Industry Overview:

In a nutshell, 'modern banking' economics function as following: 1. The money banked by people opening accounts with the institutions provides a **source** of capital for the bank 2. This capital is then **invested** for higher **returns** by offering corporate loans, individuals and other financial institutions. This capital investment is so high, that it is fundamentally a backbone for the country's economic liquidity.

In India, the banking sector collectively has a huge market capitalization of over Rs 2,256,249 crores - with around 23% owned by state banks and the rest 77% by the private sector banks[L]. As per 2018 data, the total number of current and savings bank accounts has risen to 157.1 crores, and the growth is almost exponential from 35% Indian adults having a bank account in 2011 to around 80% in 2018[L]. With an ever-increasing population and also the focus on financial exclusion, these numbers are projected to keep increasing.

Core Factors:

Government and RBI regulations: From licensing to exposure limits, the very day to day bank operations are regulated by the RBI [L].

Economic Liquidity: The economics of bank demands and commands economic liquidity. A deadlock scenario caused due to instabilities that lead to excessive money withdrawals and subsequent capital decimation, leaving the industry at a standstill to solve these instabilities, paralyzes banks. Hence, only in a very cash liquid environment like India, banks thrive well.

Key Trends:

Digital India: The drive for digitization, has given banks opportunities to further improve efficiency. With the coming of UPI and digital wallets, digital payments have increased 10-folds [L]. The number of these UPI payment applications and digital wallets is continually increasing. Mobile banking is also seeing increasing adoption.

Technology: The increasing population and demand for capital coupled with digitization have made technology essential to this industry. Be it AI/ML, big-data analytics, robotics or even blockchain - all of it is being tried out or have been successfully implemented by banks.

Rise in fin-techs: A rise in fin-tech startups like BankBazaar, LendingKart are also paving the way for technology adoption[L]. While a few fin-techs compete with the banks in some verticals, a lot of them have already started collaborating with banks to help them innovate and bring down costs[L].

Increasing financial inclusion: Initiatives like PM Jan Dhan Yojana took banking facilities to rural India, thereby witnessing an explosive growth in the number of bank accounts[L]. The initiative had set up a Guinness world record for opening bank accounts as well [L].

Banking on customer-centricity: Operations consume 15-20% of the bank's annual budget. Developing systems to innovate these to not only bring down costs but also enhance customer-satisfaction has been a focus[L]. Extensive adoption of CRM solutions, automation for self-banking are a few indicators.

The extent of Cloud adoption

Indian banks have already started to embrace the benefits of the cloud in response to fintechs leveraging AI delivering high-end customer experience and functionality. Banks with smaller operation scale, like **Urban cooperative banks** and **Regional Rural Banks,** have moved their non-core banking applications to the cloud. Dhanlakshmi Bank has adopted virtualization for storage, Nawanagar Co-operative Bank, ShamRao Vithal Bank has adopted a community cloud to extend it's solutions to cooperative banks in its region. Pondicherry Co-operative Urban Bank[L] implemented a **shared private cloud** for computing and storage with the ability to rapidly provision for additional branches.

YES Bank has adopted cloud computing[L] and has been an early adopter of cloud-based services in banking with the first implementation in payments, online account opening, and remittance services. **HDFC** uses cloud for its e-commerce business, the credit card acquiring business, merchant services and acquiring business in the e-commerce domain.[L] **Kotak Mahindra** uses cloud for non-critical applications like HR and lending customer acquisition but not for critical banking operations. **Bandhan Bank** has appointed FIS International, one of the largest banking and payments technology solutions providers globally, to develop its core banking software solutions[L]. **Meghdoot** is an open cloud initiative adopted by **IBCC** to provide Infrastructure, Platform, and Software as a Service such as CBS, SFMS (NEFT and RTGS), e-Learning, etc.

The extent of AI/ML adoption

ICICI is employing robotics to automate selected banking processes. Having automated more than **200** business processes across *retail banking, agri-business, trade, foreign exchange, treasury and human resource management*[L], ICICI is using AI-enabled technologies, including facial and voice recognition, natural language processing and machine learning. **State Bank of India (SBI)**, uses *analytics* solutions[L] to achieve a single view of customer data, enabling it to better manage accounts and operations and make more informed and timely product-launch decisions. Analytics tools also *support SBI with real-time visibility and early warnings for non-performing assets,* which helps significantly in managing credit default risk. I**nduslnd Bank** uses IBM's digital cloud solution to enhance customer experience [L]. **Axis Bank** Introduced 'Blaze' first analytical cloud application for decision-making[L]**.**

Reason for Hesitation

Investment in Infrastructure - Big banks have already invested huge amounts in the IT infrastructure, they prefer moving to private clouds for their operations. For the *small and upcoming banks* who have not invested in their IT Infrastructure, cloud is a better option to invest, which will reduce the economic burden on the banks.

Core Banking Applications - The typical implementation and **stabilization timeframe** for a core banking application is almost **five years** which makes it difficult for banks to switch to another vendor who offers cloud-based delivery. Only a few vendors in India offer **cloud-based** core banking which again is targeted for mid-size to smaller banks with a limited set of product features and offerings.

Potential Roadblocks [L]

Cloud Compatibility - A key challenge faced by the banking industry is the *compatibility of applications* for cloud computing or options for porting them onto the cloud. The percentage of **legacy applications** is significant in the financial industry when compared to other industries. Moreover, these applications in most cases have been customized to a greater extent which makes moving from in-house legacy applications to a cloud difficult.

Data Privacy - Banks capture, store, and process private financial details and demographic information on their customers. Regulations require that banks **Know Your Customer (KYC)** in on-boarding new customers, because of which they might have to store personal identification documents such as passport information, personal identification information. Data privacy becomes very important as any breach of privacy might *cost the bank lost customers, as well as possible reputation damage, legal issues, and fines.*

Storage Issues - Data storage management becomes a critical issue as data, especially finance-related, will be residing in the provider's cloud. Banks should be able to scale data storage on an as-needed basis, ***restrict the physical location of the data at rest*** (database, tapes) to handle issues of data sovereignty, ensure that proper processes for ***data purging*** and disposing of data storage hardware are followed, and administer access controls for their data.

Vendor Lock-In - *Data Lock-in:* Standards of ownership – i.e., who actually owns the data once it lives on a cloud computing platform are not yet developed, which could make it complicated if cloud computing users ever decide to *move data off a cloud vendor's platform. Tools Lock-in:* If tools built to manage a cloud computing environment are not compatible with different kinds of both virtual and physical infrastructure, those tools will only be able to manage data or apps that live in the vendor's particular cloud computing environment. Lock-in risks can also be mitigated with **robust SLAs,** as defined and agreed with vendors.

