Erlang Solutions

Fintech Trends for 2022

Building for Resiliency and Security

About us

Erlang Solutions builds fintech systems that are highly resilient and scalable. We use battle-tested technologies to design backend infrastructure to enable our clients' innovation and creativity in the financial services industry.

We prototype, build, monitor and maintain solutions used for payment systems, backend services, digital lending, blockchain and more for companies including Klarna, Vocalink (Mastercard), Visa, Danske Bank and Bloomberg.

Purpose of this report

This report brings together industry research and expert views from the fintech world to share knowledge and provide inspiration on key technology topics that are set to impact financial services in 2022 and beyond. It is produced using experiences of working with clients in financial services from around the world and by interviewing and collaborating with some of the most influential subject matter experts in the industry. We thank all that have taken part for their time and thoughtful contributions.

Forewords

We look forward to continuing to apply our deep domain knowledge and expertise in building highly scalable, fault-tolerant systems in the financial services space. Our aim is to provide the infrastructure that allows fintech firms to do what they do best – innovate and improve people's lives through better financial products. All of this without being taken by surprise when the products and services they provide surge in popularity or come under strain for reasons no one could have imagined or predicted.

Francesco Cesarini

Founder and Technical Director
Erlang Solutions

Fifty or so years ago, the world did not rely on computers. A small number were emerging from companies such as IBM, DEC, HP, Olivetti and others, but very few compared to today — although already more than IBM President Thomas J. Watson's famous prediction that "there is a world market for about five computers". It was not until the 1970s that an IBM mainframe was first used for air traffic control — one of the first 'mission-critical' uses of a computer where if the system failed, then disaster would almost certainly follow.

Philip Harrison

CCO for Fintech
Trifork Group

We now rely on computers for many things which we take for granted, including banking, payments, commerce, communications and messaging — 100 billion messages are sent via WhatsApp daily. For services in these areas, we have become conditioned to expect always-on availability. So when something fails — as with WhatsApp for 6 hours back in October — there are major negative headlines.

The explanation given by Facebook (who own WhatsApp) was that "configuration changes on the backbone routers that coordinate network traffic between our data centres caused issues that interrupted communications". The problem was not in the hardware or software, it was caused by human error. It wasn't something defective in the system that caused the outage — WhatsApp is written in Erlang, the programming language designed for use in mission-critical, high-volume, super-resilient applications.

The world today depends upon systems that are reliable, high performance and crash-proof, and Erlang Solutions has been building these types of systems for clients for more than 20 years in fintech and other industries. Here we bring you a report that describes some of the technologies needed to be competitive, agile and innovative in this new age of human-centric technology.

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Executive Summary

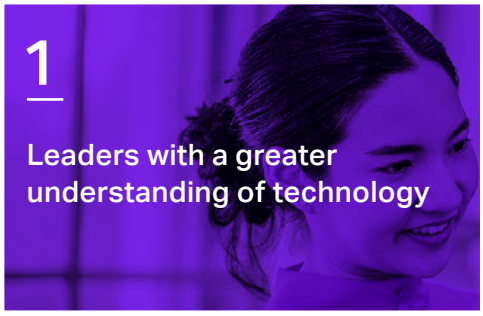
When it comes to financial technology, or fintech, the pace of change continues to accelerate. Financial services institutions are looking to their tech teams to drive innovation to protect market share and explore new opportunities. Against a background of disruptive macroeconomic trends and potentially revolutionary emerging technology, business leaders must ensure they make the right strategic decisions for future success.

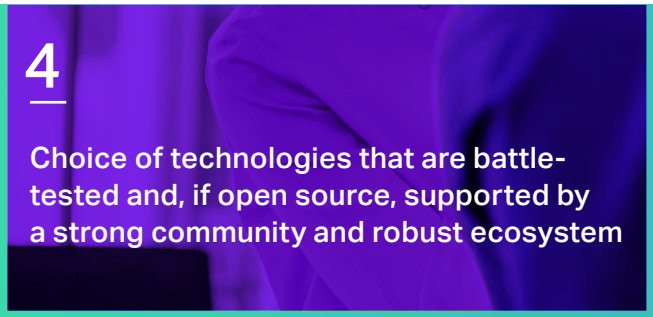
The issue of modernising legacy systems remains of foremost concern for incumbents and is an area where using outsourced resources needs to be especially well managed. The stress placed on systems caused by spikes in online commerce since the pandemic has shown that using technologies that are proven and built to cope with the unpredictability of the modern world is vitally important.

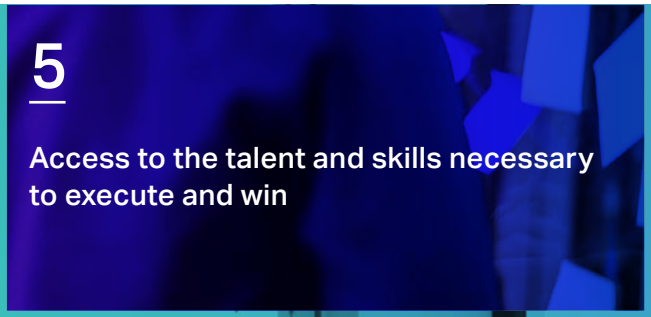
Successful financial services firms display a new way of working that is multi-disciplinary and mission-focused, pulling in the same direction to achieve value for end-users. Customer-centricity is becoming a key focus, and millennials and Generation Z will play a big part in the shape of things to come. To be part of this exciting future, business leaders in the industry must prioritise their tech strategy and place software engineering at the heart of business planning.

Key Takeaways

We see these as the five strategic must-haves for fintech success for 2022 and beyond:







Introduction

This report combines perspectives from traditional finance, fintech founders, investors, technologists, developers and system architects to review the latest innovations in the industry and look to the future. As you will discover, some expert views as to where financial services (FS) are heading are contradictory, and it is that diversity of opinion that makes fintech such an exciting field. In this paper, we set out to capture the real-world implications of these technological advances and provide a glimpse of what is to come.

This report consists of three main sections:

1. The macro environment
2. Emerging tech trends
3. Tech strategy to succeed and win

First, we look at the state of play in global financial services and the macro factors driving change. Next, we consider some of the main technology trends that impact organisations in the sector. Finally, we look at the immediate and long-term tech challenges being faced and the principles of software engineering being used to achieve success.

You're in the right place if:

You're a technologist trying to add context to the intricacies, challenges and opportunities of financial technology for your senior management team.

You're a non-technical business leader seeking to better understand the complexities behind successful fintech systems.

The Macro Environment

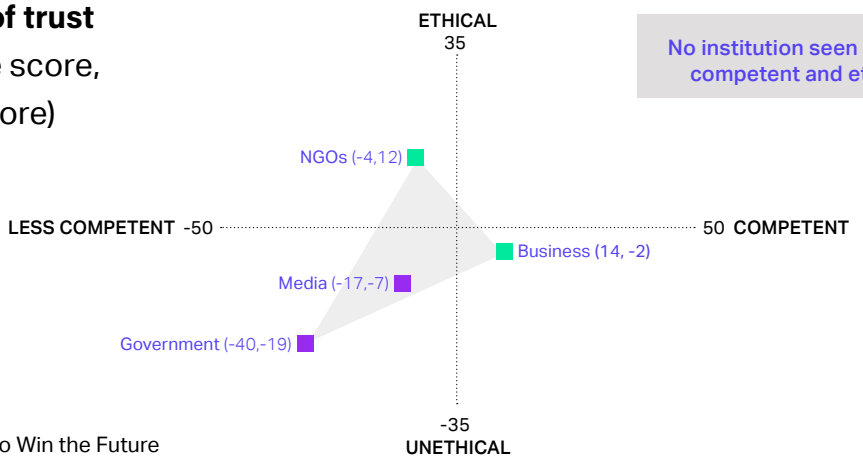
01

The Macro Environment

Changing Times for Financial Services

In some ways, the general outlook is not particularly bright. We are living through a period of skyrocketing public debt, with inflation running high and an expected hike in interest rates that will hurt many. In the Andreesen Horowtiz paper 'How to Win the Future', the picture is concerning when it comes to waning trust in traditional core institutions with none seen as being both competent and ethical.

Dimensions of trust
(Competence score, not ethical score)



Source: a16z: How to Win the Future

For many, this lack of trust has been simmering since the 2008 financial crisis. The end result is that individuals are seeking more from traditional power structures, including the financial services industry. For most millennials and members of Gen Z, the traditional paths to life's primary goals have become obfuscated, and they are looking for something more dynamic when it comes to how they manage their money.

