Dynamics of Technological Evolution in Indian Banking

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Technology offers enormous potential and opportunities to the Indian Banking sector. Rapid technological diffusion and entry of non-banking entities like fintechs, bigtechs and e-retailers into financial space have left no scope for Indian banks to delay and deny technological innovations. Given massive technological disruptions in Indian Banking, it is difficult to directly assess the contribution of technology to the performance and profitability of Indian banks. The technology-driven value proposition has eased the process of banking service requirements of customers. The study has administered a survey to understand the customers' acceptability of the new banking technologies. It is seen that customers' demand for convenient and omnichannel seamless services has increased in recent years. Despite the strong rise of the digital footprint of Indian banks, customers prefer human interaction over machines. Although technology is considered as a great customer-centric enabler for banks to induce innovation, from customers' point of view, it is not the technology that fascinates them, rather the security and personalised services. As Indian banking has now moved to a new era where investment in competitive and innovative technologies is a new reality, banks need to create public awareness about these latest technologies and handhold the customers to adapt to the digital journey through personalised services with a human touch.

Keywords: Adaptation; Innovation; Technology; Digital Payments; Sampling

JEL Classification: O31, O31, O33, O38, C83

Section I

Introduction

To uplift the Indian banking standards at par with the international best practises along with increased efficiency, flexibility and competition in the
system, the entry of technology was inevitable post-economic liberalisation of the early 1990s. The entry of new private banks further deepened the use of technology in Indian banking. In search of new revenue sources, banks have ventured into investment banking, insurance, credit cards, mortgage financing, depository services, etc. which compelled many existing private and public sector banks to adapt to technological disruption. The role of banks has undergone a tremendous shift from mere intermediation to being a service provider of various financial products under one roof. To meet the growing customer demand, the technology-driven value proposition has eased the whole array of banking services to customers. It has proved to be a great customer-centric enabler for banks to induce innovation. Rapid technological diffusion and entry of non-banking entities like fintechs, bigtechs and e-retailers into financial space have left no scope for Indian banks to delay and deny technological innovations.

Under such a dynamic and fast-changing banking environment, it is imperative to assess the present technological disruption and innovations. Hence, the study is an attempt to understand the dynamics of technological evolutions in Indian banking and customer assessment of such disruptive technologies. The organisation of the study is as follows. The current section explains the importance of technology and how it has been introduced in Indian banking. Section II presents technological adeptness in Indian Banking. The evolution of various technologies in Indian banking is presented in this section. Section III deals with the major drivers of technology in Indian Banking. The demand, as well as supply factors in support of tech innovation in Indian banking, are presented in this section. Section IV describes the measurement issues with technology-driven growth in Indian banking. Technological investments by global and Indian banks are presented in Section V. Section VI analyses the survey findings where customers' assessment of various banking technologies are presented. Section VII presents the promising technologies that Indian banks are exploring to and Section VIII concludes the paper.

Section II

Evolution of Technology in Indian Banking

Introduction of technology in Indian banking can be traced back to 1960s when mechanised banking was introduced. Later in the 1970s and 1980s, computer-based banking, as well as computer-linked communication-based banking was introduced, respectively. The first major banking technology adoption in Indian banking came with the use of Advanced Ledger Posting Machines (ALPM) in the 1980s where RBI advised all banks to go for huge branch computerization. Subsequently, Dr C Rangarajan headed committees in 1984 and 1989 eased out the way for large scale introduction of technology in Indian banking. Subsequently, in 1994, the committee on 'Technology Up-
gradation in the Banking Sector' made several recommendations in favour of technology use.

Technology has enabled the efficient, accurate and timely management of the increased transaction volume that comes with a larger customer base for the second most populated country in the world. In the automation process, computerisation played an important role, starting from the back-office automation process to branch automation and migrating from Bankmaster software to Core Banking Solutions (CBS). Implementation of CBS is the major step that deepened the usage of technology substantially in Indian banking. It enabled banks to launch new products and services targeting specific customer segments. Later, the penetration of technology in Indian banking has come out in the form of improved customer convenience by offering anywhere and anytime banking services. ATM, internet banking and mobile banking are the outcome of such processes.

In the technological advancement process, Indian banking has worked to optimise the customer experience. Implementation of electronic clearing system and electronic funds transfer facility have provided faster funds transfer and settlement for the customers of different banks and different centres with minimum time. Additionally, the penetration of internet and mobile in the country has been a great enabler to the banking sector in terms of digital banking. However, technological advancement in Indian banking has not only empowered customers, but it also has increased the ability of banks to efficiently collect, store and use valuable information about their customers. The
technological investment has augmented the use of the banking services by the mass populace as banks now can easily handle a large number of transactions economically which has reduced the cost of service offerings.

Besides the customer interfacing electronic channels, Indian banks have implemented many centralised innovative processing centres like centralised loan processing hubs, trade finance central processing hubs, liability central processing hubs, pension processing hubs, cheque processing hubs, etc. which are based on information technology edifice. Such centralized processing centres have been able to handle a huge volume of customer and business data. This has helped branches to operate on the thin model and able to convert into efficient customer-centric sales and service outfit.