Regulatory Compliances
Cross-border data flow[L] - The need to observe the differing data protection rules of each country through which a data set may pass. For example, data security guidelines from RBI need to be followed while creating contracts with cloud service providers for Indian banks. Data should reside within the boundary of the jurisdiction of the particular country. The bank should know where the data is stored. *There must also be a consideration of what happens when the provider-customer relationship ends.*
PCI-DSS Compliance - (Payment Card Industry – Data Security Standard)**[L]** The most difficult requirement of the PCI-DSS guidelines when looking at cloud computing is PCI data segmentation, in which client environments are separated from one another and cardholder data environments are segregated from non-cardholder data to limit the scope of PCI compliance. The credit card brands which enforce PCI compliance can apply fines of $100,000 for non-compliance, and they can also eliminate a retailer or card processor's ability to process transactions.
Encrypting Data - Bank should select encryption algorithms that are well established international standards. Secure and fully automated key management.
Governance- Whereas in on-premises computing, governance is limited to the enterprise, in cloud computing, some governance issues remain with the enterprise, while others have to be managed by the cloud service provider.
Information Technology (Amendment) Act 2008 - Section 43A of the ITAA 2008 deals with security practices and procedures that cloud service providers need to undertake to protect sensitive personal information from any security and privacy breach such as unlawful access, use, alteration update, or disclosure of information
Sections 69, 69A, and 69B of the ITAA 2008 facilitate the interception, monitoring, and decryption of the information with a defined legal process. the 40-bit limit on the encryption standard as part of the DoT's telecom licensing conditions and Section 84A (encryption policy) of the ITAA 2008 are applicable.

Foreign Branches of Indian Banks
RBI Policies - The data center of the subsidiaries of Indian banks established outside the country should be located in India. When a foreign bank establishes a subsidiary in India, its data center should be located in India. In the case of **ATM transactions,** it is required to be connected to the switches. If Indian bank ATMs are operating in other nations, they can be connected to either local switches or Indian switches (because they are linked via their payment consortiums such as Mastercard/Visa, etc.)

Innovative use-cases for AI/ML in banking:

Non-Performing Assets has been the biggest problem in the banking sector, especially for the public sector. The gross NPA of a set of 36 Indian banks grew to Rs. 8.97 lakh crore in June 2019.[2] The primary reason for this has been "bad corporate loans". A solution is to develop a highly efficient business analytics tool to monitor credit-risk, have a strong alert system, constantly monitor public databases and social media to gain insights about corporate borrowers and leveraging all of this to an intelligent **dashboard for the management**. Using a suite of cloud solutions ranging from the

Hadoop-powered analytics framework for analyzing big-data to scalable databases for regularly storing insights and combining all this with **Quicksight** to build a dashboard, can help banks build this solution real quick, as compared to building everything from scratch. By having an agile development model using AWS, banks can also quickly evolve this solution to match the ever-increasing digital data, especially from social media. [3]. NPA's due to loans for non-corporate borrowers can be reduced by a similar solution that specializes especially in learning about the end-consumer from social media and public databases for assigning better credit scores, track transaction histories across multiple digital platforms and again leverage all of that to a dashboard for loan-granting authorities.

The traditional systems of loan granting that used little or no AI led to this increase of NPA to a peaked 11.5% in March 2019. Certainly, not allowing new fresh bad loans is a **top priority** for Indian Banks.

Driving Smart Sales- Retail Banks are seeing as much as 50% of total sales from digital channel therefore, orchestrating internal and external data to deliver hyper-personalized communications is essential. We recommend the following use cases that banks can target with the AWS suite. **Amazon Connect** to deliver the personalized contact experience for banking queries and addressing grievances combined with **Amazon Comprehend** to derive Natural Language insights from the sales/customer care conversations that can significantly boost customer relations. Application using **Amazon Pinpoint** can be deployed to give **real-time insights to sales professionals**[4] to aid pitch delivery on the fly and during customer interaction to help deliver targeted product pitch delivery. Banks often need to consolidate their data across verticals to deliver **personalized campaigns** to select individuals that are most likely to opt for a portfolio of services[5].

This way they can boost KPIs such as Click Through Rate, thus reducing Cost per Lead. Business analytics with **Amazon ML engines** eases the technical bottleneck to deploy in-house developed solutions, trumping the In-house data centers on elasticity, ROI, usage & maintenance costs.

 Loans to SMEs - India has more than 50 Mn SMEs, accounting for **38% GDP** but funding has always been a constraint to their growth, Banks often require a **few months** to approve an SME loan. This presents a large opportunity, Even 5% of the unmet SME lending requirements in India could be a **$15 Bn** opportunity by 2020[6]. The system has the liquidity – but banks do not have the processes or risk management framework to enable lending to these firms. Banks are **partnering with e-commerce** companies for estimating the creditworthiness of SME players. Ex - SBI's partnership with Snapdeal[7] and Flipkart's partnership with SMEcorner. AWS success with **Judo Capital**[8] can be extended in India by partnering with private banks. This has the added benefit of empowering and enabling sellers to grow their businesses on the Amazon marketplace.[9]

Front-office innovation and self-banking- Highly analytics powered and data-rich dashboard distributions can be used by **front-officers** in a local bank branch, which despite increasing digitization remains to be relevant to the normal customer. Apart from this, to achieve **self-banking** services, banks are also trying to innovate their local branches by implementing text and speech-enabled robotic **chatbots** that can respond in real-time, take decisions and also drive other processes like passbook updating. AWS ML services contain many products that can directly aid in developing such solutions, helping banks develop it faster. Having an evolved **self-banking mechanism** in place, banks can aim to operate 24*7.

Strategy

A comprehensive strategy to drive AWS services adoption includes 1) Roadblock navigation strategy 2) Use case driving strategies 3) Supporting Strategy. This will ensure that the **use cases** which are

the **Motivation** for banks to innovate are paired with the **Ability** provided by the **cloud services** while navigating any **Hesitations** or roadblocks to achieve a successful collaboration.

Roadblock Navigation Strategy
We can devise two categories of strategies, Bigger Banks(> 100 billion INR Market Cap) have invested in **dedicated infrastructure** for cloud computation and hire software professionals capable of building critical/non-critical applications and maintain core banking. Small scale banks, on the other hand, have **no IT teams** and very less infrastructure, they **outsource** the building and maintenance of core-banking applications.

