BANKING TECHNOLOGY IN INDIA:
PRESENT STATUS & FUTURE TRENDS

INSTITUTE FOR DEVELOPMENT AND RESEARCH IN BANKING TECHNOLOGY
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Latest in Banking Technology

This Report on Banking Technology is an attempt to share the salient observations on the current status and emerging trends in Banking Technology. We are happy to see that the report, published every year, coinciding with the IDRBT Banking Technology Excellence Awards, is evolving into a useful source of reference for bankers, academics and researchers for the collective wisdom and data points it provides for a broader understanding of and further research in Banking Technology and related areas.

Continuing the practice, we commenced a couple of years back, this report is presented in two sections. The first section is a perspective of bankers and industry leaders on selected topics of interest and relevance for the sector. The second section is an analytical summary collated from the responses received from banks – on their technology implementation and future plans - as part of their responses to the IDRBT Awards for Excellence in Banking Technology for the year 2016 - 17.

The contributions from experts focus on an interesting array of topics like Innovation, Robotic Process Automation, Digitisation of India, Dealing with Demonetisation, Cyber Security, Inclusive Payment Systems and Analytics. The report from our knowledge partner, Deloitte Touche Tohmatsu India LLP, presents insights with data points from the bank submissions.

We sincerely thank the banking professionals who accepted our request and contributed to this digest and Deloitte India, who played a significant role as our knowledge partner, not only in the entire Awards Process, but also in presenting the analytical summary for this digest. The IDRBT team deserves compliments for all their silent background work.

Feedback is welcome at publisher@idrbt.ac.in.

Hyderabad
September 01, 2017

Dr. A. S. Ramasastri
Director, IDRBT
SECTION - I

Invited Articles
Digitisation of India – Role of Banks

Shri V. G. Kannan, CEO, Indian Banks’ Association (IBA)

It has been a challenging year for banks. In spite of the stress of NPAs, banks have been working towards a Digital India, adopting the latest technologies and introducing a number of products and applications to improve customer convenience. With the number of mobiles in the country crossing one billion of which more than 30% are smartphones, banks are vying with each other to give the best digital solutions to the customers for payments and other banking services from anywhere, anytime. After the demonetisation drive, the Government has been pushing for a less-cash society and banks have been lending support by boosting the efforts on digital banking – through POS machines, mobile wallets, mobile banking, Aadhaar-enabled payment systems, etc.

The G I strategy of JAM (Jandhan, Aadhaar, Mobile) for financial inclusion has worked well. The banks opened more than 250 million accounts in last two years, linked the Aadhaar – the Unique ID of individuals to their accounts and also linked the mobile numbers into the banking accounts. These three steps have enabled to capture the transactions of even small traders and SMEs into the digital system, in turn the more reliable and timely inputs from the system have enabled the corporates to better manage the inventory and supply chain, whether in trade or manufacturing or services. More than 65% of the active Savings accounts have been linked with Aadhaar and the remaining are expected to be linked before 31st December 2017. As per Gov guidance, Aadhaar enrolment facilities will be made available at bank premises, in at least one out of every 10 bank branches.

After the linkage of Aadhaar with bank accounts started, the subsidy for LPG was directly credited to the consumers accounts. Later, the Government started crediting the benefits of several welfare schemes like MNREGA, Scholarships, Pensions, etc. directly into the bank accounts of the beneficiaries. The DBT was the first set of “bulk” digital transactions, debiting the accounts of Government ministries and departments and crediting the accounts of beneficiaries, without the involvement of intermediaries. The banks and NPCI played a major role in the success of the DBT scheme.

A BOOST FOR DIGITISATION

Immediately after the demonetisation announcement, the availability of bank accounts with most of the households, thanks to the PMJDY scheme, made it possible for the public to deposit their SDN currency notes into their accounts. Subsequently, in the context of shortage of new currency notes, public were able to make digital transactions through these accounts using IMPS, UPI, BHIM, POS, e-commerce (Card-not-present transactions), pre-paid instruments, etc. The deployment of more than a million POS machines in four months, from December 16 to March 17, has moved more merchants from cash to digital mode.

The Gov has set an ambitious target of 25 billion digital transactions for the current year. This digitisation mission would ensure that complete data relating to all areas would be in the system helping to achieve better planning of the resources for all
stakeholders – the Government, the Corporates and the Public. It is proposed to target another 2 million merchants in the short run and cover more than 15 million in the long run.

The demonetisation exercise has given a boost to digitisation in India. Immediately after demonetisation there was a spurt in digital transactions across all channels, with peak levels achieved in December 16. However, with improved availability of cash from January 2017, there was a tendency amongst the public to go back to cash transactions and the numbers especially in Debit/credit card transactions at POS machines declined.

However, it is to be noted that, with continuous efforts from GoI and banks, in last three months there is a gradual pick-up and the volumes and value of digital transactions in June are way ahead of pre-demonetisation days. The usage of UPI has grown 10 times in June 2017 over November 2016 figures. While the digital transactions dipped slightly after the peak levels achieved in December, year-on-year, the growth is substantial. The increased and cheaper availability of bandwidth has helped to push digital transactions.

In terms of percentage of growth of digital transaction in June 2017 over November 2016, only card transactions at POS is showing negative growth, while other digital channels IMPS, UPI, Mobile Banking have shown positive growth. With GST rolled-out from 1st July 2017, and with more entities moving from manual to computerised systems for accounting, substantial growth is expected in the number of digital transactions in the near future.

**NEW TECHNOLOGIES**

The arrival of Payment banks and FinTech companies have made the existing banks to acquire new technologies, to work on totally new approaches to serve the customers and come out with innovations and new products supported by new processes to retain their customers. The last decade brought new technology solutions to the Indian banks through CBS, ATM Networks, Internet Banking, etc. In recent times, many banks have implemented digital banking – POS, MPOS, Mobile/Tablet Apps, mobile wallets, social media to capture the valuable pie of the younger generation.

Since September 2016, more than 51 banks have launched their UPI application, which enables a customer of any bank to make payments to a customer of any other bank, without demanding complete disclosure of account details of the remitter and beneficiary. The number of UPI
transactions after demonetisation has grown exponentially to 10 million transactions amounting to Rs 31,000 crores in June 2017 alone.

The BHIM application launched by the Prime Minister on 30th December 2016, has been downloaded by over 16 million customers within a short time of six months. Using BHIM, a customer can send, receive, collect money using virtual payment address (VPA), Account number + IFSC, Scan and Pay using QR code. In June 2017, there were more than 4.6 million transactions under BHIM amounting to Rs 14,867 crores across 49 banks.

Aadhaar-based Payments

The introduction of Aadhaar card and Aadhaar authentication through UIDAI has been a game changer in the Indian banking technology in the last one year. The E-KYC has made it easy for the customers and banks to open accounts, meeting the KYC requirements. The Aadhaar authentication has brought in a new payment system – AEPS and subsequently the BHIM Aadhaar – a digital PoS system, which only requires a smartphone with a biometric device for the merchant and does not require even a phone from the customer. This increases the reach of digital payments to the masses.

While BHIM is an extension of the UPI applications of the banks, BHIM Aadhaar is an extension of AEPS. BHIM Aadhaar is the common mobile, introduced by National Payments Corporation of India (NPCI), for any merchant associated with any acquiring bank on BHIM Aadhaar Pay service, to allow the merchant to accept payment from a customer of any bank, by authenticating the customer’s biometrics – currently only fingerprints, directly from customer’s bank account and receive the sale proceeds instantaneously directly into merchant’s own bank account. The BHIM Aadhaar was launched by the Prime Minister on 14th April 2017 and banks have onboarded thousands of merchants under BHIM Aadhaar. After detailed discussions with banks and NPCI on security aspects, UIDAI had come out with stringent security standards for the biometric devices to be used with BHIM Aadhaar application. With availability of these devices improving, there will be a tremendous growth in deployment of BHIM Aadhaar with merchants, especially in RUSU areas.

While Aadhaar has enabled the DBT system helping the GoI to save thousands of crores by plugging loopholes and eliminating subsidies in welfare schemes, the new notification under PMLA requiring all accounts to be linked with Aadhaar will further strengthen GoI in its drive against black money. The increased use of Aadhaar authentication will help the banks in improving operational risk management in opening of accounts and transaction payments.

QR Code to Enhance Quantitative Reachout

In recent times, payments industry in India has seen a surge in QR Code based payments solution being implemented by many banks and third party technology providers for their own “Wallets”. A QR based payment solution represents a new channel of initiating and accepting payments between buyers and sellers (or consumers and merchants) using the mobile phone. This is one technology which can be easily used to expand electronic payments for millions of small retail merchants who, do not have the options to undertake a traditional POS with card swipe EDC terminals.

The Reserve Bank of India, had advised few authorised card networks in the country, desirous of implementing QR Code based card payment solutions, to put in place common interoperable solution for such QR Code. Accordingly, the authorised card networks namely VISA, Mastercard, American Express and NPCI worked jointly with banks to formulate common standards for QR Codes to be placed at merchants’ establishments and / or e-commerce/m-commerce websites. The Bharat QR Code was launched by Shri Gandhi, Deputy R. Governor of RBI on 20th February 2017. The Bharat QR code functions as a digital POS and does not require any physical POS infrastructure.
The advantage of “Bharat QR” code is that merchants and customers need to deal with one standard logo, which will be displayed at the merchant eliminating the requirement of multiple QR codes for different cards and banks. It is a COMMON QR code across banks and network cards. The customer of any bank can download the QR application from his bank and first time link his debit/credit card/prepaid card. Using the application on his smartphone, the customer will scan the Bharat QR code with the merchant, enter the amount, authenticate and pay. The QR code will contain the beneficiary details, merchant code and the payment will directly go to the account maintained by the merchant with his bank. The payment notification will be sent to both the merchant and the customer immediately. Customer need not disclose the details of his card to the merchant, guarding him from skimming frauds. In case of online purchases, the QR code will be pre-populated by the amount also.

STRENGTHENING SECURITY

With increase in digital transactions, in recent times there has been a spurt in the number of incidents of organised gangs from few states committing cyber crimes by making calls, sending mails, etc. to gullible customers to get the confidential details like card number, username, password, PIN, OTP, CVV, etc. This is causing concern to the banks and the regulator. To educate the public to do safe and secure banking, in December 2016, the IBA conducted a week-long security awareness campaign through media – TV, FM, Print and Bill boards at public places and branches.

The Reserve Bank of India has come out with guidelines for strengthening the cyber security of banks and banks are complying with the same. An SOC – security operations center has been set up in every bank to monitor and improve the cyber security defense. Some banks have started using Artificial Intelligence for fraud prom for monitoring transactions through pattern recognition, geographies, etc.

USER-FRIENDLY BANKING

Earlier the banks were focusing on applications which worked internally within the banks and its own customers, now the trend is more on inter-operable apps like UPI, BHIM, Aadhaar pay, etc., where customer of one bank can easily push/pull /request money from customers of other banks. There is more collaboration amongst banks. Aadhaar authentication is going to have major impact on all payment applications.

Banks are making efforts to migrate 60-80% of all banking transactions to the digital channel in the next 1-2 years. This will reduce the total cost of transactions for the banks. More user-friendly and simple digital applications can also be expected from the banks.

Along with Banks, FinTechs also are expected to contribute to the Digitisation of Financial Services and help in moving India towards a less-cash Digital India.

**AUTHOR’S PROFILE**

Shri V.G. Kannan is Chief Executive, Indian Banks’ Association (IBA). Prior to joining the IBA, Shri Kannan was the Managing Director & Group Executive (Associates & Subsidiaries) of State Bank of India.
India has seen a series of significant and unprecedented events during the last one year, which have brought the issue of cyber security for the Indian banking sector to the fore like never before. The most significant factor in this regard has been the ongoing initiative of the Government of India, through its flagship Digital India programme, with a vision to transform India into a digitally empowered society and knowledge economy. The sharp rise in value and volume of digital transactions which touched record levels in March 2017, manifests the accelerated shift towards electronic payments. The continued increase in penetration of inclusive banking through the Pradhan Mantri Jan Dhan Yojana (PMJDY) – with the total number of accounts crossing 29.18 crore – brought the uninitiated and new users into the fold of banking services.

The risk issues and incidents also made their presence felt. Two of the major events included the compromise of the SWIFT payment application in a major bank and subsequent large value fraudulent fund transfer and the large scale compromise of debit cards of multiple banks, via an advanced and persistent attack on a payment processor. These raised the bar on the impact of cyber attacks, like never before.

With digitisation, India is embarking on its journey towards digital economy. Digitisation brings unmatched functionalities, coverage and usability for the large Indian population. However, as famously stated by Nicholas Carr, “When a resource becomes essential to competition but inconsequential to strategy, the risks it creates become more important than the advantages it provides.” Cyber risk now ranks among the existential risks for Indian banks and it is important that the decision makers treat it as such, if the fruits of digitisation have to be reaped and distributed to the Indian citizens.

TECHNOLOGY LANDSCAPE

The pace of digitisation of financial transactions in India continues to gather pace. It is estimated that non-cash payment transactions, which today constitute 22% of all consumer payments, will overtake cash transactions by 2023. It is estimated that the total payments transmitted via digital payment instruments will be in the range of USD 500 billion by 2020, which is approximately 10 times the current levels. The technology infrastructure continues to build up, with 100 crore mobile connections in the country, of which 24 crore are of smartphone users. The number of smartphones is expected to increase to 52 crore by 2020. Around 90% of all devices are internet-enabled and the number of internet users is set to double to nearly 650 million by 2020 from the 300 million mark in 2015.

Meanwhile, the Aadhaar enrolments continue to reach saturation levels, with two states already reporting 100% coverage. This has significant implications for KYC simplification, but also in further proliferation of services like Aadhaar Enabled Payment System (AEPS). As mentioned earlier, the PMJDY accounts extended the financial inclusion
agenda, with almost 18 crore accounts being in semi-urban/rural areas. It needs to be kept in mind that most of these account holders will be new to the banking processes and the technology infrastructure underlying it, making them vulnerable to social engineering and other cyber attacks.