The Working Group on ‘information security, electronic banking, technology risk management and tackling cyber fraud’ chaired by Gopalakrishna (2010) has emphasised the need for a proper mechanism to control risk and compliance associated with technology adoption by Indian banks. The committee had rightly pointed out that banks need to carry out due diligence concerning new technologies since they can potentially introduce additional risk exposures. The committee was very clear in iterating that “provision of various electronic banking channels like ATM/debit cards/internet banking/phone banking should be issued only at the option of the customers based on specific written or authenticated electronic requisition along with a positive acknowledgement of the terms and conditions from the customer. A customer should not be forced to opt for services in this regard. Banks should provide clear information to their customers about the risks and benefits of using e-banking delivery services to enable customers to decide on choosing such services”. Apart from customer acceptance of new technologies, the committee has rightly presented associated risks due to technological evolution in the banking system. Though Indian banks have aligned their Information Technology (IT) policies in line with the Gopalakrishna Committee Report, individual banks are even dealing more cautiously with third-party service providers while sharing critical information about customers.

In a nutshell, technological innovation has facilitated speedy processing and transmission of business information, provided easy access to the data for marketing of banking products and improved access to banking service to customers. The huge range of services including diversification of product range, broad-based product development, and opening up of new service channels have only become possible due to technological advancements.
Section III

Demand Drivers of Technology in Indian Banking

A growing economy with huge demands entails larger lending prospects which necessitate the need for consistent innovation in banking space. A paradigm shift in bank financing through innovative products and mechanisms involving constant upgradation and revalidation of the banks' internal systems and processes is essential in this regard. To bring new customers into their fold, while retaining the existing ones, the banks have to be sensitive about the customers' needs and requirements. Driven by the financial inclusion agenda, the scope of mass banking has increased tremendously. These newly boarded customers deserve numerous other services from banks apart from opening bank accounts. To meet the requirements of this vast customer base, banks need to well equip themselves with the latest technology to serve the needs of those unbanked as well as the underbanked segment.

It is important that the success of mass banking in serving the socio-economic objectives largely depends upon the willingness of the banks to innovate and reform their business processes for this cause. However, the success of the banking in driving the growth of the sector in coming days would depend upon the capacity building of the banks to meet the challenges and make use of the opportunities profitably.

Some of the fundamental drivers of technology in Indian banking are:

(a) Financial Inclusion Initiatives: The flagship digital India initiative of the Government of India has the vision to transform India into a digitally empowered society and knowledge economy. The JAM (Jan Dhan, Aadhaar, and Mobile), an initiative of Government of India has brought all India under a common financial, economic and digital space. India is home to more than 1.18 billion mobile subscriptions. Various studies[1] have claimed that mobile offers the cheapest mode of banking. Mobile banking transaction costs about 2 per cent of the bank branching cost, 10 per cent of ATM-based transaction and 50 per cent of the internet banking cost. Hence, mobile phone and internet are two basic foundations of digital transactions. Apart from these two, physical infrastructures including seamless electricity connection and robust mobile networks are the other key requirements. Though India has made significant progress in internet usage front, internet infrastructure is not as strong in the rural area where it is desired the most, as 68.8 per cent of Indian population lives in rural area[2]. The India Internet 2019 Report by Nielsen and Internet & Mobile Association of India (IAMAI)[3] shows that there is a clear rural-urban divide in internet connection. As of September 2019, internet penetration

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among 12+ yrs population in urban India (51 per cent ) was two times higher in comparision to rural India (27 per cent ). To have a successful digital India, it is imperative to bridge the urban-rural divide in internet infrastructure. As per the Global Findex data, among the 1.1 billion unbanked adults globally, 102.9 million are from India. To include the mass unbanked into the financial mainstream, technology is the only solution and cost-effective way. The flagship Bharat Net programme and Deen Dayal Upadhyaya Gram Jyoti Yojna are expected to act as positive enablers in connecting the mass unbanked.

(b) Promotion of Digital Transactions: Introduction of Digital Payment Methods by the Government of India to convert India into a less-cash society is inviting many new technologies to the banking space. Digital services like Rupay, Visa, Master, USSD, BHIM, Aadhaar enabled payment system, UPI, etc. are all technology-based. Use of Financial technology by Indian banks have increased manifold in recent years. Mobile wallets, the point of sales, Micro ATMs, internet banking, and mobile banking are some of the new banking channels popularised recently.

(c) Favourable Demography: Favourable demography is to reshape future banking. Life expectancy has been increasing in the country due to improved medical facilities and rise in per capita income. The average life expectancy at birth in India has gone up from 63.5 years in 2003 to 67.9 years in 2014, which further increased to 69 years in 2017 (World Bank). Increasing life expectancy will not only require individuals to change their financial behaviour to fit into a more complex financial requirement but also the banking industry will be required to provide new financial products and invest in new systems to cope with the fact that people live longer. Favourable demography is helping India to reap the benefit of demographic dividend. India has one of the youngest population in an ageing world. The median age in India is just 27. As the number of internet users set to reach 250 million by 2020, the promotion of internet services as an extensive, low-cost and convenient innovative online service is going to be in demand. Use of technology reduces the pressure of incremental rise in the volume of transactions and rise in the number of customers. The system would not feel the presence of such a large number of transactions unlike in the manual mode where the physical queue always posed discomfort. Thus, taking the help of technology, banks are fast moving from 'brick & mortar' banking to digital banking, though physical banking is going to stay in India due to the unique nature of Indian banking and its varied demographic pattern.

