Fintech in India – Powering a digital economy

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Fintech ecosystems have evolved significantly with a considerable effort from financial institutions, start-ups, the government, venture capitalists and regulators to create a conducive environment of collaboration and dynamism. The sweeping changes introduced by fintech start-ups are likely to have an impact that extends beyond the confines of the traditional financial services industry. Financial institutions are increasingly adopting a collaborative approach with fintech start-ups to provide personalised and engaged services to customers. Furthermore, the government’s reformist stance has led to a gallop towards building a vibrant open digital economy.

2018 started on a positive note in India with the emergence of new age fintech start-ups, investments and non-core players in the financial services industry. This is an indication of a growing acceptance of fintech making a giant stride towards its potential. The contribution from all stakeholders i.e. government, regulators, financial institutions, start-ups and investors have become a key enabler to build a robust fintech ecosystem.

With KPMG in India and NASSCOM’s 10000 Startups’ proficiency in the fintech sector, the report offers a view of three emerging themes: open banking, artificial intelligence and blockchain, which have the potential to bring a sea-change in the financial services industry. While these themes add substantial value if implemented in silos, a concurrent adoption of the triad of themes presents a compelling case to build the next generation open frameworks. The report also explores the current landscape of technological adoption in the financial services industry and serves as a guide for financial services organisations in India to accelerate their journey in the open digital era.

We hope that you enjoy reading our publication and as always, we look forward to your feedback/suggestions.

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President
NASSCOM
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Concurrent adoption of technologies

Blockchain — Enabling a distributed ledger ecosystem in financial services
Introduction

Financial institutions are undergoing a dramatic transformation in the digital age – from their roles and responsibilities, service offerings, products to the distribution channels. With the adoption of technology, ever-changing regulatory landscape and ever-growing consumer expectations, there is a rapid influx of new entrants in the market, which is of growing concern for the incumbent financial institutions (FIs).

Innovation in the fintech industry has taken the world by storm, becoming a global phenomena not limited to any one region alone. Amongst the various focus areas in which fintech has been making waves, two areas which have driven fintech adoption in the past few years stand apart, these include - adoption of data at the core of the fintech business models and adoption of open banking regulations across the globe. Going forward, it may not be surprising to see increasing participation from the non-financial service sector, such as telecom, power and retail, leveraging open data as a means to augment their portfolio by foraying into financial services.

From an investment perspective, the global fintech sector has witnessed H1 2018 investments surpassing 2017 total to reach USD57.9 billion[1]. Dominant market players continue to emerge in the areas of payments and lending. Meanwhile, a broader range of companies are focused on innovation in areas, such as artificial intelligence (AI) and data analytics, thereby attracting attention from investors.

The Asian fintech market is currently dominated by two growing economies, China and India[2]. Fintech investments in China strengthened in the first half of 2018 as compared to the end of 2017[3]. The Indian market witnessed massive investments in fintech with 31 deals in Q2 18[4], propelled by the strong government reforms to steer the country towards a digital economy.

Initiatives led by the government and regulators for digital India, aided by the growing internet and smartphone penetration, has led to the adoption of digital technologies. The financial services industry is rapidly evolving and moving from the traditional 'one size fits all' approach to a more personalised service approach.

Adoption of these technologies by financial institutions can be achieved through fintech collaboration, integration or development of in-house skill set to execute these technologies. However, the real impact of digital transformation is likely to come from concurrent adoption of open banking, AI-driven data intelligence and distributed ledger technology.

For India to embark upon the journey to become digital economy all the stakeholders in the shared ecosystem - government, regulators, financial institutions, fintech are expected to play a critical role. Developing a successful framework is vital for a flourishing environment for experimentation.

To be relevant in the current world around the customers, institutions needs to leverage emerging technologies and re-look at the customer experience, while lowering their barriers to accept innovation. In today’s world, advisors play an important role in providing the agility required to support the innovation. From customer mobility experience to risk management, emerging technologies are adding immense value to business processes in financial services.

- Gayathri Parthasarathy
  Head
  Financial Services - Advisory
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In this report, KPMG in India - in collaboration with NASSCOM 10,000 start-ups have showcased three emerging technologies, which are rapidly capturing the market and becoming effective catalyst in proliferating the digital landscape.

**Artificial Intelligence**
- In 2018, global AI spending is expected to reach USD19.1 billion, of which the banking sector will account for 17 per cent.\(^2\)
- Banking and financial institutions are collaborating with technology companies and are looking at migrating from the current AI deployment model aimed at low-impact rule based processes to high impact cognitive and predictive process.
- AI is gaining momentum in India with over 400 AI-related start-ups and attracting investments of USD150 million, just over the last five years.\(^3\)

**Open banking**
- Banks which were traditionally confined to closed ecosystems are now allowing third parties to access data in real-time through open banking standards. In our research for this report, it was observed that open application program interface (API) is the new reality leading to an open digital economy.

**Blockchain**
- Blockchain has the potential to redefine open and shared economy across areas such as payments, trade finance, know your customer, frauds reduction, clearing and settlement. Many financial institutions, in association with fintech firms, are establishing consortiums to co-create development.
- In India, it is estimated that blockchain has the potential to generate up to USD5 billion in business value over the course of the next five years.\(^4\)
Unlocking the potential of open banking
Traditionally, banking was confined to a closed ecosystem with data access in silos and limited data sharing with the customer. Consequently, the services and products offered were unique to the institution. With the leap in technology and evolution of the shared ecosystem, the wave of open banking is gaining prominence and thereby enabling financial institutions to provide more value to customers. This entails providing personalised services, through a shared ecosystem with customer consent and thereby, unlocking the huge potential for open banking.

Banking Services are moving from a 360 degree view to a 720 degree view of customer relationship.

**Introduction to open banking**

Open banking can be defined as an ecosystem that furnishes the end user with data from a labyrinth of financial institutions via application programming interfaces (APIs). APIs help a software or application (app) to communicate and work with another application and seamlessly share information.

It is observed that open banking originated as a regulatory initiative and globally got off to a slow start, with low consumer awareness and delayed implementation by banks, contributing to its stunted adoption. However, innovation and digital architecture transformation sparked by fintech firms may lead to creation of new business models based on collaboration with financial institutions.

Open banking implementation in the near future is most likely to be compliance driven, adhering to the guidelines and focused only towards implementation. Post successful adoption, the focus would shift towards value added services and reaping the benefits of this open ecosystem.

**APIs allow third parties to access banking or financial information data in real-time, enabling them to integrate their respective systems, processing the data and offering more valuable insights and services.**
The following are the roles for banks in the open banking ecosystem:

- **Integrator**
  The bank controls production and distribution of products and services

- **Producer**
  The bank focuses on products and services and distributes via third parties

- **Distributor**
  The bank distributes products and services created by third parties

- **Platform**
  The bank retains a stake in both production and distribution by acting as a market intermediary

### Revenue model

The building block of an open banking ecosystem is the open API architecture. The common misconception about an API is that it is an enabler of a product. However, an API is a product in itself and demands a product strategy.

A strategic shift from building a scalable, secure, robust and agile API to allow the consumption by outside parties is the gateway to monetise the open banking ecosystem.
API is a technology-oriented product, however, a strategic shift in the vision of businesses is required to embrace APIs.

The maturity of sharing APIs with other parties is a ‘one step at a time’ revolution.

Initially, financial institutions built APIs for their own digital transformation and eventually opened it for larger consumption thereby, leading to monetisation in terms of pay-per-use, subscription, data and revenue sharing models.

API product management is a relatively new concept in the industry. The sooner organisations realise its benefits and move towards building the right strategy, the more impressive its returns shall be.
Open banking has differing initiation, control models and maturity levels around the world. In the U.K. and Europe, regulators have been enforcing its mandatory adoption. Singapore’s regulatory authority is promoting an organic approach to adoption of open banking without coercing the banks. The adoption of open banking in New Zealand is driven proactively by banks.
India leaps towards open digital economy

Over the past few years, India has essayed several guidelines and reforms such as granting multiple licences for differentiated banking to small finance banks, payment banks and introduced the unified payment interface to include the unbanked population of India in the formal financial services folder, strengthening the payments ecosystem. To embrace open banking architecture and unleash the true potential of shared ecosystem, a foundation has to be formed on four pedestals: government, regulators, traditional institutions and fintech.