An important factor in the exciting growth of the payment ecosystem was Indian FinTech companies, which are scaling up in number and sophistication. These companies are likely to leverage technology and establish interfaces with banks and the Aadhaar database. Some of the active areas include payment systems, peer to peer and cross border transactions as well as mobile PoS processing; robo-advisory and brokerage for personal finance management; crowdfunding, P2P lending, alternative lenders and market places; and credit scoring, analytics and risk management.

These new applications are expected to introduce complexities in the interfaces between systems, which could present cyber vulnerabilities, and data security issues. Moreover, as FinTech companies embark on data based differentiation, the issues of data privacy and customer protection will become increasingly important. FinTech companies will not only have access to sensitive financial information about customers, but are likely to collect personal customer information in their quest to know more about the customer. Interfaces and APIs that facilitate seamless data hops with multiple applications, may also be vulnerable and create prospects for malware propagation, in case of cyber-attacks. Developing strong defense mechanisms and procedures to address these concerns will be an imperative for the FinTech sector, just the way it is for incumbent banks and financial institutions.

People are increasingly making their personal information available publically. Today, there is an unprecedented amount of personal data available with Government and private sector players. Digital India, Aadhaar and the telecom initiatives have added to the already growing pool of personal data with various public and private players to pursue their activities. Lack of understanding of the security and privacy implications may have already resulted in exposure of large amount of data.

Publicly available personal sensitive information can pose a risk for Indians because the majority of the population are digital immigrants, and, therefore, vulnerable to misuse of their data. Individuals are repeatedly sharing and transmitting their personal information for various activities. Aspects such as the purpose for collecting personal information, how will this information be used, security mechanisms put in place for protecting such information, for how long will this information be stored and what will be the procedure for destroying such information, are not known by the individual nor have these aspects been defined uniformly in the policies and procedures. India does not have a specific legislation focusing on data protection.

**INCIDENTS AND THREATS**

As per PwC’s Global Economic Crime Survey, cybercrime has jumped to the second position as the most reported economic crime and financial institutions are prime targets. As cybercriminals find new ways to attack, breach, and exploit organisations, threat patterns such as phishing, spear-phishing, and social engineering evolve and become more sophisticated. Organisations need solutions that assess their own and their vendors' vulnerabilities in real-time.

In India, banks have been seeing relentless attacks from possible state and non-state actors, organised crime and hacktivists. This was illustrated in the case of a bank, when in August 2016, a hacker from Pakistan, attacked and defaced the bank’s site by inserting a malicious page and tried to block some of the bank’s e-payments.

Similarly, another bank (Bank B) became the victim of an attack in July 2016. Cyber thieves nearly stole USD 171 million from its Nostro Account. The attackers reportedly gained entry using spear-
phishing, using spoofed RBI IDs. Unfortunately, one of the officials fell prey to the phishing email and clicked on the malicious link leading to the malware exploiting the system. The attempt closely resembled the cyber theft of USD 81 million from the Bangladesh central bank's account at the New York Federal Reserve.

For financial and banking institutions, the breach of Bank B highlighted a few important things. The first is, the dynamic nature of new malware; the second is, the importance of security awareness within the organisation; and lastly the effectiveness of the existing security monitoring practices. Due to effective action on the part of the bank, there was no loss to the institution, highlighting the importance of incident response readiness.

From Brazil, a novel way to attack a bank was reported. On a weekend afternoon in October 2016, the DNS records of a bank were altered to point to fake sites, resulting in redirection of legitimate traffic of 36 online properties of the bank, with possible loss of customer credentials. It is speculated that even ATM and POS networks may have been compromised. Fake sites carried malware in the form of a rusted update, exposing customers to further harm.

Some of the global trends, mentioned below, hold relevant learning for Indian organisations.

* Global expenditure on cyber security is expected to exceed $1 trillion over the next five years (2017-21): The noticeable rise in cybercrime, has pushed the expenditure on products and services to more than $80 billion in 2016, according to Gartner. Cybercrime growth is making it difficult for researchers and IT analysts to accurately forecast the expenditure

* In 2015, Frost & Sullivan forecasted a 1.5 million worker shortage in cyber security by 2020. In light of recent events and shifting industry dynamics, that forecast has been revised to a 1.8 million worker shortage by 2022. Another report, by Cyber Security Ventures, projects unfilled cyber security positions to reach 3.5 million by 2021

* Microsoft estimates that by 2020, 4 billion people will be online – twice the number that are online now. As the world goes digital, humans have moved ahead of machines as the top target for cyber criminals.

**SYSTEMIC CHALLENGES**

Some of the factors which continue to have their impact on the state of cyber security are as follows.

* **Awareness remains low:** Awareness amongst internal employees remains the first line of defense. However, not many firms invest in training and improving the cyber security awareness levels within the enterprise

* **Inadequate budgets and lack of top management support:** Budgets are usually driven by business demands and low priority is accorded to cyber security. Top management focus also remains a concern, support for cyber security projects are usually given low priority. This is primarily due to the lack of awareness on the impacts of these threats

* **A lack of cooperation is hindering progress:** Because banks were financially liable when their own systems are compromised, there is little incentive for them to cooperate with other stakeholders when it comes to cyber security. The recent customer protection regulation by RBI is expected to shift the onus on banks for doing more in dealing with cyber risk

* **Poor identity and access management:** Identity and access management is the fundamental element of cyber security. In an era where hackers seem to have the upper hand, it requires only one hacked credential to gain entry into an enterprise network. Despite some improvement, a lot of work remains to be done in this area
Ransomware on the rise: The recent episodes of malware attacks, viz. WannaCry and Petya, brought home the rising menace of ransomware. As more users recognise the risks of ransomware attack via email, criminals are exploring other vectors. Some are experimenting with malware that reinfects later, long after a ransom is paid, and some are starting to use built-in tools without any executable malware at all to avoid detection by endpoint protection code that focuses on executable files. Ransomware authors are also starting to use techniques other than encryption, for example deleting or corrupting file headers.

Mobile devices and apps: As organisations move towards adopting mobile devices as its preferred channel for doing business, it also becomes the ideal choice for hackers to exploit as the base increases. Since financial transactions can be done on mobile apps, the mobile phone is becoming an attractive target leading to an increase in mobile malware. The risk of jail-broken and rooted devices used for financial purposes increases the scope of attack.

Distributed Denial of Service (DDoS) attack: With the advent of IoT-powered botnets, destructive DDoS attacks are inevitable and have intensified in volume and frequency. Organisations in India need to improve their response capability to mitigate DDoS risks.

Social Media: Growing adoption of social media leads to more potential for hackers to exploit. Many a user puts his/her data out for anyone to see, which can be potentially exploited to attack the user’s organisation. Use of social media to propagate fake news can impact banks' reputations in an insidious manner.

Towards Finding Solutions

Many organisations and financial institutions are still exposed to various material risks. The following approach will help them to manage the risks better.

Integrated security as against layered defense: As BFSI is a highly regulated sector, banks invest time, money and effort in deploying best-in-breed technology, which, unfortunately, end up running in silos and are difficult to manage together. Moving towards integrated security, where all components communicate and work together, is essential.

Prioritise risk based security: Risks are dynamic and 100% prevention is not realistic. A risk-based approach gives a clear roadmap for the organisation to focus its effort and investment where it matters. It is prudent to classify the risk associated with each system and focus on the efforts accordingly.

Become smarter and intuitive with machine learning and big data analytics: Considering the current digitisation drive, there will be an exponential increase in the data relevant to the BFSI sector. Analytics is the key element in leveraging cyber resilience. A new generation of security analytics solutions has emerged which are able to store and analyse huge amounts of security data in real-time.

Move from security as a cost, to security as a plus: The mindset of seeing security as a cost needs an overhaul. The risks associated with security threats and the potential impact to business should make organisations see the benefits of proactive security.

Investing in Next Generation end-point protection: Traditional signature based solutions are no longer enough on their own and are prone to zero-day attacks. Banks and other financial institutions must invest in technology that can recognise and prevent the practices and actions used in exploits.
**Automating basics**: Automation can eliminate time spent on smaller and repeatable events, allowing redirection of resources for hunting, proactive defense and other tasks.

**Protect information**: The traditional approach has been to protect systems which hold the data. With data being available in different forms (structured/unstructured) and being stored on multiple devices and in the cloud, it becomes imperative to change the paradigm. In addition to keeping systems secured, it is recommended to secure the information/data such that the security remains and travels with it at all times.

**Respond and recover capabilities**: The most question is NOT ‘if’ an organisation would be attacked, but ‘when’ Organisations need to be prepared in identifying such attacks and not only respond, but recover with the least damage.

**Strategic denial and deception**: Making use of deception techniques to widely and effectively to enhance threat detection and as a threat response strategy. Deception technology is a promising new way to detect the stealthiest cyber attacks. It arms the enterprise with a set of digital tripwires to turn the tables on even the most advanced hackers.

**SUMMING UP**

There is no doubt that the challenges of securing information and financial assets of the customers and citizens, as well as to provide cutting-edge services, in a competitive business environment will test the financial institutions severely. This is a battle to be fought on various fronts and it is essential to plan well, commit fully, exercise rigorously and execute flawlessly. A lot can be done by taking a collaborative approach, which will reduce the cost of business without compromising on quality, trust and reliability.

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AUTHOR'S PROFILE

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INTRODUCTION

INNOVATION Governance! Sounds like an oxymoron. Innovation is supposed to be unstructured, free living and a barrier less free flow of creative juices. So, what is this governance around innovation?

Today, businesses, organisations and ecosystems are embracing innovation as a key anchor of sustaining competitive advantage. But every investment in innovation makes business leaders search for methods behind the madness called “Innovation”.

We are not here to define and dissect innovation. The problem is finding templates and structures for business quick wins by adopting tools and vehicles around innovation which could bring differentiated business value.

The innovative urge is always rooted in the ambition of exponential gratification for the stakeholders of the innovator, beyond and ahead of routine solutions. However, this value proposition needs to be sustained through deployment at scale and speed to ensure that the excitement about innovation does not wear off and innovation is not dubbed as a mere “Novelty”. This requires governance.

The present age is known as the age of the customer. Superior Customer Experiences (CX) and User Interfaces (UI) rule every business decision much more than the product per se. Therefore, business innovation must work in an open ecosystem that is robust, follows a laid down governance model to ensure business values of CX and UI and justifies the investment in innovation. For this, any standard model suitably modified can be adopted. For example, the five E framework of Envision, Engage, Evolve, Evaluate and Execute could be one. Organisations like IBM and Oracle follow highly structured waterfall methods in which innovation ideas are serially taken through the five Es. Others, like SBI, large and required to innovate quickly to stay competitive, use a more agile framework. They simultaneously or work in parallel on different pieces like Vision, Structure, Resources, Development, Communication and Managing Risk of multiple projects in their innovation agenda. The aim of innovation governance is to help graduation of an idea to the stature of a business innovation.

As customers are asking for products, services and experiences at the speed of light, fast innovation is a must. To begin with, the CIO or the innovation champion has to defocus from cost and operations and think outside the box to get and establish the present value of the long term and short term returns of the innovation. One governance element in innovation is the quick choice from one or a bundle from available technologies. Confusion around seemingly equivalent and equipotential technologies like mobile, big data insights, point solutions and end to end solutions, should not delay innovation projects. A blend is often the solution and different blends yield similar results. In case of large organisations like SBI, multiple technologies working in multiple ecosystems with multiple collaborations have been found to be the best milieu for enduring future readiness of innovation.
Innovation governance often is mired by distractions and hoopla. For example customer site visits, hackathons and vendor days generate a lot of short term excitement. However, even after a many of these, nothing is seen on the ground worthwhile for the money spent. Like the recent newspaper publicity around blockchain and robotics, announcements are made around POCs and “Workable Products” coming from hackathons and innovation off-sites; but that is about all. The other common activities are to setup labs, incubators and accelerators or acquire a fintech or startup, to commercialise innovation. Most of these languish due to lack of business engagement, validation and funding. In SBI, putting a process to map hackathon results into business value and mentorship, sponsorship of these processes by senior C-level executives have helped the innovation journeys to move forward.

One critical element of governance in any sphere is speed. Businesses are always looking for shortening time to market. Therefore, without speed, innovation will be bereft of business value. In design of innovation, speed elements like agile, iterative testing and simultaneous crowd sourcing must be integrated. One such example is Henry@Nestle, where an end to end platform is provided for speedy generation to sun setting of ideas.

Innovation may fail to get business value traction if it does not take the customer’s lifecycle and journeys into consideration. The rule is that instead of quantity and number of innovations in a company, more focus and boundaries around innovation are required based on focus on these. For example, a home loan journey in a bank is entirely different from a home loan product in a traditional banking world. The delta between journey and product is probably the trigger for and value of innovation.

To sum up, targeting and bringing focus on areas to innovate is the beginning of innovation governance. With ideation, incubation and commercialisation, the speed through sprints in an agile and collaborative manner are the body and soul of governing innovation to create value. Tools for measuring outcome must be embedded into the governance framework so that new innovation replaces old innovation and failed innovation does not perpetuate itself through optical illusions and sound bites.
ON 8th November 2016, at 8.30 pm, a path-breaking news was broadcast across all news channels on TV, which shook the country. The Prime Minister addressed the country and announced that, by 12 am on the same night, Specified Bank Notes of Rs. 500/- and Rs. 1000/- would be discontinued. It was also conveyed that, from midnight onwards (in three hours from the announcement), all ATMs were to be shut down and branches to remain closed, for the next two business days.

Immediately all our teams swung into action and got onto a bridge call to shutdown ATMs. The first challenge faced was to Stop 12000+ ATMs, without disrupting POS & Payment Gateway transactions. Since we have a Centralised ATM and POS Switching system, we were able to do it by making system changes at the Central Switch.

