by HNC Software licensed to banks and card processors. (Fair Isaac, now FICO, acquired Falcon when it bought HNC in 2002 and still offers the system today.) Another was the Cardholder Risk Identification System (CRIS), a neural net–based credit card fraud detection application developed by Visa in 1994.

Looking back, it is little wonder that banking and financial services rank at the very top today among the industries AI will impact greatly, according to findings from a recent survey I conducted with Cutter Consortium examining the adoption and application of AI technology in the enterprise.[1]

What's Driving AI in Banking and Financial Services?

Various trends and industry developments are driving AI adoption in banking and finance, including:

- **Competition.** Competition among traditional banks and financial firms is pushing them to create new products and services. At the same time, fintech startups are introducing new platform-based companies that take advantage of new IT technologies (e.g., AI, blockchain, big data, mobile) and new business models, which are enabling them to offer streamlined services and enter new markets.
- **Massive data sets.** Banking and financial services companies face an overwhelming need to analyze very large data sets — including structured and unstructured data for exploration and discovery, market research, risk analysis, compliance, operational engagement, and customer service and customer experience (CX) management.
- **A growing number of commercial AI offerings.** These include AI development platforms offered in the form of API-based cloud services available from such providers as IBM (Watson), Microsoft (Cognitive Services, Azure ML), CognitiveScale (AI Innovation Cloud), Expert System (Cogito), and H2O.ai (Driverless AI), among others. Cloud-based services make it easier for both corporate and commercial developers to build AI applications and commercial solutions for banking and finance.
- **Industry-specific/focused AI products.** Together with the offerings above, an incredible amount of innovation is underway among both established software providers and startups to introduce new platforms and Web services–based AI solutions targeted at specific banking and financial markets and applications. Examples include 50wise (an IBM Watson partner), Expert System (Cogito Risk Watcher), Domo Semo Sancus (SafetyNet), IQventures (SpeechIQ), Kasisto (KAI platform), Kenshoo (Kenshoo), Personetics (Self-Driving Finance), Seal Software (Seal Financial Services Suite), Sentieo (equity research platform), and ZestFinance (Zest Automated ML [ZAML]), among others. This is an accelerating trend, with more products constantly appearing on the market, making it easier for firms to implement AI capabilities into their banking and other financial processes and applications.
- **Widespread appreciation.** Many have embraced the potential offered by machine learning (ML), natural language processing (NLP), interactive natural language UIs, and AI in general. AI is the story of the day, and it's not all hype. Intense interest

in the technology has sparked its use in a range of banking and financial applications, including for providing self-service capabilities to decision support, CX management, and advisory services, among others. These capabilities are proving beneficial to employees and customers alike.

- **CX and customer engagement.** CX and customer engagement are key today in all industries. Combining AI with mobile, speech, and touch technologies supports the implementation of smart, multi-modal UIs designed to deliver an enhanced customer experience to mobile, Web, and other banking and financial applications.

Banking and financial services firms seek to make AI-powered financial guidance an integrated part of the customer experience.

Key Application Areas

AI is already significantly affecting banking and financial services, and we should expect this to accelerate dramatically as the technology undergoes increasing adoption over the next two to four years. Today, banking and finance companies are applying AI for many uses. This ranges from credit approval, compliance, risk management, research and discovery, and document capture and processing to intelligent virtual agents and chatbots employing NLP and ML for automated customer engagement and self-service applications. We are also seeing companies develop new platforms employing AI , blockchain, and mobile in order to enter new markets — including emerging markets currently not served or underserved by traditional banking and financial institutions. There are simply too many use cases to cover them all, but what follows are some of the key application areas in which banking and financial companies are applying AI.

Financial/Market Research and Discovery

Research and discovery are major application areas for applying AI; particularly cognitive technologies for financial market analysis, marketing, and product development. For instance, several versions of IBM's Watson technology, in the form of focused applications, are now utilized by banking and financial services companies in these roles. In addition, commercial solutions like Kenshoo and Sentieo, targeted specifically at supporting financial market research, are available. These targeted platforms combine NLP and deep semantic search to give financial analysts enhanced capabilities for searching, visualizing, and interpreting data, allowing them to conduct more comprehensive research, spot anomalies, and perform trends analysis.

Preventing Fraud and Financial Crimes

Banks and other financial institutions are turning to AI to deal with the rising sophistication of financial crimes and the growing complex regulations requiring strict operating and reporting standards. Indeed, efforts to manually detect money laundering, investigate false alarms, and handle complicated reconciliation processes are costly. AI, particularly applications employing NLP (for analyzing and summarizing large volumes of textual information) and ML (for auto-generating customer profiles), are allowing financial institutions to automate some of these processes, reduce errors, and accelerate response times as incidents are uncovered.

AI in Wealth Management

Wealth management is a popular domain for financial institutions applying AI. Predictive analytics are finding considerable application in this area, particularly in the form of smart advisory systems designed to assist human advisors with enhancing their client acquisition skills and formulating strategies by providing detailed profiles and insights into clients who represent a "best fit" for their wealth management practices. Such applications typically combine consumer demographic and financial and behavioral information with proprietary and third-party data. They utilize text mining and analysis for information summarization and ML for automated customer profiling.

Financial Guidance and Customer Acquisition

Banking and financial services firms seek to make AI-powered financial guidance an integrated part of the customer experience and, in so doing, attract new customers and open new lines of business. Such applications are designed to offer forward-looking

guidance to help customers control and manage their finances with their financial goals in mind. A popular segment for such applications is small business owners and managers targeted to receive insights that can help them gain greater visibility into their business accounts, optimize cash flow, and simplify everyday money management tasks.

Customer Service and CX Management

Consumers enamored of mobile and social media are forcing banks and other financial institutions to optimize their interactions with customers and transform the way they conduct marketing, sales, and service. Today's consumers expect financial companies to know them individually and deliver personalized interactions and self-service options.

One of the main goals of CX management is to make it so customers come away from interactions with a feeling that they have been treated as individuals, in a personal manner, instead of as just another number in a database. Another goal is to create a friendly, enjoyable experience for the customer — regardless of the channel they prefer to interact with.

AI, particularly cognitive systems, is well suited for optimizing customer engagement due to the ability to decipher the nuances of human language, process questions in a way that considers the way people think, and rapidly analyze vast amounts of data to generate relevant, evidence-based responses to customer wants and needs. The interactive, Q&A format in which cognitive systems interface with users can help establish a strong bond between who customers are as individuals and what types of information they require to help them attain their goals. In short, banks and other financial institutions are applying AI to: (1) achieve a greater level of automation for optimizing their customer service operations, including encouraging customers to take a self-service approach; and (2) enable an easier, more satisfying, and engaging dialogue between customers and the company across various digital channels

Additionally, financial companies are applying insights acquired from the use of AI systems in customer service and CX management to optimize overall CRM operations by developing a better understanding of customer needs in order to provide clients with more tailored information and financial products.

One area of customer service/CX management that is realizing an increasing use of AI is intelligent virtual assistants and banking chatbots employing conversational interfaces, as we explore next.

Intelligent Virtual Assistants and Chatbots

Intelligent virtual assistants and chatbots featuring conversational UIs are the most visible application of AI in banking and finance today. Banks, credit unions, and other financial institutions have taken to such applications because they allow institutions to modernize the self-service experience that they offer their customers. Banks and other financial firms are employing such systems to make it easier for customers to access basic account information as well as to personalize and enhance the customer journey across various banking channels.

This AI application area is experiencing intense commercial development. Over the last 12 to 16 months, more than a dozen banks and financial institutions worldwide — ranging from Ally Bank, ATB Financial, Bank of America, BMO Financial Group, and Capital One, to Israel Discount Bank, JPMorgan Chase, Royal Bank of Scotland, and Wells Fargo — have introduced (or announced) virtual banking assistants and bots for customer service and engagement scenarios. Consequently, such apps are now available to millions of personal banking customers. Banks are also introducing AI-powered virtual assistants for managing corporate customer accounts.

Intelligent virtual assistants and chatbots allow customers to handle various banking tasks, such as inquiring about checking account balances, tracking recent transactions, transferring money, obtaining a new debit card, learning about financial products, and scheduling meetings with a bank representative. Typically, virtual assistants and chatbots use natural language, chat-style interfaces employing a Q&A format to interpret customer intentions and provide the most relevant answers. ML enables them to learn and improve over time. A more recent, developing trend involves banks and other financial companies seeking to add a predictive analytics component to their assistant or bot to enable it to make recommendations tailored to a customer's specific situation.

Virtual assistants and banking bots vary: some are a component of a bank's mobile app; some are Web-based; some run on social media platforms like Facebook and Twitter; others function with smart speakers like Amazon Echo, Google Home, and Apple HomePod.

Bringing AI and Blockchain Together

One of the more interesting fintech developments is the combining of blockchain and AI technologies to create new financial platforms that can provide virtual banking services to people who currently are not served or are underserved by more traditional banking services. Such "virtual banking" platforms are designed to allow users (via a mobile app) to transfer money, pay bills, deposit money, make online purchases, and get a loan without requiring a traditional bank account or credit check. They are targeted at people who operate mainly in cash-based economies and who have little financial history — traits that can make them risky bets for more traditional banks to extend credit to without resorting to charging higher interest and fees.

Application scenarios vary. Some of these platforms utilize a prepaid credit card, giving customers the ability to spend their money online or at physical retailers. Others feature a mobile wallet that ties transactions to some form of cryptocurrency. Moreover, some allow users to receive bonus points or payments in the form of digital currency in return for watching advertisements and other promotional material.

Blockchain provides the secure infrastructure for supporting the payment and financing platform, complete with a mobile app and mobile wallet. In effect, blockchain makes it possible to offer virtual mobile banking and financial services in the form of a decentralized peer-to-peer lending platform. The business model is to offer cheaper credit to large numbers of consumers — typically in developing economies. To support this model, such platforms employ dynamic credit scoring algorithms that apply ML and other AI techniques to data collected from transactions, engagements, GPS, and mobile usage patterns to assess users' lending risk and offer more affordable loans in the form of lower interest rates.

Conclusion

This article has explored some of the AI applications that are getting a lot of attention in banking and financial services. There are way too many use cases to list *all* the ways AI is being applied in this area, but the bottom line is that AI is already disrupting banking and financial services. I see little reason for this to change. These companies have a history of embracing AI going back to the pioneering days of commercial AI. Moreover, they have lots of data for implementing applications and the capital to invest in the technology.

The applications of tomorrow will be even more impressive, moving beyond the current trend using AI primarily for optimizing existing processes to one in which banking and financial services firms will be able to create entirely new business models. These applications will maximize the user experience when interacting with the organization. This will happen via the use of customer behavioral modeling and emotional analytics and ML for interpreting, and adapting to, customer emotions — and for providing real-time decision making and support. Streaming analytics systems employing neural net and other ML algorithms will also play an increasing role in future banking and finance applications.

Endnote

[1]A Cutter Consortium survey conducted from early to mid-2018 examined how organizations are adopting, or planning to adopt, AI technologies. The survey also identified important issues and considerations organizations are encountering, or foresee encountering, in their efforts. See: Hall, Curt. "AI & Machine Learning in the Enterprise, Parts I-IX." Cutter Consortium Data Analytics & Digital Technologies *Executive Update* (https://www.cutter.com/article/ai-machine-learning-enterprise-part-i-current-status-498841).

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WORKING ON THE CHAIN

Transforming Fintech Architecture via Blockchain as a Service

by Magesh Kasthuri

Business architects attempting to modernize fintech architecture face a difficult task because the architecture constantly evolves. Modifying the architecture without halting processing is not a trivial task.

A typical fintech company today divides its IT organization into a front office, which oversees customer processing activities (e.g., customer applications, an investor site); a mid-office, which typically handles interbank transactions (e.g., SWIFT message handling, regulatory reports); and a back office, which generally manages report processing and scheduled activities like end-of-day processing. Organizations that divide their IT organization in this "three-tier" manner facilitate improving architecture changes and making technology upgrades to the IT systems with little or no failure. But achieving this type of success requires thorough solution design and architectural pattern implementation prior to attempting any change.

Blockchain as a service (BaaS) is a key architectural milestone in the blockchain platform and provides various avenues for implementing blockchain solutions across different industry solutions. Many industrial approaches to blockchain are being developed — especially in supply chain management — spanning manufacturing, retail, and financial services.

