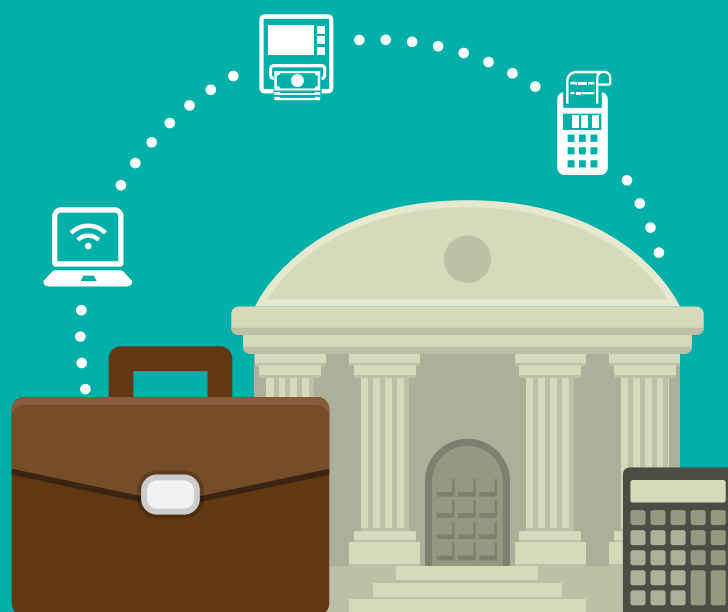




Interdependence of emerging technology on next-generation banking

January 2017

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Foreword



The quickening pace of the technological landscape, has generated the need for a differentiated value proposition, enhanced customer experience and improved operational efficiency making the adoption of emerging technologies inevitable by the BFSI (Banking, Financial services and Insurance) sector. As banks experience the age of digitisation, technology is playing a key role in shaping their future.

The emergence of innovation centres has gained traction in recent times as it is a challenge for several organisations to differentiate themselves from one another and hence, product innovation provides the needed competitive edge to garner the requisite market share.

Banks and other financial institutions have come to realise the significance of technologies such as biometrics which help secure a transaction for the customer. This has become imperative with the introduction of many digital platforms that aid with disbursement of payments and other banking transactions.

Automation via robotics and AI provides an advantage to the financial sector to focus on advisory services by automating tedious and repetitive tasks.

Blockchain, although at a nascent stage, gives hope to the entire industry of a transparent transactional system with decreased supervision and reduced IT infrastructure cost leading to a paradigm shift in the financial services industry.

At KPMG in India, we believe that the evolution and interdependence of various technologies and their applicability in the financial services sector make it a crucial area that the BFSI sector needs to keep a tab on. We examine each of these four emerging technological areas in terms of the relevant banking applications, probable challenges and the future scope. We analyse how the combination of these technologies could add greater value to the banking organisations to achieve their business objectives.

We hope you find this publication insightful, and welcome your suggestions and feedback on the same.

Introduction



Today, the world is driven by technology which strives to make our lives easier be it via ATMs, smartphones, computers, driverless vehicles or manufacturing of almost each and every product that consumers have come to use and depend upon. While the pervasiveness and relevance of technology is undeniable in the contemporary digital age, the reason to pay greater attention to such fields has become more and more important.

It is in such a state of sustained morphosis that machineries are turning heads owing to the potential that they promise. The BFSI sector in India is one such ever evolving space which, by its very inherent nature, deals with monetary products/services, that symbolise and represent economic value. Thus, such a sensitive field of work requires greater precision, accuracy, reliability and accountability at every stage and process.

This paper talks about the emergence of few innovation centres and the interdependence of evolving technologies which are driving the innovative journey of the BFSI sector. It covers different aspects such as emergence, history, present day applications, challenges and future scope for innovation centres, biometrics, AI and robotics, and blockchain respectively.

Innovation centres are organisations or units within organisations which are dedicated to the pursuit of innovation, with an aim to implement effective improvements in the concerned organisation. In the banking sector, innovation centres are being explored where a few of the banks are looking into collaborating with consultancies for establishing such centres.

Currently, there are few players in the Indian banking sector, who are in the process of setting up innovation centres, and a few leading technology players have live and functioning innovation labs/centres which are working with advanced technology, towards advancement of technology.

'A biometric characteristic is a measurable physiological or behavioural trait of a living person, especially one that can be used to determine or verify the identity of a person in access control or criminal forensics'.¹

The concept of biometrics has been developed around various forms of identification viz. –

- Fingerprint recognition
- Iris/eye recognition
- Vein recognition
- Facial recognition
- Signature verification
- Voice biometrics
- Access control
- Mobile biometrics

Automation in banking has presented opportunities to find faster, more economical and lower risk methods to reduce cost and improve customer service by reducing human intervention to bare minimum. A few recent examples of automation and software robotics, in the Indian banking industry have been highlighted below:

Banks in India are developing and deploying 'software robotics' that emulate human actions to automate and perform repetitive and high volume tasks, to save on time and human errors. Such automation is foreseen to be effecting significant improvements by reducing response times and increasing accuracy and productivity.