**Government**

For open digital economy to thrive, strong government support is a critical component. To propel India towards a digital economy, the government along with the support of regulators, is working aggressively towards creating a progressive digital ecosystem.

The government is expediting the move towards a ‘presence, paper, and cash – less service delivery’ system popularly known as ‘India Stack’.

**India Stack**

An upsurge is evident as a result of these reforms and initiatives across several key indicators. Around 878 million bank accounts have been linked with Aadhaar till March 2018. Transaction volume using Unified Payments Interface grew from 0.1 million in October 2016 to 312 million in August 2018 and transactions in value terms rose from INR0.5 million to over INR542 billion during the same period.

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02. Statistics, India Stack website, accessed on 03 September 2018

03. Statistics, National Payments Corporation of India (NPCI) website, accessed on 03 September 2018

04. Statistics, UIDAI website, accessed on 03 September 2018
The end goal of the relentless efforts put in by the government is not only to open basic bank accounts for fostering financial inclusion, but to also manage the inflow and outflow of funds in accounts. This is done by transferring the direct benefit subsidies with the Jan Dhan Yojna accounts, and then crediting various subsidy (LPG, fertiliser, day wages and so on) directly into the bank account. This inflow of cash into accounts would encourage the unbanked population into adopting formal banking practices.

Open government data

Open government data can be defined as publishing information collected by the government in its entirety such as budgets, spending records, healthcare measures, climate records and farming and agricultural produce statistics.

India currently has over two lakh data resources, over 6,900 APIs across more than 100 departments, 118 chief data officers, resulting in an overall improvement in India’s global ranking by the Open Data Barometer.

Government e-Marketplace (GeM)
- 26,556 buyer organisations
- 134,502 sellers and service providers
- INR10,829 crore orders value

E-Way Bills
- Clocked INR10 crore bills within 80 days of its launch on April 1, 2018

TReDS
- One of the three TReDS entities witnessed average monthly volume of bills discounted at INR100 crore with over 200 MSMEs registered in Oct-Dec 2017

GSTN
- 11.2 mn businesses registered under GST vs. 6.4 mn under old system
- GSTR-3B returns filed increased from INR5.4 million in Feb 2018 to INR6.3 million in May 2018

BBPS
- Facilitated INR31.5 million bill payment transactions in Mar 2018 vs. INR18 million in Mar 2017
- Tied up with various state power corporations

05. Open Government Data (OGD) Platform India, Accessed on 28 August 2018
06. Statistics, Open Data Barometer, website accessed on 3 September 2018
Regulators

Regulators have been instrumental in India’s drive towards developing and strengthening the open digital ecosystem. The key objectives of regulators is to lay the groundwork for interoperability across payment systems, and create an environment for innovation and increased personalised experience.

To address these focus areas, regulators have taken the following steps:

- **Implemented Bharat Bill Payments System (BBPS) to improve the security and speed of bill payments through multiple modes.**
- **National Payments Corporation of India has paved the way for open banking by putting infrastructural blocks such as unified payments interface (UPI) and Aadhaar enabled payment services (AePS) in place.**
- **The RBI has published a report of the ‘working group on fintech and digital banking’, providing recommendations for an environment for developing fintech innovations and testing of applications/APIs developed by banks/fintech companies.**

UPI to UPI 2.0 Journey

Globally, open banking has been synonymous to two use cases – payments and account aggregation, India with its journey from UPI to UPI 2.0 has taken a significant leap in the payments ecosystem.

Due to data access to third parties, regulators must continually recalibrate regulations and policies, develop thresholds which are based on risk, keeping cybersecurity subjection in check, and maintaining a high degree of consumer confidence.
NBFC–AA architecture

NBFC account aggregation

Reserve Bank of India (RBI) declared directives for Non-Banking Financial Company - Account Aggregator (NBFC-AA), highlighting the framework for registration and operation of an account aggregator in India. The account aggregator would give a consolidated view of a customer’s assets across the ecosystem including assets under the purview of different regulators. While the aggregators will have a holistic view, they will not be the owners of the data. It is only with the customer’s consent that the information can be passed on to various financial information users (FIUs).

Financial information provider (FIP) and financial information user (FIU)

NBFC – account aggregation is a positive step towards an open digital economy. The base of financial information providers (FIPs) is vast and includes the following as per the directives from RBI:

- Current and time liabilities
- Deposits with NBFC
- Structures investment products
- Commercial papers
- Certificate of deposits
- Government securities
- Equity shares
- Bonds
- Debentures
- Mutual fund units
- Exchange Traded Funds (ETF)
- Indian depository receipts
- Collective investment schemes
- Alternate investment funds
- Insurance policies
- Balance under NPS
- Units of Infrastructure Investment Trusts
- Units of Real Estate Investment Trusts (REIT)
- Any other information as may be specified by bank
Financial information user’s (FIU) could range from a single end user to financial services providers (FIPs), fintech firms, service-based start-ups, service aggregators and so on. Given the sheer volume of data available, various effective solutions can be developed.

**Consent architecture**

A key aspect of an AA is the consent framework. The account aggregators are ‘data blind’ in nature – which means that to collect as well as share the information, the AA would need user consent. The consent architecture is developed on the basis of the nature of the FIU, defining the purpose and the frequency of the consent. For instance, if the information is shared for flow-based digital lending, the customer might want to share the information only once. In case of personal wealth management, the information could be shared on a weekly basis.

**Benefits for financial institutions**

In the current ecosystem, a FIU has a skewed view of the customer. Based on only its relationship with the customer. The FIU is able to suggest products which might be useful for the customer. Often the relationship with the FIU might not be the true picture of the overall customer potential. With access to data from various FIPs, the FIU might have a consolidated view of the customer, leading to an effective customer servicing and elevated cross-selling. This could enhance customer stickiness.

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**Traditional financial institutions**

The financial services industry is embracing the open digital economy to provide enhanced customer services through various delivery models.

**Financial services firms’ open banking delivery models**

- A Bengaluru-based payment company has recently partnered with an online ticket booking company
- A global bank acquired a Mumbai-based startup to help build an open banking platform
- An Indian bank tied-up with an NBFC to launch co-branded credit cards using digital and API banking technology
- Banks, through their subsidiaries and NBFCs are partnering with adjacent industries such as retailers to provide digital solutions
- A global bank acquired a Mumbai-based startup to help build an open banking platform
- Banks are emerging as accelerators for fintech start-ups through various models:
  - Mentoring and collaborations
  - Hackathons
  - Innovation centres
- Most fintech firms are approaching banks for validation of their business model and access to customers’ data. Additionally, most banks provide an open architecture through APIs to fintech firms, leading to faster development of products.
Building a strategy for open banking – Challenges

To convert challenges into opportunities organisations need to build strategy around their business technology.

- Specialist with experience in technical and API strategy and development
- In-house expert to assist business users, who can build a strong sales team that can address technical queries
- Team with mix set of expertise along with cross-skill trainings

- Cross-industry partnerships
- Fintechs collaborations
- Investment/acquisition of tech firms
- Incubation of start-ups

- The government and regulators should build a strong policy framework along with the compliance and monitoring mechanism for ownership and sharing of data

What is in it for me?

Financial Institutions (FIs) continuing with old legacy systems may resist as the customers may switch to other banks.

FIs that are embracing technology can add new potential revenue streams by enhancing customer experience.
The unbundling of the banking value chain is still in its nascent stage, but it is evident that open digital economy is fast becoming a reality. Multiple initiatives from the Government of India and regulators have resulted in India moving towards a platform driven economy.

Platforms are mere dots in the larger image of digital world. When we take an initiative to connect the dots, the bigger goal of a truly open digital economy will be realised.