IBM, in particular, has a noteworthy solution: TradeLens, an open and neutral supply chain solution underpinned by blockchain technology.[1] This solution, jointly supported by IBM and Maersk, is built on the IBM blockchain ecosystem powered by Hyperledger Fabric. Major shipping and logistics players across the US and Europe now use it. Similarly, Microsoft has been inventing numerous accelerated approaches using a blockchain platform. A recently launched, breakthrough approach is the company's Azure Blockchain Workbench,[2] an open, trusted, and global platform that helps develop solutions for global market management, customer relationship management, and supply chain management.

These two giants provide dual insights into architectural solutions: both combine cross-architectural approaches using highly scalable cloud platforms for blockchain, and both concentrate on the supply chain to meet demand for these solutions. These approaches provide flexible usage in terms of quick, go-to-market solution development by simplifying development and experimentation on their prebuilt network.

This article discusses how a BaaS architecture helps the back-office service, with a focus on security aspects; how BaaS improves efficiency in cost of operations; and how BaaS, by improving security handling, differs from other popular blockchain architectures used by Hyperledger and other leading blockchain platform solutions.

Challenges in Fintech IT Services

The IT services of most banks are reinventing their solution approach to rationalize their IT architecture to address two key issues:

1. **Improve efficient handling of cost of operations.** The cost of operations for repeated activities and daily/routing activities accounts for a major portion of IT budgets[3] and can consume 20%-30%[4] of the IT budget year over year. Business architecture teams at fintech companies are engaging business consultants and functional architects to reduce the redundancy in such operations and improve system efficiency.

2. **Provide higher customer satisfaction** with state-of-the-art solutions for efficient fraud-detection solutions and a highly secure core banking solution (a retail banking solution, an internal IT solution, an advisory solution, etc.). With customers having access to more and more new technology and modern devices, they increasingly expect a low-cost banking experience that is both flexible and easy to

use. They anticipate a quick turnaround to their requests, with intuitive banking solutions that they can use on their own or with minimal dependency on the banking support team. For example, banks need to provide a highly user-friendly interface to consumers of different ages and with varying educational/technical backgrounds. At the same time, these solutions should not compromise users' security and privacy.

To address the challenges in the fintech industry, we need to understand the underlying problem, which has two dimensions: (1) the number of transactions being handled at one time and (2) the number of steps in the end-to-end business processing of a user operation (e.g., transferring funds, creating an account, and approving a transaction).

Blockchain as a Service

Although fintech industry solutions have experimented with blockchain to address the above challenges in efficient, highly scalable, and low-cost processing systems, there are many factors to consider in defining the standards and architecture patterns to use.

While, in general, a solution to address these challenges lies in back-office territory, with the advent of blockchain architecture and platform solutions, a decentralized architecture addresses the challenges of operational overhead cost and greater customer satisfaction. Indeed, a decentralized architecture reduces operational overhead in workflow management, as with approval/rule processing mid-operation in the journey of a transaction process, as shown in Figure 1.

Figure 1 shows how user data is autonomously handled in a decentralized fashion in a blockchain-integrated architecture to reduce cost overhead in security and risk handling using manual workflow operations. In a typical fintech organization, systemic risk cannot be predicted, but recovering from a systemic risk can be planned well in advance through a recoverable IT policy and a restructurable architecture upon which the IT systems are constructed. Developing an IT system based on BaaS attempts to build such a recoverable architecture. When the potential of blockchain architecture is explored, BaaS is an attractive design approach for fintech IT solutions that combines blockchain and a cloud-based approach (e.g., IBM FinTech portal powered by Watson) due to its ability to handle faster, more secure, and more transparent transactions with highly scalable solutions.

Since 2016, Barclays, Morgan Stanley, TP ICAP, Mitsubishi UFJ Financial Group, BNP Paribas, and myriad European fintech companies have come up with many practical business and technical trailblazing efforts, such as Digital Technology Architecture (DTA) and Digital Private Banking (DPB) solutions, involving auto recognition and self-executing smart contracts and financial settlements.

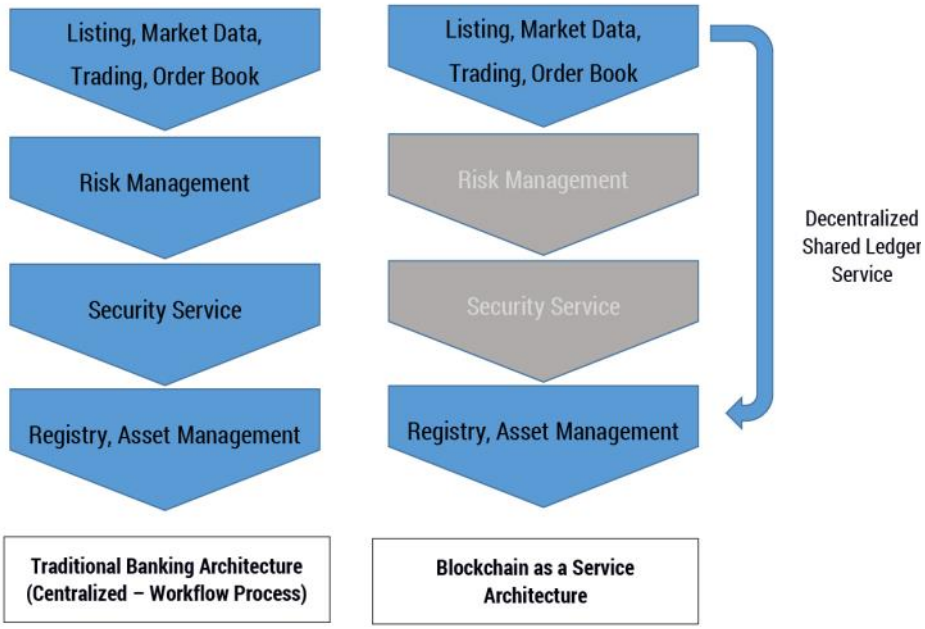

Figure 1 — Banking transaction: traditional vs. blockchain flow.

Adopting next-generation solutions in banking (see Figure 2, which depicts a typical BaaS architecture) also requires adaptive corporate governance. The model being executed must have fair fallback options and an alternate solution or path to leverage the luxury of rearchitecting and revamping the solution during a crisis situation, such as systemic risk execution, or with technical challenges, such as consumer protection or vertical scaling solutions as needed by an increasing user base.

Looking back at Figure 1, one might be interested to know how BaaS addresses security in a decentralized shared service ledger architecture where customer protection is an issue of great concern. BaaS addresses security with a multi-level, self-healing service that is much more advanced than a typical two-way hand-shake or multi-factor security service.

Security Considerations in BaaS

With the emergence of digital technology and the increasing availability of Internet service, peer-to-peer (P2P) transactions have risen dramatically over the past decade. On a blockchain platform, for instance, one user can transfer money to another user with Bitcoin. Blockchain is widely used today due to its user-friendly features, including transparency, immutability, and lower transaction costs.

P2P transactions happen in two ways: either through a public ledger or a permissioned ledger. As we know, validating a transaction with a permissioned ledger is a daunting task due to non-availability of proof of work and difficulty in creating a node for which the issuer or receiver requires permission from a blockchain developer.

Typically, BaaS security considerations are handled with a multi-level service (see Figure 3). Key store handling is done efficiently in different stages of public key markup, encryption service, and twofold signage and verification. Storing the public key outside the blockchain platform nodes also ensures better security. A multi-platform approach handles more than one smart contract for various stages of banking solutions.

Figure 4 shows the improved validation system and its interfaces with the rest of the elements in the system. The improved system typically gets input from the user or bank for initiating a transfer. Once the issuing entity receives the transfer signal, the system proceeds with further validation of a transfer.

The following three modules are loaded into the processor of the improved system:

1. **Issuer entity.** This module initiates the transfer from the source entity (e.g., bank, individual, or mercantile entity) using an online blockchain system by entering sender and receiver details along with transaction information (i.e., amount,

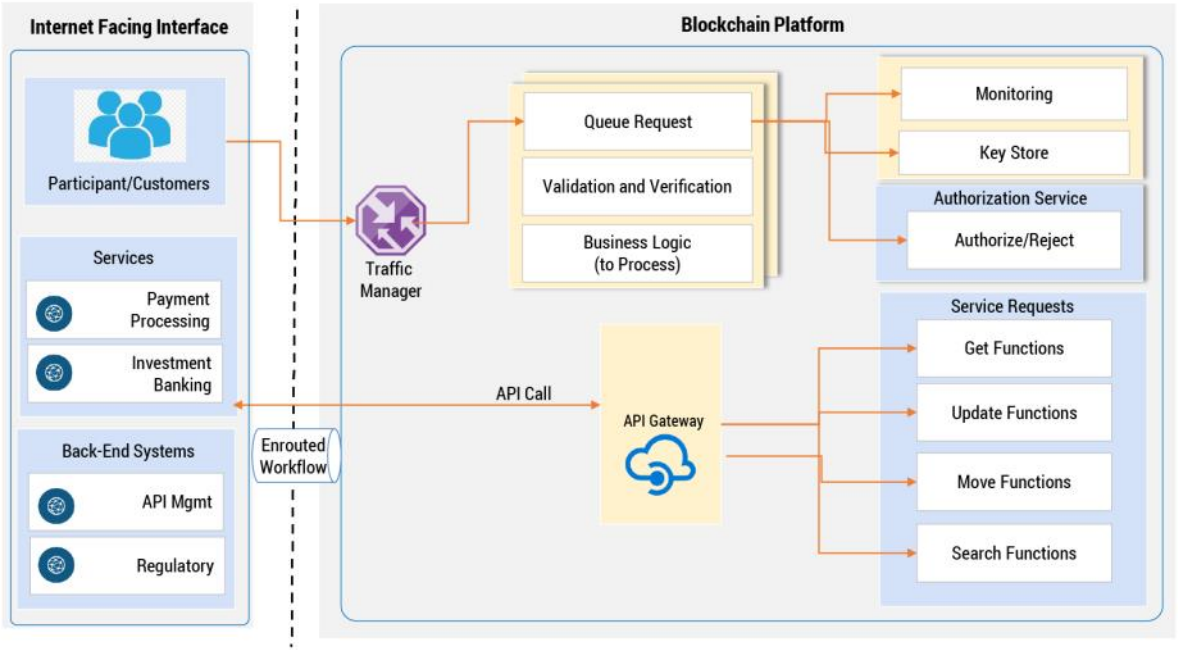

Figure 2 — High-level architecture of BaaS in a banking solution.

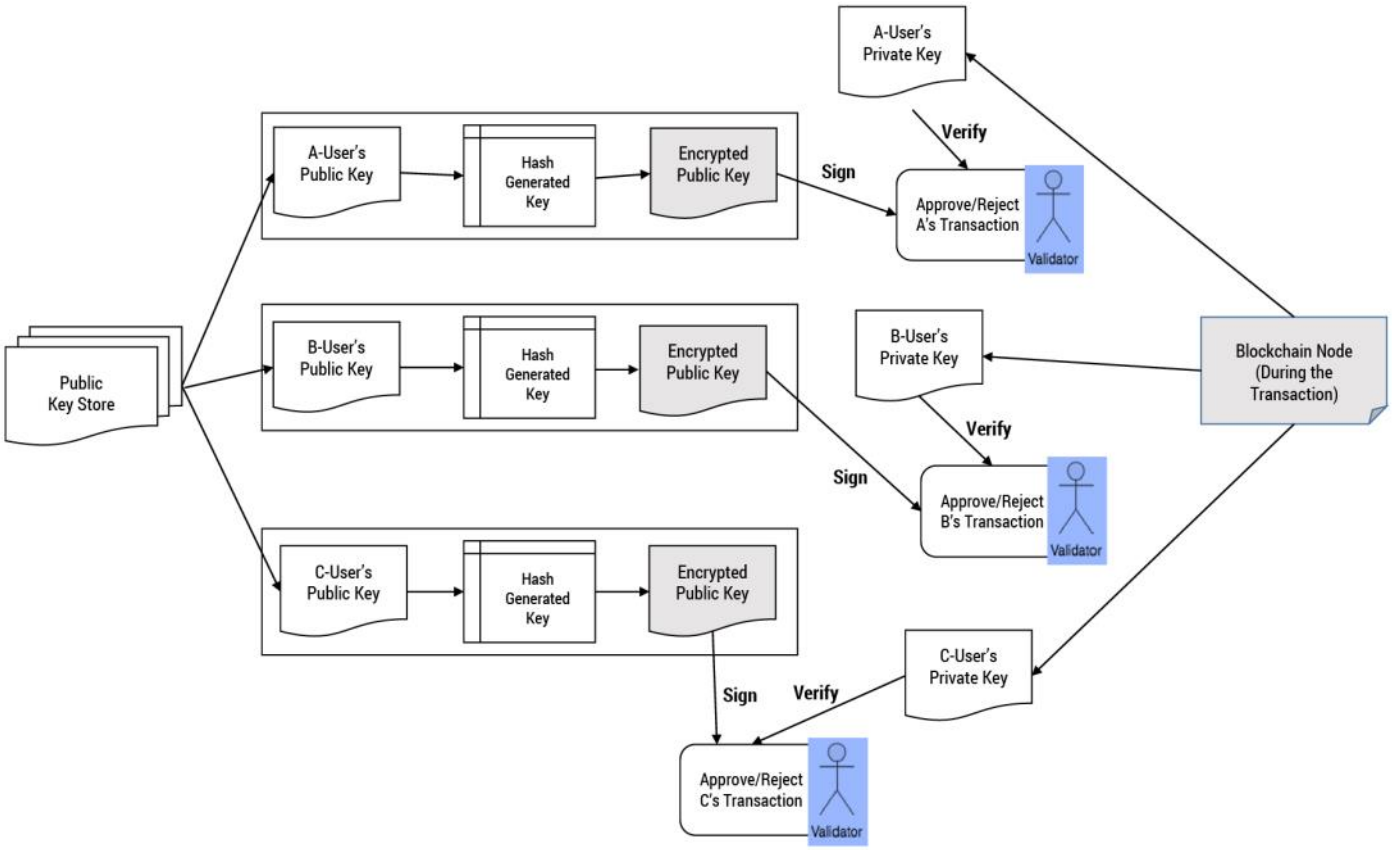

Figure 3 — Security handling in a typical BaaS transaction.