These influential groups are demanding significantly more from banks and financial products. Following the behavioural changes brought on by the pandemic, they are not alone in this regard.

"For me, we have to simplify technology, as in making it far more intuitive."

In a world advancing at such a pace from a technological perspective, politically and culturally, there is paradoxical movement in reverse gear in some areas. If this reversal came to be applied to technology and financial services, what might things look like?

We spoke to the author and speaker, Chris Skinner, one of the most knowledgeable minds in the industry and someone not afraid to offer a contrarian view of things. He warned of a "Big Regression" to possibly come over the next few years: *"my prediction is that there will be a major shift away from things people don't know and understand and a reversal to things they do know and understand."* He points to this as apparent in China and now happening in Europe and the US, citing stalling peer-to-peer lending and crowdfunding underperformance as evidence.

Chris Skinner
The Finanser
author and speaker

With faith in centralised institutions of power and the political establishment diminished, belief in the power of technology for good and in open, democratic, decentralised and distributed models are likely alternatives.

Dr. Jane Thomason is a thought leader in tech innovation, fintech and blockchain for social impact — she sees the opportunity in tech around reaching excluded groups and the underbanked: *"Mobile technology, at almost 70% of the world's population, is creating an unprecedented opportunity for the bottom billion to connect to the economy."* Add into this mix post-pandemic fallout, and while it is somewhat of a cliché to describe what has happened to how we spend and interact with financial products as 'unprecedented', it is abundantly clear that things will not return to business as usual.

"We are at a point in time with an opportunity to take advantage of the (tech) tools at our disposal to develop and deploy them for the public good. The potential benefit for individuals and society, economic, social, psychological, is immense but the Government and regulators need to keep up with the pace of change."

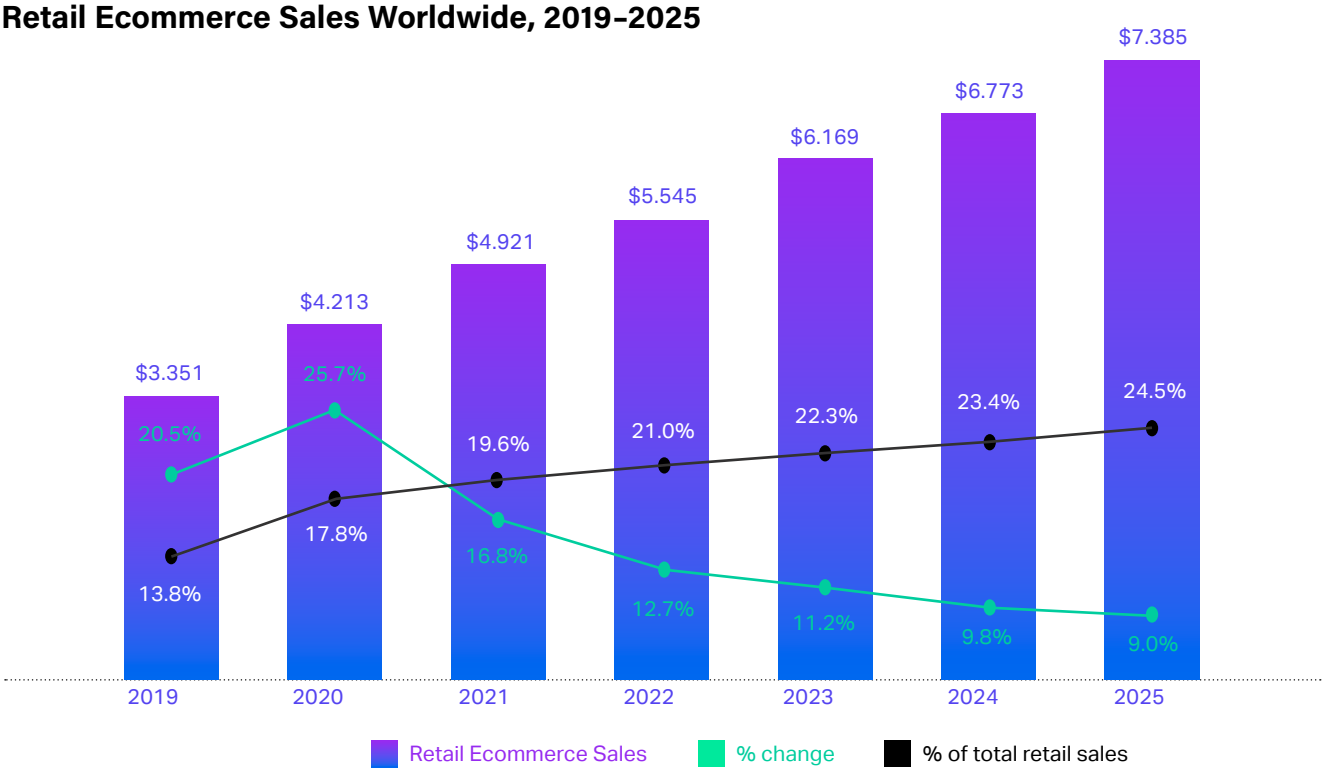
Lord Chris Holmes
of Richmond MBE

One of the most striking trends since the beginning of 2020 has been the cross-generational shift to digital channels driving demand for seamless fulfilment and instant gratification. The Capgemini World Payments Report survey found that before the pandemic, only 24% of the respondents had e-commerce accounting for more than half of their monthly spending. During the pandemic, this share increased to 47% of respondents and has stayed at 46% since.

"Payments are the connective tissue for the new economy and that's why we believe that payments are eating the world."

Jeremy K. Balkin,
Global Head of Innovation & Corporate Development, J.P. Morgan Payments

Retail Ecommerce Sales Worldwide, 2019-2025



Source: eMarketer, May 2021

We spoke with Scott Abrahams, SVP Business Development and Fintech at Mastercard, about how technology is fuelling optimised experiences for consumers: *"5G's high-speed, always-on connections will mean they're provided with more choice, information and personalised content both before, during and after a transaction. The level of connectivity it offers means that machines, devices and even objects will be able to actively participate in transactions. Choice, flexibility and security will become non-negotiable."*

Dimitar Dimitrov is Director of Technology at OpenPayd, the global payments and banking-as-a-service company, he points to Open Banking as being key to customer-centricity: *"As consumers, we've been able to initiate payments through Open Banking for some time — similar to paying for an Uber without entering card details or using cash. But (previously) it was a 'nice-to-have' feature, not core functionality. In 2020 that changed."*

Jim Marous,
Global Speaker, Podcast Host and Co-Publisher
The Financial Brand

"With data, AI and applied analytics, financial institutions will offer value-added features in terms of customers' needs and preferences. Personalized and contextual communication will positively impact both cost of engagement and financial results. Proactive and dynamic recommendations will also be delivered, at scale and in real-time."

The major new opportunity in payments sits around digital identity verification as a facilitator for expanding e-commerce volumes. Digital identity (Know-Your-Customer or KYC) solutions and fraud prevention has never been more important than in this new environment where verification needs to be especially robust and flexible for remote client onboarding.

We are seeing multiple players across the market trying to create smooth onboarding journeys with simple questions, digital IDs and biometric scans to increase conversion rates and simplify risk scoring models. Within that, there are two trajectories of how to handle compliance. One is led by the neo and challenger banks that build everything in-house as a full-service bank. The other trajectory is one where compliance and regulatory tech are being productised and fintechs are looking for vendors to serve non-core parts of their business.

Mastercard is an example of a traditional FS player paying close attention to what the future will look like. Abrahams added: *"In 2021, we've seen an uptick in popularity of payment methods that offer exactly this (customer-centricity), including Buy Now Pay Later (BNPL), which we launched across our network in September to meet the growing demand for flexible, digital-first payment options."*

As Dimitrov says, recent experiences have *"fundamentally changed the way consumers engage with digital services, and the functionality they expect from those services."* There is no going back to the way things used to be done, and those that cannot adapt will possibly become obsolete.

"We believe traditional onboarding flows over time will die and the process of storing, handling, and updating data will be decentralised and control will be given back to the consumer. With a single-sign on solution such as ComplyTeq, you can share data with whom you deem appropriate, agree to the terms, know when it's shared, what's shared, how it's stored and for how long."