(d) Cost-Effectiveness of Digital Banking: India is a rural dominated economy. As projected by McKinsey, the real annual disposable household income in rural India is expected to grow at a CAGR of 3.6 per cent over the next 15 years. Rising incomes are expected to enhance the need for banking services in rural areas and, therefore, drive the growth of the sector. Customer expectations, regulatory requirements, changing demographics and greater competition have created a compelling environment to change. To meet these
challenges, banks need to radically innovate and transform themselves to be in readiness for the uncertain future. The use of technology has enabled service providers to offer competitive services at a low margin. An earlier study by Indian Institute of Banking and Finance (IIBF) has even pointed out that per transaction cost in the branch on an average works out to Rs. 40 while in ATM it is Rs. 17. Through the call centre, the cost is still cheaper at Rs. 8. It comes down to Rs. 2 per transaction in net banking and is only 50 paisa in mobile banking. Greater the number of customers migrate to alternative delivery channels, more will be the reduction in costs. Hence, leveraging technology will be a critical differentiator for the banks to innovate and optimise costs.

(e) **Offering Personalised Services:** Banks are working on enhancing customer experience. Customers’ life cycle requirements are getting integrated with Customer Relationship Management (CRM) application and suggestive products and services are advised through message, email, etc. For instance, at the age of 25 years when they are passing out from colleges, they are offered credit cards and mutual funds; at around 30 years on marriage time they need life insurance, car loan, investment products etc.; at around 35 years they need housing loan, at 40 years they need personal loan to go on world tour, education loan for their kids at 45 and likewise at 60 years pension and reverse mortgage products to maintain their lifestyle. Customized products with different socio-economic needs of customers from different age groups and different places like metro, urban, rural on the digital platform are enabling the banks to reach maximum customers in far-flung areas. Product innovations based on technology is the key to future banking success.

(f) **Competition from New Entrants:** Arrival of Payment banks and Fintech companies have made the existing banks to be agile and acquire new technologies to introduce new approaches to serve the customers. Banks are busy with continuous innovation and product designing supported by new processes to retain their customers. Banks have implemented digital banking – POS, MPOS, Mobile/Tablet Apps, mobile wallets, and social media to capture the valuable information about the younger generation. Augmented by changing consumer behaviour and Fintech-friendly government initiatives, tech giants like Google, Amazon, Facebook and Apple have started penetrating the Indian financial sector by infusing digital innovations in various dimensions of customer services.

(g) **Rising Frauds:** The intensification of digital transactions has led to many frauds and in the process, banks earned bad reputations. There has been a spurt in the number of incidents of organised cybercrimes. This is cause of concern to the banks and the Regulator, reiterating the necessity for a robust cybersecurity mechanism. Banks have started using Artificial Intelligence for fraud monitoring.
(h) **Enticing Customers**: The technology investment trends have now changed from the earlier focus on internal applications to more on inter-operable apps like UPI, BHIM, Aadhaar pay, etc., where the customer of one bank can easily push/pull/request money from customers of other banks. Collaboration among banks and Fintech players are growing, with user-friendly and simple digital applications playing a major role in attracting and retaining customers.

### Section IV

**Assessment of Technology-Driven Growth**

Some of the earlier studies on technology-related growth of Indian banking have assessed the contribution of technology investment to total output based on certain indices or regression techniques. Study by Bansal (2015) has prepared a technology index using the discrete technology parameters including

- (a) number of ATMs;
- (b) number of computerised branches;
- (c) number of credit cards;
- (d) number of internet bank branches;
- (e) number of mobile bank branches and
- (f) number of tele bank branches.

However, in reality, it is not justified to assess the contribution of technology to banking sector growth by a few such indicators. These technology parameters are not the true parameters of today's technology use by Indian Banks. Indian banking has now moved to a new era, where investment in competitive technologies such as data analytics, cloud computing, blockchain technology, artificial intelligence, cybersecurity, robotics, automation, NLP & language support, humanoids, holographic banking and robo-advisory, voice and chatbot etc. is a new reality.

At the same time, most of the Indian banks barring a few though have entered the new technological dimensions of banking, are yet to fully explore the above mentioned technologies. Hence, it is highly unfair to assess the contribution of technology to the performance and profitability of Indian banks. As most of the banks who have adopted these technologies recently are yet to see the full outcome of such investment, given a considerable gestation period for such advanced technologies. The subsequent section of the study discusses some of the important technology investment by major private and public sector Indian and global banks.

**Technological Investment Trend by Global Banks**

The global banking industry is currently facing major challenges both at supply as well as the demand side. From the demand side, constraints such as tight regulatory compliance, cost optimisation, becoming more agile, providing a satisfying user experience, etc. are gathering momentum. However, from the supply side, the threat of disruption by fintech and bigtech companies and other specialised service providers are intensifying. While banks are still transforming their IT systems to cope efficiently with current requirements,
new technology-backed entrants are putting even more pressure on incumbent operators to rethink their business model and banking platform to survive. Banks have been adopting the latest technologies and introducing several products and applications to improve customer convenience and to serve them in digital platforms.

Globally, banks are investing heavily to upgrade their IT systems, protect their data, and improve mobile banking and other digital customer experiences. The Digital Banking Report Survey 2017 has highlighted that cyber and information security-related technology investment has taken the center stage worldwide by banks, followed by advanced analytics and big data. As per the report by Celent (2018), the technology-related spending of global banks is rising at a very high rate. The Global IT spending of banks are expected to grow from USD 261.1 billion in 2018 to USD 296.5 billion in 2021\(^4\). The survey of Chief Technology Officers of global banks has shown an increase in IT operation expenses. Among the major global leaders, Bank of America has allocated nearly USD 16 billion for global technology and operations, followed by JP Morgan Chase that have spent USD 10.8 billion in 2017 in technology. Citigroup Inc. has allocated nearly 20 per cent of budgeted expenses towards technology spending that translates around USD 8 billion. On average, global banks are now spending nearly 14-15 per cent of their expenses on technology.