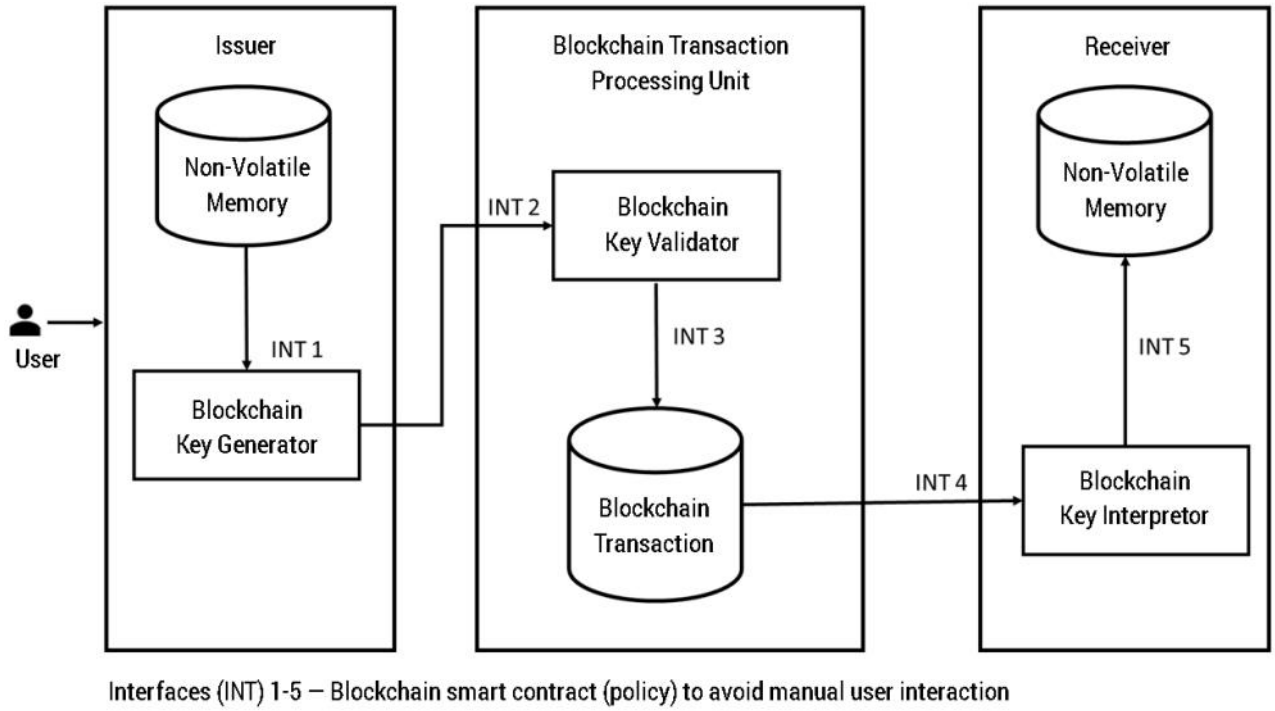

Figure 4 — Improved validation system for customer protection in BaaS.

source currency, target currency, and transaction remarks).

2. **Receiver entity.** This module receives the money transferred from the issuer entity at the end of the transaction once the validation is successfully completed and approved by the bank or any other approving authority during the blockchain validation process.

3. **Validation system.** This module consists of the following elements:

    - **Blockchain key generator.** This element generates the header information, which is sent through a blockchain transaction and contains encrypted information about the transaction and the validation data.

    - **Blockchain key validator.** This element takes the block node of the transaction received from the sender and uses the interpreter to obtain transaction details and validation details (e.g., address, identification remarks) based on the bank's regulatory requirements as required by the approver.

    - **Blockchain key interpreter.** This element converts the encrypted information received from the sender into validation remarks as required by the approver, which are used for the validation process in the validation component. The key interpreter also sends the final validation remarks to the sender after the completion of the validation.

Typical processing happens in a 10-step flow of operations as follows:

1. The user approaches the concerned bank or entity to initiate a transfer of funds from an account. The transferring entity fetches the transferee account details and customer details and initiates the transfer through the online application. After collecting the data, the issuer unit converts the collected information into a block of information in the blockchain transaction communication channel containing two compartments for customer information and transaction information.

2. The collected information is encrypted and stored in the header of the node for the first block of the transaction.

3. The transaction information is used as is throughout the blockchain communication until it reaches the receiver bank. Customer information is changed during every block transfer in the channel, depending on the requirements of the receiving bank. For example, some banks may not be interested in customer address or customer contact number during the transfer, whereas some banks prefer them as mandatory input for the transfer.

4. Each block ID is unique to the group issuer/sender, and hence duplicate transactions for the same user (issuer/sender) are invalidated during block creation as it is duplicated with another transaction having the same ID.

5. The receiver bank decides where a new node is created and chained, as part of a smart rule, to the received node to create a connection between nodes in the blockchain communication. This chain of nodes grows until a validator bank receives the information and the validation process is initiated. To preserve data security throughout the entire transaction, the blockchain consortium that defines the underlying platform (e.g., IBM Hyperledger, Microsoft Workbench) prefers a standard security mechanism of encrypting the data and transfer throughout the nodes in the channel.

6. A single lenient structure of nodes (i.e., each node containing a transactional piece of information) is created in the blockchain transmission by combining a group of nodes created throughout the transaction in a clustered node of transactions (each node is like a branch in a tree with a root node at the beginning of the transaction having customer information). When the sender bank initiates a transaction, a transaction block is created containing customer and transaction information, along with a unique generated identifier in the block's header. This header is taken through all the blocks when the header information is created in the blockchain, as per blockchain transmission protocol. When the next block is created, the header is copied to the new block, and the customer information is transmitted as per validation rules. This process of transmitting the block ID and header is done for each block created throughout the entire transmission until the final block is created at the receiver block or when the validator accepts the block for validation to complete the transaction.

7. A convenient clustered data store mechanism is introduced to enable an efficient validation mechanism and improvise the validation process for any type of blockchain transaction. This chain of nodes is formed as a clustered node (tree structure), and the details that have passed into different nodes in the transaction are stored in this tree structure and are stored as part of the node during the creation of the block that contains customer information and are transferred to the validation component. The validation node is linked (link validation process) to the approval process that the receiver bank uses to approve/reject the transaction by checking the clustered information received in the node. The clustered information can be enriched with all the blocks of the communication (that have a header with customer information) in the transaction chain as well. Once the validation is complete, this information is finally stored in the ledger transaction of the receiver bank.

8. In the transaction processing bank, the validation component receives the block to be validated and delinks the required customer data information from the node. A cluster of information is prepared for the approver to validate and the transaction proceeds. This information is decrypted and sent to the approver through a non-volatile memory transfer and will not persist until the validation process is complete so that the transaction is handled only in the respective banks of the sender and receiver.

9. Once the validation process is complete, the information on approval status is attached to the final block of the transaction and sent to the receiver bank. The receiver bank obtains the receiver account information from its (receiver bank) database, and the transaction is realized/credited to the receiver account as instructed by the sender during the initiation of the transaction (with respect to the receiver currency type and mode of receipt — cash, credit note, etc.).

10. In the validation step, a clustered node of customer/account/currency information, as required by the approver, is prepared. A subsequent step uses this node to transmit to the approver for further processing. Based on the outcome of the validation, the remaining step of realization of payment or rejection of the transaction is carried out; this is the post-validation outcome in a regular blockchain hierarchy process. This validation step works in a premised, ledger-based, blockchain transaction as the boundary of information required for clustered block preparation, having mandatory information from the customer, account, and currency blocks.

Conclusion

The primary goal of BaaS architecture is better transaction management — with a higher processing rate due to anonymous transmission and multi-node approval in a typical multi-contract platform using a blockchain solution. This goal is efficiently achieved in the validation module explained above, as the validation is self-controlled by the node where customer information is available, instead of backtracking the entire chain communication to obtain the customer details.

A customized validation rule can be added in the validation module to enforce country-based regulatory rules for better transaction management and prevention of fraudulent transactions. The result is higher transaction security, with the customer block being encrypted and transferred in each block until the transaction is validated and completed at the receiver bank.

Blockchain helps to create a smart, efficient solution design for a fintech's back office by addressing key issues like security and risk management.

Endnotes

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AND THE WINNER IS ...

Chatbots in Financial Services: A Usability Study

by Diarmuid Lane

With the recent advancements in natural language processing (NLP), the widespread adoption of chatbots has become commonplace. The term "chatbot" now defines what's known as question answering (QA) systems, which focus on locating and retrieving specific information based on a user's question posed in natural language (i.e., text or voice). This approach differs from traditional search engines, which display a list of possible results to a user's query, rather than a specific answer. The recent surge in such QA tools as Apple's Siri, Amazon Alexa, IBM Watson Assistant, and Google Assistant exemplifies the proliferations of such systems. Today, contemporary organizations are rapidly adopting chatbot systems and developing QA systems to carry out several functions, from administrative tasks to complex HR roles.[1]

As we explore in this article, the market penetration of both text- and voice-based QA systems is on the rise. This increased interest in, and development of, chatbots raises the following question: which medium of search is preferred, or is more effective, for managers within organizations — text or voice? To answer this question, let's examine some insights I gained from interviews with finance professionals to develop my own study of perceived usability to quantify the preferred system by managers in the financial services industry.

Chatbots Show Increasing Commercial Potential

The International Data Corporation (IDC) estimates that data growth within the digital universe will double every two years from 2010 until 2020, totaling 40 trillion gigabytes, or 5,200 gigabytes for every man, woman, and child.[2] Due to this growth, systems that can accurately and effectively locate specific data points within domain-specific information bases will become integral to understanding and managing vast amounts of information. IBM's Watson is one such example of a QA system utilizing the power of artificial intelligence to harness data growth. Watson, with its advanced NLP capabilities, has been utilized for myriad use cases, from medical diagnosis to serving as an interface for several Web-based query systems, based on frequently asked questions. It has even participated in, and won, *Jeopardy!*, a popular TV game show.[3]

Voice-based chatbots have penetrated the world of personal computing; yet to date, commercial chatbots have almost entirely been confined to text-based systems.

Due to the ever-expanding growth of data generation, NLP consultant and columnist Robert Dale predicts that narrowly focused industry- or organization-specific chatbots will generate global revenue of US $623 billion by 2020.[4] This startling prediction reconciles with the fact that 80% of businesses have plans to implement, or will have implemented, chatbots by 2020.[5] Chatbots being released to today's market increasingly allow customers to manage relationships with a business without interacting with a human. These applications range from entirely digital banks where chatbots handle all customer interactions[6] to Facebook Messenger–enabled chatbots, which have a proven track record of enabling increased sales and customer interaction.