Confluence of platforms of e-governance

In the past years, under the digital India initiative, multiple digital platforms have been created:

- The e-stamping, Government e-marketplace (GeM), e-way bill and Trade Receivable electronic Discounting System (TReDS) platform, Goods and Services Tax Network, Income Tax Return and BBPS platforms are functioning successfully but in silos.

If only these platforms communicate and share data mutually with customer consent and that data is made available through open APIs, it can add another layer to the current Indian digital stack.

Connecting the dots is a beloved childhood game, but what if the dots are constantly moving? The new wave of emerging technologies and changing business models is forcing businesses to create images with moving dots. We focus more on the design but it is the raw need of the customer that needs a highlight. Instead of treating a customer as a transactional segment in the digital world understanding of behavioural patterns is more important as each user is different.

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  Digital and Fintech - Management Consulting
  KPMG in India
### Boosting the ecosystem to foster collaboration and innovation

**e-Stamp**
- Replace manual way
- Tamper proof
- Can be checked by anyone through site
- Has a Unique Identification Number

**e-Way bill**
- A compliance mechanism for movement of goods
- Reduced documentation
- Linked with GST

**GeM**
- Procurement by govt. depts./organisations/PSUs
- Tools of e-bidding and reverse e-auction
- Wallet-like facility for advance payment

**TReDS**
- Financing of trade receivables of MSMEs
- Widening financing options
- Updated portal for MSMEs to list their projects for bank financing through bidding

**GSTN**
- Common and shared IT infrastructure between the center and states
- Invoice matching
- Checking the claim of Input Tax Credit

**Tax**
- Mandatory online filing with income over INR5 lakh
- e-verify facility using Aadhaar or through bank’s credentials

**BBPS**
- Integrated and interoperable system
- Timely settlements between parties
- Multiple payment modes, options and channels
- Instant payment confirmation

### Connecting Ecosystem to foster collaboration and Innovation

- **National Platform**
  - Account Aggregator
  - Information Database
  - Strong Supply-chain
  - Faster Credit Financing
  - Wider financing options
  - Quicker Payments
Catering to an elevated service experience

Customers today have elevated service expectations. An open digital economy has the potential to cater to these heightened expectations by personalising products to a large extent. With an abundance of open data the degree of personalisation might not remain isolated only to a segment of the total audience, but expected to impact individual lives.

- Big technological companies such as e-commerce platforms and online service aggregators have the capacity to add perspectives and application, and influence their services by combining financial data, spending patterns and behaviour.
- For instance, a cab aggregator can potentially get into a small ticket lending business using analytics and provide personalised lending services, thereby reducing customer acquisition costs.

Flow-based lending solutions

- Higher turnaround time and high operation costs due to processing the information across various stakeholders and lenders.
- However, the open API framework enables the lender to fetch the documents directly from the source through explicit user consent.

Big technology firms influencing/ entering FS market

- Enable viewing multiple bank accounts, and manage and communicate with financial firms through one window.
- Develop notional pooling, a mechanism for deriving liquidity based on combined balances of corporate accounts, including decentralised subsidiaries.
- Utilise analytics to help consumers manage their finances.
- Leverage artificial intelligence (AI) for intelligent cash management.

Liquidity management

- Although the relationship manager has customer’s assets data with their firm, they do not have access to data from multiple financial institutions.
- However, open banking API enables a third-party provider to access customer data from multiple data sources with explicit customer consent, thereby providing quality advisory and leading to enhanced customer stickiness.

Wealth management solutions
Public credit registry

Reserve Bank of India (RBI) is currently working to setup Public Credit Registry (PCR), which would work as a single point and real time confirmation repository for collating credit information of individuals and corporates. It is likely to help banks evaluate borrowers’ creditworthiness and offer customised interest rates. PCR comprises of the following elements:

**PCR framework**

<table>
<thead>
<tr>
<th>Core Credit Information</th>
<th>PCR-MCA Sub system (sub sys): Company ID Details, Company Financial Details, etc.</th>
<th>PCR- Fraud database sub sys: Wilful defaulter List, RBI Caution List, CFR, ECGC, etc.</th>
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<td>PCR-SEBI sub sys: Promoter, Shareholding Market borrowing</td>
<td>Tax</td>
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<td>PCR-Legal Database sub sys: Litigation against debtor/promoter</td>
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<td>PCR-IBBI sub sys: IBBI Listing Status</td>
<td>PCR-CERSAI sub sys: Securitised Asset details</td>
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<td></td>
<td>PCR-GSTN sub sys: GST Details</td>
<td>PCR-GSTN sub sys: GST Details</td>
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Public Credit Registry (PCR) will integrate information from multiple stakeholders (banks, NBFCs and regulated financial institutions) and link with other existing information systems such as those of the Ministry of Corporate Affairs, Reserve Bank of India and Securities and Exchange Board of India. The utility/statutory bill payments database and legal database will enable API utilisation and strengthen India’s credit landscape.

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09. Report of the high level task force on Public Credit Registry for India, RBI, April 2018
Open Banking in India - the road ahead

In the last few years, India has taken monumental strides in developing a strong foundation to embrace the wave of change in the financial services industry. The transformative migration from closed banking towards an era of open and shared financial ecosystem can be seen as a non-linear growth. Up until now, customers used to avail financial services from the institutions, which in turn, dictated its terms and conditions to the customer. With the advent of technology, the open ecosystem and the availability of options, now the equation is changed and the customer is most likely to dictate over the financial institutions.

The main focus now should be towards developing a strong foundation of the appropriate digital infrastructure required to support the ever-changing BFSI ecosystem. While India has taken progressive steps towards the initiative, in the form of Aadhaar, eKYC, eSign, eMandate, affordable mobile data and extensive smartphone penetration, there is still a gap that needs to be fulfilled when it comes to facilitating adoption of these reforms and techniques. Creating infrastructure and new reforms is just one aspect, the other aspect is educating the people about the benefits of the new reforms and their life changing effects.

Finally an important parameter for success of this open digital economy, would be the cooperation from the financial institution’s leadership. They must welcome this new wave of change with humility and embark on the journey of unlearning traditionally accepted methodology and learn to embrace the change and connect the dots with renewed vigor and agility.
Artificial Intelligence-led transformation in the financial services sector
The Indian financial services sector is currently in the process of tackling some of its persisting challenges such as shrinking margins and rising non-performance assets (NPAs). The sector is also ripe with opportunities due to entry of non-traditional finance players, shift in consumer preferences and rise in regulations and compliance obligations. At this juncture of challenges and opportunities, the Artificial Intelligence (AI) revolution could not have come at a better time.

Open Banking creating headway for AI applications

The world is increasingly moving towards open banking leading to the creation of repertoire of data, which can be leveraged by AI-driven intelligence in creating automation across front, middle and back office business processes.

It has become imperative for financial institutions to explore AI applications in designing business and operational strategies. The future would see an incremental shift in usage of AI applications to drive strategic initiatives for the institutions.

AI, if intelligently applied, can drive quicker insight-based decisions, provide customised solutions to customers, discover new ways of working and capture new revenue streams.

Global AI Adoption

The widespread benefits of AI have encouraged many industries to invest aggressively in cognitive/AI software capabilities.

Geographically, the U.S. is likely to account for more than 75 per cent of dispense on cognitive/AI systems in 2018, followed by Western Europe01. By 2035, AI is expected to add USD957 billion to India’s economy02.

India scenario

Indian financial services sector has started mainstreaming the concept of AI. With the push from government to converge the public data systems and movement of banks towards open frameworks, time would see proliferation in usage of AI to drive strategic decision making in financial institutions. The future would also see an inordinate focus of using AI models to reduce unbanked and uninsured gap in rural areas. Some of the use cases such as AI led credit scoring, micro insurance and distribution models can see a huge adoption in rural areas. As AI involves learning on huge chunks of unstructured and structured data, Indian regulators will have to play a key role to ensure that the concerns around data security and information sharing are safeguarded while keeping business interest of financial institutions in consideration.