Big Banks
Outposts: AWS Outposts services enable such Banks to use the same hardware and software infrastructure and a consistent set of services and tools across on-premises environments. This enables the customer to adopt AWS without discarding its investments.
BYOK: One of the main reasons for Goldman Sachs's adoption of AWS[L] was BYOK technology along with real-time data and historical logs to ensure trust management. This mitigates Indian Bank's compliance regulations and hesitation of encryption and data purging/recovery. This must be addressed while marketing AWS services to Banks.
AWS Compliance: AWS should create and regularly update a compliance document, to help Banks clearly identify AWS certifications(ISO 27017, PCI DSS) that are required for collaborating with cloud service providers. It is important to illustrate how AWS works hand in hand with the Bank to adhere to RBIs regulations on Assessment of Service Providers, Confidentiality and Security, Management of Disaster Recovery Plan and Agreements.[L]
Cloud Trail: Banks are concerned with data visibility and governance over the data and its movement while using CSPs. As a solution, AWS CloudTrail enables governance, compliance, operational auditing, and risk auditing of data.
Computer Vision applications: Building state of the art CV applications in Banking requires specialized team and research, while the applications can be many and varied - the ROI on R&D is low implying it is effective to adopt AWS for sophisticated algorithms which are cost effective and highly accurate.

Small Banks
Smaller Banks outsource their Business applications including Core Banking Solution (CBS) Document Management System, KYC, Asset Liability Management, Anti-money laundering rather than developing it themselves. Although this segment is the highest adopter of cloud services (community cloud), they prefer to **outsource** to vendors like ESDS to build them.
An effective strategy would be to target Community cloud and Core Banking **solution providers** to use AWS services. Encouraging banking application solution providers to build on **AWS Marketplace** will benefit the AWS ecosystem to utilize **CBS applications** ready to deploy and already scalable within the cloud. This also helps such providers to gain customers and build for more use cases.

Use-Case Driving Strategy:
Another factor that can give banks a trigger to move to the cloud, are the high-end innovative use-cases that can be easily experimented, scaled and tested on cloud as the bottle-neck for in-house implementation of these is quite high. Developing a **risk-analytics framework** is ubiquitous in banking today, but the talent, infrastructure and technical complexity handling required to maneuver it, make in-house development almost impractical and ready-made cloud solutions clearly offer a much better way of implementation, for banks developing themself and not relying on outsourcing. This also applies to other use-cases mentioned like **driving smart sales** and **automation**

for self-banking - that need an agile-development model. Banks showing high growth and the ones experimenting a lot on high-end use cases are a good target.

The performance data of **SMEs** listed on **Amazon Marketplace** can be strategically used to lure banks into moving to clouds. Partnership deals that offer a combined AWS solution suite for analytics and AI/ML engines along with access to this data-set on only cloud storage, can effectively trigger banks and maybe mark the first adoption of AWS cloud in their IT.

At an operational level, the inertia to not move to the cloud due to **security reasons** must be tackled. For this, a step-by-step adoption strategy of conducting a **Proof of concept and pilot programs** to move each application to the cloud must be handcrafted for each target bank.

Supporting Strategy:

Awareness Strategy

A supporting strategy should be to actively take part in **Industry-Academia** events aimed at solving Bank's problems. AWS can partner with these events encouraging solutions to be built on their cloud platform. The solutions built can be **used as pre-Proof of Concept** showcasing **prototypes** by demonstrating to banks the development agility and effectiveness achieved by using AWS services for solving their business requirements. **Security themed Hackathons** can be conducted to demonstrate the strength of compliance certificates AWS holds for Data security, movement, encryption, and access.
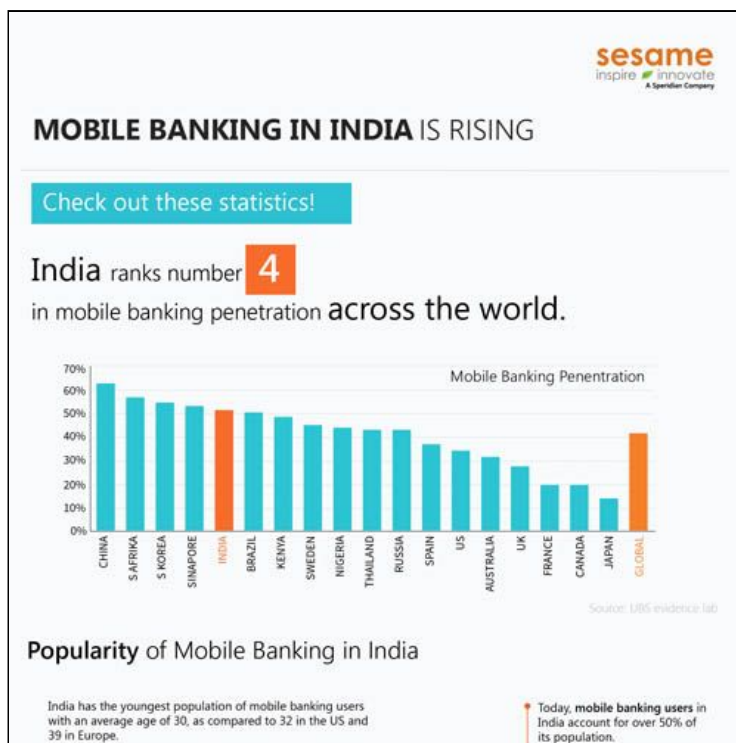
Partnering with Fintechs

While AWS can help banks develop with agility to solve a few critical problems, their inertia due to rigid systems will always inhibit end to end innovation across all verticals. Hence, strategic partnerships with highly innovating startups in fin-tech or those working to enhance CRM, business intelligence, working in credit-score awarding or any other sector mentioned before, to make their solutions either directly available on AWS cloud or provisioning seamless integrations with them should also be a focus. These startups can work very closely with their customer banks that can lead to better cloud adoption.
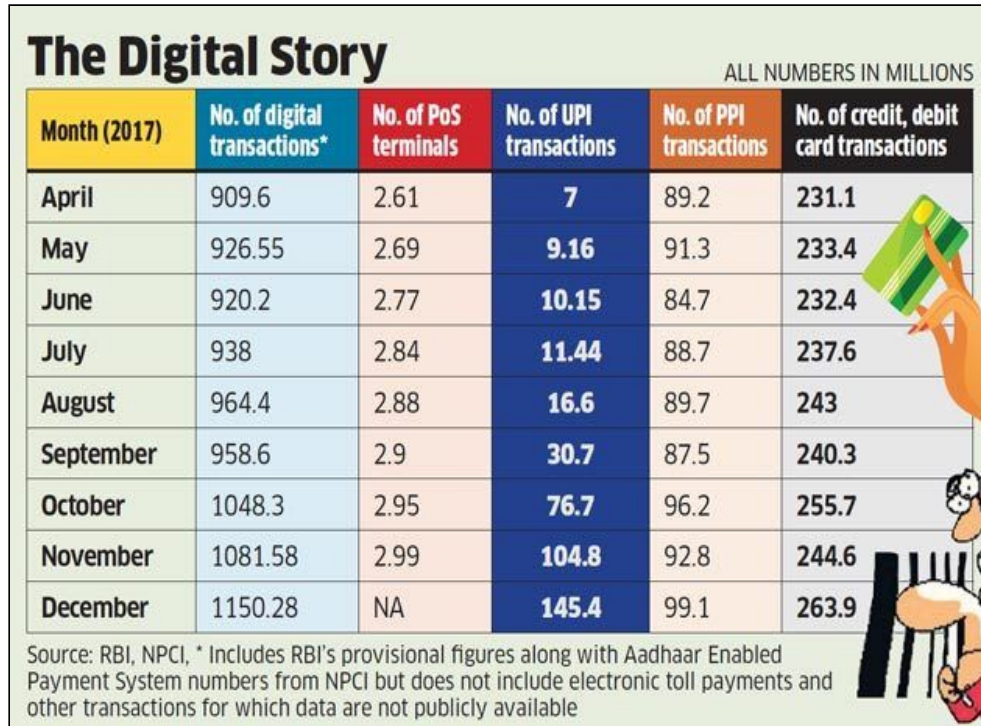
Annexure: Industry Overview