Eske Gerup
Co-founder ComplyTeq

Scott Abrahams
SVP Business Development and Fintech Mastercard

"Most of us are already living digital-first lives, and this has been dramatically accelerated by ongoing global events. The foundation is already here, and in 2022 we will move closer towards a digital only existence when it comes to how we make and receive payments."

Emerging Tech Trends

02

Emerging Tech Trends

Game Changing Technologies

Web 3.0 is an all-encompassing term that covers cryptocurrencies, smart contract computing, decentralised hardware, IoT, Non-Fungible Tokens, DeFi and maybe the most buzzwordy of them all — 'the Metaverse'. Decentralisation is key to what Web 3.0 is about, along with open source transparency and distributed computing. The impact of this internet economy evolution is an unquestionable future reality. Just look at blockchain based NFTs, where a recent boom in sales has catapulted the nascent market value to $7 billion, according to JPMorgan.

To authentically make an impact in this space is not easy and requires some of the brightest in the developer community to continue to innovate and collaborate to keep pushing the boundaries — the technical problems being tackled are far from easy. Dr Natalia Chechina is a Consultant Developer at Erlang Solutions, and as a specialist in fintech solutions and fault-tolerance at scale, she sees the distribution of a system as: *"a powerful approach that enables systems to scale and continue delivering services while parts of the system fail."* This is a significant concept, especially in the financial services space.

Dr Natalia Chechina
Consultant Developer
Erlang Solutions.

"Think carefully if a distributed system is right for your use case. The reason is that distribution is complex and easily misleads people new to the concept, as it may seem straightforward and easily implemented."

"A blockchain is a distributed database that is shared among the nodes of a computer network. As a database, a blockchain stores information electronically in digital format. The innovation with a blockchain is that it guarantees the fidelity and security of a record of data and generates trust without the need for a trusted third party."

Investopedia

"The arrival of blockchain technology has brought unprecedented disruption to financial services. I believe its application can account for far more than just transparent transactions. It can pave the way for a fully democratized financial landscape, providing a more seamless and effective alternative to banking, built around the ideas of fairness and decentralization, making it possible for individuals to manage their wealth without the middlemen or major institutions themselves."

Priya Guliani
UK President for Government Blockchain Association (GBA)

Blockchain's potential in modern FS

The spotlight is growing on distributed ledger technology, or blockchain, along with artificial intelligence (AI) and the internet of things (IoT), as we look to the recovery phase of the pandemic. In financial services, blockchain technology can improve trust and transparency while lowering costs and reducing transaction times. We spoke to Lord Chris Holmes MBE who is a leading voice in the UK government on blockchain, where, in his words, he has been *"banging the drum for years"*, such as in his 2017 report "Distributed Ledger Technology for public good: leadership, collaboration and innovation." While he describes the UK Government's stance on the technology as *"heartening"*, he does note *"we need to move from proof of concept into application" as we are "still in need of leadership, collaboration and innovation to ensure that we harness this technology for public good."*

The potential is now moving mainstream, and ideas of ownership and provenance are changing. Priya Guliani is the UK President for Government Blockchain Association (GBA): *"It has been a game-changing force in scenarios where trading occurs, where trust is at a premium, and where people need protection from identity theft — including the public sector, retail, healthcare and financial services."* We also caught up with Genevieve Leveille, Principal Founder and CEO at AgriLedger and a leading global voice in the space, who outlines blockchain's potential to increase financial inclusion: *"Another benefit will be the data that is available that can support the delivery of more efficient services. As the information will tend to be more resistant to fraudulent activities, there would be a possibility to start delivering outcomes to parts of society that could not be served previously."*

Genevieve Leveille
Principal Founder and CEO at AgriLedger

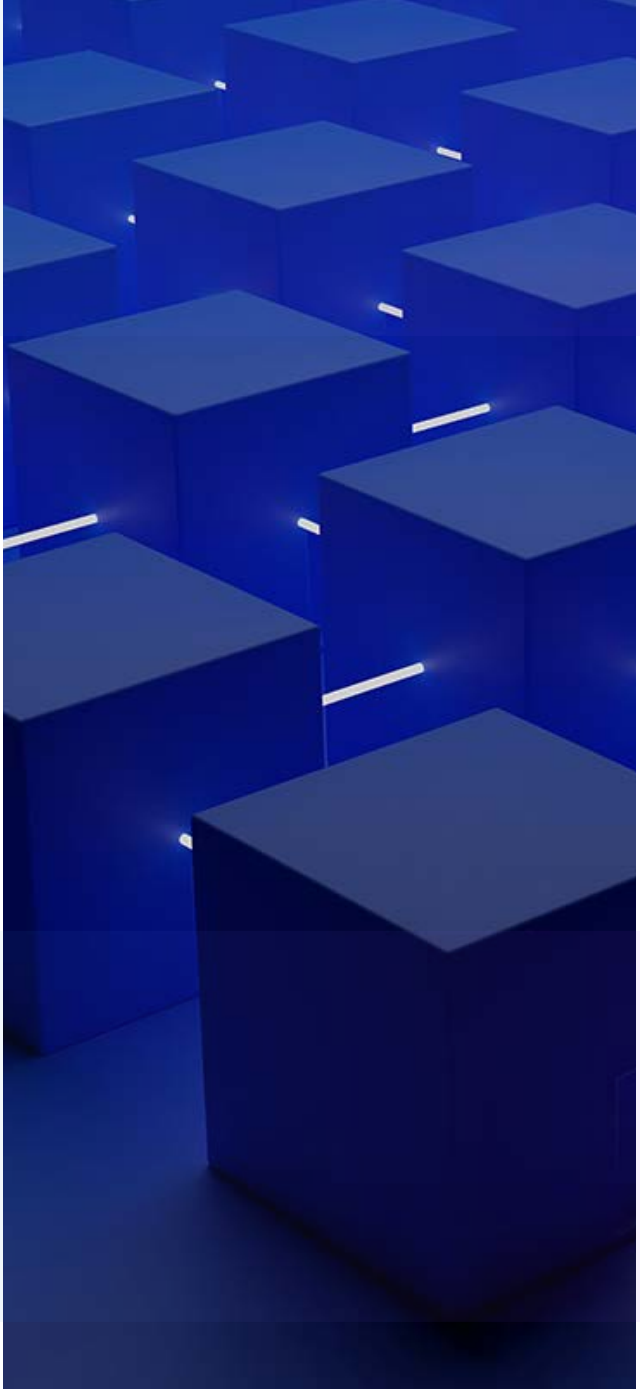
"We can now envision a paradigm shift where individuals do not need to have deposits sitting at the bank but can use the rails offered by those institutions to get access to financial services and payments. The great advantage of this new process will be the ability to bring online legions of individuals in regions such as Africa and Southeast Asia."

We spoke with Lex Sokolin, Global Fintech Co-Head and Head Economist at ConsenSys the Ethereum software company: *"Blockchain infrastructure is now being used for meaningful smart contract computation and value transfer and exchange across the economy."*

Of course, caution does remain, with questions around sustainability, regulation, scalability and interoperability, but overall the signs of forward momentum are encouraging. Consortia and ecosystems are springing up to improve processes and supply chain transparency.

We spoke with Keith Bear, Fellow at University of Cambridge's Centre for Alternative Finance and ex IBM financial markets leader who sees the ecosystem now as a 'network of networks' he adds: *"Networks built on one value proposition interconnect with others built on a different, complementary value proposition. In this way Contour (trade finance) links with the HK-based Global Shiping Business Network (GSBN), Tradelens (shipping) explores links with We.Trade (SME trade finance) and Minehub and Contour partner to drive digitalisation of metals."*

A lack of in-house expertise with blockchain technologies and the general complexities of the problems being solved are factors in many of the client projects in which our expert consultants are required to assist.



Panagiotis Kriaris
Head of Business Development at Unzer

"Digitalizing ownership rights, in a process known as 'tokenization,'' is one of the most exciting developments I see right now and could reshape the investing landscape. Imagine an integrated ecosystem in financial markets, where every real-world asset is also represented by a digital unit or token."

"If Blockchain is deployed at scale it can help alleviate many challenges faced by the poor and marginalised so they can access essential services or finance – this is the space to watch!"

Dr. Jane Thomason
Thought leader fintech and blockchain for social impact

"In keeping with Amara's law which states that we tend to overestimate the impact of a technology in the short term and underestimate it in the long term I'm optimistic for blockchain to move beyond the hype to real practical use cases and significant investment, particularly in financial services and supply chain management."