Fashion/lifestyle company Tommy Hilfiger, through use of a Messenger chatbot, recorded an 87% return rate to the chatbot after its first initial use, with consumers exchanging 60,000 messages and spending three and a half times more time conversing with the chatbot than via any other digital channel.[7] And it seems that voice-based chatbots have penetrated the world of personal computing; yet to date, commercial chatbots have almost entirely been confined to text-based systems.[8] However, as voice-based chatbot systems increasingly gain traction in the realm of personal computing, they will inevitably enter the workplace. We can see the adoption of such systems today in its infancy.[9]

Dynamic QA systems have the potential to create great benefits for organizations, but the preferred medium of interaction — text or voice — is not yet known. Given minimal current research comparing the two technologies, I ran a usability study to examine two competing QA proofs of concept (PoCs) — a text-based system developed using IBM Watson Assistant and a voice-based system developed using Amazon Alexa — in order to determine which medium of interaction professionals in the financial services industry prefer. Each of these automated QA systems was designed for querying data in natural language, developed specifically to enable financial services managers to query their data.

Concept of Usability: Why Test?

The International Organization of Standardization (ISO) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."[10] Breaking that definition down further are the three main dimensions of usability:

1. **Efficiency** — the amount of effort required to complete a task
2. **Effectiveness** — the ability to complete a task
3. **Satisfaction** — the degree to which users are happy with their experience while using a system

System usability is a key determinant for system usage and is pivotal for management to consider when designing and developing a system. Understanding how organizations and management gain insights into the method of adoption and role of certain technologies is essential to both system and business success. Thus, knowing the interaction preference associated with QA systems is an integral first step for firms in order to perceive how they might effectively embrace emerging technology.

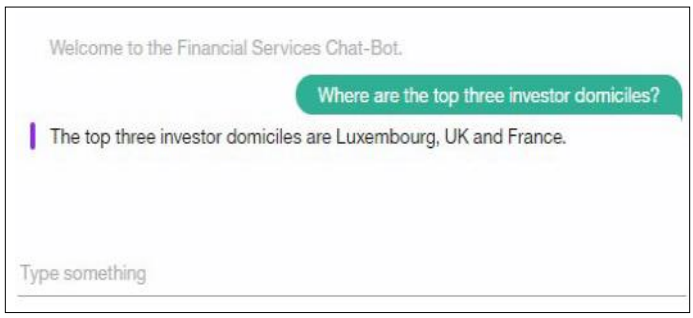

Figure 1 — IBM Watson Assistant with sample question and answer.

Voice-based systems to date are aimed primarily at personal users rather than commercial organizations. This raises the question of which interaction medium is best for organizations to implement — text or voice? Usability studies, such as the one presented in this article, can effectively answer this question.

Key Insights Drawn from the Financial Services Industry

To begin my study, I drew from previous interviews conducted with four professionals from the financial services industry, each working in a different organization, to gain an understanding of how an organization would typically use a QA system. The interviewees held the following positions: chief operating officer/head of innovation EMEA (Europe, the Middle East, and Africa), financial modeling analyst, equity trader, and business intelligence analyst. Within their specific roles, the individuals carried out tasks similar to those that a QA system could complete and would, therefore, represent typical users of such a system. The proposed QA systems would supplement rather than supplant these individuals, with mundane data-retrieval tasks outsourced to such a QA system, increasing the individuals' productivity on more valuable tasks. The interviews conducted gave an understanding of what effect an automated QA system has on the daily operations of those working in the financial services industry and provided insight to aid in the design of such a QA system. Moreover, the interviews highlighted what is of greatest importance in terms of QA system usability within the context of financial services.

To establish the preferred interaction type (text or voice), I then developed the two POCs. These POCs reflected importance in terms of QA system usability (garnered from the previously mentioned interviews). Utilizing IBM Watson Assistant, I developed the text-based user interface (TUI) and presented it to the user through an HTML website format (see Figure 1). Using Amazon Alexa, I developed the voice-based user interface (VUI) and exhibited it to the user via an Amazon Echo device.

By generating a list of queries, both POCs were designed to answer typical questions. The sample in Figure 1 illustrates one such QA example — Question: "Where are the top three investor domiciles?" Answer: "The top three investor domiciles are Luxembourg, UK,

and France." The systems were designed to identical specifications to minimize any form of system bias.

To determine the best system, I devised a test (i.e., usability study). The study, conducted within a financial services organization, assessed the three previously mentioned ISO main dimensions of usability (efficiency, effectiveness, and satisfaction) utilizing the system usability scale (SUS)[11] — see Figure 2 — to quantify, and assess, the usability of each POC. SUS is renowned as a leading industry usability survey and has been successfully extended to assess a wide range of both software and hardware products.

For the purpose of this study, I selected seven financial services professionals from the target financial services organization to participate. The selected participants were representative experts in their field who were comfortable with, and greatly experienced with, the types of data queried by the system. The participants were asked to make 10 typical queries on both the TUI and the VUI. The 10 queries consisted of locating and querying specific data points from a financial document. The tasks designed for both the TUI and the VUI allowed participants to utilize both systems in a workplace environment, which ensured accurate usability scores.

Study Findings

Upon concluding the usability study, the necessary metrics required to rank and rate the POCs were calculated. Overall, the TUI (IBM Watson Assistant) outperformed the VUI (Amazon Alexa).

The SUS scores were calculated for all participants and for both the VUI and TUI, along with a mean score

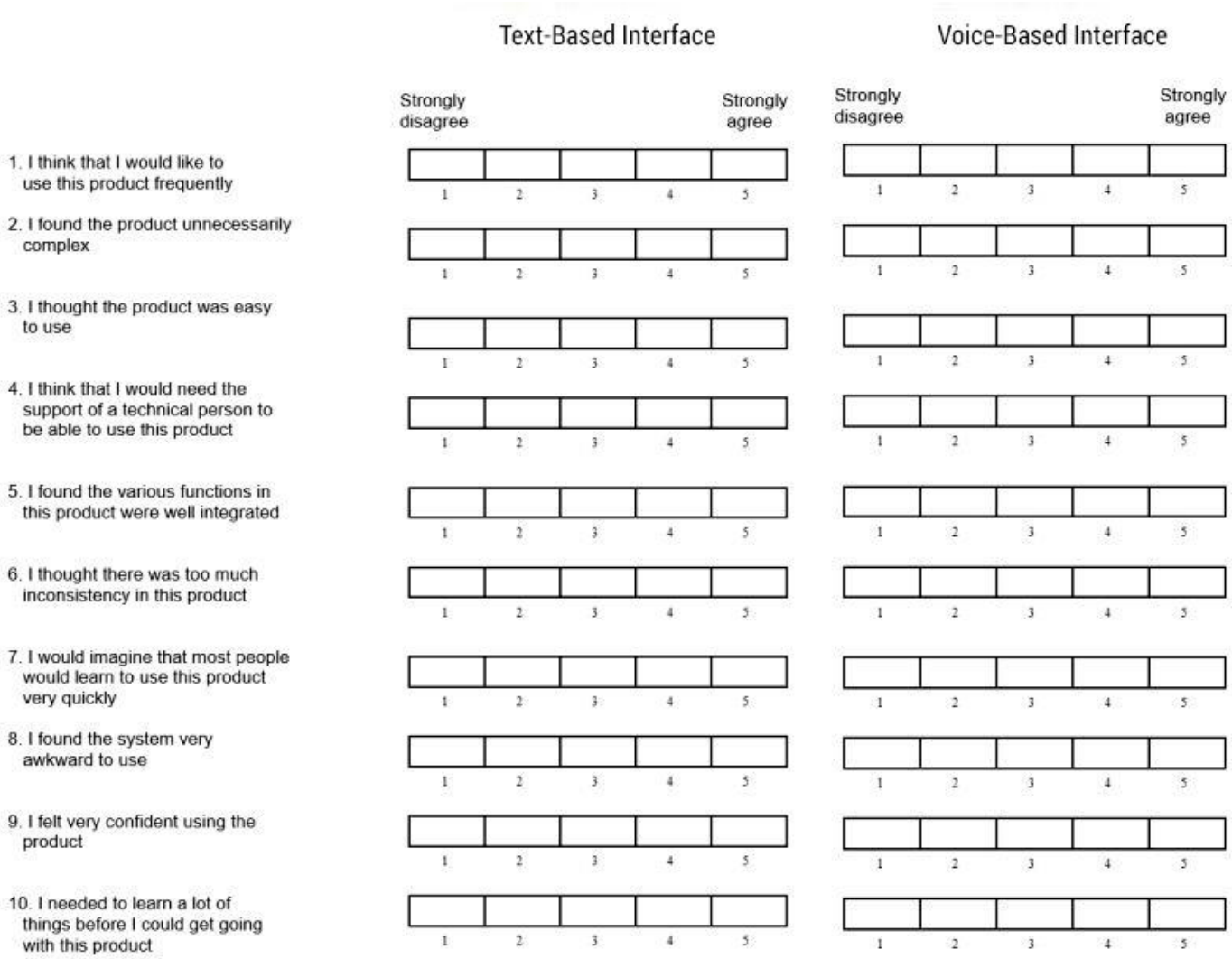

Figure 2 — System usability scale.

for both systems. The scores were described using a grade-scale format, ranging from A to F based on the SUS score received. The grading scale quantified, or graded, the individual and mean SUS scores, allowing for a more meaningful interpretation of SUS scores. (For example, a system with a SUS score of 70 would fall within the 50th percentile [the industry average SUS score] and would receive the grade scale of C.)

Overall, the TUI outperformed the VUI in all but one participant session, in which case both systems received an A grading. On average, the TUI received an A, placing it in the upper band of the acceptability range, while the VUI received an average grade of C, placing it in the lower band of the acceptability range. The acceptability range covers scores between 70 and 100, with anything falling below the lower bound of 70, or grade C, deemed unacceptable from a usability perspective.[12]

The study revealed that text is the preferred medium of interaction with a QA system for financial services professionals.

The Reality of Voice-Based System Adoption Within Financial Services

The study revealed that text is the preferred medium of interaction with a QA system for financial services professionals. Upon interviewing the seven usability testers, all felt that TUI QA systems were more suited to wide-scale adoption within the financial services industry. Most participants spoke of their familiarity with text-based systems and how a TUI would integrate more effectively into current organizational workflows.

Numerous usability and adoption issues appeared throughout the testing process. One participant noted the need to effectively "trust" hearing the answer to a question correctly while using the voice-based system, leading to lower usability scores. Another study participant claimed to be more "confident" using a TUI with the answer shown on screen. Since the roles fulfilled by the study participants are information-critical, this general lack of trust in a voice-based system resulted in lower usability scores and would thus hinder wide-scale adoption in the financial services industry.

Moreover, several study participants cited a glaring security flaw associated with a voice-based system: sound. Consensus formed among participants that fellow employees would be reluctant to use such a system because the voice-based system could relay sensitive information to the user. In an industry like financial services, where sensitive client and organization information is of paramount importance, such a flaw could hinder the adoption of voice-based systems.

Conclusion

Prior to the adoption and implementation of NLP-based QA systems, or chatbots, management must first make decisions about the preferred modality of interaction within their organization. Upon establishing a preferred medium of interaction, management can form an implementation plan based on context-specific variables, such as focused testing on the preferred medium of interaction, specific context of use, and technology acceptance testing.

The concept of system preference and user experience (UX) is not solely linked to system usability and may be derived from industry, organizational, or personal norms and practices. The UX concept comprises all aspects of user interaction with a company's products and services. The goal of usability evaluation is to quantify how well users can learn to use a product to achieve specific goals. This initial usability study gives management a base UX understanding in relation to text- and voice-based QA systems.

Upon reaching a defined mode of preferred interaction, firms can begin to understand how to incorporate chatbots. By explicitly studying and defining the preferred interaction medium, organizations can successfully foster adoption rates, especially in relation to deployment and engagement. In my study of professionals operating within a contemporary financial management firm, the usability of a text-based QA system ranked significantly higher than a voice-based equivalent. Furthermore, all usability study participants formed a consensus during a post-study interview that a text-based system was more suited to current organizational and industry practices. To improve voice-based systems, major flaws must be addressed, primarily involving the area of data security and privacy. Although voice-based QA systems are becoming increasingly prevalent in the personal computing world, this study shows that for professionals within the financial services industry the preferred medium of interaction with a chatbot is text.

Acknowledgment

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GET IN THE GAME

Banks and Digital Privacy: Monetizing "Know Your Customer"

by Shivani Raghav, Jari Koivisto, and Frank Michaud

Recent data nightmares, such as the one involving Cambridge Analytica, and new regulations like the General Data Protection Regulation (GDPR) from the European Union (EU) are showing the limits of current digital identity methods to preserve our digital privacy. In this article, we describe the current situation in this area and discuss innovative solutions for self-sovereign identity. We also explore how banks can be key actors in digital privacy evolution by leveraging their KYC ("know your customer") know-how to become identity trust anchors. Finally, we show how, by extending their capacity for trust, banks can transform KYC from a cost to a revenue source.