AI refers to the ability of machines to perform cognitive tasks such as thinking, perceiving, decision making and problem solving, which normally would have required human intelligence.

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01. Worldwide spending on cognitive and artificial intelligence systems will grow to USD19.1 billion in 2018, According to New IDC Spending Guide, IDC, 22 March 2018
02. AI to add USD957 billion to India’s economy by 2035: NITI Aayog, CMIE, 06 June 2018
Embarking the transformation journey through AI-based solutions

<table>
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<tr>
<th>Industry Headwinds</th>
<th>AI Solutions</th>
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<tr>
<td>Shrinking margins and increasing cost pressure</td>
<td>• Increased access to newer segments and niche offerings</td>
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<td></td>
<td>• leveraging differentiated insights</td>
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<td>• Reduced cost and operational efficiencies from intelligent</td>
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<td></td>
<td>• automation</td>
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<tr>
<td>Increased frauds leading to high NPAs, claims and fines</td>
<td>• Enhanced credit-underwriting decisions, computer vision for</td>
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<td>• insurance/property underwriting</td>
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<tr>
<td></td>
<td>• Pattern-matching analytics to detect fraudulent activity</td>
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<tr>
<td>Lack of customised products and need for competitive</td>
<td>• Identifies pattern to suggest relevant customer segmentation</td>
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<tr>
<td>product pricing</td>
<td>• Learn from publicly available social-media streams to</td>
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<td></td>
<td>• anticipate market movements</td>
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<tr>
<td>Lack of differentiated customer experience</td>
<td>• Conversational chatbots for personalised and omni-channel</td>
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<td></td>
<td>• experience</td>
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<td></td>
<td>• Optimise personal-finance management</td>
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<tr>
<td>Error in manual reconciliations and reporting</td>
<td>• Process automation across multiple data sets</td>
</tr>
<tr>
<td></td>
<td>• Highlight reconciliation exceptions/ mismatches</td>
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<tr>
<td></td>
<td>• Intelligent reporting and audit trails</td>
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03. Over 23,000 bank frauds worth Rs 1 lakh crore reported in 5 years: RBI, The Time of India, 02 May 2018; Financial crime on rise in life insurance sector, The Times of India, 22 February 2018
Banks and financial institutions are increasingly deploying various types of automation techniques across processes based on technical requirements and return on investment (ROI) analysis. The three key AI elements includes computer vision, machine learning and natural language processing.

**Strategic thinking**

- **NLP** helps to analyse, understand and make sense of written and spoken human language. It helps to structure and organise information in clusters which can be used to derive intelligible insights. The insights can be used to predict customer behavior patterns, automate document analysis and provide a more engaging experience to customer while on online support.
- In financial services, one of the promising use of NLP is in chatbots.

- It refers to the ability of machines to learn on their own with or without being programmed. Fundamentally, machines discover patterns and relationships in data and use them to make predictions and solve problems.
- Machine learning algorithms are predominantly used in financial services sector to provide sentiment indicators, trading indicators and fraud risk management across the front and back office processes.
- Uses artificial neural networks, similar to those in the human brain computers, to identify associations and relationships. The Visual recognition technology is capable of automatically extracting the required information using images and patterns such as face scans, tagged images, other picture contents.
- Banks offering remote check deposit via mobile or scanning facial expressions for sentiment analysis is an application of visual recognition technology.
Building the AI ecosystem

An integrated ecosystem is essential in the financial services sector to facilitate stakeholder collaboration and engagement. Collaboration will help identify breakthroughs in AI technology and translate them into business opportunities.

**AI ecosystem collaborators**

**Financial Institutions**
- Early adopters of AI solutions.
- Engaged in implementing and building pilots

**Investors**
- Provide early stage funding support and market access

**Government and Regulators**
- Develop policies, regulations and initiatives to strengthen an AI infrastructure

**Start-ups**
- Innovative solutions transforming traditional financial services

**Technology Vendors**
- Build AI infrastructure and support through several collaborative initiatives

**Research Institutions**
- Skill building and producing talented future-ready workforce

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Government and regulators

The government and regulators are prima facie catalyst for the growth of fintech sector in India. Government of India and all the financial regulators are aggressively promoting the idea of AI powered digital economy and coming with initiatives to create strong fintech ecosystem driven by investments and business opportunities.

Some of the government and regulators led initiatives are listed below:

• Government of India has allocated INR 3,073 crore for the Digital India programme, which will focus on research, training, skill development in robotics, artificial intelligence, big data intelligence and quantum communications.

• The RBI’s inter-regulatory working group on fintech and digital banking has recognised the use of AI and robotics in data analytics and risk management as a major fintech innovation.

• The Securities and Exchange Board of India (SEBI) has set up a Committee on Financial and Regulatory Technologies (CFRT) to facilitate the application of AI in securities and trading and for SEBI’s other regulatory functions.

• Insurance Regulatory and Development Authority of India (IRDA) is closely examining the impact of innovation on product design and the efficacy of inclusive insurance delivery.

Financial institutions

Several financial institutions are collaborating with emerging AI startups to develop proofs of concept on AI applications and implement in their business operations. They are not only providing business opportunities to AI driven fintech startups but also investing in the startup solutions. Financial institutions are providing open platforms to the startups and developers through APIs and also supporting incubation of early-stage fintech startups through accelerator programmes, hackathons and innovation labs.

Some examples of collaboration are:

• One of the leading banks in India is using an AI focused application that scans facial expressions and provide instant feedback on service quality. The cameras installed in the bank branches capture the facial expression of customers and immediately report on the customer’s present sentiment (good or bad).

• A leading security broker uses Phrazor, an AI tool developed by Vphrase to generate personalised, narrative-based, easy-to-understand portfolio statements for their 5,00,000 customers in four languages.
Technology players

For an AI ecosystem to flourish, collaboration between fintech startups and large technology players is of paramount importance. With the advent of usage of convoluted technologies, startups require support with respect to skills and infrastructure from large technology players. Support can come in multiple forms such as white labeled products, common go-to market strategy, direct financial investment, incubation support and access to know how.

- A leading IT player has set up a venture fund focused on providing funding support to technology startups and AI related fintech firms. It is also a part of NASSCOM Industry Partner Program (NIPP) to support the growth of startups
- Several large technology players have setup AI-focused accelerators to mentor startups that use artificial intelligence and machine learning in various areas including fintech.

Investors

AI is generating a lot of interest within the investor community. According to NASSCOM, there were more than 400 AI-related startups in India, who secured an investment of USD150 million over the last five years. Overall AI funding has increased to USD73 million in 2017 from USD44 million in 2016.

Investors are coming to terms that fintech is more than payments or lending, and manifesting their interest in various other sub-segments such as AI.

Universities and research institutions

To build an innovative AI ecosystem, industry bodies and academic institutions have undertaken several initiatives through professional courses and incubator programmes aimed at nurturing AI talent. The universities are focussing on promoting basic theory of AI, cross-disciplinary AI research as well as the integration of academia and industries.

Industry associations

Industry associations led by sector development goals can play a crucial role to build AI-focused initiatives in the country. They will need to enable the growth of the technology by undertaking various programmes around policy advocacy, skill building, cross disciplinary AI research, startup programmes and industry outreach.

Some of the notable initiatives taken by industry bodies in India are:
- NASSCOM has opened a center of excellence for data science and artificial intelligence in Bengaluru.
- NASSCOM has signed a MoU with Niti Aayog to collaboratively build an AI ecosystem in the country and accelerate innovation and skill building in various sectors including financial services.
- A leading IT player has set up a venture fund focused on providing funding support to technology startups and AI related fintech firms. It is also a part of NASSCOM Industry Partner Program (NIPP) to support the growth of startups
- Several large technology players have setup AI-focused accelerators to mentor startups that use artificial intelligence and machine learning in various areas including fintech.