Lord Chris Holmes
of Richmond MBE

"Increasing interoperability is a major indicator of the maturity of the individual blockchain networks."

Keith Bear
Fellow at University of Cambridge's Centre for Alternative Finance

"Governments are digitizing payment rails with CBDCs, banks are transforming capital markets, and exchange and clearing businesses are rethinking settlement and custody for digital assets. The integration of blockchain as a core technology is well underway."

Lex Sokolin
Global Fintech Co-Head Consensys

Digital currency adoption

No discussion of blockchain or Web 3.0 can ignore the growing prominence of digital currencies that are entering a critical new phase. The rise of cryptocurrencies and blockchain technology has brought about new possibilities in the use of money as well as exciting new forms of digital assets and markets. Aside from cryptocurrency and stablecoins, central bank issued digital currencies or CBDCs are one of the most interesting innovations in this area. They are seen as expediting and increasing the security of payments between banks, institutions and individuals.

We spoke to Richard Truin, the best-selling fintech author of of "Cashless - China's Digital Currency Revolution", who is well placed to observe first hand how CBDCs will take off: *"Digital payment is already part of Chinese people's lives, and revised the status of banks to "dumb pipes"* — simple conduits rather than revered institutional gatekeepers — a serious cause for concern in the industry."

Despite the growing calls for cashless societies, CBDCs aren't necessarily going to be a replacement for cash just yet. Although the market is far too nascent to confidently predict outcomes, those involved in the payments ecosystem should take steps to position themselves for the inevitable changes on the horizon.

Richard Turrin
best-selling fintech author

"Ready or not, CBDCs are coming. With China and India launching CBDCs a full 37% of the world's population will have access to CBDCs in the next 3 years. This is a fundamental change of paradigm for which Western banks seem woefully unprepared."

Robert Courtneidge
payments, digital assets and e-money expert

"The proliferation of privately issued digital currencies, the growth of e-commerce, and the pandemic have created tailwinds that are driving government-led experiments in CBDCs. By addressing the systemic risks and inefficiencies across the global financial eco-system, CBDCs could usher in a new era of efficiency, enhanced competition, financial stability, security and public trust."

Artificial intelligence in fintech

Another new currency making waves in financial services is the currency of data. Michael Berns is Director for AI & FinTech at PwC and says: *"Data scientists are at the forefront of innovation and scaling."*

Artificial Intelligence (AI) and machine learning have the potential to advance financial services more than any other emerging technology. With AI companies can better mitigate risk, optimise portfolios, combat financial crime, deliver personalised customer experiences and more. The key strength of AI is that it allows companies to analyse large blocks of data and make genuinely informed decisions.

"Most successful financial institutions have made AI a key strategic goal, but less than 10% of firms overall are well prepared for it. The world urgently needs the deep insights of AI to tackle complex problems like climate change."

Michael Berns
Director for AI & FinTech
PwC

We spoke with Eran Stiller, Lead Software Architect at badook, about how the massive flows of valuable data work in organisations. He explained that the area has some serious potential pitfalls: "These algorithms rely on data. If the data is good, they can build a usable model. But unfortunately, our data changes over time, and its quality decreases. Errors in data collection occur, data pipelines can inadvertently wreak havoc, and assumptions that we previously had change over time and might no longer be valid, causing potentially catastrophic business results." He highlighted the story of Zillow, the US real-estate company that wrote down 38% or $10 billion in a week. The problem was caused by flawed automated investments into property based on algorithms that did not consider changes in the real world environment.

In the age of the machine, Zillow serves as an example of where human critical thinking still has the edge. Jim Marous, global speaker, podcast host and co-publisher at The Financial Brand describes how people are still needed even around advanced automation: "data, intelligence and analytics will be used to identify opportunities, facilitate innovation, refine decisions and support contextual communications. This will not be done devoid of humans, but will be enhanced by humans and will enhance humans."

Marous continues on how AI is ultimately a tool that is linked to improving the quality of people's lives: "AI and applied analytics will facilitate customer access to financial tools, advice, and embedded solutions that can improve trust and differentiate a brand by empowering the customer to partner on their financial wellness journey. This level of sharing will also assist in protecting the customers' privacy and security."

Jim Marous
Global Speaker
Co-Publisher
The Financial Brand

"There has never been a time when the use of data, AI and applied analytics has been more important. They will illustrate what's happening across the organisation, why it happened and what will happen next. This will enable employees actions to improve back-office operations, reduce costs, save time, improve customer service, loyalty and profits."

Eran Stiller
Lead Software Architect
badook

"A crucial part of regulating AI will be ensuring that the data used to derive the algorithm is valid. Consequently, I predict that data quality and reliability will be a topic of growing concern with most, if not all, tech companies. Like we test our code, we should test and validate our data and ensure that it behaves as we expect it to. If we don't do that, we might wake up one morning and base our business strategy on corrupt forecasts, or even worse - make catastrophic fully-automated financial decisions that could cost us billions. I'm sure that none of us wants to be in that position."

Brett King
Author of 'The Rise in Technosocialism'

"There's a great deal of continued debate about Artificial Intelligence, debating if it's real, if it will really change the world, put people out of work, etc. But in 250 years whenever we've had a leap in technological capability we've always argued if, and every single time the technology wins, disrupting industries and economies. It's time we stopped debating IF AI is going to meaningfully change our societies and start planning how we introduce AI effectively and positively. Starting with global regulation on AI ethics."

Embedded finance's continued growth

It took a while, but banking without banks is becoming a reality through the phenomenon of embedded finance — also known as contextual finance or banking. Digital natives' ability to embed financial services into their platforms has accelerated the drift of customers from incumbents who no longer necessarily know their customers better than the competition.

We spoke with Dr. Efi Pylarinou, the influential global fintech commentator, on the shape of embedded finance: *"It has taken two forms in the market. One through existing financial services providers growing their stack of services via fintech Saas providers. The other form is non-financial companies now offering financial services. For example, Apple in the US is offering its own credit card, Tesla is offering insurance, and Shopify is offering business banking."*

Paolo Sironi is Global Research Leader for Banking at IBM Consulting and presents a powerful argument in his new book "Banks and Fintech on Platform Economies" on the future of the industry, with embedded finance (Contextual Banking) being central to the strategy along with trusted advisory (Conscious Banking). He explained to us that the power of such new business models will be in how they *"usher in a new era of hyper-personalisation and hyper-contextualisation."*

Bill Gates said in 1994 "Banking is necessary, banks are not."

This frictionless nature of digital processes, when compared to the old way of interacting with methods of finance, has now been experienced by a greater and more diverse part of society. Customers can now access financial products in a growing amount of settings and environments on their own terms. Meanwhile, brands have realised they benefit from higher customer stickiness, more touchpoints and additional revenue streams while also gaining valuable behavioural data to be fed back into the decision-making loop.

This is not an exclusive segment — just as fintech challengers have done, incumbents can partner with and embed themselves in the platforms and ecosystems challenging them. The goal here is to benefit from the platforms' and ecosystems' seamless digital experiences, broad customer base and access to contextual data so as to maintain their position.

Paolo Sironi
Banking at IBM Consulting and Bestselling Author

"Ultimately, it is the opportunity to eliminate the friction in user interactions that makes banking contextualised to become embedded and unlock 'new' value."

"We are now seeing the embedded finance trend picking up, which wasn't the case three or four years ago. Financial services are becoming increasingly distributed and Embedded banking is one of the enablers."

Dr. Efi Pylarinou
Global Influencer, Fintech & Disruptive Tech

Tech Strategy To Succeed And Win

03

Technology as an Enabler of Business Strategy

Time and again, we witness similar issues cropping up in clients' businesses, from system design right through to testing, deployment, infrastructure, scaling and reliability. Of course, no two projects are the same and we adopt a bespoke approach depending on the problems to be solved, but in this section, we will cover some guiding principles that will help you and your team make better technology decisions.