In the past, we had never done a “selective shutdown of only ATM services” (i.e. without stopping other cashless/digital services like POS and Payment Gateway) and this proved to be the first challenge. Numerous technical solutions were evaluated by engaging techno-functional experts within the team. Finally, we drafted a concrete plan of action to ensure a speedy shutdown of ATM services at the stroke of midnight. We arranged for all the best engineers to be available onsite in our IT Center, to carefully implement this. Also, many seniors of the bank were assembled to handhold this exercise with utmost caution. The activity was started at the stroke of 12 am and we successfully brought down 12000+ ATMs in a few minutes. This centralised technology control enabled us to do this mammoth task without sending any feet-on-street to our 12000+ ATMs, which are geographically spread across the country.

Later, the night was utilised for formalising strategy, building very quickly a reporting system and putting in place a set of revised processes to wade through the initial week of customer frenzy. This followed concerted efforts by team HDFC Bank, a Command-Center strategy, and continuous review and monitoring of situation on customer-end as well as policy and process.

From 9th November onwards, we worked round-the-clock to manage the diverse challenges faced due to this unprecedented turn of events that ensued. In the next 50 days, we received 60 circulars from RBI, mandating extremely diverse requirements. Almost all of these circulars required complex software changes in the two most critical systems, namely Core Banking and Payment Switch. Each software change required complex solutioning, testing, production and implementation within 24-48 hours, many of which were touching the Core Processing Engines of multiple software. The technology architecture deployed at HDFC Bank has helped us to manage all of this within the stipulated timelines mandated by the government.

Apart from the regulatory changes, we also implemented many technical changes for handling an unprecedented surge in transaction volumes for selective transactions like cash deposit. All customers were scrambling at our branches to deposit their cash. The cash deposit transactions
suddenly surged and this caused performance bottlenecks due to the heavy demand and concurrency across all branches. Within a day, the processing logic of this screen was re-engineered and we were able to scale up and meet the heavy demands from our customers.

We have a more stringent capacity management process for all our critical systems, especially core and customer-facing. This approach held us in good stead post demonetisation event. Within a week’s time, we started experiencing a big surge in the Point-of-Sale (POS) terminal transactions, almost up to three times the figures, especially on weekends.

Our POS terminal services saw a big uptake during this period. Merchants, doctors, hospitals, and various other business houses were requesting us to give them our POS terminals. The entire bank, from branch banking, merchant acquiring, technology and operations, got into the job of enabling this huge customer-base to adopt this digital channel for payments. Till October 2016, we had about 3.5 lakh active POS terminals on the field. Post demonetisation, we started enabling more than 50,000 new POS terminals every month. We were the first bank to place a bulk order on terminal vendors; and ensured continuous supply of POS stationary, peripherals, batteries, etc. Field services were re-aligned, with higher focus on metro locations where demand was higher. We also scaled-up the back end support team for 60% increase in terminal service calls. Cash-on-POS was enabled on field for over 20000 merchant outlets fuel and large corporates in flat 30 days with system configuration changes. Over 50000 merchants enabled with QR code payments parallely focused visits to each merchant outlet. We also scaled up the Telco network (fixed-line and mobile) significantly and simultaneously increased capacity of the Network connectivity ports/interfaces in the central Payment Switch.

Much before the demonetisation drive, we had anticipated a surge in digital transactions looking at the popularity of wallets and changing face of emerging digital trends and FinTech players. Hence, we had already completed scaling up our back end platforms of Core Banking, Credit Cards, 3dSecure, Enterprise Alerts & Enterprise-OTP and 2-factor Authentication platforms. These timely initiatives helped us to manage the increased demand on these systems during demonetisation.

During this period, our POS and Payment Gateway transactions increased by a whopping 162%.

In our digitally advanced netbanking application, we added capacity in Application and Database layer and also implemented system re-engineering changes to support higher concurrency and increase in online customers. We also added capacity to many core systems which provide data to the netbanking front-end to support higher concurrency at the interface. We increased capacity for supporting higher concurrency for all mobile platforms viz. iOS, Android, Windows, etc. During this period, our daily count of registrations of New Payment beneficiaries for Funds Transfers/Payments, increased by more than double. The third party funds transfers (NEFT, RTGS, IMPS, Within Bank) increased by 1.6 times. We also offered UPI on our Mobile and Internet platforms, for enabling quick and secure digital payments. We also embarked on a massive merchant enrolment programme for accepting UPI-based payments. In our Chillr Mobile App, the transactions doubled in just two months from October to December.

On the ATM front, we faced various challenges some of which we overcame using technology and many others by sheer over-managing and herculean efforts. On 9th November, we disallowed dispensation of old Rs. 500 & Rs. 1000 notes on ATMs by making complex changes in our Central Payment Switch. If this technical solution was not implemented, we would have needed to send engineers to visit all the 12000+ ATMs, which would have required a huge effort and time. We worked through the night and configured/tested and finally implemented the change in production in less than 24 hours.
In most Payment Systems, there is a concept of Daily Cash Withdrawal Limit. This limit gets reset every day. Also, the Daily Limit would get reduced only by a single day's withdrawals. As per the new directive, we had to make two fundamental changes.

* Daily Cash Withdrawal Limit of Rs. 10,000 & Weekly limit of Rs. 20,000

* Weekly limit had to check for the Withdrawal transactions of last seven days (rolling).

Due to this, what emerged was a complex matrix of Daily and Weekly Limit scenarios. Considering that, the customer is allowed to withdraw either from Branch or from ATM, it was very complex to implement this unprecedented business transaction logic, ensuring highest levels of data-integrity across multiple channels. Last but not the least, the system had to scan through all the withdrawals done for the last seven days, to arrive at the correct balance, which is extremely resource-intensive as a workload, as we process crores of transactions in a week. We also had to implement Separate Limits for Savings & Current Accounts. Using a combination of Core Banking and Payment Switch, we were able to implement a fool-proof and seamless logic to manage these mandatory enforcements.

All the above changes required deep understanding, thorough testing and implementation at speed of light, to support Government’s initiative for demonetisation and promotion of digital transactions. While the entire banking eco-system was going through a very revolutionary breakthrough and stressful times, we were well prepared in many areas due to advance scaling of systems and proactive digital initiatives. Without technology, this would have proved to be a very daunting situation. Technology made this an exceptional exercise that was successfully taken up by bank as a whole.

**AUTHOR’S PROFILE**

In the capacity of Group Head- IT & CIO of HDFC Bank, Shri Munish Mittal is responsible for managing the bank’s IT Strategy. Key deliverables include creating business value using Information & Communication Technology, provide best in class IT enabled DIGITAL solutions to Bank’s customers, ensure no business is missed where IT is involved and nurture a talented IT team. He also directs the IT operations of HDFC Securities Ltd., and provides Technology Strategy & Consulting to NBFC, HDB Financial Service Limited.
Banks have already implemented Enterprise wise Data Warehouse (EDW) in various forms. They have integrated various source systems through an Extraction Transformation and Loading (ETL) process wherein the data from the source systems is collected and stored in a denormalised form enabling faster retrieval of data based on queries to extract the data for taking meaningful decisions.

**BENEFITS DERIVED USING BUSINESS ANALYTICS IN BANKS**

From the current implementation of Business Intelligence solutions in banks, the following are the benefits derived even though the success rate of the implementation varies:

- With the available customer data, banks have been able to profile the customers. Various segmentations have been achieved based on the demographics and attributes of the customers.
- Efforts have been made to improve the quality of data in the source systems as Management Information System reports generated from the Data Warehouse has led to comparison of data and probe into the mismatches in the data leading to correction of data in source systems.
- Banks have attempted to improve the success rate of cross selling by targeted campaigns based on the Customer Profiling and Segmentation based on the relationship value, outstanding balance, nature of relationships, etc.
- A combination of internal and external data can be used for the campaigns.
- Text based transaction searches have enabled bank to profile customers based on the requirements. For example, for whom remittance is made in respect of housing loans and education loans, EMIs.
- Banks have maximised revenue by using data from the Data Warehouse effectively to plug revenue leakages or inconsistencies in charging rate of interest, various service related fees, etc.
- Data has been used effectively for categorisation of branches and staffing them as per the requirement by reducing the time delay in compilation of data. This has improved process efficiencies in this area.
- Banks have implemented the risk management solutions as point solutions obtaining the data feed from the Enterprise wide Data Warehouse to meet the requirements of norms relating to BASEL III, which has helped in timely implementation of risk management requirements and review of compliance of capital adequacy guidelines.
- Banks have attempted to use their manpower to cross sell and upsell products and services of the Bank and their Insurance and Mutual Fund partners, thereby improving the productivity of the staff.
- The integration of various source systems to the Enterprise Data Warehouse, has given the capability to the banks to generate a unified...
balance sheet/book of accounts across all business segments, geographical segments and territories

* Banks have used business analytics for comparative analysis of the performance of branches in various parameters at different time intervals. The dash boards and drill down reports have improved the effectiveness of business review meetings at periodic intervals leading to improved performance.

* The analytics from the data warehouse in banks has facilitated banks to move away from the traditional method of performance assessment of budget achievements on specific dates like quarterly closing or yearly closing to a more realistic and scientific approach of average performance. Data warehouse with the repository of historical data has been a major contributor to this transformation.

* Automated Data Flow of select data has been achieved from the data repository of banks to facilitate regulatory oversight.

* Submission of data oriented reports from the branches to various entities at periodical intervals has been dispensed with. The required data for analysis is extracted from the warehouse directly for various in-depth analysis and inferences.

**Limitations of Current Implementations of Business Analytics in Banks**

Though banks have implemented Enterprise Data Warehouse and used Business Analytics, there is a strong perception that much more could have been achieved given the investments made.

The following are the limitations of the current implementation of the data warehouse, which is hindering the banks from realising the full potential of the investment:

* The data to the core banking system traditionally has been migrated from the legacy source systems which did not capture adequate customer-related demographics. Further, the manual records/forms obtained from the customer earlier for account opening did not have relevant customer data needed for enhancing the relationships.

* The staff of public sector banks have been traditionally recruited with skill sets in Accounting, and trained for providing customer service and enhancing customer satisfaction, they are not fully equipped for Sales/Marketing efforts considering their age profile and mind set. There is need to reorient them towards the front office tasks relating to sales/marketing/relationship banking, etc.

* The dynamic data of the customer relating to credit relationships are highly inadequate to manage the relationships. There is high reliance on manual data especially in the credit segment, since the data required for the Credit Account monitoring at periodic intervals like the Sales cycle, inventory management, advance payments for raw materials, satisfaction of payments within time in respect of purchases made, the efficiency of collections, discounts offered, the statutory compliance to various laws of the land, etc. These are either not available or are not adequately captured. There are no efficient and easier mechanisms to cross check the information provided by the customers. The efforts always have dependency on data from external source systems, and online/real-time/near real-time data extraction capabilities are not immediately available from the external source systems. The level of automation in various organisations which are required to provide these data also varies.

* Though banks have invested much in the Enterprise wide Data Warehouse projects, there has not been proper structured and
consistent efforts to train the staff/bring in qualified data scientists to use the capabilities available in the data repositories. This has led to dependence on the large vendors who have implemented the data warehouse and this is also one of the reasons for inadequate utilization of the capabilities since there is delay in decision-making for the effort estimates of the service provider, for bringing in the desired capabilities.

* There has always been demand from the top management of banks, to provide realtime information (Online Transaction Processing – OLTP) (Online Analytical Processing – OLAP) from the data warehouse though the structure of the Enterprise wide Data Warehouse is traditionally for historical data. This has put strain on the resources. Similarly, there has been demand for Analytical Processing from the Core Banking Solution and other software applications which are traditionally OLTP systems where the data is stored in normalised form. This has resulted in creation of multiple data stores in source systems though Enterprise wide Data Warehouse has capabilities.

* Most of the banks have adopted a Big Bang approach, without proper planning leading to various limitations on the usage of the data.

HOW BUSINESS ANALYTICS CAN BE TAKEN TO THE NEXT LEVEL

**Predictive Analytics**

Predictive analytics is the branch of the advanced analytics which is used to make predictions about unknown future events. Predictive analytics uses many techniques from data mining, statistics, modeling, machine learning, and artificial intelligence to analyse current data to make predictions about future.

With mature data from the data warehouse and the credit risk solutions and external industry data, analytics can be used to predict defaults.

Predictive analytics can also be used for identifying customers where the probability of default is low and can help in bringing focused asset based products with improved pricing.

The enriched data will also increase the cross sell opportunities.

Predictive analytics can also be used to identify potential weak loan accounts based on identified parameters which can help in utilizing focused monitoring for recovery and management of these accounts.

Predictive analytics will help in identifying the probability of default in a particular segment of customers based on analysis of repayment behavior.
of various customers in similar situations in respect of historical data.

Business analytics can be used to relocate the ATMs and branches based on the distribution of the existing customers based on their present address. This can help in reviewing the location of the branch and ATMs. Based on the data, branches can be relocated/merged and the surplus staff can be utilised for deployment in areas where the potential for business growth and profitability is high, thus rationalising the deployments. Thus, it can also help in improving customer convenience leading to increased business.

Business analytics can be used for predicting the optimum cash holding in ATMs so that there can be process efficiencies and improved customer convenience.

Business analytics can be extensively used in improving the loaning process in the pre-sanction appraisal and post sanction monitoring and follow up stages. This can bring about process efficiencies and improve the credit portfolio and the extent of recovery from the stressed assets of the bank.

Targeted campaigns can be developed for the customers supported by data where there is potential for credit based on the spending pattern of the customers as reflected in the transactions over a reasonable period.

Data warehouse can also be extensively utilised to identify overseas client relationship of customers and identify locations for overseas expansion or providing services to the customers and their clients.

Data Mining

Data mining is the process of finding anomalies, patterns and correlations within large data sets to predict outcomes. Using a broad range of techniques, you can use this information to increase revenues, cut costs, improve customer relationships, reduce risks and more.

While querying is on data where the outcomes are predicted based on the SQL queries, data mining can throw up unpredicted co-relations, which needs to be inferred and translated into meaningful analysis for further diagnosis of data and bringing actionable insights.