The Problem

Today's reality is that to obtain a service, especially via the Internet, we must give up personal data. Consequently, our personal data is replicated in so many places that it is no longer under our control. Instead, service providers control our data and oversee our digital life, which they ultimately see as the new oil.[1]

On top of that, Edward Snowden's revelation of the PRISM surveillance program, the Equifax data breach, or the more recent scandals around the misuse of data by Cambridge Analytica and Facebook illustrate the extent of the threat to our personal data.

So how did we get to a place where so much of our personal data is disseminated across the digital world? One response is that the Internet just wasn't built to handle our identities on the Web and all the associated data of our lives. According to Kim Cameron, chief architect of identity for Microsoft, "The Internet was built without a way to know who and what you are connecting to."[2] This "hole" has moved the management of user identity up the Open Systems Interconnection stack[3] to the application layer, resulting in the dissemination of personal data, since the service provider manages and operates the application layer. Because each service provider tries to monetize that data, providers do not share data and thus create silos.

Eventually, politicians had to react and enact protections for citizens to help safeguard and control their data. The EU's GDPR is one example (in addition to other regulations already in place, such as those in Germany[4] and Singapore[5]). As a result of the GDPR, service providers dealing with EU citizens, in addition to other requirements, must explain how they will use those citizens' personal data and must ask for their consent to use it.

In the financial industry, regulators in many countries have already established rules on how service providers must manage customer data. One example is the Swiss Financial Market Supervisory Authority (FINMA), with its Annex 3 of the circular on "Operational Risks at Banks,"[6] which provides rules for handling electronic client data.

But these rules and regulations don't solve the whole problem. Service providers not directly covered by such rules and regulations continue to host personal data far outside the control of the data's real owners. In the next section, we introduce a technical response that can transform the way banks operate their KYC operations by offering new services to other industry verticals.

A Technical View of Digital Privacy

A digital identity is composed of an identifier and the data associated with that identifier. It is important to understand that in the digital world, an individual can have as many digital identities, of any kind, as he or she wants. For example, an individual's username is the digital identifier for a Facebook account, and all the information that individual shares on that account is the data associated with that identifier. Private data makes up part of this information. Bringing control of that private data back to the individual requires that identifiers and data cross service providers, while staying under the control of the individual and being attested to by specialized parties.

Regaining control of private data starts with standards-defined universally unique identifiers (UUIDs) to access services and manage data across service providers. UUIDs will greatly simplify the current user experience and will allow individuals to interact with service providers in ways that were previously unimaginable. In addition, attestable data enables a trusted third party to cryptographically verify user information in real time, limiting dissemination of data. To understand how UUIDs can impact current customer requirements regarding privacy, let's look at the evolution of digital identities and the current landscape.

Centralized and Federated Identity Systems

The identity industry is migrating from authentication based on the current client-server model (aka the siloed model introduced above) toward a peer-to-peer (P2P) relationship model based on a private encrypted connection. Federated identity systems brought convenience to business customers, as they allow users to log in from their corporate network to Internet services with their own (business) IDs or with credentials they already possess, like a social media login, bank IDs, or digital identities issued by mobile network operators. These federated systems are replacing the siloed database access system that has existed for years. However, as discussed previously, there are several disadvantages with the siloed model, such as data breaches, distributed denial-of-service attacks, data replication, and so on. With the centralized model, the identity provider has full control over the user's data.

Advances in passwordless authentication, such as OpenID or WebID, have solved the problem of multiple identities with multiple providers to some extent by providing a UUID under user control. The problem with data silos and data breaches remains, however; the only difference is that identity data is centralized with an identity provider instead of with multiple service providers. In addition, using the same identifier across sites allows the central mediator (e.g., an OpenID provider or certificate authorities issuing public keys) to trace information about users' online activities, leading to concerns related to privacy and identity theft.

Decentralized Identities

Three primary concepts (all of which exist in theory and implementation but are not yet widely used) are needed to implement a new generation of decentralized identity solutions:

1. An *identity* needs to be unique and universal for a particular entity (e.g., person, organization, or thing).

2. Different *entities* should be able to make claims or assertions about themselves or about a third party, and these claims should be verified by attested authorities or third-party verification proofs.

3. There should be a *method* for locating and verifying a claim about a specific identity.

Self-Sovereign Identity

A new movement, commonly known as self-sovereign identity (SSI), is taking shape. Diverse communities are coming together to build an open, interoperable, and standards-based decentralized identity solution that will address some concerns with the centralized business model. Blockchain technology promises to revolutionize digital identity by returning ownership of personal data from centralized organizations to individuals, who can choose to share their data with others and revoke that sharing as they please.

In this decentralized solution for digital identities, users create a global universal identifier that is stored in a distributed ledger. The ledger technology allows the creation of an immutable record for a UUID and all events associated with it. This decentralized ID (commonly known as a DID[7]) links to decentralized public key infrastructure metadata that contains public key material, authentication descriptors, and service end points. This is analogous to the global domain name system (DNS), which maps domain names to the numerical IP addresses needed for locating and identifying computers, services, or other connected devices. Similarly, an SSI solution based on DID allows the mapping of UUIDs to an entity — a person, organization, or connected device.

In addition, for most digital transactions and interactions (e.g., an application for a bank loan), it is essential to have end-user data (e.g., address, income, passport number) verified by an authoritative source, the validator. Mortgage brokers and loan officers, to cite only two types of digital transaction gatekeepers, do not just accept an information claim provided by an end user; they insist on proof of that information's veracity. The validator's role is to attest to the authenticity of

certain user claims. These digital online verified claims are associated with an individual's DID and are signed and verified by authorities/validators. Because this new model requires validators, banks that leverage their KYC process, as we will see below, have the opportunity for a new revenue source.

Verifiable credentials that are linked to an entity's DID and associated personally identifiable information (PII) are never placed on a public ledger. A verifiable credential is cryptographically shared between peers at the edges of the network. The recipient of a verifiable credential (known as a verifier) in a P2P connection would use the associated DID as a resource locator for the sender's public verification key so that the data in the verifiable credentials can be decoded and validated. To verify the source of the signed information, anyone can look up the corresponding public key. After authenticating the user with the authentication method presented in the ledger, the claim itself can be verified and accepted or rejected by the requester. Information requesters, in accordance with their security and compliance needs, can choose to trust only credentials that certain attested validators have issued.

Fortunately, open standards are being developed to facilitate these SSI concepts. The Decentralized Identity Foundation (DIF)[8] and the W3C Credentials Community Group[9] are leading this open source work, with participation from the wider identity community. Based on these common standards, many platforms are being developed today that use blockchains (e.g., Ethereum and Hyperledger). Notably, several industrial organizations (e.g., Sovrin and uPort) are coming together to provide a common framework for creating claims linked to an identity using different kinds of decentralized technologies. And DIF is developing a universal resolver to allow interoperability among various DID implementations present today. With an implemented driver, the resolver can support Sovrin, uPort, Blockstack, Bitcoin, Interplanetary Identifiers (IPIDs), and Veres One.

Leveraging KYC and Verifiable Credentials in Banks

KYC, a key process for banks today, remains, in most cases, a very costly and long process. Most challenges lie in the efficiency of verifying customer-provided information. With digitally verified claims, verification can be improved, accelerated, and replicated on a large scale. KYC and digitally verified claims open new business opportunities for banks to act as validators for other organizations. Thus, a process that today is mostly considered a cost for banks could be monetized. If a bank can issue uniformly recognized and trusted verification of identity claims, a second bank that might have the same customer could use some of the KYC verification done by the first bank for that customer's information, accelerating its own KYC. This would start to establish a market for KYC as a service (KYCaaS). It is important to note that KYCaaS would work only if the regulations defining the required checks around the verification of identity claims were openly established and uniformly shared. It is not totally futuristic thinking to consider KYCaaS as a reality. We are already seeing it implemented today, as illustrated in the examples below.

KYC for Banks in Finland

At some banks in Finland, you can easily open a new bank account online, provided you already have a bank account at another Finnish bank and have the online banking codes for that bank. For example, at Nordea in Finland, you can open an account with online banking codes from another bank operating in Finland, including Danske Bank, Osuuspankki, Aktia Bank, S-Bank, Ålandsbanken, Handelsbanken, OmaSP, or POP Pankki. To do so, you identify yourself with an existing online banking code and provide Nordea permission to handle your personal data and check your credit history. For new customer identification, your existing online banking codes are sufficient, although the bank may want to run its own credit history checks as well.

Finland's Osuuspankki has a similar process to Nordea's for onboarding a new customer. To open a new account online at Osuuspankki, you can use online banking codes from Handelsbanken, Nordea, OmaSP, Aktia, Danske Bank, or S-Pankki. You enter a personal ID code, select the bank you would like to use for identification, accept that Osuuspankki will handle your personal data and may run credit checks, and then the bank authenticates the data using the existing online banking codes. Within two days, new customers receive an SMS message that the application has been approved and the final paperwork is sent via post.

E-Identification in Finland

Many public programs in Finland, such as for filing taxes or applying for unemployment benefits, use banks' online identification services to identify the customer. The e-identification service offers 10 different

banks' identification options plus a possibility to use a certificate card or mobile certificate. A mobile certificate is in the SIM card of the mobile phone, and mobile operators DNA, Elisa, and Telia offer the service.

The exact amount that each bank charges to identify an individual for a public or other service provider has been difficult to determine. The numbers are between each bank and service provider and can vary depending on the frequency of the identification service used. In 2017, a new law limited the maximum price per identification to 10 euro cents; earlier, the price was 50 euro cents on average.[10]

You trust your bank with your money, would you trust it with your data? By extending KYCaaS, banks or any other institution to which you give your trust could start to be your partner in protecting your privacy in the digital world. Extending the concept of KYCaaS and considering the trust people have in their financial institutions, banks could start to deliver services that would make them the guardians of PII. The combination of customers' trust and close supervision from regulators puts banks and other financial institutions in a favorable position to provide those services.

Conclusion

With the current fast pace of digitalization in our world, financial institutions, especially banks, have the opportunity to evolve their KYC process to start to monetize it. New technologies like SSI enable this evolution by introducing a new way to manage the identity and privacy of end users, solving the missing identity layer problem on the Internet.

Verification of identity claims can be an enabler for banks to optimize their KYC process and even start to monetize it through KYCaaS. By extending KYCaaS, banks or any other institution that you trust with your money could become your partner in protecting your privacy in the digital world.

Citizens and politicians are becoming increasingly frustrated with the lack of privacy protection on the Internet. Regulations can be implemented to attempt to fill the gap, but regulations alone will never be able to fully address the issue. New technologies such as decentralized identities, digital claim verification, and blockchain enable new ways of managing identities and privacy. Today, banks have an opportunity to embrace this new model and be a vital part of the coming transformation.

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IT TAKES TWO (OR MORE)

Becoming a Platform Organization:
How Incumbent Companies Stay Competitive

by Markus Warg, Markus Frosch, Peter Weiß, and Andreas Zolnowski

Using emerging digital technologies and data advancements, insurtechs are disrupting the market and transforming culture and code into value for their customers. Platforms, in particular, have evolved as a pivotal element in connecting actors and enabling them to integrate resources that can create value. With state-of-the-art technology, platforms enable insurtechs to take advantage of myriad key benefits, including value orientation, speed, data-based customer understanding, continuous improvement, and openness.

Incumbent companies, on the flip side of all this disruption, need to develop and empower their organizations to compensate for their disadvantages and remain competitive. Platforms allow incumbents to not only gain characteristics such as speed and openness but also help them establish new, innovative business models and embark on transformation journeys.

Connecting a platform with an existing company to a platform organization is beneficial for both established companies and insurtechs. Without pursuing that avenue, the insurtechs face the risk that their competitiveness may decline if others can copy their digital skills at low cost. Thus, connecting their platforms with the incumbent organizations that possess hard-to-copy capabilities guarantees the uniqueness and sustainability of their own business model. This article describes the basic action mechanisms of platforms and platform organizations and the associated opportunities for organizational and workforce development.

Insurtechs

Co-Creating Value-Added Services

As observed in examples such as Lemonade Insurance Company for home insurance and German health insurance company ottonova, insurtechs establish innovative, customer-focused solutions based on emerging digital technologies. Without having to worry about legacy systems characterized by outdated software, closed infrastructures, and slow applications, insurtechs use emerging technology to generate competitive advantages such as real-time capabilities as well as openness to connect with other solution providers. These advantages enable insurtechs to focus on customer needs and solve their customers' immediate problems. Digital technologies are integral in ensuring unique customer experiences as major differentiators from competitors' offerings. In most cases, insurtechs focus their communication and interaction with customers exclusively on digital channels.