Robots with the ability to respond to queries across various relevant subjects have slowly started featuring in select bank branches on an experimental basis. The realisation of such high levels of automation marks a significant stride in productive transformation in the offing.

Blockchain is a data structure that helps create a time stamped, programmable, almost real time and tamper proof digital transaction ledger to be distributed over a network of computers. It is expected to bring transparency, simplicity, security and cryptography in transactions. The technology enables transparency as new blocks of transactions are updated and the chain of blocks is ever growing.

A few prominent players in India are working on developing technology for bitcoin, which is closely linked with blockchain technology, as they believe in the potential it holds.



1. <http://www.gartner.com/it-glossary/biometrics/>; 20 December 2016

Emergence of innovation centres

Measuring innovation

Innovation can be measured in as many ways as the mind may perceive its meaning.

One of the foremost indices employed for generating a ranking to measure the level of innovation, detailed later, is the Global Innovation Index (GII). This index was originally pioneered by INSEAD and it has evolved and developed into the modern day GII.

There is an advisory body set up to provide guidance on the research underlying GII. This body consists of individuals from ITIF, UNESCO, CERN, CSIR, etc. and each year, GII receives inputs from various organisations across countries like Confederation of Indian Industry and National Confederation of Industry.

The GII framework today², is composed of the following aspects –

Five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions (2) Human capital and research (3) Infrastructure (4) Market sophistication and (5) Business sophistication. Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs.

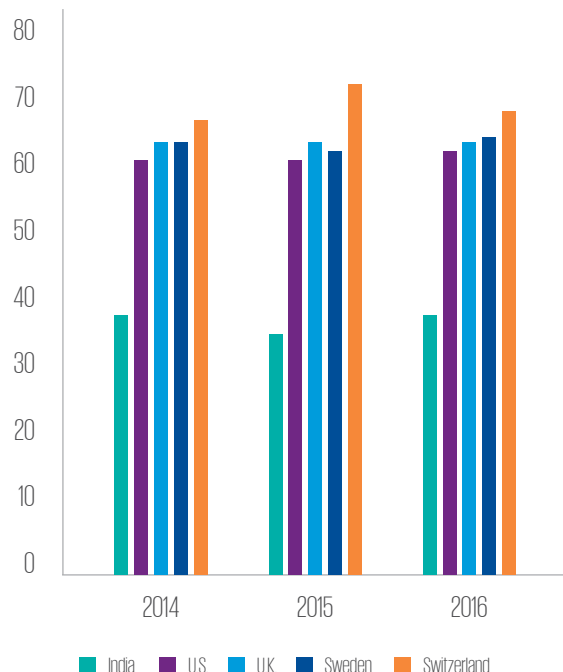
Each pillar is divided into sub-pillars and each sub-pillar is composed of individual indicators (82 in total in 2016). Sub-pillar scores are calculated as the weighted average of individual indicators; pillar scores are calculated as the weighted average of sub-pillar scores.

Four measures are then calculated:

- Innovation input sub-index: is the simple average of the first five pillar scores
- Innovation output sub-index is the simple average of the last two pillar scores
- The overall GII score is the simple average of the input and output sub-indices
- The innovation efficiency ratio is the ratio of the output sub-index over the input sub-index



Innovation Scores



Data for graph sourced from Global Innovation Index Report 2016, on 21 December 2016; Graph representation by KPMG in India, post analysis, basis industry discussions;

The above graph depicts minor fluctuations in the innovation scores over the past three years where Switzerland, Sweden, U.K. and USA have secured the top four positions in the latest GII, published in 2016.

India has been ranked 66 in 2016. It has been labelled an 'innovation achiever' by GII. This label is provided to those economies that perform at least 10 per cent higher than their peers in their level of GDP.

As per the GII report published in 2016, China is the only middle-income economy to have moved in the top 25, with other prominent middle-income economies including Brazil, India and South Africa, remaining below the top 25 innovative countries in the world.

Today, India (categorized as a middle-income economy) is viewed as a country with an innovation friendly environment due to supportive policies. This state which encourages innovation has translated to excellence in fields like ICT services export and creative goods imports, as per the findings of GII.