Social Media Analytics

Social media is emerging as one of the important data sources providing customer behavior patterns and the availability of unstructured data is going to be the raw material for extensive data mining.

HADOOP

Hadoop is an open source, Java-based programming framework that supports the processing and storage of extremely large data sets in a distributed computing environment. It is part of the Apache project sponsored by the Apache Software Foundation.

Hadoop makes it possible to run applications on systems with thousands of commodity hardware nodes, and to handle thousands of terabytes of data. Its distributed file system facilitates rapid data transfer rates among nodes and allows the system to continue operating in case of a node failure. This approach lowers the risk of catastrophic system failure and unexpected data loss, even if a significant number of nodes become inoperative. Consequently, Hadoop quickly emerged as a foundation for big data processing tasks, such as scientific analytics, business and sales planning, and processing enormous volumes of sensor data.

Hadoop is reported to have been created by computer scientists Doug Cutting and Mike Cafarella in 2006 to support distribution for the Nutch Search engine. It was inspired by Google's MapReduce, a software framework in which an Application is broken down into numerous small parts. Any of these parts, which are also called fragments or blocks, can be run on any node in the cluster. After years of development within the open source community, Hadoop 1.0 became publicly available in November 2012.
Since its initial release, Hadoop has been continuously developed and updated. The second iteration of Hadoop (Hadoop 2) improved resource management and scheduling. It features a high-availability file-system option and support for Microsoft Windows and other components to expand the framework’s versatility for data processing and analytics.

BIG DATA ANALYTICS

Driven by specialised analytics systems and software, big data analytics can point the way to various business benefits, including new revenue opportunities, more effective marketing, better customer service, improved operational efficiency and competitive advantages over rivals.

Big data analytics applications enable data scientists, predictive modelers, statisticians and other analytics professionals to analyse growing volumes of structured transaction data, plus other forms of data that are often left untapped by conventional business intelligence (BI) and analytics programmes. That encompasses a mix of semi-structured and unstructured data – for example, internet click stream data, web server logs, social media content, text from customer emails and survey responses, mobile-phone call-detail records and machine data captured by sensors connected to various devices.

On a broad scale, data analytics technologies and techniques provide a means of analysing data sets and drawing conclusions about them to help organisations make informed business decisions. BI queries answer basic questions about business operations and performance. Big data analytics is a form of Advanced Analytics, which involves complex applications with elements such as predictive models, statistical algorithms and what-if analyses powered by high-performance analytics systems.

Cloud Computing for Business Analytics

The availability of expandable resources for database, processing capacity, storage, etc. on demand through the cloud infrastructure has helped in bringing in efficiencies in the BI initiatives by various organisations. This has helped in increasing the scope of analysis besides reducing the time taken to derive the desired results based on processing of huge data. The various models available to choose like Platform as a Service (PAAS), Software as a Service (SAAS) or the rental models for the infrastructure through cloud is expected to expand the extensive use of analytics in the financial services industry.

Analytics for Fraud Monitoring and Cyber Security Initiatives

Business Analytics and Big Data can be extensively used for fraud prevention and cyber security initiatives. The historical structured and unstructured data including signatures and images/photos/photographs/biometric characteristics from multiple delivery channels can be processed for customer profiling and transaction behavior patterns and any outlying transactional behavior can be flagged for further investigation and fraud prevention.

The Security Operations Center can be integrated with the data warehouse and the data from various security devices and transactions can be grouped and correlated to generate alerts for meaningful timely action and incident management.

DIFFERENCE BETWEEN DATA LAKE AND DATA WAREHOUSE

What is a Data Lake?

A data lake is a storage repository that holds a vast amount of raw data in its native format until it is needed. While a hierarchical data warehouse stores data in files or folders, a data lake uses a flat architecture to store data.

What is a Data Warehouse?

A core component of business intelligence, the data warehouse is a central repository of integrated data from one or more disparate sources, and it’s used for
reporting and data analysis. When the board makes a strategic decision on its future, or a call center agent reviews a customer’s profile—the data is typically being sourced from a data warehouse.

**Which Should You Choose?**

For an analogous definition of both structures, who better to turn to than the person credited with coining the phrase in the first place: James Dixon, the founder of Pentaho, the Big Data Analytics company. He explains, “Think of a data warehouse as a store of bottled water—it’s cleansed, packaged, and structured for easy consumption. The data lake meanwhile is a large body of water in a more natural state. The contents of the data lake stream in from a source to fill the lake, and various users of the lake can come to examine, dive in, or take samples.”

We can classify the key differences between these two as follows:

**Data Retention:** Put simply, data lakes retain all data, while data warehouses do not. During the data warehouse development phase, decisions are made about which data sources to use, and which business processes are required. If data isn’t required to answer specific questions or in a defined report, it is often excluded from the warehouse in order to reduce cost and optimize performance. Meanwhile, a data lake stores all the data—relevant or not. This is possible because the lake resides on lower-cost storage hardware.

**Data Type:** Most data warehouses store transaction system data, or quantitative metrics; ignoring unstructured sources such as images, text, or sensor data. Why? Because it's expensive to store them. Data lakes aren't so picky. They absorb all data—irrespective of volume and variety. It is stored in its raw form and only transformed when it is needed. It's called "Schema on Read" vs. the "Schema on Write".

**User:** The data lake users are more cosmopolitan than those that use the data warehouse. It supports people with “Operations” in their title, who are using the data to access reporting data quickly and get analytics information to the board for accelerated decision-making. It supports the users performing more in-depth data analysis, perhaps using a data warehouse as a source and then accessing the source systems for more analysis. And the data lake supports users wanting even deeper-dive analysis. Data scientists, for example, mashing together different types of data and coming up with entirely new questions to be answered.

**Changes:** Business today is all about agility; however, many data warehouses are not configured for rapid change. The complexity of the data loading process and the work done to make analysis and reporting easy, make change unnecessarily slow and expensive. Not so in the data lake. Because data is stored in its raw format and is always accessible, users can go beyond the structure of the data warehouse to explore data in novel ways and answer their questions at their pace.

**Synopsis of the differences between both environments:**

<table>
<thead>
<tr>
<th>Data Warehouse</th>
<th>Versus</th>
<th>Data Lake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured, processed</td>
<td>DATA</td>
<td>Structured/Semi structured/Structured/ Raw</td>
</tr>
<tr>
<td>Schema-on-write</td>
<td>PROCESSING</td>
<td>Schema-on-read</td>
</tr>
<tr>
<td>Expensive for large data volumes</td>
<td>STORAGE</td>
<td>Designed for low-cost storage</td>
</tr>
<tr>
<td>Less agile; fixed configuration</td>
<td>AGILITY</td>
<td>Highly agile; configure as required</td>
</tr>
<tr>
<td>Mature</td>
<td>SECURITY</td>
<td>Maturing</td>
</tr>
<tr>
<td>Business professionals</td>
<td>USERS</td>
<td>Data scientists, et al.</td>
</tr>
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</table>
CONCLUSION

While banks have leveraged Business Analytics in areas like Operations, Customer Profiling, Compliances, etc., much needs to be done by building data mining and big data analytics in areas like Customer Experience, Customer Satisfaction, Fraud Prevention, pre-empting Cyber Security Threats, Optimising Return on Investments, etc.

Service Bureaus for Business Analytics for a group of banks like regional rural banks, cooperative banks etc., can be formed, to bring in process efficiencies and optimisations which will lead to improved return on investments besides improving the customer experience.

AUTHOR’S PROFILE

Shri Rakesh Kumar is General Manager of Information Technology Division of Punjab National Bank and is responsible for the Bank’s entire Technology Infrastructure - including Operations, Projects, Infrastructure Architecture, Data Center Management, Disaster Recovery Site, Network setup, IT Security and implementing key IT based digital initiatives.
Evolution of Intelligent Automation

Shri Abhijit Singh, Head, Business Technology Group, ICICI Bank Ltd.

From automated advisers to digital ledgers, the banking landscape is transforming like never before. A new wave of innovative technologies – such as blockchain, artificial intelligence, analytics and robo-advisory – is revolutionising the way we manage, control and distribute money. Gone are the days when you had to go to the bank to carry out a banking transaction. Today, with the unprecedented usage of smartphones everything happens right in there, with your mobile banking app. In fact, today you can even seek financial advice without the need of human interaction – courtesy the advent of artificial intelligence.

Over the past decade, banks globally had been embracing innovation at a staggering pace to enhance many of its customer facing and front end operations to come up with diversified banking solutions across multiple digital channels such as Internet, Mobile, Social Media, 24X7 Electronic Branch, Digital Wallet, etc. providing customers with an unparalleled banking experience.

With key focus on enhancing efficiency and managing associated risk, digital technologies are seen as challenges and enablers at the same time, resulting in businesses to continuously adapt and ensure its processes are geared to meet the overall business strategy. Banks have started realising the frequent changing behavior of its customers. To sustain and keep delivering value added services for its customers, banks must strategically plan their investments with clear focus on transforming the back end operation and integrating with front-end.

Most of us would agree that a successful business requires highly productive environment to execute organisational goals, but the underlying question is how do we ensure greater results? A simple answer to this is SMART AUTOMATION.

We live in a digital age and no institution can be immune from automation. Use of technology to maximize business productivity had prompted businesses to overcome the challenges of executing strategy everyday in today’s competitive era. In a highly technological and rapidly evolving world, technological systems are playing profound role in determining how information is managed and distributed. Information technology is widely used across business channels to increase productivity through process automation, product innovation and skilled workforce. In the past decade, banks and other financial institutions had to accelerate their mode of work in order to remain competitive. With a clear focus on improving efficiency, banks are smartly investing in automating back end operations by digitizing processes and increasing productivity by the use of Robotics Process Automation (RPA), which has been gaining maturity over the last few years to the point where they are being used for large scale deployment. Essentially, banks are leveraging RPA to increasing productivity by streamlining end to end process in order to make it quicker and easier to manage. This gives banks the opportunity to utilise its employees on more value added tasks which can significantly boost the ROI for the bank and the time can be reinvested in improving the products and processes which has positive impact on customer experience and to improve their loyalty to the bank.
While extremely good at executing defined tasks, IT Leaders of banks foresee the limits of RPA tools i.e. it cannot adjust to new conditions. The need for cognitive intelligence for improving process execution efficiency, managing risk and driving growth is imperative for which banks globally are innovating and adopting intelligent automation, leveraging computing power of Natural Language Processing, Machine Learning and Speech Analytics in RPA to deliver unprecedented level of efficiency and performance. The transactional data generated by rule-based robotics tools can provide an analytical insight to drive AI capabilities to develop deeper level of understanding that can in turn, be applied to expand RPA adoption even further. Application of Machine Learning for drawing out predictions in activities involving high volume of data such as fraud detection and customer spending habit will help banks to transcend its conventional performance. Adoption of bots in financial industry will also rise as more and more services are being automated and will be handled by effective use of NLP which interprets human action and processes appropriate answers.

The highly scalable ability of automating processes by interpreting actual information, taking a logical decision and adapting to frequent changes without the need of explicitly programmed instruction had diversified the usage of cognitive technologies in solving variety of business problems. Fundamentally, artificial intelligence in banking industry is seen as a productivity lever, in automating areas where people are performing high-volume repetitive tasks to improve the accuracy, cycle time and productivity, resulting in improving efficiency, but the benefits of it are much broader than efficiency enhancement, that includes better product outcomes & innovation. The most challenging aspect of bringing in a 360 degree transformation in banking industry is replacing the legacy systems that continue to be used in silos costing lots of money to the bank. However, banks have to realign their investments in a way to improve processes and IT infrastructure as the outdated systems and processes may lead to inefficiency and add to cost.

WHY AUTOMATE?
Banking and financial institutions heavily rely upon documents (electronic and paper) and the legacy systems that are used to carry out majority of the work. Right from the initial application for a banking transaction by the customer to deposits, withdrawals, loan documents and account management documents, the whole lifecycle of day to day transactions inevitably generate humongous amount of documentation. Processing these high volume of documentation being generated daily requires man power doing redundant task, leading to slower processing time due to series of approvals, etc. Automating these back office tasks, can help banks create a more productive environment with highly efficient and accurate processes.

In order to ensure high availability of mission critical systems and cut down redundant task being carried out by support teams, ICICI Bank has leveraged dynamic workload management solution to integrate and automate most of the jobs catering to multiple applications, from a single point of control. This has cut down time and effort required in monitoring and helped timely completion of processes.

Today, the biggest challenge faced by banking industry before implementing automation is to connect with systems working in silos for managing and retrieving information for efficient execution of task. However, the use of robotic process automation has brought in revolution as more and more processes are being streamlined to integrate and bridge the systems working in silos, creating a much more uniform approach to data management. Results of this has been adoption of automation by banks at a staggering pace to cut down high degree of manual processing. Internally, business leaders have foreseen these challenges to maximise efficiency, while maintaining maximum security levels and efficiently managing risk.

ROBOTIC PROCESS AUTOMATION (RPA)
Robotic Process Automation (RPA) offers a great opportunity to the financial community to reduce time
and partially or fully automate activities which are manual, repetitive and rule-based, allowing them to enhance efficiency and speed up critical processes for reducing the time to market new products and services to end customers. RPA is a software approach for indulging in activities involving multiple systems. It simulates human actions for any transaction processing in single/multiple applications including Windows, Web, Java, mainframe, cloud-based, virtualized or citrix-hosted applications – without modifying the source code of original applications. Predominantly the use of Robotics Process Automation technology is seen as a productivity lever, in areas where people are performing high-volume repetitive tasks to improve the accuracy, cycle time and productivity thus resulting in improving efficiency. Robotic software allows configuration of a “software robot” which is programmed to capture all the steps involved in an application process right from user recognition to workflow execution. These software robots simulate the same steps as robotic processes within applications, thereby reducing human intervention. Software robots also provide simpler implementation of automation, carrying out exactly the same steps as the human. This requires little or no system intrusion and provides 100% consistency with the process requirements.