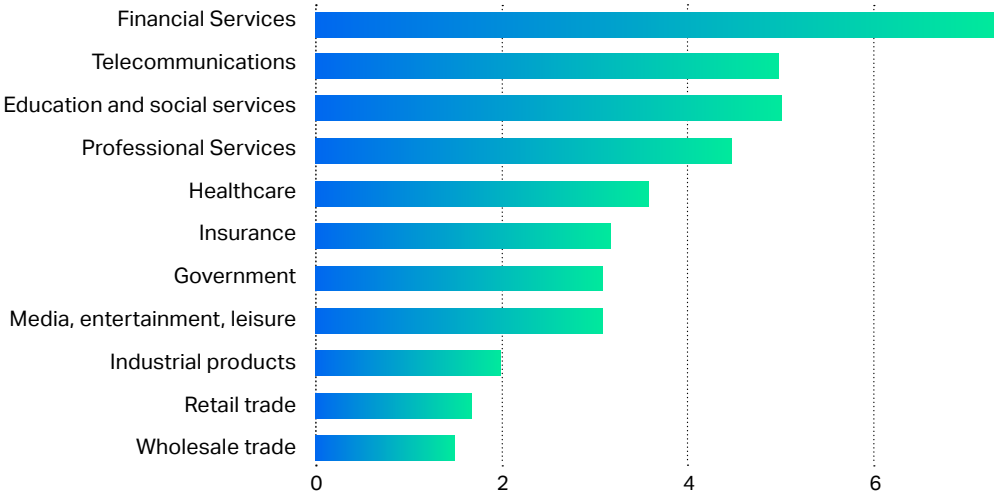
Whether in financial services or elsewhere, any company lacking a strong technology strategy will struggle to succeed. Banks are no longer standalone entities with a century's old monopoly over things. Much like in telecoms, there has been massive disruption driven by technological advances, and incumbents must look at themselves as part of a larger FS ecosystem.

With technology as the enabler of business strategy, the lines between tech and business functions are increasingly blurred. So 20 years on, Watts S. Humphrey (the father of software quality) is right — the software solutions created by a company do determine how it is run. Many financial services incumbents have been attempting to keep pace with fintech firms through mostly superficial improvements focused on the frontend customer experience. This short-term strategy was put to the test when dealing with the spike in online activity at the outset of the pandemic, as the backends are still running on legacy infrastructure.

> **"Every company is now a software company"**
>
> Watts S. Humphrey

Back in the early stages of the pandemic, the US stock trading app Robinhood experienced three outages in a week as stock market volatility peaked. The problems led to this statement being published by Baiju Bhatt and Vlad Tenev, Co-Founders and Co-CEOs: *"Multiple factors contributed to the unprecedented load that ultimately led to the outages. The factors included, among others, highly volatile and historic market conditions; record volume; and record account sign-ups. Our team is continuing to work to improve the resilience of our infrastructure to meet the heightened load we have been experiencing."* More recently, Bank of America Corp.'s online banking platform went down for several hours, leaving thousands of customers locked out of their accounts. Digital engagement growth and more users of BofA's app and website are believed to be the root of the problem.

Financial Services spend heavily on IT



Total IT spending as % of revenues or gross output

Source: Forrest Research Inc., DB Research

IT spend is significantly higher as a percentage of total revenue in financial services in comparison to other industries.

Financial services incumbents have various core legacy systems written in different programming languages with other services being added in to solve emerging problems. This, when combined with multiple mergers and acquisitions, has led to a state of overlapping systems across different operational workflows which are complex and fragmented and pre-date the digital era.

The modernisation of legacy infrastructure is one of the most vexing problems in the industry. We spoke to Nikolai Hack, Head of Strategy at Nucoro, the leading digital wealth platform, who work with incumbents to offer digital propositions. He said; *"For a while now, there has been an acceptance that moving a bank's legacy systems to a new core is the only route to achieve innovation via end-to-end digitalisation. However, between multi-year long core transformation projects and a phased approach, more players will realise that oftentimes smaller is more beautiful and can outweigh waiting for the big bang project that solves all problems forever — but then doesn't."*

"I expect there to be more of a start-small transformation approach. Banks can move forward on their journey of digital transformation by investing in parallel technologies that sit alongside their existing stack but connect to their core in neuralgic and necessary points. These parallel infrastructure projects are lower risk, lower cost and allow banks to launch a new proposition in less time and, over time, turn off legacy systems: transforming bit by bit."

Nikolai Hack

Head of Strategy at Nucoro

With incumbents' resulting IT architecture being expensive to run and maintain, but also inflexible and difficult to change, it is first advisable to fully evaluate what the real goal is before committing to major decisions in this area.

We spoke to Adrian Mountstephens from the Payments & Banking team at Equinix on this topic: *"Companies are under pressure to modernise. This often leads to conversations that jump straight to the technology — cloud, SaaS, Kubernetes, containers, all the sexy stuff. But unpacking the pressure to modernise should start with a conversation around what is really driving that pressure, it's coming from the need for competitive advantage".*

"The strain was felt by some companies more than others during lockdowns. From outages in online banking, stock brokerages and e-commerce sites, forcing you to virtually queue for hours before you were allowed to shop. With these lessons learned from the pandemic, it must now be the case that best practice system architecture and software engineering must prioritise fault-tolerance and reliability. It was a strange feeling, as we had been advocating these best practices for decades, first in the telecoms space, and later in fintech."

Francesco Cesarini
Founder and Technical Director
Erlang Solutions

"RabbitMQ, EMQx and Kafka are examples of technologies that can open up commercial opportunities and innovation while reducing risk. The point is to enable transition to the new and make use of innovations as they become mainstream through leveraging middleware and messaging technology."

John Samuel
Head of Middleware Technologies
Erlang Solutions

A common problem of legacy is the independent black box applications that are not really understood by anyone. Introducing gradual decoupling and adding modularity to system architecture is possible although not easy. In this scenario, the use of a message bus or message queue can handily solve the problem of getting these different applications to talk to each other reliably. For instance, when a message broker such as the Erlang-based RabbitMQ is used to solve this problem, you are able to isolate and decouple components, which is very important when dealing with fintech monoliths.

"The path to modernisation is not straightforward, and this is where CIO/CTOs are losing sleep. Digital leaders are tasked with how to plot a path to rapid product development by embracing cloud native approaches like Kubernetes and containers which allow for portable application environments that can be run in any cloud IaaS environment. This path can be paved with danger, risk, and ultimately failure. Honestly, I don't envy the challenges faced by the CIOs of legacy financial institutions!"

Adrian Mountstephens
Growing Payments & Banking Ecosystems at Equinix

"Programming consists of overcoming two things: accidental difficulties, things which are difficult because you happen to be using inadequate programming tools, and things which are actually difficult, which no programming tool or language is going to solve."

Joel Spolsky

The human element

Just as we have already spoken in some detail about customer-centricity being a key driving force in shaping the evolution of financial services and fintech, the human element of your internal systems is equally as important. The amount of IT employees actively writing code is drastically higher at successful incumbents. Therefore, cultivating a technology literate workforce has never been of such value in organisations as it is today.

Part of this is deciding how to create an engineering mindset at your organisation to foster technology-driven thinking. This means adopting a solutions focused and scientific approach to problems and encouraging the agile mentality of trial and error, and understanding that failure is actually progress. When it comes to shipping new products and features in this dynamic market fear of failure needs to be eliminated throughout the organisation.

"Agile development is delivering real business value in shorter cycles where the whole team becomes more engaged with the new product or feature which builds trust. A small team, squad, tribe - you name it - will sit in the same boat, rowing in the same direction; adding value to the customers."

Márton Veres
Technical Project Manager
Erlang Solutions

Wherever possible, governance and planning should be lightweight with a value-based prioritisation. This creates the environment for autonomous teams to make critical decentralised decisions. Agile working means communicating and responding more effectively, comprehensively and faster within teams, with a focused multi-functional approach to problem solving.

The financial industry has adopted agile working methods in order to innovate and iterate faster, be more responsive to changing market dynamics, regulatory reform and advancing technology. Márton Veres is a Technical Project Manager at Erlang Solutions and has substantial experience in the areas of project management and consultancy in telecoms and financial services, and says that the agile approach is: *"essential for building trust within the organisation."*

To help communication, working with frameworks such as design thinking can be of great use. Design thinking skills help companies design intelligent services and solutions that customers will value and use. This can help avoid the situation where a seemingly brilliant product idea makes it all the way to production before anyone realises that it does not add any value for the end-user. Márton Veres shares: *"with the use of design thinking tools, we are able to identify the customer needs better and investigate early how the market responds to our solutions without investing too much into them unnecessarily."*

"Culture eats strategy for breakfast."

