Banking Technology in the next decade from SMAC TO FABS

Dr. A. S. Ramasastri*

1. Introduction

In the past decade, disruptive technologies have shrunk the world leading to location agnostic production and consumption of services. This has transformed the banking industry to a great extent, altering the way the business is conducted.

Banks have created digital infrastructure to offer various solutions like mobile banking, e-wallets and virtual cards, for successfully fulfilling the changing needs of the modern-day customer. Wholesale banking is also catching on this trend of designing and delivering the right mix of products and services to corporate customers, harnessing digital technologies.

Banks have adopted the SMAC technologies – Social, Mobile, Analytics and Cloud – very innovatively.

Social media has become integral in the daily routine of a large number of human beings across the globe. Banks have used the reach of social media to spread awareness of their products to potential customers. Social media has also helped to assess the public sentiment about the functioning of a bank. Some banks have also been offering a few products through social medial platforms.

Mobile payments have transformed financial services, with customers now expecting to make transfers and transact through their phones as first choice. Multiple stakeholders are coming out with various innovative products to make mobile banking useful and exciting.

Analytics, along with big data, has become part of banking lingo. Banks are making all efforts to put in place analytics infrastructure – both in terms of technology and human resources. The banks which could achieve a fair degree success in implementation of analytics based solutions are reaping benefits in terms of better CRM, risk profiling and fraud analytics.

Cloud technology has matured and banks have been finding suitable adoption models in terms of private, public and hybrid clouds for varying requirements. Some of the banks, including urban cooperative banks (UCBs) have been using the Indian Banks Community Cloud (IBCC) a unique community cloud experiment initiated by IDRBT.

While the SMAC technology developments will continue to be exploited by banks, there are several new technologies emerging in the realm of quantum computing, high speed networks, biometrics, machine learning, robotics and smart wearables.

Among them, the four key technologies we identified to be having a great impact on banking are FABS – Five G, Artificial Intelligence, Blockchain and Smart things. We feel that in the next decade, Banking will witness a continued trend of reinventing itself, riding on FABS in addition to SMAC.

2. Five G

The next generation telecom network (5G), an evolution of broadband technology having disruptive capabilities, is expected to be in place by 2020. The Tokyo Olympics in 2020 are supposed to present the very first showcase of the full range of what 5G technology can offer [1]. The 5th generation wireless

*Director, Institute for Development and Research in Banking Technology (IDRBT).

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system will have dense, virtualized and optimized network delivering up to 10 Gbps data rate with 1 ms latency, with a possibility of connecting 100x devices per unit area in the spectrum range of 3-30 GHz. The technology is expected to have a life term of 20+ years and make the whole world as Wi-Fi zone. The massive and burgeoning IoT ecosystem may well be served by 5G by providing communication services to billions of connected devices at an appropriate speed, latency and cost. As per 5G Infrastructure Association's 5G vision document [2], by its unique network and service capabilities, it will ensure user experience continuity in challenging situations such as high mobility (e.g. in trains), very dense or sparsely populated areas, and journeys covered by heterogeneous technologies. It further states that "5G will be an economy booster by fostering new ways to organize the business sector of service providers, as well as fostering new business models supported by advanced ICT. In addition, 5G should pave the way for a larger number of partnerships and Business to Business to Customers (B2B2C) business models through APIs deployed at different levels (assets, connectivity, enablers)".

Other features of 5G include:

- 99.999% availability
- 100% coverage
- 90% reduction in network energy usage
- Up to 10-year battery life for low power IoT devices

The ability to send and receive large data at a high speed opens new opportunities. As mentioned in the wire article, self-driving cars have to communicate with each other, road signs, traffic signals, guardrails and other elements human drivers simply see. The low latency and high speed of 5G can cater to such needs.

Figure 1 presents the developments in IMT in the coming future citing use scenarios in critical applications and automation.

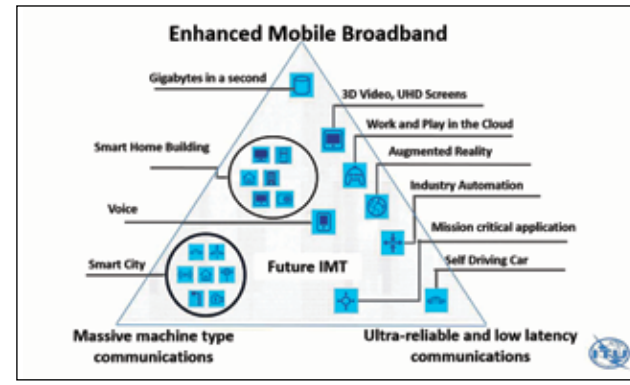

Figure 1. Usage scenarios of IMT for 2020 and beyond

(Source: ITU Report [3])

Because of these technical features, some of the possible benefits of 5G are:

- Pervasive network availability facilitates people to use their communication devices concurrently anywhere anytime.
- High peak bit rate and larger data volume per unit area.
- Higher reliability of the communications.
- Cognitive radio technology will facilitate different versions of radio technologies to share the same spectrum efficiently.
- Better connectivity irrespective of the geographic region.
- Provide uniform, uninterrupted, and consistent connectivity across the world.