Figure 12: Payments and alternative lending segments attracted the maximum funding in India in 2018

India VC/PE funding by FinTech segments in 2018 (USD million)

Total VC/PE funding (India, 2018) = USD 1.83 bn

	Payments	Alternative lending	InsurTech	Wealth	B2B Fintech
Funding (USD mn)	709	530	378	122	37
Deal count	21	67	17	23	11
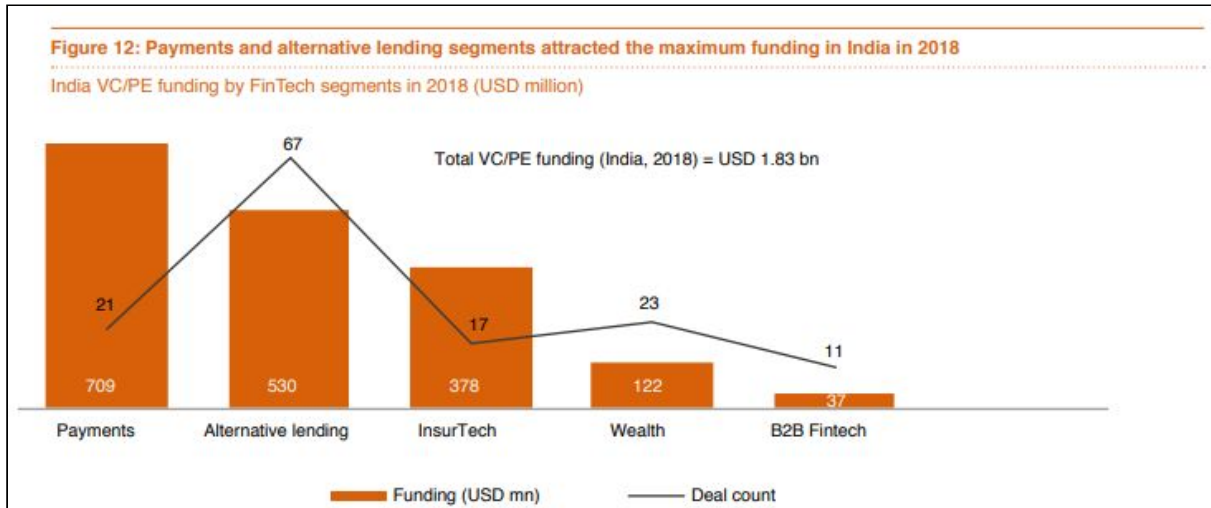
Annexure: Key trends in Banking

[Rise of Mobile Banking in India]

The Digital Story

ALL NUMBERS IN MILLIONS

Month (2017)	No. of digital transactions*	No. of PoS terminals	No. of UPI transactions	No. of PPI transactions	No. of credit, debit card transactions
April	909.6	2.61	7	89.2	231.1
May	926.55	2.69	9.16	91.3	233.4
June	920.2	2.77	10.15	84.7	232.4
July	938	2.84	11.44	88.7	237.6
August	964.4	2.88	16.6	89.7	243
September	958.6	2.9	30.7	87.5	240.3
October	1048.3	2.95	76.7	96.2	255.7
November	1081.58	2.99	104.8	92.8	244.6
December	1150.28	NA	145.4	99.1	263.9

Source: RBI, NPCI, * Includes RBI's provisional figures along with Aadhaar Enabled Payment System numbers from NPCI but does not include electronic toll payments and other transactions for which data are not publicly available

[2017: A continued rise in no. of digital transactions and number of UPI transactions]

[Fin-Techs in India]

Expected Annual RoI on FinTech Investments

India — 29%
Asia — 25%
North America — 23%
Latin America — 22%
Global — 20%
Africa — 18%
Oceania — 16%
Europe — 14%
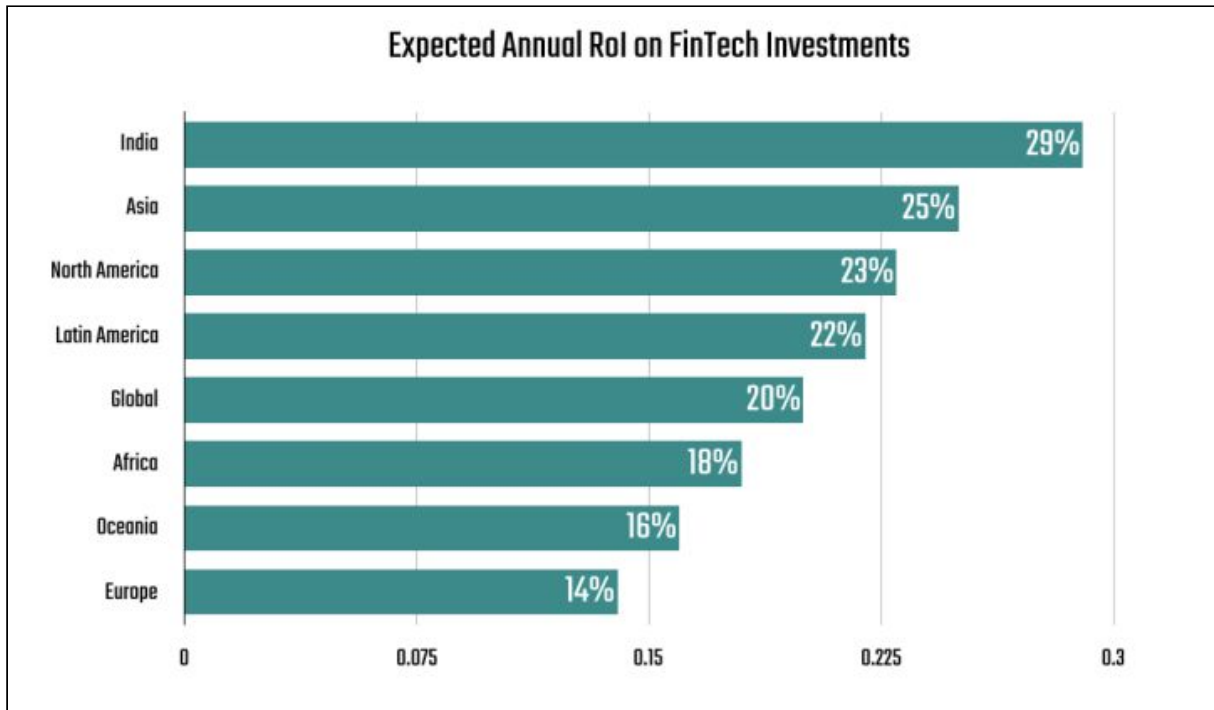
Funding Obtained by Fintechs on rise