Major competitors for insurtechs (the incumbent insurers) must deal with existing, stable, but not agile legacy systems (monolithic systems) and the cultural barriers their silo-like structures create, all while keeping their offers up to date and convenient across many channels. The latter challenge should not be underestimated. As a result of these differences, insurtechs have advantages in five areas: (1) value orientation, (2) speed, (3) data-based customer understanding, (4) continuous improvement, and (5) openness.

ottonova illustrates all these advantages. Its consistent focus is on *value orientation* and value creation for customers, a focus that also shapes the company's brand and Internet presence. Its approach is to make life easier for its customers, with health insurance that is more geared to people's needs and with processes that are simpler and faster than traditional offerings.

The company integrates and bundles all relevant resources, such as actors or functionalities, on its platform (e.g., actors such as customers, employees, or doctors; functionalities such as a personal concierge). As all resources are integrated and connected via the platform, ottonova can orchestrate them and offer all services via its app. Its Concierge service, for example, serves as a helmsman for all questions and issues that customers have, whether they need to obtain a second opinion, talk to specialists, obtain help abroad, arrange appointments, and so on (see Figure 1).[1]

Real-time interactions with customers at a fast *speed* (within a framework of data protection regulations) are used to build a *data-based customer understanding* in order to offer valuable data-based services. Examples are the Digital Doctor´s Visit (as shown in Figure 1) and Documents, a service that brings together all documents in the app so that the customer is spared tiresome paperwork.

New services and features await ottonova customers all the time. A co-creative process with policyholders, any interested party who gives ottonova feedback, and ottonova itself determine these new services and features. Some new services coming to ottonova and its customers include:[2]

- **Direct billing.** The doctor and ottonova take care of the billing; policyholders have less administrative work and no longer must pay in advance.
- **Appointments.** Policyholders can make appointments directly through the ottonova app.
- **Health impulses.** By providing the latest research from medicine and psychology, ottonova inspires policyholders to make wiser decisions every day.
- **Preventive planner.** This service recommends sensible preventive medical check-ups based on gender and age.
- **Self-tests.** Policyholders can take their health into their own hands. Test kits (e.g., for vitamin D levels) and questionnaires (e.g., on stress) make it easier for policyholders to take better care of themselves.

The delivery of new value-added services, co-created between ottonova and its users, enables *continuous improvement*. By connecting all stakeholders and integrating the required skills, the platform enables customers to interact with the company in real time and integrate external solutions to their advantage.

Co-creating value-added services requires new technical capabilities, mostly enabled by new digital technologies. Thus, interconnectivity, scalability, modularity, and interoperability are key building blocks of platforms and, consequently, need to be viewed as new design imperatives aiming at the effective reuse and integration of technical functions (e.g., authorization or display functionalities). Reuse and integration especially require new capabilities. In this context, the inside-out and outside-in *openness* of platforms play a key role and become a strategic mandate.

The Role of Platforms for Continuous "Empowerment"

Digital disruptors use platform approaches to build and bundle relevant resources and capabilities. All capabilities are then made available to the customer via one channel, the app, as illustrated by ottonova's Concierge service. To continuously develop professional and technical services, it is important to ensure that the reusability and orchestration of resources and capabilities on the platform are possible.

Modern architectures, used to implement these platforms, are based on technical principles that go hand in hand with the company's culture. Therefore, cultural development is a major issue. Instead of silo-like behavioral patterns aimed at differentiation, all talents in the company must be recognized and deployed where their benefit is greatest. Technical principles like reusability, scalability, openness, independence, transferability, agility, and evolution can neither be realized in a technically applicable way without a suitable culture, nor can they develop value for the company. These principles are expressed in open source technologies and OpenStack initiatives that minimize vendor dependency and maximize service interoperability across different environments.

Following the maxim of modularity, functions are realized as collections of loosely coupled services (microservices), and the critical role of reusable APIs is key for an insurtech's system architecture. In this

Figure 1 — ottonova services: Concierge and Digital Doctor´s Visit.

way, insurtechs ensure that they are constantly growing a modular system of valuable services for customers and are continuously developing and reusing the technical capabilities of the platform (e.g., the connection of external solutions and platforms or the provision of functions the insurtech has developed).

This continuous process of improving the capability to integrate resources that generate value for customers marks the difference between insurtechs and incumbent companies. Through rapid improvement and a continuous delivery of value to customers, insurtechs can transform their open culture and digital code significantly faster into business value.

Incumbent Companies

Less Competitive in the Long Run?

Established insurance companies have usually grown over decades and are characterized by a completely different strength and weakness profile than insurtechs. Using the ability for continuous improvement as a benchmark, incumbent companies have significant disadvantages. These concern the integration and application of the internal and external workforce (workforce management) as well as the technical debt that limits the possibilities to integrate and apply valuable resources. Instead of focusing on value for the customer, established companies focus mostly on their products and their product-driven process flows. Their technical support is based primarily on legacy systems of the 1970s and 1980s. In contrast to modern OpenStack infrastructures, incumbent companies' technical infrastructures are characterized as closed, transaction-oriented, inflexible, and slow.

The heritage of industrial production processes has also defined the way in which established companies handle cooperation and workforce management. Hierarchical, silo-like structures, inherited from industrial production processes, can be advantageous for independent manufacturing and delivery processes. However, by following this old-school working process, the associated workforce management and the corresponding culture prove to be very disadvantageous in the information age with the requirements of integration and reuse of all services.

Characteristics in established companies including product orientation, slowness, and a closed and hierarchical culture are clearly disadvantageous for continuous improvement. If the incumbent companies do not recognize and respond to the value orientation, speed, and openness of insurtechs, they increasingly will find themselves losing in the league of intelligent, empowering, and value-based customer solutions.

Despite their disadvantages, however, incumbents do have several advantages over insurtechs. They can usually build on large customer bases characterized by long-standing relationships. Moreover, established insurance companies continue to enjoy stable corporate earnings, possess a wealth of information about their clients, and benefit from the capabilities and services they have built up over the years. In particular, their employees' skills, products, and established solutions lead to major advantages. Unlike digital services, which may be replicated without too much difficulty, these skills and capabilities are not easy or quick to copy.

The Role of Platforms for Digital Transformation

The disadvantages of established companies, in comparison to insurtechs, are the reason why traditional companies need platforms. Platforms require changing the culture and business logic in a company from product to service dominance, making processes in relevant areas real-time capable, opening the company to the reuse and integration of solutions and services from other actors, and replacing a hierarchical culture with modern, agile, team-oriented approaches that make optimal use of the internal and external workforce.

While making these changes, incumbent companies need to retain their existing unique, competitive capabilities; their value propositions; and their existing competitive advantages. However, these unique capabilities are "buried" in siloed integration approaches and monolithic systems of record. As a result, paying down technical debt and modernizing IT infrastructure are major challenges. Established companies need modular, interoperable, and flexible systems. They must build platforms as agile *systems of engagement* to pay down their technical debt, and they must modularize their monolithic application landscapes and infrastructures.

Figure 2 illustrates the two strands of action for becoming a platform organization. The upper part of the figure shows the assembly and disassembly of the platform. Companies must develop the platform first, and then, for interactions with customers, next develop the connection of external abilities and the integration

of the abilities of the existing *system of records*. The lower part of Figure 2 shows the requirement to modularize the existing system of records parallel to the development of the platform.

In the platform organization, the services of the existing organization (system of records) and the platform (system of engagement) are controlled and orchestrated uniformly and comprehensively.

Why Become a Platform Organization?

Platforms, Organizational Development, and Platform Organizations

Companies like ottonova exploit opportunities for digitization and introduce innovative service business models that have the potential to disrupt the existing customer interaction and value propositions of incumbent insurance companies. They use platforms that facilitate value creation and innovation by engaging customer interaction, integrating external capabilities, and building innovative value propositions.

Although incumbent companies can develop and design digital strategies, they struggle with their implementation and execution. Most incumbent companies are too technology-focused and do not recognize the need to take a holistic approach that goes beyond the implementation of new IT assets and infrastructures. They need a long-term strategy and architectural vision that disrupts established structures and processes.

Companies also need to switch their product-dominant mindset to a service-dominant one to develop digital strategies.[3] Digital transformation requires "view[ing] service as [the] transcending model for all types and forms of innovation (tangible or intangible)"[4] and, hence, a transformation from a goods-dominant logic to a service-dominant logic. Thus, service innovation is an opportune strategy for companies to compete in the digital era. Service platforms are characterized by capabilities that nurture innovation and digital business models. As in our ottonova example, organizations can build capabilities that help integrate different services and facilitate interaction with their customers.

We believe that incumbent companies must see service platforms as a strategic mandate. Service platforms serve as the "venue for innovation,"[5] allowing for the co-creation with customers of experiences that are the basis of value creation.[6] In this way, service platforms transform business models by facilitating resource integration and interaction. The aim is to reconceptualize current value offerings to compete with insurtechs.

The main target of service platforms is to "liquefy" resources and enhance resource density (liquefy refers to the unbundling of information from its associated physical entity or device; resource density describes the amount of resources that are integrated and made accessible on the service platform to create and deliver innovative services).[7]

Focusing on their facilitating role, we characterize service platforms as follows: a service platform is an actor and resource integrating and orchestrating a

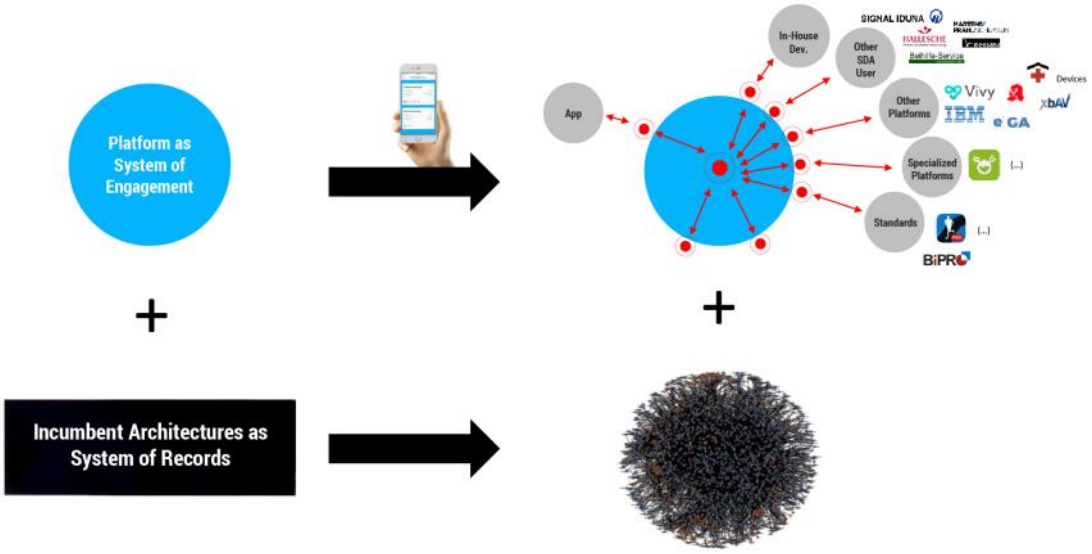

Figure 2 — Becoming a platform organization.

service system that facilitates interactions between different systems to enable value propositions. In particular, we prefer the following simplified definition:

> Platforms bundle resources that by their usage enable new transactions between actors.[8]

The challenge, especially for incumbent companies, is to analyze the existing possibilities from the resource side, not from the product side,[9] and to find strategies that best exploit the company's resources and capabilities relative to external opportunities.[10]

In his work, Professor Robert Grant has emphasized the central meaning of a company's resources as the foundation for its strategy and, thus, organizational development.[11] The challenge for insurtechs and incumbent companies alike is to identify the resources and capabilities that constitute their unique and sustainable market position. To build on that market position, a company must define the resources, capability, and workforce gaps that it needs to fill and then invest in upgrading its resource base. Grant's analysis of the rent-generating potential of resources concluded that companies' most important resources are those that are durable, difficult to identify and understand, imperfectly transferable, not easy to replicate, and over which a company possesses clear ownership and control — aka the "crown jewels."[12] In the case of ottonova, this potential is in the company's unique capabilities with entirely digitalized processes and its ability to build up an innovative ecosystem.