2.1 Banking Applications

Based on the technical features and the related technical benefits, we see banking and financial services in India and across the world benefitting from 5G. Some of the possible use cases are:

- Low latency and ultra-reliability lead to revisit the need of near shore DCs.
- Better control of fraud detection and other monitoring activities.

- ATM monitoring can help in further reducing the transaction failure rates.
- Financial inclusion.
- Biometric based authentication.
- Better connectivity to remote banks / branches and deeper coverage for rural banking.
- Enhanced customer experience through Omni-channel implementation.

Adoption of 5G technologies can benefit the customers in several ways some of which are:

- AR and VR based banking, reducing to a greater extent the need for visiting branches for KYC, issuing clarifications and providing personalized attention.
- IoT related use cases including usage of drones for monitoring fields, capturing images of accident sites for genuine insurance claim settlement etc.
- Artificial intelligence and Robo-advisors in the branches.
- Mobile trading

2.2 Concerns

Any disruptive technology is expected to have some risks. As 5G usage is yet to be in place, some of the issues gathered from the literature are:

- The speed, this technology is claiming seems difficult to achieve in the near future because of the incompetent technological support in most parts of the world.
- Many of the old devices would not be compatible to 5G, hence, all of them need to be replaced with new ones, which may prove very expensive.
- 5G would have a huge task to offer services to heterogeneous networks, technologies, and devices operating in different geographic regions. The challenge is of standardization to provide dynamic, universal, user-centric, and data-rich wireless services to fulfil the high expectation of people.
- These services largely depend upon the availability of radio spectrum, through which signals are transmitted. Though 5G technology has strong computational power to process the huge volume of data coming from different and distinct sources, it needs larger infrastructure support.
- 5G needs to ensure the protection of personal data and will have to define the uncertainties related to security threats including trust, privacy, cybersecurity, which are growing across the globe.

3. Artificial Intelligence

AI though several decades old, is marching fast with many innovations in the recent past. Some of the applications of AI include understanding natural language, speech recognition and translation, vision systems, intelligent robots, expert systems, chatbots, game playing etc.

Organisations and countries are now vying for control and are investing money, time, and energy to advance in AI. A recent McKinsey report [4] says that Alphabet invested roughly $30 billion in developing AI technologies, and that Baidu invested $20 billion in AI last year. It is reported [5] that China is planning to build a $1 trillion AI industry by 2030.

Forbes [6] mentions about the City Brain project of Alibaba, which help cities, run their operations by AI. City Brain uses a cloud-based system where data about a city and everyone in it is stored and processed through AI algorithms. The project's success in reducing traffic jams by 15% was achieved by monitoring every vehicle in the city.

Some AI applications in China being used by Ali Baba, as per the report are:

- T-mall Smart Selection: This AI-powered algorithm backed by deep learning and natural

language processing helps recommend products to shoppers and then notifies the retailers to increase inventory to keep up with the demand.

- Dian Xiaomi: This AI-powered chatbot can understand more than 90 percent of customer's queries according to Alibaba and serves more than 3.5 million users a day. The latest version of the chatbot can understand a customer's emotion and can prioritize and alert human customer service agents to intervene.
- Robots to pack, drones to deliver: More than 200 robots in automated warehouses can process 1 million shipments each day. In some cases, their efficiency allowed same-day shipment. Alibaba also used drones for some deliveries.

According to Gartner [7], "Over the next few years every app, application and service will incorporate AI at some level. AI will run unobtrusively in the background of many familiar application categories while giving rise to entirely new ones. AI has become the next major battleground in a wide range of software and service markets, including aspects of ERP".

3.1 Banking Applications

AI can play an important role in helping banks understand their customer behaviour patterns and risks associated with them, and take "smart actions". Banks initially invested in data analytics to understand customers' needs and offer new services. They are now going further to adopt AI in various areas such as:

- Fraud detection.
- NPA analysis.
- Detection of suspicious transactions.
- Personalised customer interaction through chatbots.
- Efficient credit assessment.

HDFC bank, ICICI bank, and Canara bank have introduced chatbots for customer service. Accenture's recent Accenture Banking Technology Vision 2018 [8] reports that 83% of Indian bankers believe that AI will work alongside humans in the next two years.