In Gartner (2017) report on IT spending trends of global banks, in response to the question 'which technology areas do you think are most important in helping your organization differentiate and win (achieve your mission)?', BI/analytics topped the list as 26 per cent of Chief Information Officers (CIOs) voted for it, followed by digitalization/digital marketing at 21 per cent. Most of the CIOs thrust on four emerging technologies which are going to play as differentiators – Artificial intelligence (AI), a combination of application programming interfaces (APIs), legacy modernization and Internet of Things (IoT).

**Chart 2**

*Top 10 Tech Spending of Global Banks*

<table>
<thead>
<tr>
<th>Technology Area</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI/analytics</td>
<td>26%</td>
</tr>
<tr>
<td>Digitalization/digital marketing</td>
<td>21%</td>
</tr>
<tr>
<td>Mobility/mobile applications</td>
<td>11%</td>
</tr>
<tr>
<td>Artificial intelligence</td>
<td>8%</td>
</tr>
<tr>
<td>Cloud services/solutions</td>
<td>8%</td>
</tr>
<tr>
<td>Legacy modernization</td>
<td>4%</td>
</tr>
<tr>
<td>Application programming interface</td>
<td>4%</td>
</tr>
<tr>
<td>Customer relationship management</td>
<td>4%</td>
</tr>
<tr>
<td>Automation</td>
<td>3%</td>
</tr>
<tr>
<td>Omnichannel/multichannel</td>
<td>3%</td>
</tr>
</tbody>
</table>

*Source: Gartner (October 2017).*

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When the CIOs are asked about the top new tech spending by banks, most of them voted for investment in business intelligence and analytics. Planned digitalization/digital marketing is now the top priority, followed by business intelligence/analytics and cyber/information security and Cloud services/solution. This was followed by an investment in digitalization/digital marketing. Some of the other IT investment areas in banking are: Mobility/mobile applications, Artificial intelligence, Cloud services/solutions, Legacy modernization, Application programming interface, Customer relationship management and Automation.

**Chart 3**

Top 10 New Tech Spending of Global Banks

<table>
<thead>
<tr>
<th>Category</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitalization/digital marketing</td>
<td>22</td>
</tr>
<tr>
<td>BI/analytics</td>
<td>18</td>
</tr>
<tr>
<td>Cyber/information security</td>
<td>13</td>
</tr>
<tr>
<td>Cloud services/solution</td>
<td>13</td>
</tr>
<tr>
<td>Data management</td>
<td>10</td>
</tr>
<tr>
<td>Mobility/mobile applications</td>
<td>9</td>
</tr>
<tr>
<td>Networking, voice/data communications</td>
<td>7</td>
</tr>
<tr>
<td>Infrastructure/data center</td>
<td>7</td>
</tr>
<tr>
<td>Artificial intelligence/machine learning</td>
<td>7</td>
</tr>
<tr>
<td>System/process information</td>
<td>7</td>
</tr>
</tbody>
</table>

*Source: Gartner (October 2017).*

The transition of the Indian economy to a less-cash society has created many opportunities for technology investment into digital payments infrastructure. As per the report by Gartner, IT spending by Indian banks is the second most important spending source in 2017. Device spending in the Indian banking sector has grown the fastest at 20 per cent in 2017, followed by IT services at 15.8 per cent. The IT spending in Indian banking and securities firms is projected to grow at the double-digit in coming years, mainly driven by investments in digital payments infrastructure and up-gradation of existing infrastructure. The use of digital technologies is necessary to provide affordable banking services to the unbanked mass. Banks are already making a considerable investment in creating digital infrastructure to offer various solutions like mobile banking, e-wallets and virtual cards. Some of the key innovations in digital banking are digital-only/virtual banking, biometric technology, artificial intelligence, blockchain technology, and robotics.
Section V

Technological Investment Trend by Indian Banks

It is a well-accepted fact that investment in technology is critical for the existence of banks in the future. To serve the tech-savvy and aspiring millennial and Gen Z customers, banks need to invest heavily in technology to be able to meet the needs of the young customers and to offer services 'on the go'. Similarly, technology can also play an important role in NPA management by providing timely warnings as well as credit monitoring. Unified Payments Interface has been consistently ranked as the most disruptive technological innovation by the US financial services company FIS. Most of the banks operating in India are at different stages of digital readiness and are relying heavily on technology to win over the competitors.

Technological innovations are compelling banks to change their business models. As banks are now providing diversified services in several market segments, including payments services, raising deposits, lending, and investments, etc., deployment of technological innovation will be resulting in more high-grade products at lower prices. Delay by individual banks in adopting new technologies may put their business models under pressure. Loss of consumer contact and fragmentation of the value chain could then diminish banks' ability to profit from the cross-selling market. Global technology players are displacing existing financial institutions by exploiting their scale and innovative capacity. The scope of fintech is rapidly diversifying at both macro and micro levels, from providing online accounting software to creating specialized digital platforms connecting buyers and sellers in specific industries. According to the EY Fintech Adoption Index 2017, India is ranked second globally at 52 per cent, behind China (69 per cent) in the adoption of fintech services.