Startups

Evolution of start-ups is imperative for a successful fintech ecosystem. The flourishing effect of AI related Fintech startups has been catalysed by an increasing demand for personalised financial products by consumers, need for building stronger risk and fraud models by financial institutions, rampant rise of connected devices and support of venture capitalists.

Startups have played a major role in the growth of AI innovations by offering solutions to incumbent organisations to redefine their core products, achieve operational excellence and create additional revenue opportunities. The trend is increasingly shifting from start-ups seen majorly as disrupters to also being enablers of change. For example one of the AI startups ThirdWatch is helping to prevent online fraud using their platform Mitra. Mitra captures over 200 parameters and flags every transaction as red or green in real time. Hence future is ripe to see greater collaboration between different players of the ecosystem.

---

10. Wipro USD100 Mn venture fund discloses investments in 8 startups between FY ’15-17, inc42, 05 June 2017
11. Google Launchpad Accelerator India to mentor 10 startups, LiveMint, 13 July 2018
12. How AI startup ThirdWatch is keeping an eye on and preventing online fraud through Mitra, Yourstory, 10 December 2017
13. Artificial Intelligence Primer, NASSCOM, July 2018
14. NASSCOM opens centre for data science, Business Standard, 05 July 2018
15. NASSCOM unveils centre for data, AI, The Hindu, 05 July 2018
With digital transformation and customer experience at the forefront, financial institutions are looking at AI solutions to deliver superior customer experiences, reduce costs and unlock new revenue streams. They are either developing in-house capabilities or forming partnerships with fintech players to leverage the technology.

As per a NASSCOM-CMR survey (Artificial Intelligence for Banking, Financial Services and Insurance Sector, 2018) on adoption of AI in financial services sector in India, the key objective as per financial institutions is to offer enhanced customer experience, followed by automation of back-end business processes, and effective compliance and risk management.  

AI is utilised across front, mid and back office segments, with existing and potential uses cases ranging from customer services, targeted sales and marketing, smart automation of manual intensive processes, and compliance and risk management.

As per our internal analysis conducted with leading financial service players, the highest impact of AI applications is envisaged on the business processes related to the front office.

16. Artificial Intelligence for Banking, Financial Services & Insurance sector, NASSCOM, Accessed Date, 29 August 2018
The following framework illustrates how the aggregated ecosystem capabilities would drive automation across the financial value chain leveraging AI applications.

**Creation of next generation AI model in financial services**

<table>
<thead>
<tr>
<th>Aggregation of Ecosystem pillars</th>
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<tbody>
<tr>
<td>Fintech companies</td>
</tr>
</tbody>
</table>

**Front office**
- **Sales and Distribution**
  - Cross sell and Upsell
  - Customer segmentation
  - Product recommendation
  - Customer Churn Analysis
  - Targeted Distribution
  - Customer behavior analysis

**Middle office**
- **Risk Management**
  - Underwriting Automation
  - Portfolio Risk Analysis
  - Claims Forecasting and Investigation

**Back office**
- **Fraud Management**
  - Fraud Detection and Investigation
  - Anomaly Prediction

- **AML**
  - Reducing false positives
  - Intelligent customer and transaction segmentation

**Reporting and MIS**
- Invoice automation
- Smart Accounting
- Intelligent document check
- Smart reconciliation, audit trail, variance analysis

**Compliance Management**
- Image recognition to digitise documents
- Automate legal disclaimers
- Intelligent text extraction

**Core engines**
- Aggregator Platform
- Trading Platform
- Advisory Engines
- Transaction Platforms

**AI Tools to Create Business Intelligence**
- NLP
- Robotics
- Machine Vision
- Image Recognition
- Machine Learning
- RPA
- Speech/Text Recognition
Availability of computing power, cloud services, digitalisation agenda of the government and evolving regulations around open banking would lead to the rapid adoption of AI led automation across the financial services value chain.

One of the fintech startups, Gyandhan is enabling the education funding using AI driven models to underwrite large ticket education loans for students by predicting the employability score (Gyandhan Score) \(^{17}\).

Large technology players are developing their AI platforms and providing access to open source libraries. Meanwhile, smaller AI technology companies are contributing significantly by developing targeted solutions for the financial services sector. The effectiveness of aggregation capabilities across the ecosystem players to drive front-to-back adoption of AI technologies can be a key value differentiator.

Such symbiotic collaborations between the ecosystem players will provide opportunities to deploy AI technologies in financial services functions and mature from using AI in low impact rule-based processes to high impact cognitive and predictive processes.

Regulations governing the privacy and security of data, policy initiatives and talent infrastructure will further shape the ability of financial and non-financial institutions to utilise AI.

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17 Education loans marketplace GyanDhan raises money from Sundaram Finance, The Economic Times, 06 July 2017; Match-making between knowledge and money, BusinessLine, 11 December 2017
The future of financial services with AI

AI will prove to be a major driving force in years to come in the financial industry and play a significant role in augmenting strategy and business decision making. The financial services sector is expected to embrace AI-led technologies to reap its benefits and evolve with changing needs.

While AI technologies have the potential to transform the Indian financial services sector, incumbents will have to counter challenges related to legacy IT systems by adapting to different regulatory and compliance standards across the globe such as the GDPR; transforming front and back office systems; and understanding the ROI impact to ensure maximum customer satisfaction.

AI integration in back-office processes may still be easy due to few stakeholders involved, however its effect on employees needs to be addressed with care. Back-office AI deployments also need to converge other prerequisites such as global regulatory and compliance standards (for example GDPR) and a ‘zero-fraud’ architecture.

In the front-office processes, integration of AI is likely to attract bigger challenges that involve correctly educating the staff, correctly educating the customers and having a ‘zero-error’ user interface.

Financial organisations that are able to achieve both ‘zero-fraud’ and ‘zero-error’ in their AI, automation and digital infrastructure are likely to be role-models and leaders.

In a country like India, where the unbanked population is yet to be financially included, an AI interface plays a huge role in defining their inclusion in the financial world.
Blockchain — enabling a distributed ledger ecosystem in financial services
Introduction

Blockchain utilises decentralised storage for recording all peer-to-peer transaction data in the form of blocks. It preserves old blocks and simultaneously adds new blocks, making it nearly impossible to manipulate documents, transactions and any other information. Blockchain, which is also the underlying technology of all cryptocurrencies, is a secure, transparent and decentralised database that drives efficiency and immutability and brings in unanimity in organisations’ data records. Its characteristics have eventually resulted in an increased interest from the financial institutions.

Since then, the financial services sector has seen major traction in blockchain applications, such as know-your-customer (KYC), anti-money laundering (AML), trade surveillance, settlement and clearing, smart assets, and collateral management.

Evolution of blockchain

While interest in cryptocurrencies is still disorderly, the interest in blockchain has increased largely. Global financial institutions spend about USD1.7 billion annually on blockchain and are moving beyond the proof-of-concept stage to commercially deployable solutions.

- The blockchain budget of global banking and capital market firms increased by 67 per cent in 2017, with one in ten firms reporting budget in excess of USD10 million.

- 14 per cent of the banks and other financial institutions have successfully deployed a production blockchain application in 2017.

In India, blockchain gained visibility in 2016. Consequently, financial institutions and fintechs have started investing heavily in the technology. Within the next 5 years, Blockchain has a potential to create value to the tune of USD5 billion in India across all sectors.

01. The evolution of blockchain throughout the years, CoinOps, 14 November 2017
02. The technology behind bitcoin is only halfway through its evolution, Business Insider, 12 January 2018
03. Financial services industry spends USD1.7 billion on blockchain, Greenwich Associates, 12 June 2018
04. Blockchain can add USD5 billion to Indian economy in 6 years: NASSCOM official, Business Standard, 27 July 2018
The financial services industry has been evolving constantly with changing regulations, new entrants that is fintechs, increasing competition and rising consumer expectations. Financial services are automating manual processes and minimising the frauds by exploiting the potential of blockchain. Its intervention has led to emergence of multiple use cases across financial services, which will help mitigate current challenges.