3.2 Concerns

Some of the concerns of AI are:

- Availability of trained resources.
- Non-availability of data or data spread across disparate systems.
- Supporting large number of languages in speech recognition, speech to text etc.
- Legal challenges related to the consequences of wrong decisions made by algorithms.
- Privacy-preserving machine learning products in compliance with GDPR.
- Safety of robotic apps.
- Training data sets may make AI algorithms biased due to the inherent socio-cultural biases. For critical decision making such biases need to be avoided.
- One of the biggest barriers to the adoption of AI for regulated entities is the difficulty in showing exactly how an AI reached a decision.
- AI audit trails become essential.

Fairness, transparency, and ethics are essential in adoption of AI. Efforts are on to create a responsible AI. Monetary Authority of Singapore brought together a group of thought leaders and practitioners called the Fairness, Ethics, Accountability and Transparency (FEAT) committee [9], to develop a guide that will set out key principles and best practices for the use of AI and data analytics for financial institutions and FinTech firms in Singapore.

4. Blockchain Technology

Blockchain is a type of decentralized distributed database that is spread across multiple computers in a network. Its decentralised nature eliminates the need for an intermediary to process, validate or authenticate

transactions. Each computer keeps its own copy of all transactions on the network, and works directly with other computers to check a new transaction's validity through a process called consensus. Each of these transactions is encrypted and sent to every computer on the network to be verified and grouped into a timestamped block of transactions. The new block is chained to the previous block, forming a "Blockchain" – an immutable / tamper-resistant record of historical transaction data.

Key benefits of Blockchain technology:

- Disintermediate
- Secure
- Immutable

Blockchain technology is not a panacea, but quite useful in certain scenarios / applications. According to the World Economic Forum report [10], the characteristics of high-potential Blockchain use cases are as follows:

- A shared repository of information is used by multiple entities
- Multiple entities generate transactions that require modifications to the shared repository
- A level of mistrust exists between entities that generate transactions
- Intermediaries or central gatekeepers are present to enforce trust
- Transactions have inter-dependencies

4.1 Banking Applications

Banking and finance industry is the front-runner in experimenting with Blockchain technology, mainly because of the security and immutability aspects provided by it. IDRBT, in its Blockchain technology whitepaper [11] identifies the following potential areas:

- Trade Finance
- Cross-border Payments
- KYC
- Securities Servicing
- Loan Syndication
- Supply Chain Financing
- Consortium Accounts

The three main advantages of Blockchain technology in banking and finance are:

- Transparency
- Efficiency
- Cost Savings

Transparency is brought about due to the elimination of information asymmetry. Further, the technology is by design such that it provides for: (i) immutable transactions, (ii) information provenance, and (iii) ease of audit, all of which contribute to enhancing transparency.

Naturally, transparency coupled with ready availability of trusted information leads to efficiency. Some of the factors through which Blockchain enables efficiency are: (i) resilience through redundancy, (ii) reduced time through high availability, (iii) faster settlements, and (iv) savings in decision making time through smart contracts.

Transparency and efficiency often result in cost savings. Adopting Blockchain technology results in cost savings in the form of: (i) savings in reconciliation costs, (ii) prevents losses due to documentary frauds, (iii) saves costs on forex volatility, and (iv) saves costs over delayed settlements.

4.2 Concerns

The most impactful applications of Blockchain technology will require deep collaboration between incumbents, innovators and regulators, adding complexity and delaying implementation. Further, there are business concerns, technology concerns and risks that need to be understood before adopting the technology.

Business concerns: (i) application of Blockchain technology yields expected results only when there is a critical mass of participants, (ii) adopting Blockchain technology requires a number of changes to existing practices, which may increase costs and risks, and (iii) flexible settlement timeframes may be preferable to perform compliance checks or to fund positions.

Technology concerns for adopting Blockchain technology: (i) must achieve sufficient scale of operations and interoperability with legacy systems and other Blockchain systems, (ii) effective management of cryptographic keys and access credentials, (iii) security and privacy, and (iv) thorough testing of smart contracts for preventing malicious behaviour that can undermine the entire network.

Risks posed by the adoption of Blockchain technology: (i) cryptography could be used to conceal identities and undertake fraudulent activities, (ii) cyber risk, risk to fair competition and orderly markets, risk to financial stability through increased market volatility, (iii) quick propagation of errors due to high automation, and (iv) privacy risk due to the presence of competitors in the network.

5. Smart Things

Smart things are electronic appliances and other physical objects enriched with smartness – ability to operate interactively and to an extent autonomously. Examples include smart phones, watches, bands, key chains and speakers.

According to the Harvard Business Review article [12], smart things have three primary components; physical, smart, and connectivity.