Some of the successful technology adoption by Indian banks in collaboration with fintechs is as follows:
### Chart 4

**An Illustration of Bank Fintech Partnership in India**

#### Public Sector Banks

<table>
<thead>
<tr>
<th>Bank</th>
<th>Partnerships</th>
</tr>
</thead>
</table>
| State Bank of India| - Ezetap: Merchant acquisition through mobile POS  
                     - Snapdeal: SME credit; Created an online real-time analytics tool to assign credit scores to sellers on the platform  
                     - Fidom: Personal wealth management app |
| Bank of Baroda     | - Alternate: algorithmic credit assessments  
                     - Power2SME: India’s first buying-club for SMEs  
                     - Fidom: Personal wealth management app |
| State Bank of India| - Uber: Instant vehicle finance to driver partners  
                     - FundsFiger: Loans and other ancillary products for MSMEs  
                     - IndiaLends: Credit underwriting, analytics and lending marketplace  
                     - KredX: Invoice discounting platform for SMEs |

#### Private Banks

<table>
<thead>
<tr>
<th>Bank</th>
<th>Partnerships</th>
</tr>
</thead>
</table>
| HDFC Bank          | - ToneTag: Proximity payments  
                     - NotifyVisitors: Marketing and customer engagement solutions  
                     - Taptix Technology: Biometric payments  
                     - Fastrack (PingPay): Multi-social payment app  
                     - mSwipe: Mobile POS  
                     - Senseforth Technologies: AI customer response  
                     - Bugclipper: Quality assurance, in-app feedback tool |
| AXIS Bank          | - Fidom: Personal wealth management app  
                     - Payoneer: End-to-end merchant-centric mobile POS |
| IDFC Bank          | - FSS: ‘Bank in a Box’ solution for payment processing, card management, e-commerce and AEPs |
| YES Bank           | - Ultracash: Sound based payment processing  
                     - Taisys Technologies (Taiwan) and NPCI: Platform to issue mobile banking SIM for financial inclusion  
                     - T-Hub (India’s largest incubator): Centre of excellence for Fintech startups  
                     - ISPIRIT: Fintech app store for Indian startups  
                     - Online remittance solution |

**Source:** Deloitte-CII: ‘Banking on the Future: Vision 2020’
Technological Progress by Largest Banks in India

State Bank of India
1. State Bank of India is the leader in digital banking in India, by embracing technological advancements. SBI spends nearly 7-8 per cent of its operating expenses on technology, far more than other Indian banks. In April 2018, SBI has partnered with South Africa-based digital infrastructure company Dimension Data to set up digital branches for enhanced customer experience for its advisory and banking services. The bank has been investing heavily in digital channels. It aims to transform itself into a digitalised organisation, supported by technology-enabled backend operations. Along with the digitalisation of consumer-facing operations, the Bank continues to invest in the automation of internal processes to improve efficiency and reduce the cost of operations.

2. SBI has launched an integrated omni channel digital platform, 'SBI YONO' as an integral part of its digital drive. This is India's first fully digital service platform designed to facilitate banking as well as the lifestyle needs of its customers through an all-encompassing B2C marketplace. Apart from banking services, the application is designed to offer other financial products including investments, insurance and credit cards. This product has been developed using the latest digital technologies.

3. The bank is also investing in potential new-age technologies like blockchain, machine learning, artificial intelligence and IoT with data and analytics as their foundation. Centres of excellence, proofs of concept and a collaborative and definitive time-bound plan with fintech companies and vendors have been put in place to harness and harvest the benefits of these technologies for greater customer engagement, enhancing the productivity of the bank and empowering its employees. The share of digital transactions in total transactions of the bank has reached 56 per cent by H1 FY20. The bank has also set up 385 tech-learning centres across the country to train customers in mobile and Internet transactions every month.

HDFC Bank
1. The Bank operates in a highly automated environment in terms of information technology and communication systems. Branches have online connectivity that enables the bank to offer instant funds transfer facilities to its customers. The Bank has been making a substantial amount of investments in technology to drive scale. It has acquired the best technology of international standards to build a robust IT infrastructure. Its corporate banking business is supported by Flexcube software, while the retail banking business is supported by Finware. All the systems of the Bank are open, scalable and web-enabled. HDFC is the first bank that has invested in a mainframe computer for the cards business.
2. The bank has tied up with e-retailers and online platforms and is offering customised and personalised deals. The bank has developed two chatbots, IRA and Eva, with help from start-ups Niki.ai and Senseforth Technologies, respectively. HDFC Bank has embraced social media for marketing and customer engagement. It is the first bank to provide bot-based social media banking services to its customers. The country's first social media banking bot, OnChat, helps customers to transact on Facebook messenger that enables customers to search, discover, confirm, and pay for services, all within the same chatbox. Using OnChat, customers can pay bills, check stock prices, recharge, book cabs, hotels, movie tickets and can do many other activities.

3. A significant portion of IT investment of the bank is deployed for building scale and security to ensure a secure and fast network available (24x7). To ensure customer convenience the bank is investing substantially in digital platforms and uses the digital channel to build the capability to improve top-line and providing instant and frictionless services to new as well as existing customers.

ICICI Bank
1. ICICI Bank has been partnering and investing in financial technology companies. The bank has set up an innovation lab and a team to conceive digital solutions. The bank has been using technology to offer micro-lending at more feasible way, improving cash management efficiency and developing a market place for corporate commercial papers and debt.