### Areas of transformation in financial services

<table>
<thead>
<tr>
<th>Potential areas</th>
<th>Present challenges</th>
<th>Benefits from blockchain</th>
</tr>
</thead>
<tbody>
<tr>
<td>International funds transfer</td>
<td>High cross-border transaction fee</td>
<td>Shorter settlement time reduces the cost as well as foreign exchange risk</td>
</tr>
<tr>
<td>Trade finance</td>
<td>Executing a letter of credit is a slow, paper-based process taking a week to complete</td>
<td>Automate payment process, elimination of intermediaries and instruments such as LC</td>
</tr>
<tr>
<td>Know your customer</td>
<td>High KYC costs, KYC checks performed individually in different financial institutions</td>
<td>Industry-wide customer registry to facilitate the encrypted transmission of customer data</td>
</tr>
<tr>
<td>Capital market trading</td>
<td>Data reconciliation, high costs, long transaction times and operational risks</td>
<td>Secured and reduced processing time</td>
</tr>
<tr>
<td>Manual accounting</td>
<td>Maintaining of different account books</td>
<td>Automate with trusted consolidation in one data model</td>
</tr>
<tr>
<td>Paper invoices</td>
<td>Checked, confirmed and forwarded by lengthy manual processes</td>
<td>Bill-free transactions in conjunction with the use of smart contracts</td>
</tr>
<tr>
<td>Claims management</td>
<td>Lengthy and complicated process requiring verification from multiple intermediaries before a payment can be made to the claimant</td>
<td>Automate the steps involved from coverage verification, claims validation, and, in the case of an auto insurance claim, loss determination</td>
</tr>
</tbody>
</table>
Blockchain has surpassed a phase of being a mere concept, to one where blockchain based solutions are being deployed by banks, exchanges and insurance players. These solutions have attracted the eyes of a number of parties that are now increasingly getting involved in building a sustainable ecosystem for this new-age technology.

**Blockchain ecosystem players for financial services**

- **Global banks, insurance players and exchanges** are exploring blockchain technology since 2014.
- **Governments across the world** are actively trying to build a conducive environment for all the ecosystem players.
- **Large technology players and new age start-ups** are collaborating with legacy players for testing blockchain use cases.
- **Regulations** are still in nascent stages across the globe, but the general opinion of policy makers is positive.

**Financial institutions**

Since 2014, financial services has been one of the first sectors worldwide to carry proofs-of-concepts to test blockchain. Payments, clearing and settlement, trade finance, and identity management are key services currently being explored for the application of blockchain to resolve inherent system complexities and reduce fraud risks. Many banking, insurance and capital market players have started implementing the technology to strengthen their internal processes before applying it on a larger scale for commercial use.

Blockchain development in financial services started about four years ago. Since then, the banking sector currently is closest to being production-ready — moving from adopting small niche solutions and pilots to larger adoptions in a phased manner. Even though pilots have not entered the production stage, there are many ongoing experiments especially in payments and cross-border trading. Insurance players are conducting several pilots and trials, especially for claims management and workflow improvements. Furthermore, securities exchanges and clearing houses are testing blockchain to reduce time taken for trade settlement and reconciliation and remove inefficiencies in processes such as proxy voting.

Financial institutions and blockchain companies are collaborating to standardise and resolve issues around data security, compliance, operational inefficiency and high costs.

Financial Institutions are exploring multiple blockchain models, which include the following:

- **Invest in blockchain fintech startups:** Ever since 2014, as many as 50 financial institutions have plunged in supporting blockchain startups.
- **Incubate blockchain startups:** Major global banks and financial intermediaries work with startups in their blockchain centres of excellence.
- **Collaborate with fintech companies:** Nearly all blockchain-based proofs of concept have been developed in collaboration with fintechs.
- **Develop in-house:** Financial services have started to construct their own blockchain-based solutions through in-house efforts.
- **Form consortium:** Financial services have created consortia to co-develop solutions, distribute potential investment costs and to establish standards.
Indian scenario

Blockchain development in Indian financial services is in line with its global counterparts. Many industry-specific consortia are prototyping blockchain for numerous use cases. Players are also joining international consortia to gain exposure. Apart from the banking sector, many insurance players and a leading Indian stock exchange are also exploring blockchain. Since 2016, trade finance, cross-border payments, bill discounting, digital identity and supply chain financing have been the top blockchain application areas in India.

Government

Governments worldwide are following a multi-pronged approach to enable the use of blockchain. Few governments are actively participating with ecosystem players and are trying to build a sustainable ecosystem. According to the World Economic Forum (2016, 2017) reports, more than 30 governments and 90 central banks are investing in blockchain05.

The U.S., Canada, Australia and China are prominent economies where respective governments have been able to establish blockchain hubs. They are followed closely by other jurisdictions such as Japan, Korea, Malta, Gibraltar, and Liechtenstein06.

Major blockchain-based solutions development worldwide05,06,07

Canada
- ETF for blockchain technologies issued on Stock Exchange
- Government utilises blockchain technology to track and publish information about grant funding

U.S.
- Stock exchange has issued ETF’s of blockchain technology companies

Europe
- 23 European countries established European Blockchain Partnership
- European Commission launched EU Blockchain Observatory and Forum with investment plans of over EUR300 million by 2020

China
- One of the banks is implementing a production blockchain system to provide syndicated lending capabilities

Japan
- Announced a blockchain-based data sharing platform for the trade industry

South Korea
- Announced investment of over USD200 million in blockchain initiatives by 2022

Australia
- A stock exchange in Australia has implemented a blockchain-based solution to replace its current post-settlements process

Switzerland
- Accepts digital currency in payment of city fees
- Added bitcoin as a means of paying small amounts up to CHF200

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Indian scenario

In India, the government envisions blockchain technology to be used in areas such as land records, supply chain management, identity management, benefit distribution, educational certificates, power distribution and cross border finance. In that light the government is taking many steps such as providing infrastructure and institutions to help in developing blockchain skills, piloting the technology in its internal systems, and developing interoperable platforms.

Skill development and educational initiatives

• NASSCOM collaborated with a research institute in Canada08
• Blockchain hackathon organised by Government of Karnataka09
• Blockchain academy set-up in Kerala10.

Pilot for government departments

• Andhra Pradesh has become the first Indian state to start testing blockchain for governance. It has piloted two key projects: (1) Managing land records to curb property-related disputes and (2) Streamlining vehicle registrations. The state plans to implement blockchain across its entire administration11
– Andhra Pradesh government is focusing on building a robust blockchain ecosystem and has also partnered with a New York-based blockchain software technology company. The partnership looks promising for its Fintech Valley Vizag initiative12.
• The Government of Chhatisgarh has taken initiatives to deliver proactive e-governance by leveraging blockchain for a pilot in identity management, e-health records, land records management, in collaboration with NITI Aayog13
• Many other states such as Maharashtra, Karnataka and Telangana are also gearing up for blockchain in their governance.

Platform development initiatives

• Niti Aayog has launched IndiaChain14, a blockchain project similar to Unified Payments Interface. It is interoperable platform for both the government and private entities to build scalable blockchain solutions. An aim of the project is to develop a system that minimises frauds, speeds up enforcement of contracts and increases transparency15.

IndiaChain proof-of-concept use cases

Curb property-related disputes which occur due to mismatch of property dimensions, multiple stake claims, etc.

The government is generating soil health cards for agricultural land. Every patch of land will be digitised in terms of quality of land, crops grown, seasonality, etc.