Resources management among others. The software robots are configured to capture and interpret information from systems, recognise patterns and run business processes across multiple applications to execute activities including data entry and validation, automated formatting, multi-format message creation, text mining, workflow acceleration, reconciliations and currency exchange rate processing among others. The bank has implemented the ‘Software Robotics' platform, leveraging recent advancements in artificial intelligence such as facial and voice recognition, natural language processing, machine learning and bots among others. These software robots have reduced the response time to customers by up to 60% and increased accuracy to 100% thereby sharply improving the bank's productivity and efficiency. It has also enabled the bank's employees to focus more on value-added and customer-related functions. The software robots now perform over 10 lakh banking transactions every working day.

Some of the major benefits envisaged by the use of RPA:

- Automation of high volume repetitive tasks
- Significant reduction in errors and turnaround time
- Cross platform integration
- Proactive monitoring and alerting
- User Management and Audit trails
- Code independent integrations.

Implementing RPA in the existing banking infrastructure is easier said than done. A lot of due diligence needs to go in identifying viable business scenarios to automate processes within desired timelines. Banks have to be more agile and overcome traditional way of development. IT teams have to look at reengineering IT systems and vigilantly participate in identifying business priorities and offer innovative solutions reducing complexity. A thorough analysis of all processes being carried out manually on a repetitive basis and associated risk of automation needs to be studied collaboratively by IT,

At ICICI Bank, we have deployed these software robots in over 500 business process functions across the organisation including retail banking operations, agri-business, trade & forex, treasury and human

Banking Technology in India : Present Status & Future Trends
Operations, Business and Subject Matter Expert of respective area along with technology partners. This team involving specialists in various roles need to prioritise processes based on business impact and feasibility depending on interfaces and system connectivity required to enable RPA. The focus on eliminating redundant steps for processing a transaction by creating automated workflows without altering existing IT systems has been the key for banks to go for large scale automation of back office processes.

**ARTIFICIAL INTELLIGENCE & INTELLIGENT AUTOMATION**

The software robots designed for RPA are not “smart,” and are limited in function to what they have been programmed to do. These robots memorise a process that is assigned to them and repeat it over and over again. In many situations, the experience and intuition of the human is required to impact the decision. Because of this, “intelligent” technologies such as Artificial intelligence and Machine Learning are widely being integrated along with RPA, creating intelligent automation.

While the majority of back-office processes have clear rule-driven nature making them candidates for RPA, the use of analytics and machine learning technologies is picking up pace for process automation involving judgmental calls. Software robots with Artificial Intelligence (AI) capabilities are making their way in business world for Smarter Process Automation. Unlike RPA, AI based software robots have the ability to train themselves to automate more complex and subjective work through pattern recognition. These robots can also process natural language (NLP), unstructured data such as voice, vision, search, etc. and adapt to change in environment to process new data.

Machine Learning on the other hand involves training of AI systems to identify patterns out of unstructured data with the help of mathematical and statistical algorithms such as Open NLP, Stanford NLP, Deep neural network, PIDA to name a few. As a result of this training, the algorithm gradually becomes increasingly intelligent as it processes large historical data records for discovering patterns in the data, and describing the relationship in the form of rules. These rules are then programmed into RPA to automate the decision making. The integrated execution of RPA and forms of machine intelligence will become increasingly amalgamated to take the business benefits of automation to the next level.

Since machine learning algorithms infer the logic by observing human responses over a considerable number of cases, they are most ideal until the underlying process or policy is unaltered. When there is a change to the underlying process, the algorithm needs to be recalibrated with a sufficient number of human responses under the new process. A control mechanism needs to be built in the implementation of RPA to include a checkpoint to demarcate those cases to which the new logic must be applied and reroute them to a human until the algorithm has been exposed to sufficient data to learn.

Chatbots, which are AI-enabled virtual assistants use NLP to communicate via text, have been gaining traction in the market. Several banks in India and across the world have deployed chatbots to answer customer queries that mimic human-like interaction and improve services that are being offered. ICICI Bank, the largest private bank in India by
consolidated assets, has been a front runner in technology-driven solutions and went on to deploy chatbots in its mobile banking, remittances and trade platforms. Cognitive intelligence can interact with customers solving their queries on the go and this has been widely accepted by our customers across different platforms.

**AUTOMATION FOR FUTURE BANKING**

Cognitive Intelligence is expected to have a major impact upon the world of work as it can draw patterns from large amount of data to make predictions. It can complement human input in complex work requiring creativity and judgment. The use of Machine Learning-Artificial Intelligence (ML-AI) will be significantly seen in a number of business areas where large amount of data is being generated. These technologies will help organisations to model their processes and have a computer orchestrate them by taking decisions in back office processes performing high volume of work. With AI automation technologies, processes will become increasingly intelligent as they adapt to change and become more precise with time, quality and quantity of the data processed.

The end result of intelligent automation being adopted will hopefully see scalable, efficient, more agile and smarter banks, delivering highly sophisticated services which are customer-centric and are fit for purpose in this increasingly competitive and regulated market.

**AUTHOR’S PROFILE**

Shri Abhijit Singh heads the Technology Group at ICICI Bank. He is responsible for provision of technology services to Retail Banking, Wholesale Banking, Commercial Banking, Small and Medium Enterprises and Corporate Agri Group (SMEAG) and International Business of the Bank. He is also responsible for Technology Operations and Infrastructure Management.
INNOVATION in banking technology is driven by the constantly evolving customer expectations and internal business mandates. Customer behavior patterns have shifted over the last couple of years and the focus now is on instant fulfillment – be it for account opening, transactions (financial/non-financial) or problem resolution. Customers today demand a 24×7 consistent access to systems and services, with the fastest transaction processing possible and there is no room for system downtime (even scheduled maintenance) or latency.

The competitive marketplace has led to a rise in business demands – to increase growth in terms of accounts and transactions, retain customers by responding effectively to their ever-growing needs, reduce costs to maintain profitability.

Towards meeting the rising customer and business demands, a multitude of technological innovations are taking place at a wild pace now than it has in the past. Large organisations are ready to embrace new ideas and leverage the capabilities of FinTech partners who are extremely responsive and agile.

In this article, I am focusing on two major technology trends, API & Micro Service (amongst many others) which will help in addressing the customer and business demands.

APPLICATIONS PROGRAMMING INTERFACE (API)

It is well understood that banks cannot do everything in-house and banks that want to be successful in the future will have to consider opening up their transactional data to third-party developers and consume third party capabilities via APIs.

<table>
<thead>
<tr>
<th>Inside-in</th>
<th>Outside-in</th>
<th>Inside-out (Partners, Trusted Developers &amp; Public)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Enable more rapid, scalable, and efficient re-use of our services</td>
<td>• Leverage the explosion of third-party APIs to improve our products and experiences and to invent new ones (Finintegration).</td>
<td>• Extend the distribution of our products and services to new digital platforms by meeting customers where they are.</td>
</tr>
<tr>
<td>• Drive improved cost and time-to-market by decoupling back-end systems from applications.</td>
<td></td>
<td>• Become an enduring part, if not enabler, of the broader FinTech ecosystem.</td>
</tr>
</tbody>
</table>

APIs IN FINANCIAL INDUSTRY

Banks are concentrating on internal (private) APIs at present, with some recognition that once their architecture is in place, they will move towards opening partner and public APIs.
OPEN API ECONOMY AND ITS IMPACT ON FINANCIAL SERVICES

Advent of open API economy has potential to unleash new wave of changes in the financial services industries. Bank Regulators and leaders are looking to drive better deals for the customers by generating more competition, innovation, customer information sharing, transaction initiation, and payment mechanisms. Their efforts, along with changing customer sentiment, are creating both threats and opportunities as the open API economy emerges.

Evolution of Open API Economy

An open API economy will accelerate competition and innovation within banking industry, creating new demands on banks’ business strategies, pressure on future revenue streams, and challenges to profitability. Leading banks of the future will have a clear focus on their end customers and markets and will collaborate with other organisations to accelerate their market position. An open API economy will enable the delivery of new products and services through collaboration among business units within a bank, among banks across the industry, and between banks and other related sectors of the economy, particularly technology and data businesses.

Impact of the open API economy on banks’ value chains

Adoption of open API is accelerating customer centricity and bringing transparency, at the same time enabling banks to be more nimble to scale on demand. Banks with retail and SME customers will see accelerated fragmentation of their value chain from new competitors entering the market and potentially disintermediation from their customers.

The rise of the open API economy will see an unprecedented number of new entrants entering the financial services markets. Challenger banks such as Fidor (Germany), Atom & Starling in UK are adopting “API first” strategy to define their business model, which is enabling their customers to have on demand product and services. FinTech have disintermediated banks to large extents where end consumer has started engaging with FinTech for variety of financial transactions whether it is in Lending or deposits space. Technology giants like Apple, Facebook, Google are advancing their game in financial services business and taking full advantage of possibilities by entering payments market and getting ready for further disruption.

Response from banks to rise of an open API economy

Banks have acknowledged API banking and gearing up towards responding to it. Banks are adopting short to long term strategy (in parallel accelerating value delivery through FinTech partnerships).

Short-term (0-12 months)

* Define overall strategic direction in light of the rise of the open API economy, resulting in refresh of business and technology strategy and;

* Determine future markets and revenue streams based on existing/new products and services, powered by an open API economy.
Define the pathway(s) to future operating model(s) based on specific products and services.

**Medium-term (12-36 months)**

- Actively seek to "test and learn" using key strategies by leveraging internal expertise and appropriate partnerships in the open API economy and confirm initial operating model, including bank's customer data approach
- Continue to learn and refine.

**Long-term (post 36 months)**

- Launching new business innovations and staying ahead of competition.

**MICROSERVICES IN BANKING**

The microservices architecture splits monolithic applications into a set of services that talk to each other via open APIs. Each service performs one function extremely well; the service and its API are products that are discoverable, well-defined and carefully maintained. Self-contained services are then assembled as required. Services cooperate to deliver complex functionality, even if they are deployed independently of each other.

Services can scale independently too, making the software adaptable at runtime. And if one service fails, it typically won't bring down the entire system because of the resilience built into microservice-based digital banking solutions.

Separation means that each service can be developed independently using whichever methodology, programming language, application framework or data storage options are appropriate to the specific task it fulfills. And this also means that the microservices assembled into a solution can be developed by entirely separate organisations.

**How can Banks Benefit**

Microservices architecture has its own benefits which include improved agility, better reliability, elasticity and finally global scalability. In the current climate when challenger banks are being built ground up and are able to accelerate their digital value propositions at lightning speed, large banks are actively rethinking the fastest way to accelerate transformation, microservices has been one of the well-adopted approach.

Adoption of microservices brings its own challenges which banks need to deal effectively, challenges such as IT delivery organisation adopting Agile and DevOps, new skill matrix across design, development and testing.

**ARCHITECTURAL MODELS CONSIDERED**

**Service Based Architecture**

- A service-based architecture provides more delivery speed than a monolith or service-oriented architecture (SOA) by breaking the code apart in the domain-centric way advocated by microservice and DDD proponents. SOA advocates breaking the architecture apart into layers rather than by domain. This ends up meaning that a simple change from a business perspective is more likely to be spread across multiple layers, requiring lots of testing to release. A domain-centric architecture will increase delivery speed compared to monolith or SOA by decreasing the testing surface to a single component to be released. The smaller the component, the smaller the testing surface, which is what microservices optimise for. But a service-based architecture should still speed up delivery of working software

- Service-based architectures consist of deployable services, (lesser than the numbers advocated by microservice proponents). These services may have separate data stores, or may still share a single monolithic data store.
Tactical Microservices

* Instead of proactively decomposing the application into microservices to allow separate lifecycle and deployment, isolate them or separately scale each out, to take advantage of the common infrastructure and environment uniformity where possible, while explicitly identifying and extracting components that warrant separation. The tactical microservices is either reactively separating out microservices that require complete isolation or have separate scaling needs, or anticipating such scenarios and proactively deploying them as individual microservices

* For example, if one of the business services [e.g. Reporting Services] in the application is best maintained and upgraded as a small and separate unit that is managed by a dedicated team, it may be deployed separately. Similarly, a component within another business service may be extracted and separated.

Business-driven Microservices

* A distributed, business-driven, microservice architecture can achieve many of the benefits. An important and distinguishing characteristic of this architecture is that microservices do not communicate with one another. Instead, an aggregation layer is provided in the form of a web application that provides the required coordination. In its simplest form, microservices in this architecture remain self-contained within the system by avoiding any dependencies on other microservices. This does not include external dependencies, but is an attempt to simplify the environment by avoiding a large and deep dependency graph within the system

* When a certain component requires special consideration, either in its scaling requirements or in terms of fault isolation, it can be broken out and deployed independently. This can lead to a hybrid solution incorporating some of the tactical considerations of the previously described architecture depicted in Tactical Microservices.

Strategic Microservices

* The Microservice Architecture paradigm can be fully embraced by decomposing entire applications into Microservices and implementing entire systems as separately deployed Microservices regardless of actual or anticipated isolation needs of individual services

* In this architecture, each microservice includes its own persistence, which is at least logically encapsulated within the service. Each such service can be independently deployed, scaled, upgraded and replaced. The environment is fundamentally heterogeneous, so while frameworks and infrastructure services may be available to provide features and functions, each microservice is free to use its preferred technology.

... and the recommended approach is:

* A tailored "Hybrid Microservices/Service-Based" architecture model which decomposes the system into Domain-Specific Macro-Services

* This model would resolve orchestration, transaction issues, allow complex business processing, use shared database for service clusters, reduce contract dependencies, improve performance due to fewer remote calls, allows transformations of contract differences, non-transactional orchestration of services, protocol-agnostic heterogeneous interoperability and less complex service governance

* For example, at high level, we recommend domain service clusters for current & savings accounts(CASA), Client Demographics, Investments and Insurance, Assets and Core Service Clusters like Fund Transfer.

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Banking Technology in India: Present Status & Future Trends
A domain service cluster like CASA can be further decomposed into services like Account Opening, Cheque Processing and Debit Card Processing.