Even if digital transformation puts into question the characterization of a company's most important resources by emphasizing digital capabilities, we believe the essence of Grant's theory remains true. A company must design a strategy that makes the most effective use of its core resources and capabilities. Indeed, our understanding of organizational and business development is resource-based:

> Organizational development is a concrete improvement of functional capabilities understood as improving the ability to adjust, integrate, and apply resources.[13]

The integration of platforms and existing organizations into platform organizations can be useful for insurtechs as well as for existing companies. Insurtechs can build the crown jewels (i.e., skills that are difficult to copy and transfer) and existing companies can, by combining their companies with platforms, compensate for their disadvantages in value orientation, speed, data-based customer understanding, continuous improvement, and openness, without losing their existing unique skills.

Architecture Makes the Difference

To make use of platforms to solve the challenges mentioned, companies first need to realize that business and IT need to be co-designed as a whole.[14] Viewing an enterprise as an assembly of various architectures and building blocks allows the development of a coherent vision of how an organization can build the required capabilities to meet anticipated changes in its environment.[15] Enterprise architecture, in particular, helps provide guidance and communicates how the company needs to change to survive. Importantly, operational and transformational capabilities need to be combined in a balanced way in an architectural effort.[16] Enterprise architecture brings a shift in focus from technical systems to designing coherent sociotechnical systems that meet strategic requirements and organizational needs, such as those around workforce development, culture, structure, and processes.

Next, companies must introduce the operational and transformational capabilities with the aim of evolving into a platform organization. But, as the ottonova example shows, it is not only real-time interaction with the customer that one must consider, but the respective context of the customer must be kept in mind to ensure a company offers a valuable service. This consistent orientation toward value for the customer — *value in use* and *value in context* — explains the high importance of data-based customer understanding. Every interaction with the customer can further develop the data-based customer understanding and help companies better understand customers and their unique situations.

The *Service Dominant Architecture (SDA)* can overcome some of the challenges faced when evolving into a platform organization.[17] SDA draws primarily from service-dominant logic and "translates" its axioms and foundational premises into adequate concepts and components.[18] The SDA constitutes an environment for integrating and orchestrating internal and external resources. In this way, the SDA supports the digitization of companies by structuring actors and their resources and reducing overall complexity. Service-dominant logic acts as the foundation of a science of service systems.[19]

The SDA responds primarily to the need to react quickly and flexibly to customer preferences and changing conditions. Thus, it is vital to understand how

customers determine and calculate value in their given context.[20] The customer's process must be the focus. To ensure this customer focus, the SDA comprises three service systems and a data lake (see Figure 3):

1. **The system of interaction** supports real-time customer interactions and value co-creation activities through their respective structures and mechanisms "to access resources in a coordinated and purposeful manner."[21]

2. **The system of participation** integrates external resources and provides access to resources of other platforms or systems. Thus, it provides access to the actor-to-actor network and the stakeholders forming the service ecosystem.

3. **The system of operant resources** implements the capabilities to integrate and orchestrate resources from the established organization.

4. **The data lake** exchanges data with other systems; for example, from interactions with the customer (system of interaction) or from the existing customer relationship (system of operant resources).

Next, we examine the basic suitability of the SDA based on the objectives and challenges of both insurtechs and established insurers.

Uniqueness and Sustainability for Insurtechs

In addition to the continuous development of its health insurtech platform, ottonova is focusing on two additional goals to secure its business model in the long term: (1) to be a provider of digital services for other companies, and (2) to be a core player in the health ecosystem.

The company aims to provide its existing services — such as Concierge, Document, and Timeline via the system of participation — to other companies as "software as a service" and to develop them on an ongoing basis. As shown in Figure 4, ottonova could provide these services through the system of interaction. Now, to become a core player in the health ecosystem, ottonova ideally would have to connect the existing silos in the health system. It could then offer services to other companies, in the system of participation (the right side of Figure 4).[22] In this way, the insurtech positions itself as an open platform and integrator in the middle of the silos of the German health ecosystem. By following this path, the insurtech is permanently looking for new cooperation possibilities and ensures a fast and open connection to already existing systems (middleware, APIs).

Speed and Openness for Incumbent Companies

For established companies, developing platforms and connecting with existing organizations result in several opportunities. Initially, platforms can compensate for the disadvantages of the existing IT application landscape and infrastructure. The design space of the SDA enables the incorporation of all resources (i.e., data, functions) required for customer-centered, valuable solutions.

In this way, the existing insurer can create solution after solution for customers. A first step may be, for example, a lightning-fast contract view or a real-time change option for contact information. These solutions could be provided to the customer via an app and implemented via the system of interaction and data lake of the SDA. Services like ottonova's Concierge or IBM's billing app

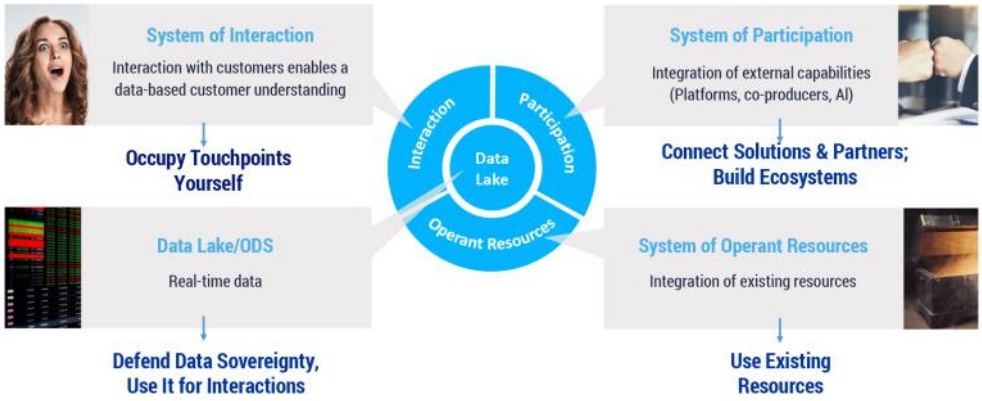

Figure 3 — The Service Dominant Architecture (SDA).

could then be integrated into the app without losing the contact point to the customer.

In parallel, the established insurer can individually design and build its ecosystem via the system of participation of the SDA. For this purpose, institutionalized standards such as the payment method PayPal, specialized platforms such as mySugr for diabetes management, and others can be integrated, along with individually developed solutions.

Finally, the capabilities of the established company can also be meaningfully integrated. This integration must be done in conformity with data protection regulations and with customer consent when required (e.g., digital medical records).

The central advantage of an architecture such as the SDA results from the interaction of the systems. If, for example, a customer submits an invoice for medication via an app (system of interaction), then a connected medication check (system of participation) and the digital medical record check (system of operant resources) can be done to ensure the customer does not have an existing allergy or intolerance to the prescribed medication and, if necessary, provide the customer with a message — in real time.

With each resource integrated into the SDA through solutions and services delivered to customers, resource density and data-based customer understanding increase. Established insurers thus gain the characteristics they are missing, such as speed and openness for cooperation and partnerships with solution providers and other platforms. In this way, they can compensate for their disadvantages compared to insurtechs and integrate their unique capabilities to their competitive advantage.

Findings and Outlook

This article has explored how the integration of platforms and existing organizations into platform organizations can generate competitive advantage. Insurtechs can further develop their continuous rapid empowerment advantage and reduce their vulnerability to being quickly copied by competitors by building ecosystems and links with established organizations, thus creating unique, hard-to-copy resources. Likewise, incumbent companies can compensate for their disadvantages in the areas of customer-centric solutions, speed, openness, and data-based customer understanding by transferring their unique capabilities and resources to the platform.

Architectures can be very valuable for all actors. As our example of a medication check under the SDA shows, the interaction of the three service systems and the data lake results in dynamic opportunities that grow with increasing resource density.

Thus far, the potential of platforms has concentrated almost exclusively on technological service capabilities. The development of organizational culture and the reshaping of cooperation through the rapidly growing possibilities of integrating external capacities (i.e., the workforce design of the future) have hardly been considered. This field promises exciting developments.

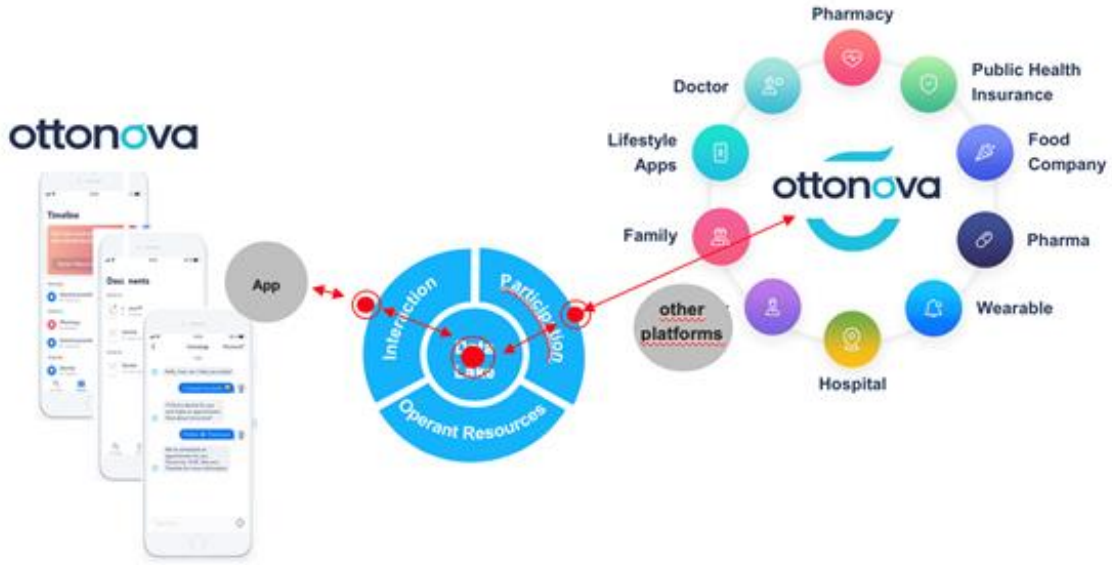

Figure 4 — Providing services with SDA.

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DO PUT ALL YOUR EGGS IN THREE BASKETS

The Fintech Arms Race

by Steve Andriole

Before we discuss the state of the fintech arms race, let's first establish a working definition of fintech. According to *Investopedia*, fintech is:

> New tech that seeks to improve and automate the delivery and use of financial services. At its core, fintech is utilized to help companies, business owners, and consumers better manage their financial operations, processes, and lives by utilizing specialized software and algorithms that are used on computers and, increasingly, smartphones.[1]

Companies and countries are implementing fintech tools and techniques at a surprisingly fast pace.[2] Indeed, we are witnessing an ever-growing array of fintech methods, tools, and techniques, including artificial intelligence (AI), cryptocurrency, blockchain, insurtech, smart contracts, regtech, robo-advisors, cybersecurity, open banking, and underbanked services.

But three are foundational to fintech adoption: AI, blockchain, and cryptocurrency (see Figure 1). Let's look at these three and how well (or poorly) countries are faring in the fintech arms race as measured by their investments in, and adoption of, these three fintech technology baskets, as well as their investments in the readiness of their national digital infrastructures.

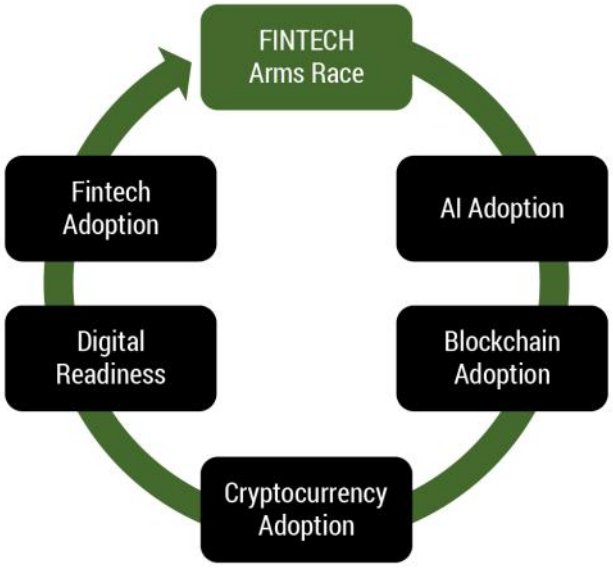

Figure 1 — Fintech arms race investment cycle.

AI and Fintech

Cryptocurrency, blockchain, insurtech, smart contracts, regtech, robo-advisors, cybersecurity, open banking, and underbanked services all require digital intelligence to operate. Some, like smart contracts, robo-advisors, regtech, and insurtech, require massive amounts of digital intelligence, while some require a little less. However, in time, all fintech technologies and applications will rely heavily upon AI.