2. The bank is prioritising fintech partnership. It has set up a Rs. 1 billion funds for fintech partnerships and has partnered and invested in fintech player 'FingPay', which enables merchant-on boarding by using electronic KYC, PAN & IMPS verification. The bank has partnered with digital onboarding solution company 'Signzy' and used it for enabling the bank's current account opening application. ICICI group also holds a 20 per cent stake in Arteria, which provides supply chain solution and payment integration services to original equipment manufacturers and their supply chain network. The Bank is investing in service automation through Natural Language Processing (NLP) and Artificial Intelligence (AI). iPal, the AI-powered virtual personal assistant, handles around 1.3 million queries a month with nearly 90 per cent success in resolution. The Bank has adopted software robotics to power its operations and has deployed 750 software robotics that is handling close to two million transactions per day.

3. Investment in robotic process automation by the bank is also sizable, which is currently used for 30-35 per cent of the bank's processes. It has five mobile applications for various segments of customers viz. iMobile- its primary banking app, iPal - an Artificial intelligence-powered chatbot, iBiz for corporates and MSMEs, meraiMobile for rural lending and Pockets- the bank's e-wallet. The bank has embraced social media for marketing and is active in using Open API, innovation labs, voice-based payments, blockchain, Twitter banking.
mobile app quartet, Facebook banking app, chatbot iPal, etc. ICICI has also introduced robotic process automation, 'software robotics,' as early as September 2016 in over 200 business processes. It has reduced the response time to customers by up to 60 per cent and increased accuracy to 100 per cent, thereby sharply improving the bank’s productivity and efficiency. This enabled the bank’s employees to focus more on value-added and customer-related functions.

4. The bank first used blockchain in October 2016 to execute transactions in international trade finance and remittances in partnership with Emirates NBD, a leading banking group in the Middle East. ICICI Bank has played a pioneering role in promoting the usage of blockchain technology across banking. In 2018, ICICI Bank has launched a blockchain application for trade and remittances that have already been adopted by more than 250 of its corporate clients in the first year of its launch.

Section VI
Primary Survey Analysis: Acceptance of Banking Technology among Customers

The study has assessed the acceptance of new banking technologies among customers. For the said purpose, a survey is administered both online and offline among adults spreading over various geographies in the country. The study has deployed non-probability convenient sampling in the selection of sample units. Feedback obtained through questionnaires is analysed below.

The feedback has been obtained from a diversified group of customers with a fair representation of each of the age groups. Out of a total of 325 respondents, 70 per cent were millennials/Gen-Y (those were born between 1980 and 1996) and Gen-Z (born after 1996) together. Gen-X (born between 1965-1976) and Baby Boomers (born between 1946-1964) were 23 per cent and 7 per cent, respectively. Similarly, categorisation of respondents by geography shows that 32 per cent of them were from rural area (population < 10,000), followed by 29 per cent from semi-urban area (10,000 ≥ 1 lakh), 20 per cent from urban area (1 lakh ≥ 10 lakh) and 19 per cent from metropolitan area (≥ 10 lakh).

Chart 5
Respondents Classification: By Age Group & Geography
The technological disruption in Indian banking and the effort to bring the mass unbanked under the formal financial net is built on leveraging mobile technology. As per the latest World Bank data (2018), India currently ranks second in the World having over 1.18 billion mobile subscriptions, after China (1.64 billion). Despite being the second-largest mobile user in the world, India is yet lagging behind many African low-income countries in the usage of mobile banking.

As per the latest Global Findex (2017), only 5 per cent of Indians accessed a financial institution account from their phone or the internet, and 2 per cent of the population owned a mobile money account in India in comparison to sub-Saharan Africa, where 21 per cent of adults had a mobile money account in 2017. Similarly, the usage of digital payment channel is widespread with 97 per cent of adults in Kenya making a digital payment in 2017 and 60 per cent in South Africa, against a mere 29 per cent in India. The successful experience of some of the African economies shows that even featured mobile phones are sufficient to carry basic mobile money accounts related transactions. But in India, the practice of carrying out banking activities using featured mobile phones are limited.

To understand customer preferences in the usage of banking channels, the respondents are asked to share their preferred banking channel for day-to-day banking transactions. 38 per cent of respondents preferred bank branches for routine banking activities, followed by alternate channels like ATM/CDM/ Cash recyclers/ passbook printing machines, etc. (31 per cent), mobile/app-based banking (18 per cent) and online banking (13 per cent). The dominance of branch banking, as well as alternate channel banking, shows the respondents preferences towards physical banking. However, age-specific analysis shows that Gen-Z, as well as Gen-Y customers, prefer app-based banking (39 per cent), followed by internet banking (28 per cent), and branch and alternate
banking channels (33 per cent together). This shows the preference for convenient banking among new gen customers.

Chart 7
Preferred Banking Channel of Customers

The finding of the study is in line with the latest Global Findex report of the World Bank that presented strong preferences towards physical banking channels among Indian customers. Indian customers prefer human interaction over the machine for financial transactions. As per the Global Findex report 2017, 54 per cent of customers in India prefer to withdraw cash from the bank teller, followed by 33 per cent from ATMs.

Chart 8
Preferred Mode of Cash Withdrawal Among Economies

Source: World Bank, Findex Database 2017
In India, the inclusion of mass unbanked into the mainstream has made it difficult for banks to provide quality service at branches as the growth of physical and human infrastructure are limited. This is resulting in overcrowded branches in semi-urban and rural areas. It has been a constant endeavour of the banks as well as the Regulator to divert the traditional deposit, withdrawal and passbook printing related services to alternate channels.