Source: "The battle for the Indian consumer," EY, October 2017
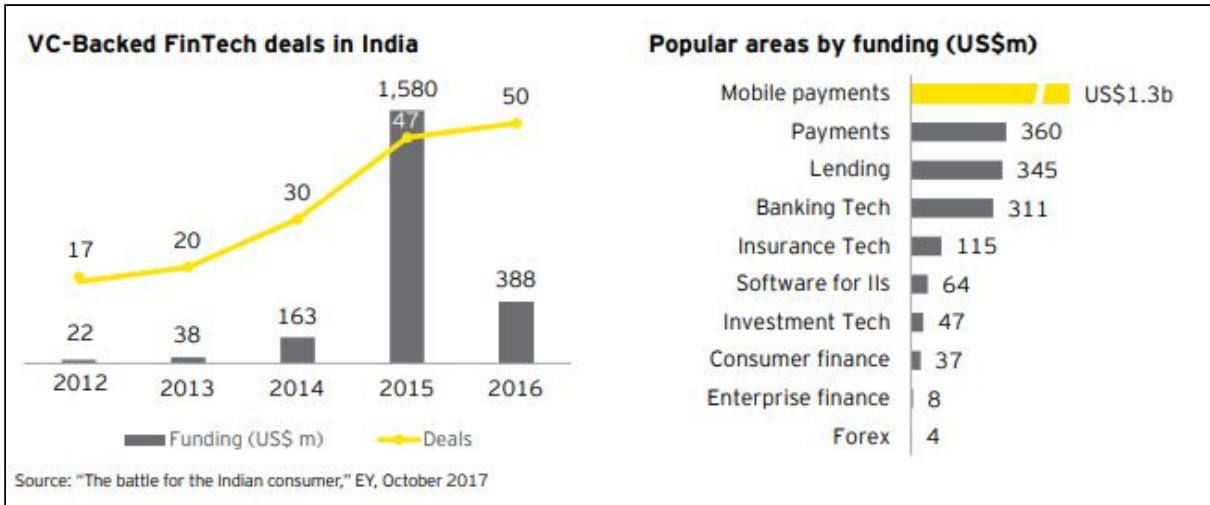
A small study on the publicly available data/reports on a few top banks of India shows their increasing adoption of BI and analytics technologies primarily for CRM and risk-analytics.

Bank	Tools used	Use cases	Links and Reports
HDFC	Revelus by I-flex	**CRM**	News
ICICI	Siebel CRM	**CRM, risk-analytics**, and performance	Report
Axis	Tableau, SAP, Experian	**CRM, risk-analytics,** and growth	BIU Report
Yes Bank	Tableau	**CRM**	News
SBI	Cognos	**Loan-risk evaluation** especially on student loans	Report
Kotak Mahindra Bank	SAP BO	Fraud Analysis, **Risk-Analytics**	Report

Annexure: Extent of AI/ML Adoption

BFSI – percentage of decision makers indicating AI-powered solution to be highly impactful

Category	Percentage
Machine learning	44%
Automated data analyst	44%
Robotics	44%
Virtual private assistants	33%
Automated research and information aggregation	33%
Automated sales analyst	33%
Automated communications	22%
Predictive analytics	22%
Automated operations and efficiency analyst	11%
Decision support systems	11%

Comparison of cloud services being offered by competitors.

Table 2: Various Service Providers for Big Data Analytics

	Google	Microsoft	Amazon	Cloudera
Big Data Storage	Google cloud services	Azure	S3	
MapReduce	App Engine	Hadoop on Azure	Elastic MapReduce	Map Reduce YARN
Big Data Analytics	BigQuery	Hadoop on Azure	Elastic MapReduce	Elastic Map Reduce (Hadoop)
Relational Database	Cloud SQL	SQL Azure	MySQL or Oracle	MySQL, Oracle, PostgreSQL
NoSQL Database	App Engine Datastore	Table Storage	DynamoDB	Apache Accumulo
Streaming Processing	Search API	StreamInsight	Nothing pre packaged	Apache Spark
Machine Learning	Prediction API	Hadoop + Mahout	Hadoop + Mahout	Hadoop + Oryx
Data Import	Network	Network	Network	Network
Data Sources	A few sample dataset	Windows Azure Marketplace	Public Datasets	Public Datasets
Availability	Some services in private beta	Some services in private beta	Public Production	Industries