- Physical – made up of mechanical and electrical parts
- Smart – made up of sensors, microprocessors, data storage, controls, software, and an embedded operating system with enhanced user interface
- Connectivity – made up of ports, antennae, and protocols

These components work to enhance the capabilities of one another resulting in a virtuous cycle of value improvement. First, the smart components amplify the value and capabilities of the physical components. Then, connectivity amplifies the value and capabilities of the smart components. These improvements include:

- Monitoring the conditions, external environment, operations and usage
- Control of functions to better respond to changes in the environment, as well as to personalize the user experience.
- Optimization of the overall operations based on actual performance data, and reduction of downtimes through predictive maintenance and remote service.
- Autonomous operation, including learning from the environment, adapting to users' preferences and self-diagnosis and service.

Smart things enable businesses to evolve from making products to offering complex value-added services through “an intelligent system of systems” the Internet of things (IoT). IoT is the network of smart things – reflects the growing number of smart things and highlights the new opportunities they represent.

5.1 Banking Applications

Deloitte report [13] suggests that banks can analyse the data collected from customer’s smart things and use it for:

- Lending
- Transaction services
- Risk management
- Fraud analysis
- Assess creditworthiness
- Monitor debts
- Micropayments
- Recordkeeping

Infosys' white paper [14] identifies the following benefits of IoT in banking services:

- Increase / decrease the installation of ATMs depending on usage volumes
- Bring on-demand services closer to customers
- Increase the accessibility of services to customers
- Identify customers' business needs
- Gain customer insights for providing value-added services, financial assistance, and customized products
- Estimate the value of the crop output and provide flexibility in financial terms for loans
- Analyse fraud in debit / credit card transactions
- Track raw materials and inventory stocks to identify borrowers indulging in fraudulent practices in loan repayment

5.2 Concerns

One of the key drivers of the IoT is data and, therefore, success of the idea is dependent upon secure storage, processing and retrieval of data. This leads to privacy and security concerns, including issues relating to consumer consent, ownership of data and its usage.

A report published by the Federal Trade Commission (FTC) [15] made the following recommendations

- Data security – businesses must ensure that data collection, storage and processing would be secure at all times
- Data consent – users should have a choice as to what data they share for what purposes, and must be informed if their data gets exposed
- Data minimization – businesses should collect only the data they need, use the data only for the purposes for which it was collected, and retain the collected information only for a limited time

Big data infrastructures such as the IoT and data mining are considered by many to be inherently incompatible with privacy. These technologies could not only result in the invasion of public space, but can also be used to perpetuate normative behaviour.

6. Innovation Ecosystem

Many entities play a key role in the banking technology innovation as depicted in the figure below.

Figure 2. Technology Innovation Ecosystem

(Source: Hitachi Inspire the Next [16])

Academic institutions provide the research inputs necessary to propel the advances in technology, and supply trained human resources required for the industry. Big IT companies and new FinTech companies build on these inputs and develop innovative products.

For certain technologies, there will be a need for a scalable large infrastructure support. The Central and State Governments are taking many initiatives such as the Digital India Programme, National Knowledge Network etc. towards enabling the necessary

infrastructure for the development and adoption of these technologies.

An important overarching concern with all the new technologies is the risk of cyber security they pose. Cyber security experts are constantly innovating new ways for protecting the cyber space from being misused.

Banks and FIs engage with the solution providers to benefit from the advances in the technology. When there is large scale adoption of a technology across an industry, the regulators have to watch out for systemic risks posed by the technology while not unduly impeding their adoption. To this end, some actions taken by the regulators include: proactive engagement with existing firms and new entrants, research and publishing papers, modifications to supervisory processes, and introduction of new guidance or regulations.

In this context, IDRBT is a unique institution that bridges the gap between academic research and its application to banking. IDRBT has been playing a pioneering role in the pursuit of FABS technologies through its centre for mobile banking (5G), centre of excellence in analytics (AI), centre for payment systems (Blockchain technology), and centre for cloud computing (smart things / IoT). Further the institutes centre of excellence in cyber security helps in assessing and mitigating the security risks posed by these technologies, and the centre for affordable technology encourages the use of existing open source technologies for realizing the applications in a cost effective manner. IDRBT has published several white papers, best practices, FAQs and other knowledge resources covering several banking technologies.

7. Conclusions

With the pace of events in technology in the recent past, it is becoming extremely difficult to forecast the technology developments even in the short run. While certain technology innovations are too short lived to have an impact, certain innovations re-emerge after a long gap. In such an uncertain setting, based on our experience and understanding of banking and banking technology, we identified the FABS technologies as having great potential for a meaningful impact on the banking sector in the next decade. These are also in line with the predictions of some recent studies including the 2018 INSA report [17].

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