As banks have gone digital and are offering various banking services via online platforms, the study has attempted to understand the proportion of mobile (smartphone) users who prefer to carry out financial transactions using their mobile phones. Out of 142 smart mobile phone users, 35 per cent of respondents use smartphones for accessing entertainment and social media, followed by 26 per cent who use mobile phones for bill/utility payments/money transfer/remittance services, and 24 per cent of respondents use mobile phones for e-commerce activities. The significant share of carrying out financial activities via mobile phones clearly shows the growing importance of digital banking.

**Chart 9**

*Customer Preferences for Financial Transactions via Mobile Phones*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entertainment &amp; Social Media</td>
<td>35%</td>
</tr>
<tr>
<td>Bill/Utility Payments/Money Transfer/Remittance Services</td>
<td>26%</td>
</tr>
<tr>
<td>E-commerce (Booking of Tickets/online Shoppings etc.)</td>
<td>24%</td>
</tr>
<tr>
<td>Health/Travel/ Leasing etc.</td>
<td>10%</td>
</tr>
<tr>
<td>Purchase of Mutual Funds/Insurance/Shares Etc.</td>
<td>5%</td>
</tr>
</tbody>
</table>

Given strong efforts by the banks to migrate customers to low-cost digital channels, the study has tried to understand customer preferences for both branch and digital banking in the coming days. Nearly 75 per cent of the respondents felt that branch banking will still be important and relevant in future. This observation is in line with customer feedback on some of the advanced economies. The study by Fiserv among the customers of the USA claims that 44 per cent of customers prefer branch banking. The same study has presented that though 60 per cent of transactions are now digital, 80 per cent of sales activity still occurs at the branch. It indicates that customers though prefer doing banking activities over digital channels, they prefer human interaction over machines while buying financial products or services.
Given the strong demand for brick and mortar banking in India, the study tried to understand which attribute of a bank, the customer values the most. It is seen that trust is valued by most of the customers, followed by personalised customer service and simplified product and processes.

Having known that a significant proportion of Indian customers have recently shifted to digital banking, the study tried to find out the important factors that prompt customers to get engaged in digital banking channels. It is observed that customers give importance to the security features of the online banking.
platform than any other attributes. Nearly, 38 per cent of the respondents opined that enhanced security feature is the most important factor encouraging customers to opt for digital banking. This was followed by 25 per cent of respondents believing that speed and simple interface are the important factors for increased digital transactions. Prompt customer service and offers and deals are favoured by 20 per cent and 17 per cent of the respondents, respectively.

The study has attempted to assess preferences of the customers while selecting banking partner based on technology. Nearly 80 per cent of respondents disagreed to the question of whether they will prefer having relation with a bank based on technological advancement. What customer prefers is convenient and secure banking. They are not concerned about the technology supporting these services. They evaluate the technology quotient of banks based on the digital interface customers are exposed to including: internet banking speed, the uptime of alternate channels (ATM, CDM, Cash recyclers, check deposit machines, etc.). The technological assessment of customers regarding banks is fully biased towards the safety and efficiency of the delivery mechanism.

During the survey, when customers are asked to share their opinion towards some of the advanced banking technologies including: blockchain, artificial intelligence, robotic process automation, chatbots, big data and analytics, cloud computing, open banking, wearables, etc., it is observed that many customers do not appreciate the advanced technologies much as they correlate advanced technology with number of online frauds. Customers are very much sensitive about the safety of their money with banks. When they are asked to rank some of the factors they seriously consider in building or terminating banking relationship, internal frauds where staff is involved, is voted as most sensitive factor customer considers while changing a banking partner. This was followed by frequent unauthorised transactions or disputes and quality service offered across channels. Service quality and proximity are identified as third and fourth important factors that customer considers in building or terminating banking relationship.

**Section VII**

**Where Indian Banks to Invest in Future**

The average age of an Indian will be 29 years by 2020. The young customers are technology savvy, always connected and looking for a personalised, contextual experience with real-time online information. As per the predictions of Boston Consulting Group (BCG), the cell phone penetration in the country is expected to reach 85 per cent and the rise of the middle class will add to the number of households with high-speed internet connectivity. Banks are well acknowledging this trend and almost all banks are in the process of rolling out or have rolled out online, mobile and social banking extensions to their
core offerings to respond to this changing demographic conditions. Several banks have deployed best in class online and mobile banking features including personalisation, bank-wide customer relationship views and cross channel integration. Convenience and frictionless banking are going to be the new norm. As reported by Avaya, 51 per cent of Indians use online banking channels and 26 per cent prefer to access services through their bank’s website and the same number prefer to use a mobile app rather than talk to a human agent. As per the report by Facebook and The Boston Consulting Group, the number of users opting for online banking is expected to double to 150 million by 2020 from the current 45 million in India. This is going to increase the demand for digital services by customers.

Some of the new potential technologies, where some of the Indian banks are already started investing and may invest more in the future are:

**Blockchain:** As acknowledged by World Economic Forum, investment in blockchain holds great promise in the future. Banks can use blockchain for data sharing, to build transparency and brand loyalty for the digital bank, while it streamlines the financial process. By educating customers on their banking journey, Blockchain is set to change the way customers will interact with their bank. Blockchain technology can be used in banking activities like secure document management, reporting, payments, treasury and securities and trade finance. HSBC has executed the first trade finance transaction using blockchain.