IDRBT

Annexure: Roadblocks

Infrastructure
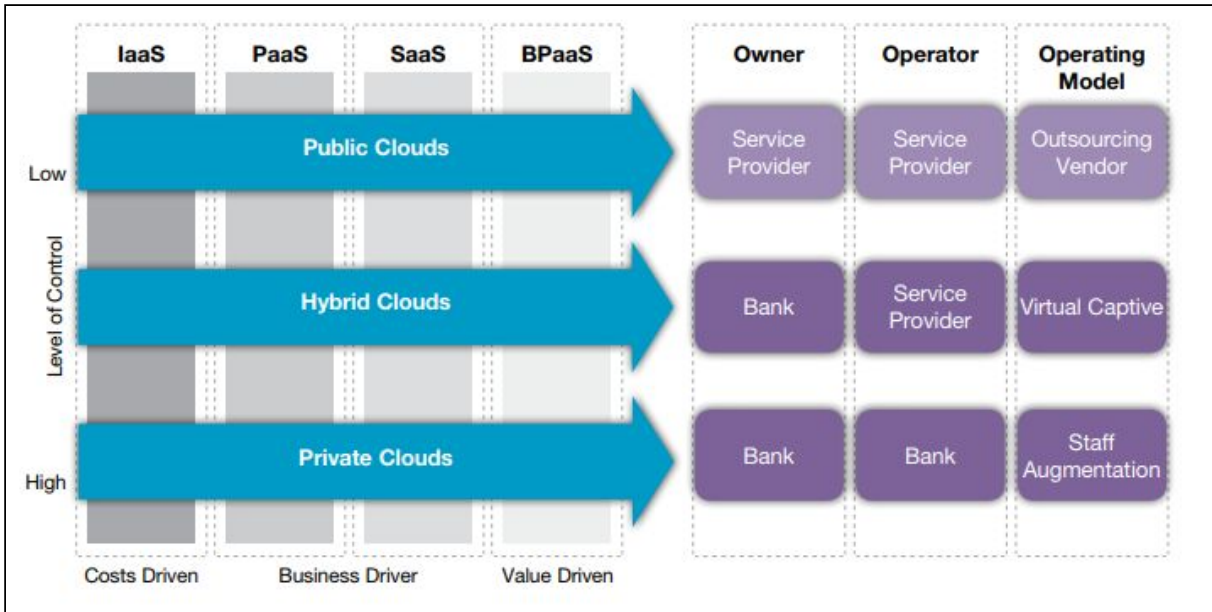
Annexure: Regulations

Cloud security Regulation as laid down by IDRBT [Link]

Figure 3: ITAA 2008 Cloud Computing Provisions
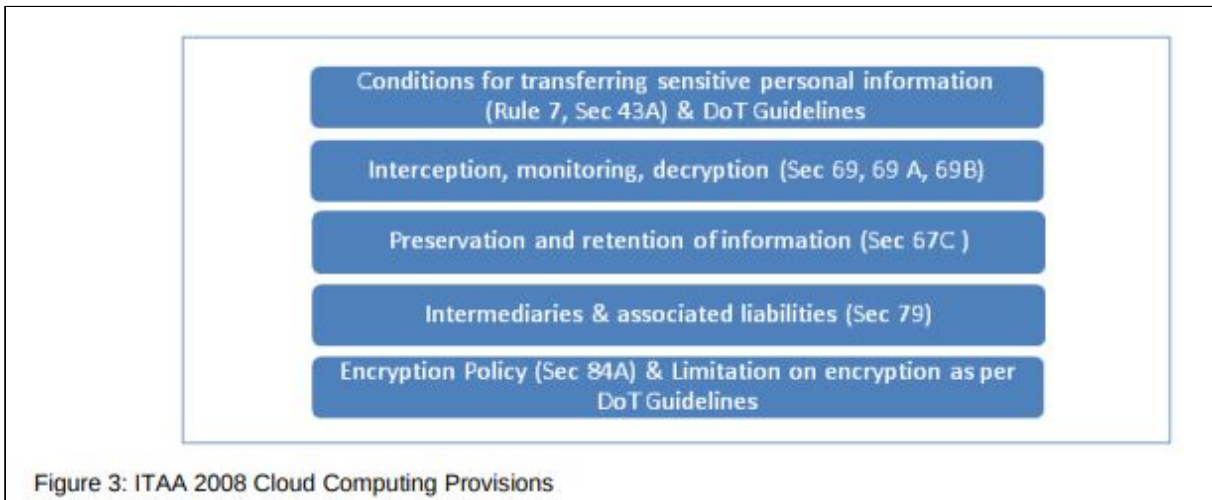
Link

Data Security and Governance[Link]

Figure 1: AWS Shared Security Responsibility Model
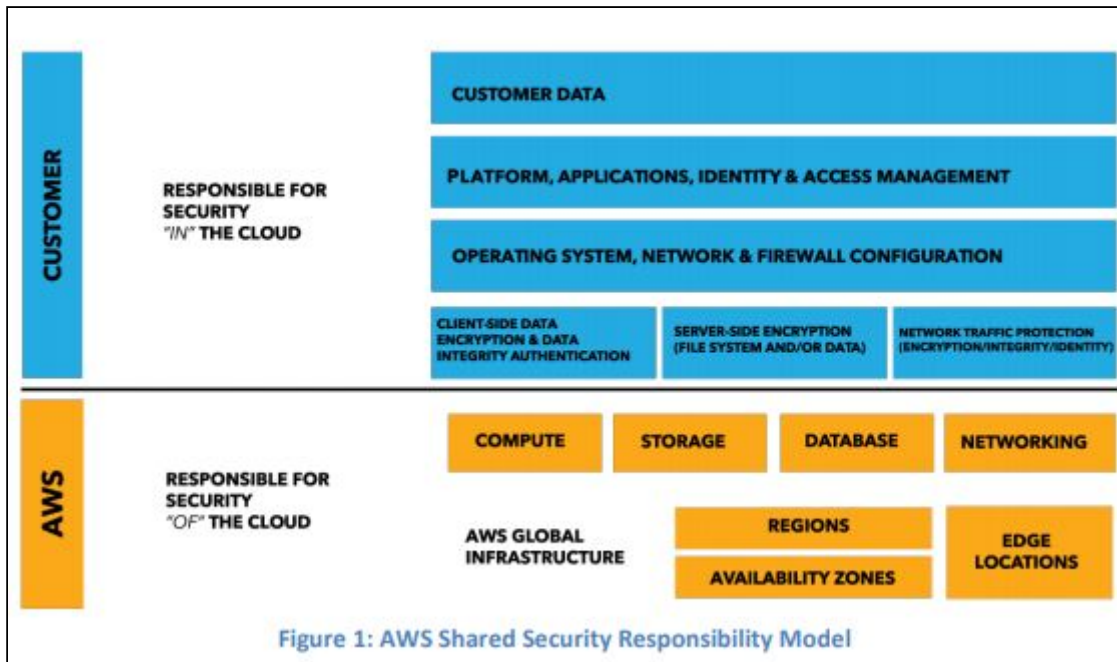
Annexure: NPA

Public Sector Banks:

Bank Name	Gross NPA
1. State Bank of India	Rs. 2.01 trillion
2. Punjab National Bank	Rs. 552 billion
3. IDBI Bank	Rs. 445 billion
4. Bank of India	Rs.434 billion
5. Bank of Baroda	Rs. 416 billion
6. Union Bank of India	Rs. 380 billion
7. Canara Bank	Rs. 377 billion
8. Central Bank of India	Rs. 324 billion
9. Indian Overseas Bank	Rs. 317 billion
10. UCO Bank	Rs. 243 billion
11. Allahabad Bank	Rs. 231 billion
12. Andhra Bank	Rs. 215 billion
13. Corporation Bank	Rs. 218 billion

Private Sector Banks:

Bank Name	Gross NPA
1. ICICI	Rs. 54,063 crores
2. Axis Bank	Rs. 34,249 crores
3. HDFC	Rs. 8,607 crores
4. Kotak Mahindra Bank	Rs. 3,825 crores
5. Yes Bank	Rs. 2,627 crores

[source]