Peter Drucker, the well known management consultant, once wrote, "Culture eats strategy for breakfast." This implies that, in the end, the culture of your company determines its success. So, it is vital that tech teams do not lose the human factor in their working dynamic.

Traditional banks don't always hire for culture, and this flaw in the hiring process can result in a lack of diversity and quality in talent. This is partly due to continually looking to recruit from the same channels or talent pools as they always have. Genevieve Leveille is a leading voice in the global tech and entrepreneurship space: *"To build systems with diversity in their core, it is important to build teams with different experiences and backgrounds. We can no longer assume that a solution built for a European society will perfectly fit the need of an African and/or an Asian society."*

"For the last 20 years, there have been several initiatives towards achieving greater Diversity and Inclusion. The challenges I would put against these efforts are that they tend to be more about indoctrination and assimilation rather than acceptance and embrace. We hear a lot about getting women into the technology field, but there are no real efforts to understand how they can balance their family needs against the demands of their work. This results in many choosing to not participate as often the failure to address the demands of their employers results in negatives both financially and mentally."

Genevieve Leveille
Principal Founder
and CEO AgriLedger

More than half (54%) of all employees will require significant reskilling by 2022.

World Economic Forum

The Ethnic Diversity in UK Fintech report by Tech Nation found that while the participation in UK fintech of individuals from underrepresented backgrounds has increased between 2011 and 2021 from 12% to 20%, this has not been distributed equally across different communities. The number of individuals from an Asian background has increased from 7.5% to 12.2%, but the proportion of Black people working in fintech has remained static, at 3.1%.

There is also an issue when it comes to gender representation in the industry. We spoke to Lloyd Wahed, CEO and founder of Mana Search, the UK based fintech recruiters, who points to the problem existing even in the next generation of tech: *"...the national average is 18% for female computing undergraduates across the UK, and the leading universities, for example, Imperial College London Department of Computing, had only a 24.5% female cohort in 2018/2019."*

Leveille explains the importance of diversity being placed at the centre of organisational strategy: *"To deliver unbiased solutions, it is imperative that organisations onboard teams that are diverse and create more inclusive environments. This is an exercise that cannot just be done in words but needs to have careful planning and continuous engagement. The diversity cannot be only at the operational levels but must also be in place in the management so that shared purpose can be at all levels of the organisations."*

"There is an ongoing dispute about the lack of diversity in tech, but we need to understand that it's impossible to acquire diverse talents from a non-diverse pool. We suspect that the change requires future initiatives across all institutional levels, including higher education and not only talent acquisition."

Lloyd Wahed
CEO and founder
Mana Search

Fintech firms and incumbents are using technologies such as cloud, blockchain, artificial intelligence and machine learning, but there is often a lack of skilled employees within these organisations that truly understand how to leverage them. Finding and onboarding experienced fintech software developers is insanely difficult for CTOs. When you are looking to build a minimum viable product (MVP), talent acquisition can soon become your most pressing challenge.

Partnering with an extended team to work on your architecture and backend services while your in-house team does the frontend and UI/UX can improve your working capacity. This can achieve faster time to market by developing and launching products quickly. As Nucoro's Nikolai Hack explains: *"Faster innovation. A core principle of the modern economy is the separation of tasks and the efficiency gains we derive from it. By focussing on what you're good at and getting someone else to do the other bits, everybody can play to their strengths and bring new propositions to life or launch a new product faster than otherwise possible."*

Nikolai Hack
Head of Strategy
at Nucoro

"To be in the race to digitalisation, there's little point in banks starting to build in-house solutions. Partnering circumvents the limitations of both these options as banks can gain a depth of specialism, expertise and innovation that they lack internally in a short time frame."

Security and Resilience as Fintech Priorities

With a lot more business activity online, the threat of a potential cyberattack causing worldwide panic and loss of confidence in the financial system is at the top of any business leader or CTO's agenda. The next grey swan event (predictable but unlikely) might be such an attack. Such an event would cause grievous losses and severely harm public trust in financial institutions.

Financial institutions possess a wealth of information about their customers, including personally identifiable information (PII), phone numbers, credit scores, addresses, social security numbers, credit card numbers, birthdates and more. Therefore, customers are investing substantial levels of trust that their data is safe.

Michael Ashford
CTO at Wealthify

"Having a culture where security is everyone's responsibility, not just a select few people, means embedding security best practice in the products we build, the processes we develop, and the procedures for detection and escalation. We conduct robust, regular penetration testing, and act on it."

We spoke to Michael Ashford, CTO at Wealthify, the leading online investment service: *"Trust is paramount in fintech — customers trust us with their money and keeping their account secure. Therefore, risks such as account take over, fraud, hacking and data breaches cannot be ignored."* Or as Jim Hart, Chief Security Officer at Pollinate, the payments platform for small businesses, puts it: *"trust is hard to build but easy to lose with one security breach."*

Data breaches have affected various financial service providers including banks, loan providers, payment processing companies and credit reporting bureaus. Equifax experienced one of the biggest data breaches of the century — it cost them nearly $4 billion dollars!

Increased reliance on technology within financial services and connectedness between different parties means a heightened risk of operational failures and security problems. We spoke with Carl Nightingale, partner and member of the Global Digital Trust and Cyber Security team at PA Consulting in the UK. He explained: *"Growth in the integration of third-party applications and/or services, such as payment gateways, rely on 'trusted suppliers' and in line with refreshed regulation — now require constant monitoring for risk."*

"Security is not a one-off activity. The lens over risk management now exceeds the typical corporate boundary and now pushes deep into the supply chain."

Carl Nightingale
Global Digital Trust and Cyber Security team PA Consulting

"For Fintechs, what's really key is to ensure getting the partnership right in the B2B space and understanding the responsibilities and compliance of each partner in creating secure products and experiences."

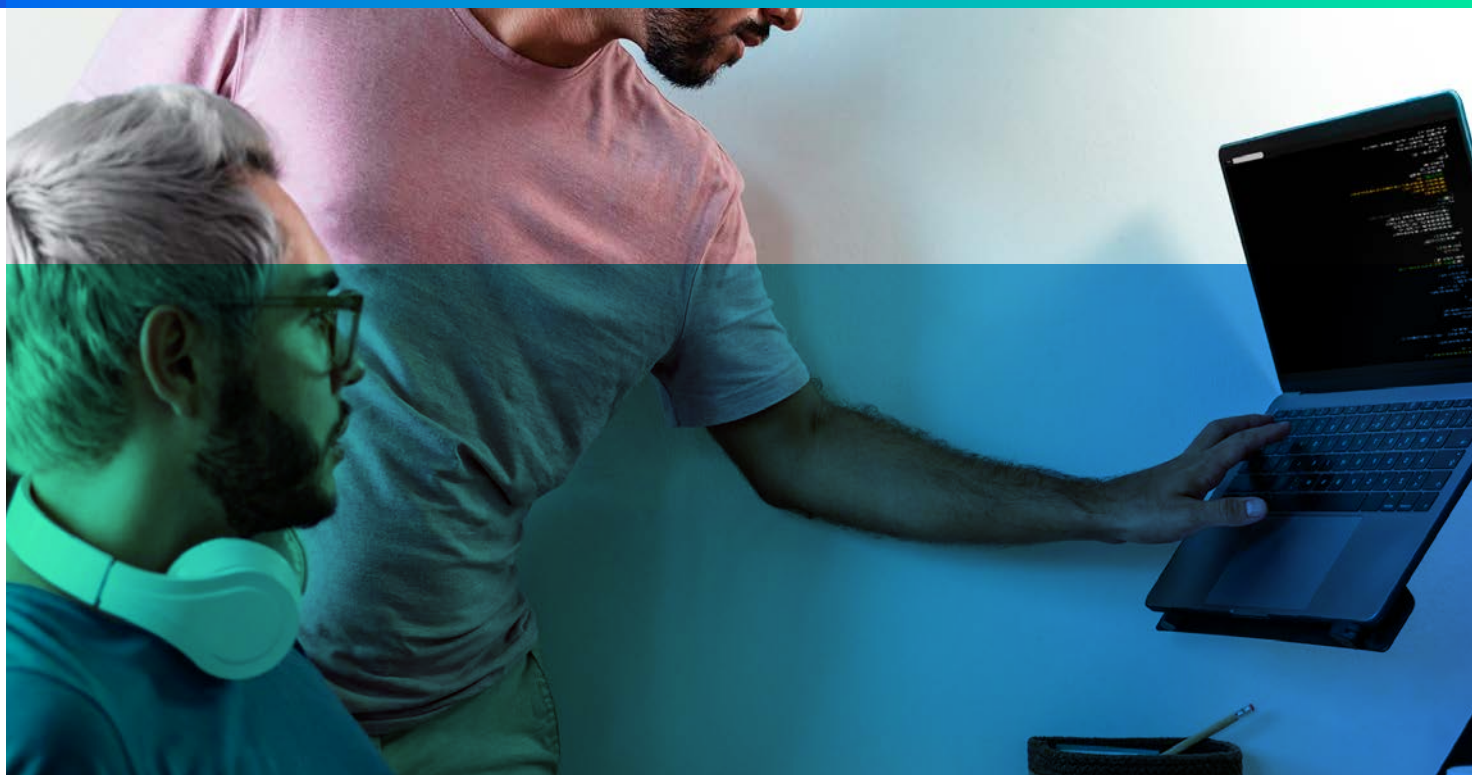
Jim Hart
Chief Security Officer
Pollinate