**Artificial Intelligence (AI):** Artificial Intelligence is the blend of three advanced technologies – machine learning, natural language processing and cognitive computing. AI provides quick and personalised services by dealing with each customer and focusing on their specific requirements. Banks can make better and quicker decisions using AI tools such as chatbots, machine learning, and even robo-advisers. Indian banks are likely to use AI like machine learning to re-engineer back-office processes.

**Robotic Process Automation (RPA):** Robotics is a technology that mimics the actions of human performing simple rule-based processes. Using RPA, processes that are rule-based and repeatable can be automated within the digital bank. The use of robotics in the Indian banking sector though not yet widespread is expected to gain ground in the coming years. Robotics is expected to automate repetitive processes, rule-based and require less human judgement. Canara Bank has already deployed two robots named Mitra and Candi for customer service.

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**Big Data and Analytics:** This has helped banks to onboard new customers and cross-sell products efficiently. Banks are using big data for campaigns with existing customers to understand them better, using the information available in their database. Once they understand customers better, they can cross-sell. Simultaneously, using the customers' transaction profile, banks can identify fraud and do risk management analysis.

**Cloud Computing:** This allows for asset-light models with a lower cost of transactions by facilitating storage and sharing of data. Some of the Indian banks including SBI has already invested in developing their private clouds.

**Visualization Tools:** These tools analyse financial data and throw light on key insights that can be useful to top management in making organization-wide decisions.

**Application 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 transaction data to third-party developers and consume third party capabilities via APIs. This would enable rapid, scalable, and efficient re-use of services. At present Indian banks are focusing on internal (private) APIs, with some recognition that once their architecture is in place, they will move towards opening partner and public APIs, subject to regulatory approval.

**Risks and Compliance:** Due to development of payments systems and digital transactions, banks are poised to risks of frauds and they need a significant amount to invest in technology to meet the internal as well as regulatory compliance norms. Starting from detection of frauds to liquidity management and monitoring of business activity, banks need to focus on risk management system more efficiently. Deployment of advanced technology would help the banks to achieve the twin imperatives of regulatory compliance and operational efficiency.

Apart from these technologies, there are many other technologies which Indian banks could harness in future. Some of the areas which demand sophisticated technology in Indian banking are cybersecurity, credit monitoring, cost optimisation, and human resource management, etc. Augmented Reality (AR) App is used to integrate digital information with the user’s environment in the real world. In India, AR mobile app has been launched by Axis Bank which lists all dining destinations, property lists, and shopping centres, bank ATMs, branches, etc. with real-life pictures along with distance and directions. Some banks have installed Bluetooth beacons at bank branches to allow banks to integrate physical and mobile channels to provide effective communication. Indian banks are yet to experience extensive adoption of many technologies, however, significant investments and having dedicated teams to test these technologies are positive signs.
Section VIII

Conclusion

Over a decade, Indian banking has witnessed a tremendous transformation, with the main driver of the change being the fast adoption of technology. While Indian banks continue to transform their businesses by deploying technology-intensive solutions to increase revenue, enhance customer experience, optimize cost structure and manage enterprise risk, there is a wide variation in the technology agenda and implementation capability across different players of the Indian banking industry. Banking in India is shifting from bricks and mortar banking to digital banking.

Today banking without technology is something which cannot exist. Starting from branch computerisation to rolling out APIs, everything is technology-enabled. The Indian banking industry is consistently working towards implementing technological changes in banking operations. Consequently, Indian banking environment has become more compatible as compared to the standards of the international financial system. This explosive growth in technology has considerably changed the way commercial banks conduct business. To survive and adapt to the changing environment, the banks are putting more stress on understanding the drivers of success to generate superior financial performance.

However, the impact of technology on the performance of an organisation is still a paradox. Investing in technology is part of the banking business. The adaptation and innovation of new technology is the new parameter of success in banking. Emerging technologies like big data, artificial intelligence, data analytics and the availability of digitally-enabled infrastructure will enable banks to become competitive and efficient. The transition from traditional banking to state-of-the-art digital banking will enable banks to stand at par with innovative tech giants. Banks, by increasing their investment in technologies, can significantly reduce the cost involved in expensive human interactions and improve digitisation across the various aspects of customer services. Going digital has become more decisive as digital banking solutions help banks to meet both business and technological goals and sustain their position in the core market.

Technology offers enormous potential and various opportunities to the Indian banking sector. It provides cost-effective, rapid and systematic provision of services to the customer. The efficient use of technology has facilitated accurate and timely management of the increased transaction volumes of banks which comes with a larger customer base. Today banks are not only providing banking services but are operating as banking superstores. In future, to compete with the big techs, banks need to provide all financial as well as non-financial needs of the customers through a banking ecosystem where banks to be able to aggregate services and seamlessly integrate the processes of specialized providers.
Technological transformation has been able to provide doorstep personalised banking services to customers even in rural areas which are going to have a long-run impact in the economy by integrating mass unbanked to the mainstream. Being the second-largest mobile subscriber base, India needs to learn from many low-income African economies how to leverage mobile technology. Though banks are investing heavily to migrate to digital channels, it is seen that customers still prefer human interaction over machines for financial transactions. Customers are concerned about the quality of services and the security of transactions. Moreover, customers evaluate the technology quotient of banks based on the digital interface they are exposed to. What essentially binds customers to their bank is the quality of services offered, the fairness and affordability of pricing and the promptness of service.

References