Prevent ration and electricity loss by bringing transparency and accountability to the government schemes like Public Distribution System

IndiaChain will be linked to IndiaStack, unique identity project Aadhaar which will enable know your customer (KYC) data on IndiaChain

Crops and the vegetables can be tracked and tagged once it reaches the market

School and college leaving certificates will be included, which see a high degree of forging and duplication

Banks can create sidechains which can be linked to their domains linking back to IndiaChain

08. Report on “NASSCOM signs MOU with Blockchain Research Institute (BRI) to evangelise a blockchain ecosystem in India”, NASSCOM, 21 February 2018
09. Blockchain and government of Karnataka: an emerging love story, YourStory, 15 February 2018
10. Kerala to set up blockchain academy, business standard, 18 January 2018
11. this indian City is embracing Blockchain Technology - Here’s Why, Forbes, 5 March 2018
12. Andhra Pradesh govt. signs MOU for blockchain innovation in the state, Inno42, 6 March 2018
13. Chhattisgarh successfully conducts its first Blockchain Grand Challenge, Your Story, 31 August 2018
14. NITI Aayog initiates the blockchain effort, The United Service Institution of India, 02 August 2018; BankChain, IndiaChain & India’s Tech Future, Tech Story, 29 June 2018; NITI Aayog announces indiachain blockchain based UPI, Owlt Market, 28 June 2018; What is IndiaChain: a blockchain system that could soon be the heart of governance in India?, Business Insider, 21 June 2018
15. Ethereum co-founder’s startup to make blockchain prototypes for Niti Aayog, Tech Circle, 17 April 2018
Regulators

Blockchain regulations are still at a nascent stage. However, regulatory bodies are showing increased interest in blockchain. While few countries’ regulatory bodies have launched blockchain frameworks, many countries are still interpreting the technology to develop a formal framework. Despite the slow progress in formulating regulations, global policy makers are positive about blockchain.

Some of the steps taken by global regulatory bodies include:

- Zug, Switzerland hosts several blockchain startups and offers flexible taxation. The city provides legislative protection from the negative aspects of crypto but encourages blockchain companies to increase crypto transactions.
- Many central banks have stepped up their efforts towards digitising their fiat currency to leverage blockchain’s underlying benefits.
- Various international organisations established standards for blockchain technology and development of Digital Ledger Technology:
  - At the G20 summit, members countries agreed to cooperate and ease regulatory laws on cryptocurrencies. This is in line with the view that blockchain can disrupt industries and cooperation among countries can benefit controlled growth of this sector.

Some of the steps taken by global regulatory bodies include:

- The global body for standardisation established Technical Committee 307 to develop standards for DLT and blockchain. Representatives from more than 45 countries attended the inaugural meeting of the Technical Committee. Of these, 25 participating countries designated ISO/AWI 22739 as the first standard to be developed to establish uniform terminology and concept description17.

Indian scenario

Government of India and the RBI are formulating regulations for blockchain. In the 2018-19 budget, the Ministry of Finance said that it planned to utilise blockchain gradually and safely.

- The RBI has formed a new unit to use emerging technologies such as cryptocurrency, blockchain and AI. This new unit will research, draft rules and supervise new emerging technologies in the future.
- The Institute for Development and Research in Banking Technology (IDRBT), RBI’s technology research arm along with other stakeholders has published a whitepaper18 detailing the concerns, global experiences and possible areas of adoption of blockchain in the financial services sector in India. The whitepaper highlights several advantages of blockchain, such as cost savings, efficiency, and transparency.
- IDRBT has also developed a proof-of-concept on blockchain’s applicability in trade finance along with prominent government bodies, leading private and public sector banks and an emerging fintech firm. The proof-of-concept enables automation of Letter of Credit (LC). It has real-time automated tools for AML, and other customs and payments activities18.
- The RBI has also formed an inter-departmental group to study and provide guidance on feasibility to introduce fiat digital currency, backed by blockchain19.

Regulatory landscape16

<table>
<thead>
<tr>
<th>Regulations - In Place</th>
<th>Regulations - Under Way</th>
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<tbody>
<tr>
<td>Estonia</td>
<td>Netherlands</td>
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<tr>
<td>Switzerland</td>
<td>Canada</td>
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<tr>
<td>Malta</td>
<td>Bermuda</td>
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<tr>
<td>U.S. - California</td>
<td>India</td>
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<tr>
<td>Vermont, Arizona</td>
<td>South Korea</td>
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<tr>
<td>Maine, Nevada, Hawaii</td>
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<tr>
<td>Illinois, Nevada,</td>
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<tr>
<td>North Dakota</td>
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</table>

16. Blockchain technology & Malta’s regulatory framework, business matters magazine, 3 August 2018; California Blockchain Bill is Finalized in State Legislature, Cryptodisrupt, 30 August 2018; Canada postpones plans for crypto regulation until late 2019, Coin Geek, 30 August 2018; US States working on blockchain legislation in 2017, Brave New Coin, 02 April 2017
17. The year of blockchain: global legal framework begins to take form, White Case, 27 February 2018
18. Whitepaper on “Applications of Blockchain Technology to Banking and Financial Sector in India”, IDRBT, January 2017
19. RBI explores feasibility of launching ‘fiat’ digital currency, Indian Express, 6 April 2018
Blockchain technology players

There were 115 ‘pure’ blockchain startups worldwide (excluding cryptocurrency-focused firms, consulting firms and firms, which were engaged in blockchain development before 2012) between 2013 and 2017. Most of these startups operate in areas such as peer-to-peer (P2P) payments, lending, remittance, cross-border foreign exchange (FX) transactions, proof of identity, digital security trading and smart contracts. Apart from startups, blockchain has also attracted many large and seasoned technology players. These players have moved beyond their traditional product portfolio to include blockchain-based solutions.

Fintech players, once seen as disruptors, are now becoming strategic partners and collaborating with financial institutions to test blockchain-based solutions. Financial institutions are funding startups and forming partnerships with fintech innovators to build efficient, cost effective and competitive platforms and applications.

One of the startups, Monetago, has designed a blockchain solution for TReDS exchange that records hashed invoice data in order to avoid double financing.

Another fintech startup Snapper Technologies’ blockchain solution addresses some of the persistent challenges faced by the real estate industry.

India is embarking on a fintech revolution with blockchain startups having raised over USD5.3 million between January 2016 and April 2018. A lot of this traction is owed to the Indian government’s constant efforts towards building India as a world-class digital hub.

Fintech Valley Vizag was successful in raising USD900 million and creating more than 5,500 jobs until December 2017. The government, academia, entrepreneurs, and investors are hosting blockchain, data analytics, artificial intelligence, machine learning, cyber security and cloud computing as a part of this initiative. Banking Financial Services and Insurance Use Case Repository Program and Fintech Valley Accelerator Program in Vizag were launched by the state government in 2017 to develop fintech infrastructure in India.

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20. Blockchain Technology and Corporate Governance, OECD, 6 June 2018
21. Blockchain solution to prevent trade finance fraud goes live in India, Global Trade Review, 03 April 2018
22. Snapper Technologies - Transforming the Business Ecosystem through Blockchain Technology, CFI Review, 2017
23. Domestic blockchain startups mop up over USD5.3 million since 2016, Business Standard, 20 June 2018
24. The Indian city is embracing blockchain technology - here’s why, Forbes, 5 March 2018
25. Andhra Pradesh govt. wants Vizag to act as global hub for fintech firms, Business Standard, 5 September 2017
Blockchain is still a nascent technology and the use cases will principally come from the countries that have adopted it such as Estonia, Lithuania, and Sweden\(^\text{26}\). The Indian regulatory agencies will evolve as they interact continuously with countries like Singapore\(^\text{27}\) and Australia\(^\text{28}\) that are in process of implementing blockchain.

Financial institutions that plan to utilise blockchain have to comply with privacy laws and ensure data safety. As many products and services are likely to be transacted over blockchain, highly regulated industries such as financial services need to develop common regulatory standards.

In the financial sector, blockchain will have to handle large data sets, therefore, scalability will be of paramount importance. With rapid growth of blockchain, demand for blockchain experts is bound to increase.