Similarly core service cluster like Fund Transfer will consist of services like Payee, Transfers (Internal, External - NEFT, RTGS, IMPS).

Inter-service communication will be realized through Event Stores, APIs or Service to Service Calls.

This architecture will support customer centric framework and API based development scalable for future requirements. Shared database across service clusters will require minimal changes to core data model and peripheral applications testing effort.

**CONCLUSION**

While many innovative technology trends are emerging to address ever-growing customer and business demands, the two topics that I have addressed in this article will prove to be a backbone as this will completely modernize the core banking system. Front end interfaces will be achieved through the APIs which will be channel and partner agnostic. Back end systems will be truly component based and will contribute substantially towards improving scalability and high availability. This architecture will also enable banks to utilise cloud infrastructure which will help in considerably bringing down the infrastructure costs.

**AUTHOR’S PROFILE**

Shri N. K. Subbu is Head of Technology for the South Asia Cluster of Citibank from 2012. Prior to this he was the Director with Citibank - Asia Pacific Global Consumer Technology (GCT) based in Singapore. He spent the early part of his career with Citi, at Citicorp Overseas India Limited (COSL) and CITIL (currently Oracle financial services) he was responsible for design and delivery of technology systems for products on Corporate & Investment Banking and Retail Banking platforms.
DIGITAL initiatives are transforming the Payment System worldwide and India is no exception. In fact, the evolution of Digital Banking landscape is so effervescent in India that the initiatives have penetrated deep into the rural fabric and Inclusive Banking has emerged as the most effective technology-backed banking service.

Payment systems enable smooth and hassle-free financial settlements for business and consumption purpose in a secure manner and inclusive banking refers to delivery of financial services at affordable costs to sections of disadvantaged, marginalised and low-income segments of society, especially in the rural areas.

Though the setting up of various pocket-friendly digital payment systems by the National Payment Corporation of India (NPCI) and the recent demonetisation initiatives of the Government of India have given a much needed impetus to evolution of payment and settlement structure, unlike the developed countries, electronic banking is yet to emerge as a prominent financial transaction channel in India. Cash transactions still constitute a whopping 86% of consumer payments in India.

We will briefly discuss the various established payment systems prevalent in Indian economic scenario and how it can contribute towards inclusive banking.

The fact that India is a heavily cash-reliant economy was the most significant impediment for effective establishment of Financial Inclusion.

Bank automation that opened up in a big way in the second half of '90s transformed the banking landscape. ATMs became ubiquitous by the turn of the century and major players like SBI, ICICI, HDFC Bank literally opened the floodgates of electronic banking that took the banking services out of the brick and mortar confines. Credit/Debit Cards, Internet Banking, NEFT, RTGS and Mobile Banking added convenience and diversity to banking experience. However, all these channels were skewed strongly towards the Metro and Urban population since bankable population—and consequently banking services were geographically concentrated in these areas.

Rural populace continued to be marginalised as far as banking services were concerned until the government introduced policies to promote non-cash payments, provide hundreds of millions of new payment-capable accounts to the unbanked, and encourage new technology and innovation throughout the banking sector. These policies paved way for a major impact on economic welfare and financial inclusion in the coming years.

Most Indians habitually rely exclusively on cash in daily transactions. Only an estimated 10-15% of the population has ever used any kind of non-cash payment instrument, compared to 40% of people in countries like Brazil and China. Meanwhile, India’s ratio of currency in circulation outside of banks to GDP was higher than other emerging economies like Russia, Mexico, and Brazil, even after the demonetisation initiatives.

This excessive cash-driven market contributes to inflation, which erodes the value of cash not earning
interest in a formal account. It also renders the thrift savings of the rural masses – which contribute the majority of Indian population – unavailable to fund broader economic activity, as banks cannot lend cash held at home. Additionally, people operating exclusively in cash and without a bank account often face tougher borrowing conditions.

One way to reduce cash-related economic inefficiencies is to create inclusive non-cash payment systems. These systems provide benefits to a country's poor citizens across a number of indicators, lowering the cost of transactions and increasing the return on savings. The availability of convenient, reliable, secure, and affordable payment system can also introduce the unbanked to proper financial products like loans at reasonable rates and different flavors of deposit schemes that earn interest, creating synergies with vibrant financial inclusion objectives.

In an endeavor to address these payment paradigms, India's policymakers established NPCI in 2008. The main objectives of NPCI was to consolidate India's complicated retail payment systems into a standardised, coherent national network to make transactions easier and cheaper. Since then, the NCPI has initiated multiple reforms, including a National Automated Clearing House (NACH) system for efficient settlement of payment instruments, the RuPay electronic payment card scheme, the Immediate Payment Service (IMPS) for mobile transactions, Unified Payment Interface [UPI] for instant transfer of funds between two bank accounts on mobile platform and Bharat Bill Payment System (BBPS), which offers integrated and interoperable bill payment services to customers across geographies with certainty, reliability and safety of transactions. In the meantime, in a massive nationwide initiative, the Government rolled out an universal identification–popularly known as Aadhaar cards – during 2009. Subsequently, the Unique Identification Authority of India (UIDAI), a statutory authority was established on 12th July 2016 by the Government of India under the Ministry of Electronics and Information Technology, under the provisions of the Aadhaar Act 2016. More than one billion Indians are currently enrolled for Aadhaar Card, that lets any holder be authenticated by UIDAI and NPCI. This not only makes it easier for financial institutions to comply with “Know Your Customer” regulations, but also allows the payment system to support the government's financial inclusion efforts.

Having established a more robust national payment infrastructure, the Indian government and RBI have initiated policies to attract unbanked citizens to the financial system through payment-focused accounts.

 Shortly after coming to power in mid-2014, the government of Prime Minister Narendra Modi announced the National Mission for Financial Inclusion (Pradhan Mantri Jan Dhan Yojana, or PMJDY) and instructed banks to leverage Aadhaar cards to provide unbanked citizens with new accounts and link them directly to welfare benefit payments. The ambitious initiate was to bring the convenience of authentic basic banking facilities to the unbanked rural masses by employing the services of Business Correspondents (BCs) and, more importantly, inculcate an inclination for thrift.

This strategy is most evident in the bundling of PMJDY accounts with the Direct Benefits Transfer (DBT) program, established in 2013 to send benefit payments (e.g. scholarships, pensions or subsidies) directly to the poor in an effort to reduce the siphoning off of funds by corrupt intermediaries. PMJDY accounts can receive various government subsidies via a unique payment system called Aadhaar Payment Bridge System (APBS) implemented by NPCI, which uses Aadhaar number as a central key for electronically channelising the Government subsidies and benefits in the Aadhaar Enabled Bank Accounts (AEBA) of the intended beneficiaries. This bundling highlights the potential collaboration of coordinated efforts to improve the country's payment system and increase financial inclusion. This has also contributed to reduce the
leakage in the system considerably. DBT-enabled accounts offer benefits to the unbanked that attract them into the mainstream banking system. At the same time, a growing customer base creates positive network effects that make the payment system more vibrant and useful for all participants.

Aadhaar has also contributed significantly for efficient KYC compliance for bank account opening, through various touch points, including the Business Correspondent. This has rendered the bank account opening process paperless and hassle-free. Facility for authenticating customer identity by online demographic/biometric verification has been enabled by UIDAI and made mandatory, which will go a long way in weeding out spurious accounts from the banking system.

As of March 2016, the programme had already opened 213 million new accounts, a remarkable achievement in under two years, but it remains a work-in-progress. About 29% of accounts held a zero balance, in part because the government has not yet fully utilised the DBT programme for all welfare payments.

More recently, the RBI licensed new specialty Payment Banks in August 2015 to promote innovation in delivering payment services to India's unbanked populace. The new payment banks are promoted by telecommunications ventures, mobile payments specialist, the National Securities Depository and India Post. They have physical and virtual networks in the rural areas where many of India's unbanked live. The RBI expects the payment banks will take advantage of their parent companies' strength to leverage new technology and innovative strategies for convenient and secure banking experience.

The payment banks will need to comply with RBI requirements to qualify for a full payment bank license. Threshold limits are prescribed for accepting deposits that can be placed in savings bank accounts that will earn interest. This solves the primary problem previously faced by non-bank mobile payment operators – an inability to let customers participate in these new payments networks without linking to a separate bank account.

The addition of these new players to India's payment system also brings challenges. One open question is how payment banks will compete with the new PMJDY accounts. With more than 200 million accounts opened, many of the previously unbanked will now have access to formal payments and will not necessarily need a payment bank account. For existing commercial banks facing asset quality problems and significant capital raising requirements, new competition poses risks to future earnings.

Payment operators will confront financial illiteracy and limited awareness among their customers, a common barrier to financial inclusion efforts around the world. The rapid rollout of new payment models also creates additional operational risks for the industry. The new players face an evolving legal environment in the treatment of customer privacy, with the Indian Supreme Court continuing to debate the extent to which non-government entities can leverage Aadhaar numbers to improve the speed and efficiency of payments transactions. Meanwhile, innovative business models have the potential to lead payment banks into unregulated areas, necessitating enhanced supervision by the RBI.

All these payment systems have a certain level of dependency on the customer, either on his financial literacy or the mobile device that he held for initiating a transaction. The NPCI conceived an innovative transaction mode, called Aadhaar Pay, which required only the biometric authentication from the customer. This is the easiest and cheapest method of payment, which can be used by the urban rich and rural poor alike. Aadhaar Pay is an app designed basically for the merchants and shopkeepers. Customer is required to authorise the transaction only using his fingerprint. The fingerprint will be validated with the Aadhaar database in a secured manner and on successful authentication, the
transaction amount will be debited to the Aadhaar-linked account. Aadhaar Pay will be the game-changer that is sure to revitalise the Financial Inclusion landscape in India.

While 86% of business operations in India are still transacted in cash, the share of non-cash transactions is likely to surge because of the ongoing reforms in the payment space. With a national infrastructure put in place for seamless and secure electronic transfers, which is undergoing rapid improvements and innovations, coupled with millions of new payment-capable accounts, the promise of a modern non-cash payment system has arrived.

This is sure to usher in substantial advancements in financial inclusion for one of the world’s most significant and important emerging economies.

**AUTHOR’S PROFILE**

Shri. S. Kumar is heading the Information Technology Division, as General Manager, in Corporation Bank. He is responsible for Strategy, Infrastructure and Operations in IT. He has contributed towards development of various in-house software for the Bank. He was involved in the development and implementation of Total Branch Automation and thereafter Wide Area Network and Core Banking Solutions in the Bank.
SECTION - II

13th IDRBT Banking Technology Excellence Awards 2016-17
BACKGROUND

In order to infuse a spirit of healthy competition and speed up the process of technology absorption among the banks in the country, IDRBT instituted the Annual Awards for Excellence in Banking Technology (BT) in the year 2001. The 2017 edition marks the thirteenth year of recognising the contribution of Indian banks in the field of Banking Technology. Over the years, the categories under BT Awards have evolved to reflect changes in the banking industry and technology landscape.

Banks are nominated and evaluated for the IDRBT Banking Technology Awards 2017, under the following categories:

For Commercial Banks

- Category I – Use of Technology for Financial Inclusion
- Category II – Digital Banking
- Category III – Electronic Payment Systems
- Category IV – Analytics and Big Data
- Category V – Use of Technology for Fraud Detection and Prevention
- Category VI – High Performance IT Ecosystem
- Category VII – Cyber Security and Defense
- Category VIII – Innovative Use of Technology

For Other Categories

- Best IT-enabled Co-operative Bank
- Best IT-enabled Regional Rural Bank.

This year’s edition of the BT Awards also recognises banks that have demonstrated commendable performance across multiple categories. The award has been termed as ‘Best Emerging Bank’ award.

In addition to these categories, BT Awards 2017 sought inputs from banks on technology initiatives undertaken by them during the demonetisation period. Some of the important technology initiatives undertaken by Indian banks during this period are covered in the last section of this article.

To carry out effective evaluation, commercial banks are sub-divided into large, mid-sized and small banks. This provides a level playing field for the banks to be compared for evaluation on similar scale and size. Categorisation criterion for commercial banks is detailed in Table 1 hereunder:

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Business as on 31st March 2016 (in crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Banks</td>
<td>Above Rs 3.5 lakh</td>
</tr>
<tr>
<td>Mid-sized Banks</td>
<td>Above Rs 1.5 lakh and less than Rs 3.5 lakh</td>
</tr>
<tr>
<td>Small Banks</td>
<td>Up to Rs 1.5 lakh</td>
</tr>
</tbody>
</table>

EVALUATION AND AWARD PROCESS

The process of evaluation and confirmation of awards under various categories consisted of four stages:

- Finalisation of award categories
- Questionnaire administration
- Response submission by banks
- Critical evaluation of responses by Jury, and decision on awardees.