A centralised network, typical of mainframes at incumbents, is exposed to a 'single point of failure' vulnerability. Should the central node break down or become congested, then this will affect all the other nodes in the system. With decentralised and distributed networks, the failure of a single node should not significantly impact any other node.

Although the ideas of distributed computing are not new, their effective use is not straightforward for non-experts. The 2021 Architecture and Design InfoQ Trends Report listed the topic of "correctly built distributed systems" as only at the "early majority" stage of adoption, for instance, which is why you should consult with experts in this field.

Lars Krantz
CTO and Co-founder
Upptec

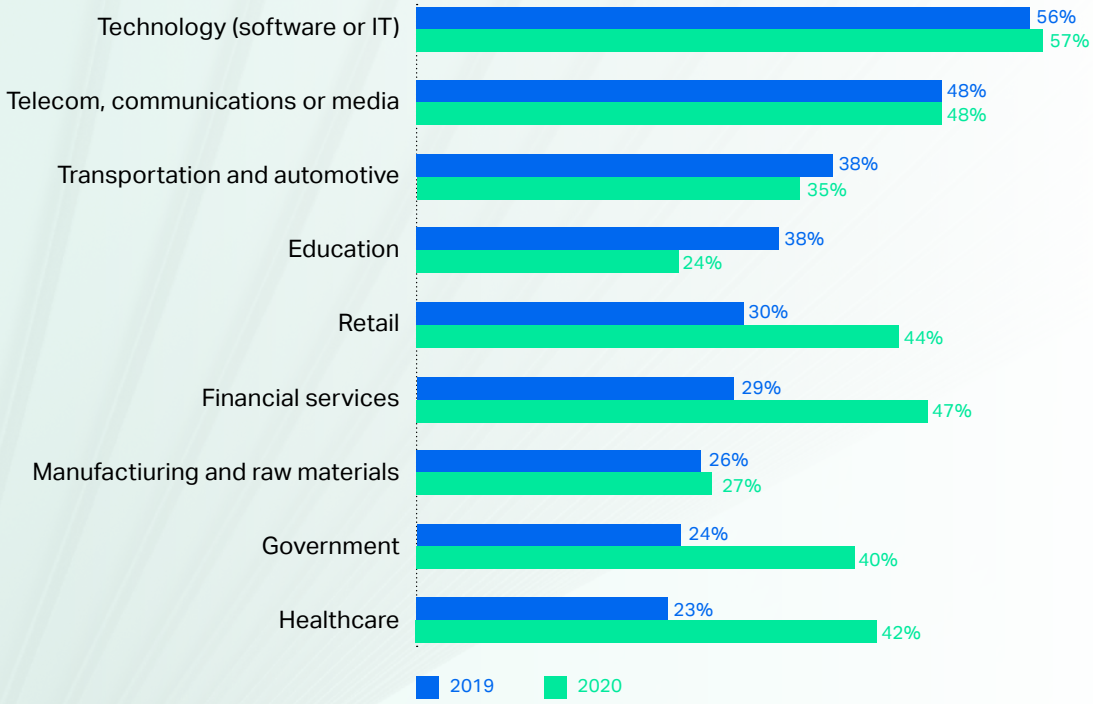
"Leveraging the power of more processor cores and scaling your application across multiple servers is difficult and bug-prone to do in other programming languages and platforms and requires a higher number of engineers for maintenance. With Elixir and it's built-in support for distributed computing, this is a breeze that doesn't require additional maintenance or engineers so they are able to spend more time inventing innovative cutting-edge solutions."



Leveraging Open Source Technology

Standing on the shoulders of giants

% of open source technology sometimes or frequently contributing upstream



Source: The New Stack

Open source projects are a great option that is growing in use for financial services and offer the chance to benefit from existing communities and battle-proven technologies. A recent study was commissioned by the European Commission to analyse the economic impact of Open Source Software and Hardware. It found that the main advantages are: higher-quality software and reduced cost of ownership vs proprietary software options, no vendor lock-in, access to knowledgeable, active communities to innovate and share and enhanced security.

"We openly embrace open source technology. It enables true innovation by allowing sophisticated exploration of new ideas without any financial overheads. Open source products are able to naturally follow the direction of innovation through their enthusiastic community support."

Pascal Jerome
Head of Data Innovation
Pollinate

We spoke with Valentin Rothberg Principal Engineer at Red Hat: *"Building on top of open source has proven to allow focusing on the real business value without having to deal with the entire complexity of today's operating systems stack."* We also grabbed a word with Daniel Pilon, Engineering Manager at the fast-growing fintech SumUp, who highlighted: *"The speed that companies are now able to deliver new technologies without the burden of having to reinvent the wheel or pay a huge amount for proprietary software is one of the foundations for such a transformation."*

Valentin Rothberg
Principal Engineer
at Red Hat

"It makes sense to collaborate on common problems that do not have a business value on their own. Working on open standards further guarantees backwards compatibility, increases interoperability and lowers the risk of vendor lock-in."

The Fintech Open Source Foundation's "2021 State of Open Source in Financial Services Survey", found that: "despite open source adoption in financial services being widespread, there is a huge opportunity to leverage it to make gains in efficiency and innovation." There are also some shortcomings of which to be aware, such as implementation and usability issues where, for example, software may not be personalised for the specific use case. To mitigate this and other general concerns about using open source tech, you should engage with specialist partners experienced in the area.

The Erlang and Elixir ecosystem is especially strong and well established, with the technologies found in some of the biggest systems in the world from WhatsApp to Cisco. As Daniel Pilon from the fintech firm SumUp says: *"the power and synergy of the Elixir community are impressive as there's always somewhere one can reach out in order to seek help or contribute."*

Daniel Pilon
Engineering Manager
at SumUp

"In the Elixir community, contribution to open source is just an organic aspect. When I started my journey, the community was something that really caught my attention. The energy and the willingness to help each other was way advanced when compared to my days with .NET or Java."

"We have a long-term collaboration with Erlang Solutions and they are our preferred partner since they are the driving force in the Erlang/Elixir community and they give us access to world-class technical skills and knowledge."

Jens Lundberg
Head of Development Kivra

Let's start a conversation about how your project can benefit from the power of the Erlang and Elixir programming languages

Find out more

Conclusion

We hope that this report has helped to shed some light on where things are heading in fintech. The aim was to close the knowledge gap between business and tech functions because, in successful fintech firms and incumbents, the silos have been broken down through a shared understanding of technology. This is important as software engineering has become the core of value creation in many companies, and the methods used to build software can significantly influence business results.

For leaders to have a greater understanding of and relationship with technology doesn't mean they need to know how to code, but they do need to be able to have meaningful conversations about technology to make good decisions.

The pandemic has shown that disruptions can happen at any time, and even the best-prepared institutions are unable to predict them. Preparation does, however, yield greater resilience, and we see this along with security, flexibility and faster speed-to-market as the gateway to greater innovation and improved scale and growth. It is clear that system design and technical infrastructure are vital as the foundations to succeed in the space.

Of course, some problems will occur no matter what choices you make around programming languages and your tech stack. The aim is to use ways of working which can help reduce the number of issues experienced and their severity.

At the end of the day, technology is a means to an end. Where tech choices drive a solution instead of the other way around, problems will arise. This is where working with a partner with experience in dealing with many different types of systems in the industry can be a major competitive advantage to help inform on the right architectural decisions and choices of technologies from the outset of new projects.