We believe the following are critical success factors in blockchain adoption:

<table>
<thead>
<tr>
<th>Governance</th>
<th>Regulation</th>
<th>Consortia</th>
<th>Education</th>
</tr>
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<tbody>
<tr>
<td>Need of a governing body to monitor the access rights and designate the responsibility of maintaining blockchain applications</td>
<td>Need for globally acknowledged regulatory standards that promote the use of blockchain in a controlled manner</td>
<td>Need for industry participants to work in cohesion designing solutions specific to asset classes and processes</td>
<td>Need for government and organisations to build blockchain expertise by setting up university programmes and organising events like hackathons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scalability</th>
<th>Align emerging technologies</th>
<th>Security</th>
<th>Cost benefit analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for industry participants to factor in blockchain’s long-term aspects and build scalable sustainable solutions</td>
<td>Need to align blockchain with other emerging technologies to maximise and foster an efficient digital ecosystem</td>
<td>Need for financial institutions to conduct a comprehensive security check of their blockchain solutions to ensure their resilience in commercial use</td>
<td>Need for institutions to perform detailed cost benefit analysis, as initial investments can be significant</td>
</tr>
</tbody>
</table>

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\(^{26}\) Blockchain being used in banking, contracts, The Hindu, 28 May 2019

\(^{27}\) Singapore proposes regulatory boost for decentralized exchanges, CoinDesk, 23 May 2018

\(^{28}\) Report on “Roadmap for blockchain standards”, Standards Australia, March 2017
What awaits us in the near future?

Gartner forecasted that blockchain will generate an annual business value of more than USD3 trillion by 2030\(^2\). However like any technology innovation, blockchain will evolve with new discoveries. For example, the internet is continues to evolve and has new regulations after many decades of existence.

Artificial intelligence (AI), internet of things (IoT), and robotic process automation (RPA) technologies have gained relevance over time and represent different aspects of the data world. However, their use is restricted due to their inherent vulnerability to security risks owing to the internet. With the emergence of blockchain, many such issues can be resolved by creating indexed records that are tamper proof and referenceable without censorship. The emergence of new technologies do not present complete solutions, but convergence of technologies should help players customise solutions. For example, in usage-based insurance, IoT sensors collect data and insurance companies access usage patterns on a secure blockchain. A blockchain-based marketplace that connects AI companies and data providers is another example.

Convergence of technologies can disrupt multiple business models. Thus, it is on the radar of many governments and companies. In future, we may see fully operationalised systems with enterprise-ready blockchain solutions, blockchain-based cities, standard and frictionless global identity systems and many other comprehensive solutions that are likely to directly benefit the financial services industry.

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Concurrent adoption of technologies
The next wave of innovation in banking and financial services industry is set to reshape the industry and bring in profound changes in the way business strategies shall be defined. The change would be largely driven by consolidation, collaboration, and convergence with fintech.

Many of the technology elements have crossed the initial level of piloting and the time is right to stitch the components and create frameworks for concurrent adoption of these technologies.

We believe that open banking, AI and blockchain have the potential to create the next wave in financial services. The adoption of these technologies will enable financial institutions to redefine the business strategy, achieve deeper level of personalisation and disintermediate the financial industry.

Following are some of the emerging trends which we foresee would drive this industry:

**Open platforms and aggregated business models**

Adoption of open banking standards and API driven technology models have enabled collection of relevant data. This data is being used extensively to build platforms that enables interactions between the consumers and suppliers to create business value.

Financial services is the latest entrant to foray in the open platforms business, with multiple institutions looking for alternate revenue streams and designing sustainable business models to leverage the non-financial ecosystem. The financial institutions are adopting a two-fold approach:

a. Acting as a platform provider and bringing the ecosystem together
b. Participating as a service provider on existing platform and adding value.

In near future, we are likely to see financial institutions adopting a mix of above strategies and bring incremental revenues driven by lower operational and customer acquisitions costs.

**Redefinition of the customer journeys across all the digital touch points**

Customer expectations are changing every day and customers are looking for holistic solutions. Financial institutions are facing challenges to keep up with the needs of its customers and provide them with personalised, omni channel, services and products in an effective manner. The future is likely to be about customer oriented use cases defined on the concurrent framework using blockchain, AI and open banking.

A next generation customer journey illustrates how the entire ecosystem can collaborate to assist a customer in mortgage buying process and create a differentiated experience in the journey as highlighted in the exhibit ‘Next generation open aggregator platform’ leveraging AI, blockchain and open frameworks. Here’s how the process works:

- Customer can log in to the real estate aggregator platform and view several options. The platform proactively assesses the profile of the customer on basis of quick data entry done and through direct linkages with the financial institutions. The platform has access to the financial information of the customers, government databases, land registry data, and so on
- AI-driven recommendation engine provides suggestions to customers such as best offers and housing options, what other people are purchasing, simulation tool to analyse future cash flows
- All the processing can be done through the platform enabled by the electronic land registry which acts as a single source of open information accessible by the registered institutions
- All the records or transactions are smart contract-driven, and stored on a permissioned ledger secured through cryptography.

In near future, we are likely to see financial institutions adopting a mix of above strategies and bring incremental revenues driven by lower operational and customer acquisitions costs.
Next generation open aggregator platform

1. Listing of the property

2. Requirement listing and request for options

3. Customer Creditworthiness and Eligibility Check

4. House details:
   - General valuation
   - Ownership details
   - Financing details
   - Technical report

5. e-Contract execution

6. Authorisation to disburse loan

7. Access rights to the pool of property data from centralised register

<< Individual verification through Blockchain >>
<< Open platform where listed property details can be accessed >>
<< AI driven recommendations >>
<< Electronic data records over blockchain secured through Cryptography >>
<< Smart Contract based assessment and verification >>

Transaction details
Property Finalisation and agreement on transaction terms

Digital land record

Transaction execution (e-Contract)

Aggregator platform

Buyer

Buyer bank

Lender

Seller
Al-driven business and operating models

AI can unleash its real potential in confluence with large data sets. Adoption of open API-led business models could lead to enhanced use of artificial intelligence. With the acceptance of open API in the near future, we might see financial institutions adopting innovative methodologies to incorporate emerging technology for streamlining its current business processes.

We believe the following parameters are likely to be adopted by financial institutions for an enhanced customer experience and incremental revenue:

- **Reduced operational cost**
  Performing process reengineering and redefining traditional methodologies are imperative steps to change. Financial Institutions can optimise their operations leading to enhanced customer satisfaction and reduced operational cost

- **Enhanced cross selling**
  With the abundance of data, customer behavioural pattern-based selling services could be encouraged. Illustratively building chatbots, processing natural language and using predictive analytics can develop an algorithm to give product suggestions

The financial superstore would act as a one stop solution for all financial product and services. For setting these superstores the three basic decisions which have to be considered are selection of the value chain segments to operate, product/service mix to be offered and onboarding the right product/service providers. The superstore would be supplemented with linkages to the government platforms such as GSTIN, ITR and government led e-marketplaces. These superstores will serve an excellent source of authentic data and would be a progressive step in direction of collaboration amongst financial institutions and government to develop open frameworks such as ‘Public Credit Registry’.

Amalgamation of authentic financial information of an end user with technology will lead to assessment of behavioural patterns and guesstimation of solutions, products, informative tips and so on to the end user.

In the coming years with open digital economy and the increased maturity level of technologies, financial institutions would be capable of moving to models which are highly personalised in nature, and with a capability to collaborate with multiple applications resulting in a seamless customer journey.

It is expected that with the advent of new digital technologies, the boundaries between financial institutions and fintech companies would diminish, and the ecosystem would move towards a more collaborative approach.

Rise of financial superstore leveraging product and government platforms and interoperable payments structures

The future would see emergence of financial superstore which would provide e-platforms to bring multiple private and government entities together and create value across the traditional financial processes. The financial superstore would serve two basic objectives of matching the buyer with the seller and facilitating exchange of goods and services. With the availability of internet enabled smartphone and the convenience of options at doorstep, financial superstore will gain lot of prominence in the current ecosystem.

- **Reduced operational cost**
  Performing process reengineering and redefining traditional methodologies are imperative steps to change. Financial Institutions can optimise their operations leading to enhanced customer satisfaction and reduced operational cost

- **Enhanced cross selling**
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