The Jury consisted of eminent personalities from industry, academia and the banking fraternity. The Jury members first recommended the award categories along with broad evaluation parameters. A detailed questionnaire was then prepared for each category by IDRBT, in association with knowledge partner (Deloitte India). The questionnaire was then sent to the banks. Banks were given four weeks to prepare and submit their responses. This was followed by a detailed evaluation of the responses. The Jury members went through the detailed workings, considering merit of each case before choosing a winner for the category.
BT AWARDS 2017 WINNERS

<table>
<thead>
<tr>
<th>S No.</th>
<th>Category</th>
<th>Large Banks</th>
<th>Mid-sized Banks</th>
<th>Small Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of Technology for Financial Inclusion</td>
<td>State Bank of India</td>
<td>Vijaya Bank</td>
<td>Karnataka Bank Ltd.</td>
</tr>
<tr>
<td>2</td>
<td>Digital Banking</td>
<td>Axis Bank Ltd.</td>
<td>Vijaya Bank</td>
<td>South Indian Bank Ltd.</td>
</tr>
<tr>
<td>3</td>
<td>Electronic Payment Systems</td>
<td>State Bank of India</td>
<td>Andhra Bank</td>
<td>The Federal Bank Ltd.</td>
</tr>
<tr>
<td>4</td>
<td>Analytics and Big Data</td>
<td>ICICI Bank Ltd.</td>
<td>-No Award-</td>
<td>-No Award-</td>
</tr>
<tr>
<td>5</td>
<td>Use of Technology Fraud Detection and Prevention</td>
<td>HDFC Bank Ltd.</td>
<td>-No Award-</td>
<td>-No Award-</td>
</tr>
<tr>
<td>6</td>
<td>High Performance IT Ecosystem</td>
<td>Bank of India</td>
<td>IndusInd Bank Ltd.</td>
<td>South Indian Bank Ltd.</td>
</tr>
<tr>
<td>7</td>
<td>Cyber Security and Defense</td>
<td>HDFC Bank Ltd.</td>
<td>IndusInd Bank Ltd.</td>
<td>City Union Bank</td>
</tr>
<tr>
<td>8</td>
<td>Innovative Use of Technology</td>
<td>HDFC Bank Ltd.</td>
<td>YES Bank Ltd.</td>
<td>The Karur Vysya Bank Ltd.</td>
</tr>
<tr>
<td>9</td>
<td>Emerging Bank Award</td>
<td>Union Bank of India</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Best IT-enabled Co-operative Bank</td>
<td>The Cosmos Co-operative Bank Ltd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Best IT-enabled Regional Rural Bank</td>
<td>Andhra Pragathi Grameena Bank</td>
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</table>

BANKING TECHNOLOGY AWARDS 2017: A SUMMARY REPORT ON TRENDS AND PROGRESS

The insights presented in this summary report are based on, and limited to the responses provided by the participating banks, unless otherwise stated.

CATEGORY I – USE OF TECHNOLOGY FOR FINANCIAL INCLUSION

The government has taken numerous initiatives like PMJDY, PMSBY, DBT, etc. to bring the unbanked and underbanked population under the formal banking umbrella.

Technology has played a major role in bringing banking services to the masses. There is a shift from the traditional brick and mortar business model to a more asset light (using digital channels) model. By utilising the ubiquity of internet and smartphones, banks have been able to provide financial services in rural and semi-urban areas in a cost-effective manner:

**Highlights**

* An increasing number of banks have deployed the Kiosk Banking model, where laptop/desktop is provided with biometric devices to enable banking services
* Banks in the large and mid-sized category have seen a stabilization in the number of accounts opened under BSBDA in FY17 vs FY16
* Average account balance maintained in BSBDA account is close to Rs. 3,500
* Banks regularly organise training programmes for Business Correspondents (BCs) and Self-
help groups (SHGs). Some of these include entrepreneurship development program, skill training programs for SHG, self-employment trainings, etc.

- Banks are taking steps such as Aadhaar seeding, issuing account linked Rupay Debit card, incentives under PMJDY, financial literacy programs to keep BSBDA accounts active.
- Some of the banks have reported greater than 50% of transaction through digital modes under various financial inclusion initiatives.
- Active accounts (greater than one transaction in a quarter) as a percentage of total accounts under various financial inclusion initiatives for banks range between 6% and 71%.
- Zero balance accounts as a percentage of total accounts under various financial inclusion initiatives for banks range between 12% and 89%.
- Most of the banks are utilising eKYC to open accounts; with leading banks opening more than 2 lac accounts (per bank) through eKYC in Fy17.
- Connectivity issues and biometric authentication rejection are cited as major reasons for transaction failure. Some of the banks have reported a failure rate which is as high as 30% and 12% in BC and Mobile Banking channels respectively.
- Banks conduct regular meetings at the village level to inculcate the habit of savings. These include financial literacy camps conducted by banks.

New Initiatives

- Some banks have deployed an iris based eKYC transaction authentication system.
- Few banks have deployed industry specific technology solutions. One such initiative is a solution for dairy farmers of remote villages, which has led to the development of a cashless ecosystem in villages, with generation of credit history and payment at the doorstep of farmers through the BC network.
- Banks have deployed applications which work on low network bandwidth. These applications can run on a WHIP or a V-Sat linked system.
- Some banks are using analytical tools and dashboards to monitor BC performance. Banks have deployed SAS based applications for real-time monitoring of BCs and BC agents.
- A few banks have implemented centralised commission payment module to facilitate faster payout of BC commission.

Way Forward

Initiatives taken by Government of India and the Reserve Bank of India have helped in bringing banking services to the masses. However, the challenge lies in encouraging people to continue using banking services and the ability to provide banking services in remaining remote areas, where connectivity is still a challenge.

The Indian Government is banking on technology to overcome the above mentioned challenges and to provide access to cost effective financial services. Innovative uses of technology such as MicroATMs and Ultra Small Branches (connected through GPRS and VPN) have the potential to expand banking reach to remote areas. By embracing latest technology solutions, banks will be able to provide cost-effective services and enhance user experience for the people at the bottom of the pyramid. Differentiated banks like Small Finance Bank and Payments Bank are expected to further the cause of financial inclusion.

**CATEGORY II – DIGITAL BANKING**

As Indian economy embraces 'Digital India' concept, banks too are increasingly using digital solutions to enhance customer experience and to manage costs. The recent demonetisation exercise by the Government has accelerated transition to a digital economy.
Latest technology and service offerings in the new age digital payments space by the government, regulatory agencies and banks such as Unified Payments Infrastructure (UPI), Bharat Interface for Money (BHIM), Bharat Bill Payment System (BPSS), mobile money, e-wallets, etc., have revolutionised the banking world.

Banks are leveraging digital banking and mobile technologies to expand banking reach, manage increased banking volumes, promote financial inclusion, and achieve operational efficiencies with economies of scale.

**Highlights**

- Banks are allocating a higher amount of resources towards process automation. Some of the large banks have allocated more than 10% of their IT budget towards process digitisation and automation.
- More than 60% growth in digital transactions in 2017 over 2016, is reported by some of the mid-size and small banks.
- High growth is reported in Fixed Deposits (FD) through digital channels in banks. Figure 1, provides detail of growth of FDs booked through online mode under various categories of banks.

```
<table>
<thead>
<tr>
<th>Large Bank</th>
<th>Mid-Sized</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100%</td>
<td>62%</td>
<td>53%</td>
</tr>
</tbody>
</table>
```

- Large banks have digitised most of their front-end and back end processes, leading to improved turn-around-time and better operational efficiencies. Mid-size and small banks are in the process of digitising their back end processes.
- Banks have reported healthy growth in user base across internet, mobile and USSD banking. The Figure 2, provides detail of average growth in user base in 2017 over 2016 observed across internet, mobile and USSD banking.

```
Figure 2: Average growth in user base

<table>
<thead>
<tr>
<th>Internet Banking</th>
<th>USSD/SMS User</th>
<th>Mobile Banking and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>30%</td>
<td>40%</td>
</tr>
</tbody>
</table>
```

- Some banks have set up digital branches which are equipped with state-of-the-art digital technologies. Few notable features of these branches are:
  - Printing of personalised debit card within a few minutes.
  - Financial counselling for customers through hi-definition audio-video conferencing services.
  - Branch layout to foster efficient customer service and generate revenue for the bank, by creation of robust cross-sell modules for credit cards, personal loans and FD/RD products.

- Banks have undertaken multiple initiatives to increase digital adoption by bank employees. Some of the notable initiatives are:
  - Incentive schemes for usage of digital banking.
  - Reward to employees who convince customers to use digital banking.
  - Capsule programmes to train employees to use digital banking.
  - Digital themed campaigns to reduce cash teller transactions and encourage the use of ATMs and Mobile apps.
New Initiatives

★ Some banks have deployed automated customer engagement online chat platform, which is based on artificial intelligence

★ A few banks are using speech analytics to support the bank to identify escalations with respect to irate customers and develop areas of improvement in service and up-selling

★ Some banks are leveraging social media for managing customer complaints

★ One bank has initiated selfie account opening initiative. Customers can apply for account opening by clicking a picture through their mobile phone and scanning documents.

Way Forward

With rapid adoption of digital technologies by Indian customers, banks too need to develop new age digital models. Banks need to forge non-traditional alliances and adopt FinTech capabilities to make banking affordable and customer-centric.

Innovative business models supported by digital technologies need to be further fine-tuned to reap maximum advantage in an increasingly digital society. Banks must leverage digital technologies to demonstrate superior performance in all spheres of customer service.

CATEGORY III – ELECTRONIC PAYMENT SYSTEMS

Indian Payments landscape is currently undergoing a massive transformation. Indian economy is transitioning to a cashless economy. The electronic payment landscape consists of cards, mobile and internet banking, wallets, amongst other products and channels. Payment initiatives such as Aadhaar-linked cashless payment solution and ‘Bharat QR’ are some of the latest additions.

The Government of India has undertaken multiple initiatives to encourage a cashless society. Measures such as reduction in Merchant Discount Rate (MDR), incentivising digital payments at fuel stations, railway tickets, insurance portals, and creation of new products and services such as UPI, BHIM, will support the adoption of electronic payments. The demonetisation move by the government during November-December 2016, has given a significant boost to electronic payment adoption in India.

Highlights

★ Majority of the banks are on UPI. Banks that are not on UPI, are planning to do so in the near future (within one year)

★ Some of the large and mid-size banks have developed their own application for UPI, while others are partnering with existing players to offer UPI services

★ Most of the banks have adopted Aadhaar Enabled Payment System (AEPS)

★ Most of the banks register and track customer complaints online

★ Banks have launched awareness campaigns, marketing and communication initiatives to educate customers on the merit of digital payments

★ Some of the large banks have introduced contactless cards.

New Initiatives

★ Some banks have deployed social media banking tool to enable payment services such as transfer of funds, bill payments, etc. through Facebook and Twitter

★ One of the banks has developed an application for mobile banking which does not require internet connection. The transaction happens over the SMS platform, helping the bank to provide services even in the remotest locations

★ One bank offers automated facility for salary payment for various private sector enterprises

★ Some banks provide the option of self-sign up
for retail customers, enabling them to register for the internet banking facility by using their Debit card, PIN & OTP

* Few banks have tied up with central and state governments to enable electronic payment of bills challans, taxes, etc.

### Way Forward

To transition to a less cash economy, banks need to strengthen their efforts to educate customers on electronic payments: helping them understand the benefits of using electronic payments, at the same time highlighting the robustness of the bank’s secure infrastructure which enables these transactions. Currently, there are around two million merchants only with POS terminals. Creation of a wider acceptance infrastructure for digital payments will be crucial in transitioning to a digital economy.

The above mentioned measures would go a long way in increasing the adoption of electronic payments in the country.

### CATEGORY IV - ANALYTICS AND BIG DATA

Increased digital banking has led to generation of massive amount of digital data. Banks today are no longer simply storing data as required; they are actively using it in order to generate business insights.

Leading banks are now using analytics beyond conventional data analytics areas. Some of the newer areas include: (i) using analytics to predict behaviour traits like probability of a customer to increase/reduce business with the bank; (ii) study the discounts that other banks are offering to customers to look for any anomaly; and (iii) observe employee conduct and limit opportunities of breaking regulations and fraud, etc.

Analytics offer enormous potential for banks to generate valuable insights about customer as well as on their internal operations. Only by establishing analytics as a true business discipline, banks can utilise its full potential.

Indian banks are going beyond conventional data sources. Figure 3, depicts some of the conventional as well as non-conventional data sources.

### Highlights

* Some banks are using analytics to identify customers with similar identity to put them in the same managed portfolio, thereby creating a household ID mapping. This has helped banks to enhance customer experience and at the same time increase revenue generating avenues

* Banks are using Hadoop to analyse Petabytes of information. Owing to its distributed nature, it has significantly reduced the data processing time

* Some banks are using intra-day business performance monitor with branch level drill downs for enhancing employee productivity
Few banks have deployed real time dashboards that help to keep track of all comments about the bank on social media.

Some banks have deployed behavior based scorecard models to determine transaction approval/rejection for credit card transactions. This helps in controlling delinquency from customers who have shown signs of stress in their account behavior.

A few banks are using Multi-Channel Campaign Management (MCCM) capability. This capability is designed to tap customer footprints on digital channels, to determine their preferences as well as for providing better customer experience.

Banks are following multi-level checks to maintain data integrity. For e.g. data is first checked while uploading and then in production. Any gaps identified are then validated against the source system.

New Initiatives

- Communication of relevant offers to card users in real-time based on recent transaction behaviour
- Implementation of rule engines to monitor suspicious financial transactions
- Implementation of rules for Anti Money Laundering alerts, through network analysis and other techniques.

Way Forward

Technology, in combination with vastly expanded data sources, is combining to provide the foundation for tremendous advancements in the application of big data insights in the financial services industry. Analytics and use of big data have the potential to radically reshape the old patterns of banking processes.

To maintain their competitive edge, banks need to focus on continually assessing the business case for expanding their analytics activities, to encompass Big Data. There has to be integration and synchronisation of data sources to enable real-time determination of relevant data points for: 1) analysis, 2) communication, and 3) decision-making.

**CATEGORY V – USE OF TECHNOLOGY FOR FRAUD DETECTION AND PREVENTION**

The Indian Banking Sector is undergoing a transformation to Digital Banking. An increasing number of transactions are happening over the click of a button, either through smartphones or desktops/laptops. In light of the increase in electronic transactions, fraud detection and prevention has become an important area for all banks.

Banks across the country are investing in new and robust measures like secure networks, chip cards and encryption technologies to safeguard their businesses and customers. Different Indian banks are at different maturity levels with respect to their fraud prevention and detection systems, and policies.

**Highlights**

- Most of the banks have implemented centralised log management systems, which maintain system logs of all critical operations and processes
- Banks have implemented dual password access control on all critical systems. Some banks use biometric authentication
- A few large and mid-sized banks have deployed self-learning processes to detect and prevent frauds
- Most of the large banks have fully automated processes to generate fraud MIS and reports
- Banks monitor fraud transactions at various stages i.e. origination stage, transaction stage, post transaction stage. Banks cover the entire lifecycle of any account or transaction for fraud detection and prevention.
Most of the banks have a decline rate of more than 0.05% of transactions due to fraud.