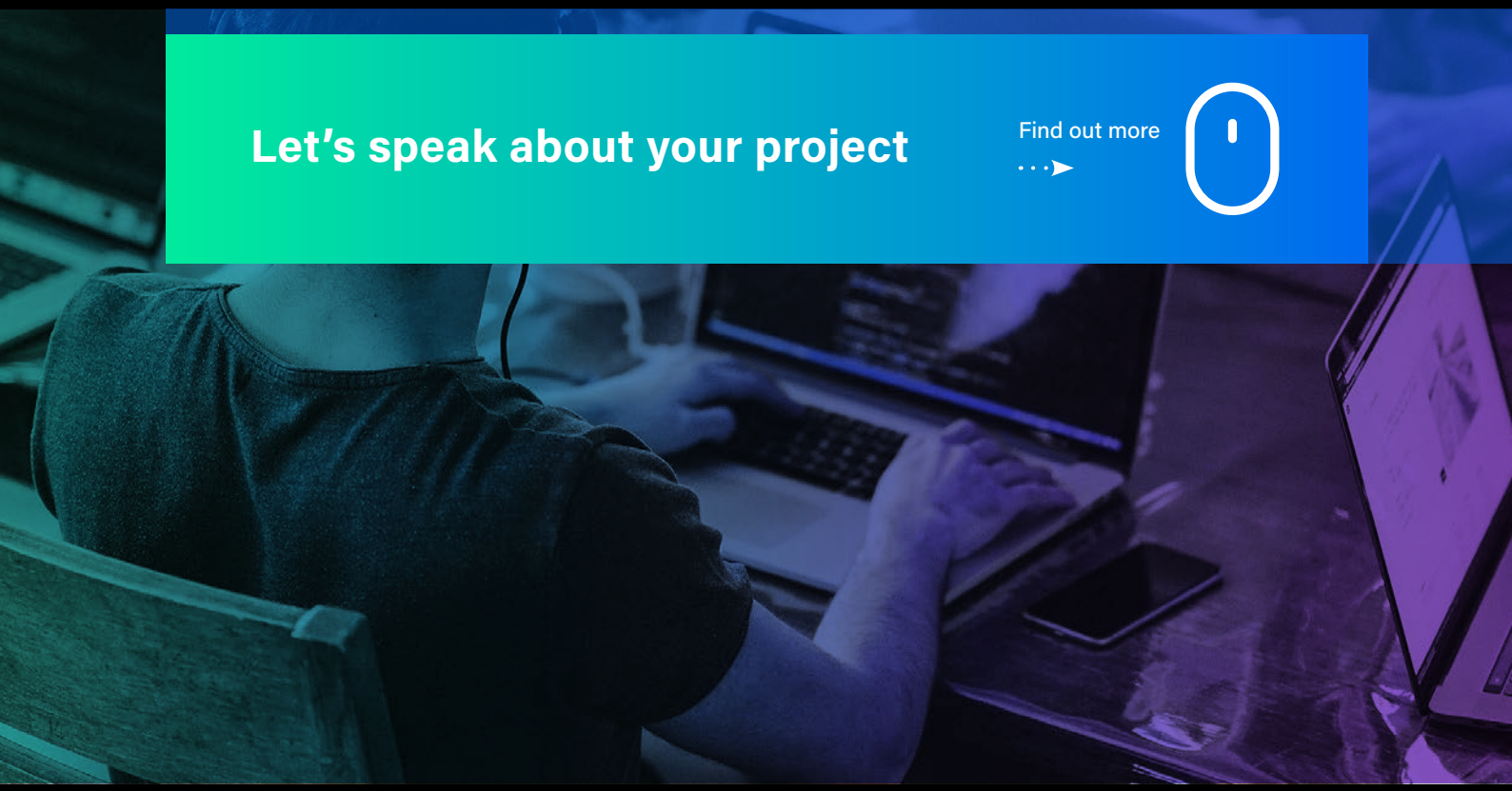
We work with clients, from global payments giants to bootstrapped startups, and know that individual projects need a tailored approach to be a success. We have deep domain knowledge of building resilient, fault-tolerant, distributed systems and have seen firsthand how the technologies we specialise in can propel massive growth in the fintech sector with the likes of Klarna, Brex and Vocalink.

Erlang and Elixir – The Right Tools for Building Fintech Systems

Erlang is a programming language designed to build massively scalable, soft real-time and distributed systems that require high availability. Elixir is a programming language that runs on the BEAM virtual machine — the same VM as Erlang — and can be adopted throughout the entire tech stack. Many of the world's largest banking, e-commerce and fintech companies depend on these technologies to power their systems such as Klarna, SumUp and SolarisBank.

As a programming language originally designed for the telecoms industry where fault-tolerance and reliability are essential, Erlang and Elixir are the right tools for the job for many fintech use cases. Of course, there are many languages being used successfully across financial services but, the big differentiator with Erlang and Elixir is that high availability, fault-tolerance and scalability are built-in. This along with powerful libraries and reduced lines of code makes developers' lives easier and allows them the freedom to concentrate on rapid prototyping and getting to market before the opposition to deliver features to end-users.

If you have a fintech project you think we could help with, please do not hesitate to get in touch to speak with one of our expert consultants.



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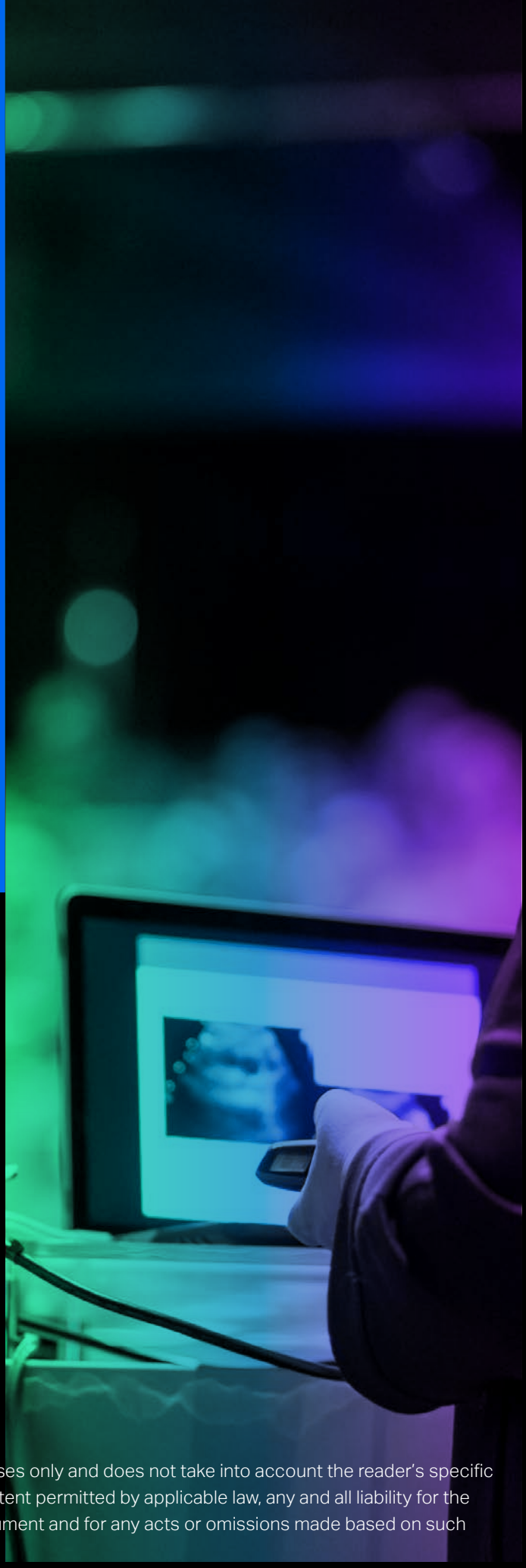

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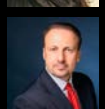

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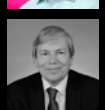
and Head Economist Consensys



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Fintech & Disruptive Tech

Nikolai Hack
Head of Strategy at Nucoro

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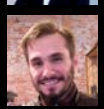

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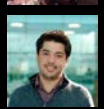

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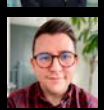

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Paolo Sorini
Banking IBM Consulting, Bestselling Author
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