While there are myriad fintech drivers, AI powers, amplifies, and supersedes them all. AI is foundational to fintech. This is because it's more than one technology. In fact, it's a family of technologies. AI is also foundational because its fintech application potential is so wide. Moreover, it satisfies ROI models of all shapes and sizes.

AI includes machine learning (ML), deep learning, image recognition, robotic process automation, natural language processing, text mining, vision systems, speech systems, neural networks, and pattern recognition, among other methods, tools, and techniques that enable and amplify fintech technologies and applications. All the major technology companies are heavily invested in the technology, but the most important investment portfolios belong to countries that have declared AI as a strategic national objective. China, for example, defines AI as one of its core industries.[3]

The Economist Intelligence Unit ranks countries according to their automation and AI readiness.[4] There are three broad categories (mature, developed, and emerging) in ranking order below:

1. **Mature countries** — South Korea, Germany, Singapore, Japan, and Canada
2. **Developed countries** — Estonia, France, UK, US, Australia, Italy, China, and United Arab Emirates
3. **Emerging countries** — Malaysia, Turkey, Russia, Argentina, India, Brazil, Colombia, Saudi Arabia, South Africa, Mexico, Vietnam, and Indonesia

This index is important because it describes each country's ability to succeed with AI and automation. Indeed, as suggested by the Economist Intelligence Unit:

> The Automation Readiness Index measures countries' preparedness for the coming wave of intelligent automation. The index provides a snapshot across a set of 25 countries of current government-led efforts to anticipate the resulting changes and shape the outcomes of technological progress…. It measures policies that promote technological progress, the creation of new businesses, [and] the development of skills and policies that can help manage transitions in the labour market.[5]

The World Economic Forum provides other rankings, including share of global AI startup funding in 2017 (where China leads the US and all other countries):[6]

1. China (48%)
2. US (38%)
3. Other (13%)

PwC identifies the countries and regions most likely to benefit from AI as measured by the potential positive impact AI will have on GDP:[7]

1. China (26.1%)
2. North America (14.5%)
3. Southern Europe (11.5%)
4. Developed Asia (10.4%)
5. Northern Europe (9.9%)
6. Africa, Oceania, and other Asian markets (5.6%)
7. Latin America (5.4%)

Given fintech adoption rates and the role that AI plays in the overall fintech adoption process, national governments should strategically commit to AI. This means that the national research laboratories, including the US's National Science Foundation, should receive additional funds to pursue a broad program of R&D that assures a global presence in the development and application of AI. China appears to have gotten the message:

> China's next-generation AI plan, released in 2017, declared AI as a strategic national priority for the country and showcased the top leadership's vision for a new economic model driven by AI. Unlike the US, the Chinese government is putting this plan into practice…. The country is already strong in AI. Baidu, Alibaba, and Tencent are among the global AI leaders. Chinese programmers recently won the ImageNet AI competition. And its leading ecommerce companies are using highly sophisticated AI in their warehouses and across the business…. [While] other countries also have innovative engineers, universities, and companies … China stands apart in the extent to which its government is prioritizing AI.[8]

Blockchain and Fintech

Blockchain is another foundational fintech technology that solves many of the most vexing technological, professional, and personal financial transaction problems we face, especially security. In fact, blockchain will rewire whole industries, especially the financial services industry. Initial blockchain applications occurred with cryptocurrency, but the real power of blockchain lies in its transactional versatility. While blockchain enables cryptocurrency transactions, it's by no means limited to currency exchanges. Blockchain is transaction-agnostic.

Remember that the world today works with lots of hands in every process and transaction. Whole industries such as banking, real estate, and mortgage lending are built upon millions of small pieces of managed transactions — that is, "managed" by value-extracting "intermediaries" who validate and verify transactions (for a fee). But are they always necessary? No, and the adoption of fintech generally and blockchain specifically accelerates the elimination of intermediaries across a broad range of financial transactions.

Blockchains are transparent ledgers that validate and verify transactions (which only sometimes involve cryptocurrency); the application range of blockchain technology is much broader than initially suspected. There are already compelling indicators of extensibility.[9] All this interest is the result of conceptual and actual applications, and the possibilities around transaction seamlessness. Fintech application areas already include at least the following:[10]

- **Financial services** — asset management (trade processing and settlement), insurance (claims processing), payments (cross-border payments)
- **Smart property** — unconventional money lenders/hard money lending, car/smartphone, blockchain Internet of Things (smart appliances, supply chain sensors)
- **Smart contracts** — blockchain healthcare; blockchain music; blockchain government; public value/community; vested responsibility; blockchain identity

In addition to the growing number of blockchain application domains, we can expect AI and ML to fuel blockchain's basic architecture. Intelligent transaction validation is also well underway.

When we look at the adoption of blockchain, perhaps surprisingly more and more local, regional, and national governments are adopting blockchain or approving blockchain investments. For example, blockchain is being widely adopted in China and Asia in general across multiple vertical industries, such as insurance and agriculture.[11] Australia's Data61, a research network of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has formed "a consortium with international law firm Herbert Smith Freehills and IBM to build Australia's first cross-industry, large-scale digital platform to enable Australian businesses to collaborate using blockchain-based smart legal contracts."[12] Moreover, the European Union (EU) has made blockchain "a priority for trade and business."[13] Other countries and territories are making similar commitments to blockchain, including Dubai, Estonia, Gibraltar, and the US, among other government offices and agencies.[14] Latin America, in particular, is also aggressively pursuing blockchain, as demonstrated in Mexico, Argentina, Brazil, Chile, and Columbia, among other countries.[15] Finally, advisor and entrepreneur David Freuden adds a handful of geographical areas to the growing list of blockchain adopters: Canada, Georgia, India, Indonesia, Singapore, Sweden, Switzerland, UK, Ukraine, US state of Delaware, US state of West Virginia, and Venezuela.[16]

Cryptocurrency and Fintech

There are still large challenges (and undefined opportunities) around cryptocurrency. Let's start with the features of cryptocurrency accelerating its adoption:

- It's transaction-agnostic.
- Identify theft is essentially impossible.
- Governments cannot control it, though they can and will regulate and tax cryptocurrency once standard blockchain architectures and platforms emerge.
- More and more businesses are accepting it (because many of them have no choice).
- It's securely exchanged on blockchains with cryptography.

Cryptocurrency provides a safer and cheaper way to transact. Its organic adoption growth will eventually stimulate governmental and nongovernmental institutional interest and offerings. Even payment system incumbents will eventually champion cryptocurrency. It's inevitable because it's anonymous, secure, and cost-effective. For those and other reasons, incumbents will have no choice but to adopt cryptocurrency — or lose business.

But timing is unpredictable because whenever an established process — in this case, payment systems — can be replaced by another better/faster/cheaper one, there are repercussions, and some of them are not so savory. Why, for example, would anyone laundering money, stealing/selling data, or just hiding financial activity of certain kinds not use cryptocurrency?

Cryptocurrency adoption rates are much, much trickier to discern because countries have: (1) slowly accepted cryptocurrencies like Bitcoin; (2) flat out rejected Bitcoin; or (3) just explored the use of government-backed cryptocurrencies.[17] Some countries are open to the use of Bitcoin and other cryptocurrencies, though nowhere is it a substitute for, or tied to, a country's legal tender — yet. As reported by Investopedia, the US is open to the possibilities of cryptocurrency, as is Canada, Australia, EU, Finland, Belgium, Switzerland, Malta, Cyprus, Bulgaria, UK, and Germany; some countries, such as China, Russia, Vietnam, Bolivia, Ecuador, and Columbia, have essentially banned Bitcoin and cryptocurrency, though several of these countries have a lot of blockchain and cryptocurrency startup activity within their borders.[18] As Table 1 illustrates, some rankings of "bitcoin-friendly" countries have begun to emerge.[19] While the definition of "friendliness" is loose, it's nonetheless important to track over time as more and more countries wrestle with the challenges and opportunities Bitcoin and cryptocurrency offer.

The major questions around Bitcoin and cryptocurrency are about future adoption based on what countries decide over time. The general position is that cryptocurrency will be impossible to "stop" in any conventional way, which leaves governments no option but to accept its use through a set of initially soft regulations that permit its specialized use. Will cryptocurrency replace "legal tender"? Unlikely for a variety of deeply rooted, vested financial interests. Will there be alternative national digital currencies? Yes, eventually.

1.	Estonia
2.	US
3.	Denmark
4.	Sweden
5.	South Korea
6.	Netherlands
7.	Finland
8.	Canada
9.	UK
10.	Australia

Table 1 — 10 "Bitcoin-friendly" countries. (Source: Shnurenko.)

Digital Infrastructure Readiness and Fintech

In addition to investments in AI, investments in blockchain, and the acceptance of cryptocurrency, a country's ability to participate in the fintech arms race depends upon the readiness of its digital infrastructure. Digital readiness provides an assessment of the condition of a country's overall digital infrastructure and its ability to adopt fintech. Countries that have well-developed digital infrastructures, such as Sweden and Norway, are able to leverage fintech, as long, of course, as they are inclined to do so. For countries to leverage fintech, they must possess basic and always-improving digital infrastructure capabilities (e.g., broadband, cloud, big data, cybersecurity) because fintech requires a modern digital infrastructure.

Several organizations and companies collect data about digital infrastructure readiness and apply a scoring mechanism. The scores reflect a direct measure — digital infrastructure readiness — of a country's ability to participate in the fintech arms race. The World Economic Forum, for example, developed the Network Readiness Index (NRI), which assesses:

> Countries' ability to capitalize on the digital revolution and their preparedness to benefit from the emerging Fourth Industrial Revolution…. The Index aggregates data from 53 indicators…. Networked readiness rests on whether a country possesses the drivers necessary for digital technologies to unleash their potential."[20]

1.	Singapore	14.	Canada
2.	Finland	15.	Germany
3.	Sweden	16.	Iceland
4.	Norway	17.	New Zealand
5.	US	18.	Australia
6.	Netherlands	19.	Taiwan
7.	Switzerland	20.	Austria
8.	UK	21.	Israel
9.	Luxembourg	22.	Estonia
10.	Japan	23.	Belgium
11.	Denmark	24.	France
12.	Hong Kong	25.	Ireland
13.	South Korea		

Table 2 — Top-25 digital readiness rankings. (Source: World Economic Forum.)

1.	Liberia
2.	Nicaragua
3.	Malawi
4.	Myanmar
5.	Guinea
6.	Madagascar
7.	Mauritania
8.	Haiti
9.	Burundi
10.	Chad

Table 3 — Bottom-10 digital readiness rankings. (Source: World Economic Forum.)

Table 2 displays the top-25 digital readiness rankings from the World Economic Forum; on the flip side, Table 3 shows the bottom 10.[21]

Another source is the Digital Evolution Index (DEI) developed at the Fletcher School at Tufts University (with help from Mastercard and DataCash).[22] Yet

another is Cisco's digital readiness scoring methodology, which identifies three stages of digital readiness: activate, accelerate, and amplify.[23]

Fintech Adoption Rates

Overall fintech adoption rates, which include AI, blockchain, and cryptocurrency adoption, also suggest that the fintech arms race is well underway with some clear leaders and laggards. In its top-20 fintech adoption rankings, Ernst & Young (EY) reports that China is way ahead while some surprising countries like Japan and Canada are lagging (see Table 4).[24] This set of rankings speaks directly to the priority many countries place on fintech readiness.

Conclusion

The fintech arms race is on full steam ahead. While there are myriad fintech methods, tools, and techniques, three baskets — AI, blockchain, and cryptocurrency — are perhaps the most important indicators of commitment to fintech adoption and, ultimately, readiness. For countries to truly compete, they must invest in these three baskets as well as in their overall digital infrastructure. They should also show a commitment to fintech adoption.

If countries fail to invest and adopt, they will not have the ability to compete in the global fintech arms race, and they will ultimately suffer economically, politically, and militarily. As the saying goes, "Watch this space."

Countries that invest heavily in their digital infrastructures, AI, blockchain, and cryptocurrency — and adopt fintech — will fully participate in the fintech arms race. Those that fail to invest in these and related fintech areas will find themselves falling in the fintech adoption rankings and, therefore, lagging in the fintech arms race. Some of the early rankings discussed in this article should serve as a wake-up call to countries that for whatever reasons are losing the race.

Endnotes

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2. India	12. South Korea
3. UK	13. Switzerland
4. Brazil	14. France
5. Australia	15. Netherlands
6. Spain	16. Ireland
7. Mexico	17. Singapore
8. Germany	18. Canada
9. South Africa	19. Japan
10. US	20. Belgium and Luxembourg

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