**New Initiatives**

- One of the large banks has implemented a privilege identity and access management solution, that maintains an audit trail of all user actions.
- Another bank has deployed a customer profile building solution, enabling the bank to detect anomalous transactions, based on customer profile and transaction history.
- Banks are utilising data from multiple sources; (i) unstructured data such as emails, call logs, and (ii) structured data such as industry sources, to build fraud detection models.
- Some banks are deploying specific fraud detection solutions, to check and prevent increasing incidents of fraud in ecommerce transactions.
- Some banks have partnered with network companies like Visa and MasterCard to deploy real time fraud detection solutions.

**Way Forward**

Banks need to continue to invest in developing a comprehensive fraud risk management system that will detect frauds in real time, and prevent them on the go. Although, Indian banks have taken steps to implement anti-fraud controls, there are still areas of improvement.

Banks need to implement quick fraud detection capabilities, and set up transaction monitoring processes. Fraud prevention needs to be part of the culture of the bank, and proper training needs to be given to front-end staff (customer facing staff). An important practice to follow is participation in fraud monitoring forums, through which information on frauds (prevention and awareness), is shared amongst participants. Considering the growing volume of digital transactions, banks will also need to continuously update their systems, processes and guidelines.

**CATEGORY VI - HIGH PERFORMANCE IT ECOSYSTEM**

Banks are differentiating in the marketplace in terms of service levels offered to the customers. IT assets including intelligent software and robust hardware are important elements in maintaining and improving service levels. Banks are increasingly using online tools to monitor and manage their hardware. Virtualisation of systems and leveraging cloud have now become the norm across all bank categories. Indian banks have realized the change in customer preferences and have initiated investment in IT infrastructure to upgrade their systems. Many banks have taken up initiatives in the past few years to scale up their capabilities and provide faster and secure service to their customers. Investment in IT infrastructure is expected to continue as banks build capabilities and thwart competition from FinTech companies and NBFCs.

**Highlights**

- Majority of the banks have a fully automated mechanism to track the availability of IT infrastructure, its ageing and replacement.
- Banks have implemented capabilities to manage IT infrastructure remotely, without compromising on security.
- IT systems of most of the large and mid-sized banks are interoperable, and compatible with multiple platforms.
- A majority of banks have undertaken multiple initiatives in the last three years in areas such as security, AI, machine learning and improving connectivity to branches.
- Public sector banks spend a higher amount of their IT budget on network and infrastructure, while private sector banks spend more on software licenses.
All the banks have well laid out IT policies and procedures. A majority of the banks have feedback and improvement/change mechanisms in place, for IT policies and procedures.

Most of the banks have tailored their business continuity policies (BCP) on the lines of international standards.

A majority of the large banks utilise cloud and virtualisation to optimize usage of technology infrastructure. They also utilise advanced tools such as VMware, VCOps, and Microsoft SCOM to monitor utilization.

Most of the banks across segments (Large, Midsize and Small) are focused on training to develop in-house capabilities and to enhance returns on IT infrastructure.

New Initiatives:

Some banks are using "Internet of Things" (IOT) technologies for Data Centre “Power Usage Effectiveness” (PUE) optimisation.

Banks are utilizing "Smart Cloud Control Desk" (SCCD) to compile and reconcile IT assets (hardware and software).

A few banks are using automated AI enabled tools to get insights into the functioning of systems. These include, understanding the resource consumption, usage patterns, capacity management, fault detection and, early warning signals, etc.

A few banks are implementing “Lending Automation and Processing System” (LAPS), for automated processing of retail, agriculture, and corporate loan proposals.

Banks are also implementing an automated DR workflow to switch over to an alternate site, without any manual intervention, thereby avoiding any chances of human error.

Some banks are extensively using virtualisation to reduce dependence on physical servers. One of the banks reported 80% reduction of physical servers due to virtualisation.

Way Forward

Indian Banks have taken a number of steps to upgrade their IT systems and improve scalability. However, customer preferences are changing continuously, and they expect better and innovative services. Thus, banks need to take a futuristic view while planning for IT assets.

Banks need to invest in new technologies such as AI and machine learning to cater to changing customer preferences. Further, banks need to continuously train their employees to enable them to take forward the bank’s initiatives centered on improving customer satisfaction.

CATEGORY VII – CYBER SECURITY AND DEFENSE

Banking is increasingly taking place online. Banks can offer increased access and convenience to customers because of digitisation of transactions; however, this has also opened the door to online security risks. A number of gaps in cyber security protection and infrastructure in the banking sector surfaced in 2016. The year saw an increased number of attacks (ransomware attack, hack on ATM switch server, etc.) on banking systems.

Understandably, at numerous banks and financial institutions, chief risk officers have identified cyber threats as their top priority for 2017. This issue has been moved to the forefront of bank’s board meeting agenda, and senior managers are acting fast to mitigate these growing threats.

While a lot has been achieved, India still needs to raise the bar by way of a strong cyber security framework in Financial Institutions (FIs). Putting in place an effective cyber security methodology, i.e. combination of defence, resilience and assurance mechanisms, is critical. It is essential that companies protect their data centres, network perimeters, and end points (including ATMs). With the increasing
number of partnerships between banks and FinTech companies, there is a strong business case for FinTech companies to focus on cyber security.

**Highlights**

☆ Some of the large and mid-size banks are allocating as much as 10% of their IT Budget towards cyber security initiatives

☆ Banks are implementing cyber security governance frameworks (involving governance, implementation and assurance), and setting up dedicated Information Security committees

☆ Majority of banks have reported an increased involvement of bank’s top management teams in IT Security meetings

☆ Most of the banks have set up centralised Security Operations Centre (SOC), built on SIEM technology. Real-time threat intelligence feeds from the global communities into the SOC. Banks also ensure that SOC is staffed with skilled resources

☆ Banks are building security metrics with measurable indexes to assess the effectiveness of defense mechanisms that are being undertaken

☆ Periodic trainings for staff in the form of e-learning, emails, sessions with experts, role based training, are being undertaken to keep staff abreast of latest threats, controls and, new technologies

☆ Banks are taking up initiatives to raise awareness among customers through e-mails, ATM screens, social media, mobile applications, and are issuing security tips on charge slips, banners, etc.

☆ Procuring cyber security insurance is another method used by banks in protecting against liabilities on account of cyber-crimes and losses

☆ Some banks are organising Hackathons, where they encourage developers, start-ups and students, to come up with innovative ideas and solutions for the banking sector in the field of cyber security

☆ Banks are undertaking initiatives focused on new technologies such as Predictive Analysis, FinTech/Blockchain, IOT etc., to strengthen their cyber security programme.

**Usage of Tools & Technologies**

Following is a brief list of initiatives and technologies that banks have adopted to reinforce security of their IT systems:

☆ **Infrastructure Protection**
  - “Next Generation Network Intrusion Prevention System” is used to prevent against advanced threats and attacks on the network
  - “Host Intrusion Prevention Solution” on Critical Servers is used for real-time detection of security events occurring in the server environment, for proactive intrusion prevention
  - “Identity and Access Management System” is used to initiate, capture, record, and manage user identities, and related access permissions
  - Encryption of laptops and critical devices has been undertaken as a policy.

☆ **Information Protection**
  - “Data Loss Prevention” while in use (end point actions), in-transit (network traffic), and at rest (data storage), is being given high priority
  - “Information Rights Management Solution” using DRM (Digital Rights Management – a software that enforces security policies for documents through encryption), has been implemented
  - Encryption of Critical Data at Databases has been undertaken.
Access Control and Security Monitoring

- Comprehensive "Vulnerability Management" and "Penetration Testing" programs, including "Application Security Testing" for Mobile / Web Applications
- "Web application firewall (WAF)" for the HTTP applications - detects and blocks application level attacks
- "Security event monitoring" (SIEM) system solution for log collection and analysis from servers and devices – the collectors forward events to a centralised management console, which performs inspections and flags anomalies.

Way Forward

Banks need to consistently provide assurance and confidence of dealing with a secure bank to its customers and investors. To achieve this, they need to make the necessary security changes, and allocate significantly larger resources (capital and manpower) towards cyber security initiatives.

Banks need to improve responsiveness to cyber-attacks by improving security infrastructure, process, and be up to the curve in terms of global security standards. Proactive detection and isolation of cyber threats will help maintain "Business as Usual".

CATEGORY VIII – INNOVATIVE USE OF TECHNOLOGY

Next Generation Banking is about achieving customer delight by delivering a rich customer experience. This can be achieved through the use of innovative technology solutions. The key to success is the ability of technology to deliver hyper-customised experiences to its customers. Another dimension is ensuring customer's trust with the highest level of security.

Globally, financial institutions are leveraging many cutting-edge technologies. The launch of mobile-only banks, contactless payment cards, use of gesture and voice recognition for securing transactions, are a few innovations that banks have introduced.

Biometrics, Blockchain and Robotics, powered by Artificial Intelligence & Machine Learning are some of the upcoming trends in the Indian banking sector.

Some innovative uses of technology by Indian banks are:

- **Deployment of Intelligent Robotic Assistant (IRA) in branches to service customers:** The robot can sense the presence of the customers, greet customers, provide service related information to the customer, and guide them personally to their respective counters for the application/registration process.

- **Adoption of Robotic Process Automation (RPA):** RPA helps banks to transform repetitive back office and front desk operations, thereby improving business performance. For e.g. issuance of credit card has become an 8-10 second process at the back-end due to the adoption of RPA.

- **Detecting and preventing fraud using location look up technology:** Bank is able to map customer location, using customer’s mobile phone against the location of the transaction and detect any anomalous transaction.

- **Deployment of chatbots:** Banks are deploying natural language processing based Artificial Intelligence chat bot on Facebook messenger, which provides e-commerce services. Chat bots can also be configured to provide banking transactional services.

- **Use of software robotics:** Banks are using robots that emulate human actions to automate and perform repetitive, high volume and time consuming business tasks. Some of the tasks cut across multiple applications. Software robots reduced the response time to customers by up to 60%, with increased accuracy. One bank is
using robots for over 200 business process functions across the organisation, including retail banking operations, agri-business, trade & forex, treasury and human resources management among others

- **Blockchain technology**: One bank is using Blockchain technology in vendor financing to optimize the working capital cycle. The technology has enabled real-time capture and authentication of information from different sources, thereby reducing processing time and enhancing working capital management.

Another bank is focusing on digitisation and incorporating customer data in blockchain, to protect such information.

**Way Forward**

Customer preferences and corporate business models have changed drastically in past few years, and it is important for the banks to realign themselves with the new landscape. Redefined corporate and customer strategy should drive innovation. This alone will lead to the successful implementation of NextGen Technologies in Banking.

Robot advisory is one of the technologies that can help increase customer touch, offer consistent & unbiased advice, and reduce human resource cost. Virtual and Augmented Reality can take customer experiences to a new level. Internet of Things (IoT) though in the nascent stage, is going to be another revolution in the making, especially with its promise to integrate into customer’s daily life and decision making.

Globally, there are an estimated 2.51 billion users of social networks (250 million from India alone). Therefore, social media should be a part of any innovation strategy to have an impact at scale.

In addition to customers in the upper half of the income pyramid, banks need to use innovative technology solutions to provide low cost and secure banking to customers at the bottom of pyramid.

**Initiatives by Indian banks during demonetisation period**

Digital Payments has been growing significantly in India, even before the Government’s November 2016 move of “Demonetisation” of high value currency notes. Demonetisation gave digital payments the much needed momentum and substantial push.

**Technology initiatives undertaken by banks during demonetisation period**: To ensure smooth transition of currency, Reserve Bank had instructed banks to put sufficient infrastructure with sufficient checks and balances. Banks in collaboration with regulatory and industry bodies, quickly responded to the need of the hour and deployed multiple delivery models of digital financial services such as Bharat Interface for Money (BHIM) app, Aadhaar-enabled payment system (AEPS), cards, wallets, USSD, UPI, India QR code, POS, mPOS and other pre-paid instruments. Some of the major technology interventions during this period were:

- **Banks deployed new POS terminals at merchant locations on a war footing to increase digital payment adoption**
- **Some banks waived Merchant Discount Rates (MDR) in this period. This encouraged POS adoption and, in turn, digital transactions. This additionally incentivised merchants to convert cash transactions to digital transactions**
- **Instant account opening was facilitated at branches, bringing more people in the banking net**
- **Initiatives with respect to on boarding customers to mobile banking platforms, significantly added volumes to digital transactions**
- **Banks launched a multitude of e-payment methods: QR code, e-wallets, NFC based debit cards, etc. Apps launched by these banks**
enabled collecting payments through UPI, debit/credit cards, net banking

* Banks updated bandwidth of rural branches, enabling faster and frictionless digital transactions
* Aadhaar based app for merchants was launched to enable merchants to carry AEPS transactions
* Few banks tied-up with State Governments to create an Aadhaar Enabled Payments Distribution system, leading to higher number of transactions through digital mode
* Suitable capacity enhancements were carried out by banks, to cater to high transaction volumes.

Way Forward

Post demonetisation, the effect on digital payments adoption has been slowing down, and use of cash has resurfaced. Following initiatives can help in transitioning India to a truly digital financial economy:

* **Increasing customer awareness:** Cash transactions are still prevalent in rural and semi-urban geographies, banks need to step up efforts to increase customer awareness especially in these geographies

* **Expanding digital payment acceptance ecosystem:** Acceleration of digital adoption at micro and small merchants, is a key success factor in realising the vision of a less cash society. Multiple delivery models of digital financial services across touchpoints such as Kiranas, Schools, and Hospitals, etc., need to be developed

* **Enhancing security levels of digital transactions:** Comfort and trust will have to be enhanced in financial transactions to reduce the “what if?” scenarios. Cyber Security is an important consideration in driving large scale adoption of Digital Financial Services (DFS).

The government, regulators, banks, and technology companies have to work in collaboration for India to transition to a truly cashless economy.

(This report has been compiled by Deloitte Touche Tohmatsu India LLP (DTTILLP) as the Knowledge Partner for IDRBT Awards).
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