Annexure: Loan to SMEs
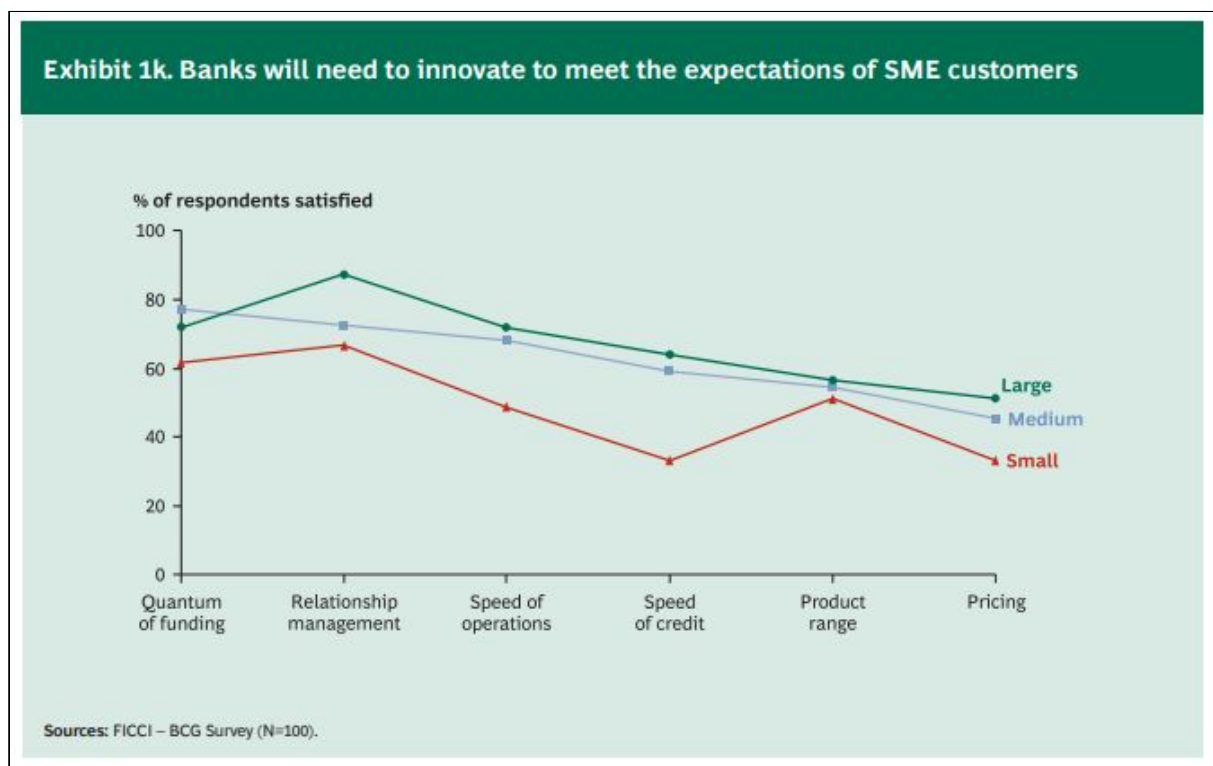
BCG Report

Annexure: Front-office innovation and self-banking

AI Robots/Chatbots being used by banks:

Currently, the following Chabot's are being developed or already in use: [1]
- ICICI - iPal [90% accuracy]
- HDFC - IRA [in RnD]
- SBI- SIA
- Axis- AHA [87% accuracy] [1]
- Lakshmi Robot [in RnD] [1]

Other banks are likely to follow suit and invest in AI robotics for implementing a Chabot. SBI is also working on deploying a solution (known as Chapdex) that essentially scans cameras installed in the branch and captures the facial expressions of the customers and immediately reports whether the customer is happy or sad to give real-time or near real-time feedback. A highly futuristic goal indeed!

These trends show an increased tendency of Indian Banks to use AI/ML to implement Chabot's and also integrate AI robotics into their physical spaces.
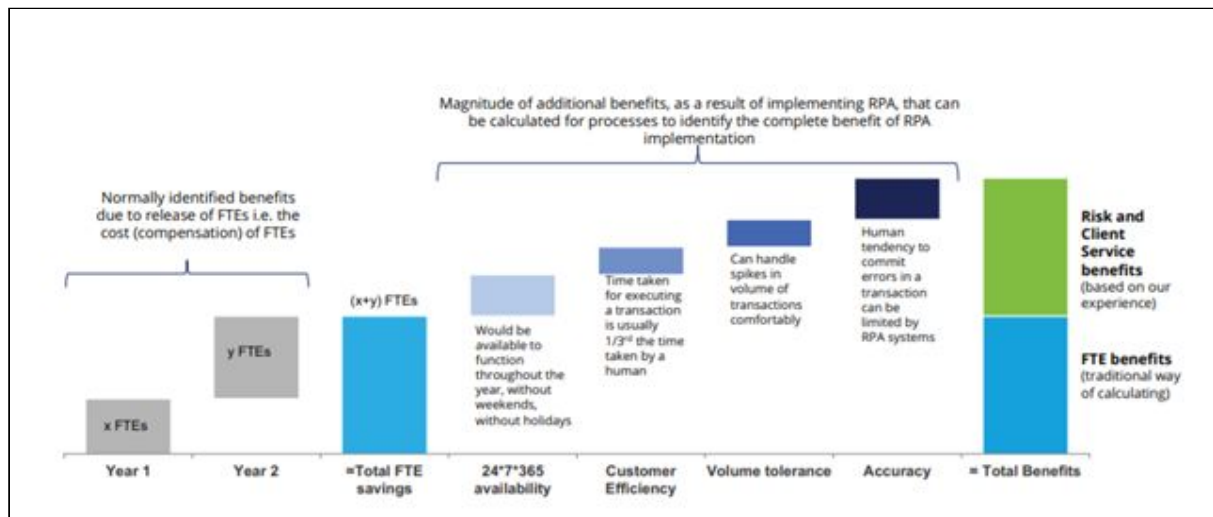
Future of Banking with Robotic Process Automation [source]

Annexure: Roadblocks

List of Big Banks

Company Name	Last Price	% Chg	52 wk High	52 wk Low	Market Cap (Rs. cr)
HDFC Bank	1,248.40	0.49	1,285.00	942.2	682,970.16
Kotak Mahindra	1,630.40	0.06	1,682.40	1,002.30	311,402.11
ICICI Bank	449.25	-0.62	458.45	294.8	290,166.49
Axis Bank	704.1	0.57	826.55	534.15	184,493.66
IndusInd Bank	1,512.35	-2.22	1,835.00	1,267.50	104,800.75
Yes Bank	49.7	-2.64	285.9	49.7	12,675.15

List of Small Banks

State Banks:

Company Name	Last Price	% Chg	52 wk High	52 wk Low	Market Cap (Rs. cr)
Bank of Baroda	104.15	0.92	157.45	90.7	40,063.67
PNB	67.95	2.03	99.9	58.65	31,284.50
Bank of India	69.5	0.8	110.05	66.05	22,774.62
IDBI Bank	28.1	0	65.8	26.6	21,738.99
Canara Bank	231.7	1.25	302.1	205.15	17,452.68
Allahabad Bank	37.15	1.23	58.8	33.25	13,826.18
Corporation Bk	20.95	-0.48	32.15	20.95	12,557.82
UCO Bank	16.25	1.25	23.4	15.3	11,963.57
Union Bank	65.65	1.16	100.3	61.4	11,574.20
Indian Bank	199.2	4.9	380	160.2	9,791.37
IOB	10.7	0.38	17.25	10.2	9,781.56
Oriental Bank	65.05	1.4	119	58.1	8,913.21
Syndicate Bank	32.1	2.07	46.6	29.55	8,614.75
Central Bank	17.45	2.35	73.8	16.8	7,199.73
Bank of Mah	12.3	0.16	20	10.73	7,163.65
United Bank	9.59	1.27	13.25	9.05	7,123.37
Andhra Bank	20.25	1.25	36.65	18.65	6,043.59
Punjab & Sind	24	7.14	35.25	22.15	1,444.94
UTI - Gold	3,228.00	0.44	3,230.00	2,610.25	448.1

Private Banks:

Company Name	Last Price	% Chg	52 wk High	52 wk Low	Market Cap (Rs. cr)
Bandhan Bank	503.25	-0.08	635.55	369.15	60,043.63
Karur Vysya	60.05	1.52	95	54.6	4,799.92
Karnataka Bank	77.8	-0.95	138.95	71.9	2,198.69
South Ind Bk	11.28	-2	18.55	10.1	2,041.37
JK Bank	35.4	-0.56	65.95	31.25	1,971.28
Lakshmi Vilas	36.6	-4.81	97.35	35.3	1,232.33
Dhanlaxmi Bank	14.8	-1.53	21.25	10.8	374.46
StanChart PLC	54.7	-1.71	60.9	45.15	95.48

Annexure: Use-Case Targets

1. Kotak Mahindra - [L] cloud a significant consideration this year(2019)
2. ICICI - significant on-going AI/ML applications
3. Axis - "blaze" - cloud analytics tool
4. Induslnd - Uses IBM's digital cloud solution to enhance customer experience [L].
5. Bandhan Bank - have outsourced a lot - core banking [L] and security [L]
6. Yes - completely on the cloud [L].
7. IDBI - outsource bid for network management solution etc [L]

Annexure: Hackathons Data

List of few hackathons conducted by banks:

● Yes bank Datathon Link

● Innovation at SBI Link

● Axis Bank Link

● HDFC HackAssurance Link

● EY- Blockchain Challenge Link (This was sponsored by banks like ICICI and HDFC. Microsoft partnered the event)

● DBS Hack2Hire Link

** SBI's face-recognition system Chapdex came from a winning team's solution during their first Innovation at SBI challenge.

Annexure: Reason for Acceptance / Hesitation to Adopt AI/ML

1. Lower one-time spending and operating cost	2. Use and allocate on-demand
3. Easy to expand, increase agility	4. Secure data storage (Disaster recovery)
5. Professional provider which delivers better and more stable services	6. Big data management and deep data mining
7. Accelerating product time to market	8. Accelerate establishment of new innovative business
9. Simplify internal process, reduce management burden	10. More convenient, able to access and monitor anytime, anywhere
11. Increase IT management transparency (e.g. expenditure and performance)	12. Others

Figure 3: Factors Favoring the Adoption of Cloud Computing in Indian Banking

1. Cloud is not stable for supporting the business requirements	2. Data security and confidentiality issues
3. Performance issues	4. Lack of convincing business use cases
5. Still need to consider quality and credibility of cloud provider	6. Single provider solution (Vendor lock-in)
7. Compatibility and interoperability with current system	8. Difficulty and cost of moving into cloud platform
9. Unsure return on investment (ROI)	10. Policies and regulations issues

Figure 4: Factors Hindering the Adoption of Cloud Computing in Indian Banking

Annexure: Strategic Partnerships with Fin-tech Start-ups

A report by Deloitte lists down a few partnerships brokered between traditional banks and fin-tech start-ups.[1] Such fin-tech start-ups can be partnered with and their solutions brought to Cloud.

A few other startups to be considered:
1. Cred
2. Rockmetric Innovations Pvt Ltd
3. Wingman
4. Allincall

Annexure: AWS Suite for BI end-to-end development using cloud
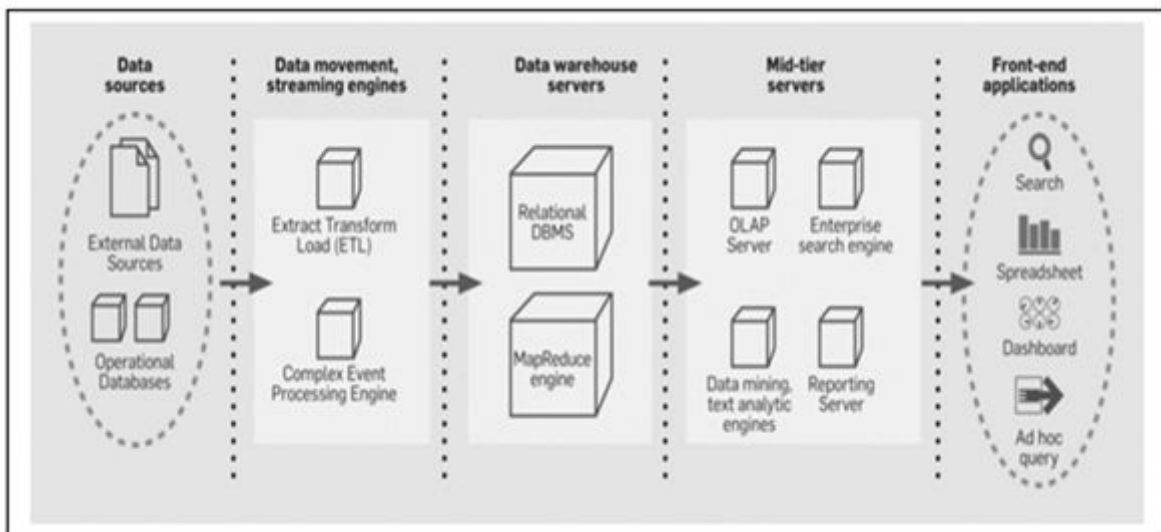
A typical BI architecture

Task	AWS product that can be used
Data movement	Redshift
Data warehouse servers	Aurora/RDS
Analytics Engine	EMR framework
Front End Dashboard	Quicksight