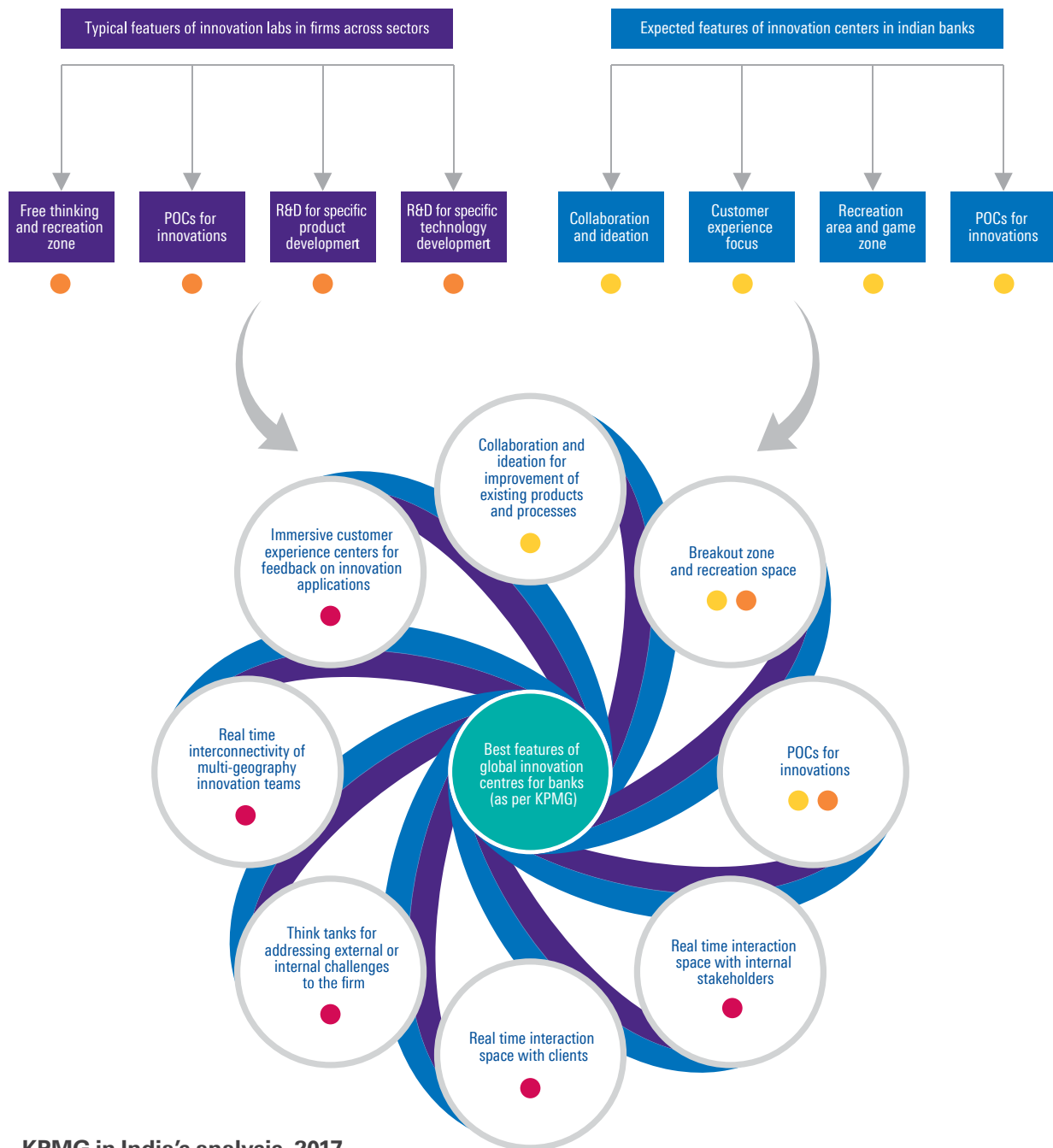
Thus, it is only logical that innovation centres start to assume greater importance and focus on all industries and sectors within India. The banking and financial sector (esp. among the government owned/sponsored

2. globalinnovationindex.com; accessed on 21 December 2016

organisations), is known for its traditional and conservative approach and policies due to the sensitive nature of business which deals with finances. With a strong push for financial inclusion and micro financing, the need for

innovation is at an all-time high. This contrasting scenario where innovation is being sought by traditional banks and financial institutions, makes it an interesting space to watch out for.

Key features of global innovation centres for banks



KPMG in India's analysis, 2017

Emergence³

Although still a fairly new concept, the idea of innovation centre is quickly gaining traction in India. 'Innovation centre' has become a common phrase in the modern world of technology. The phrase often presents itself in close association with frontrunners in the technology world like Apple, Google, Microsoft and others.

Innovation centres as a concept, are departments or complete organisations created with the purpose of ensuring continuous innovation and improvement in specified areas of the concerned organisation. The pursuit of innovation has evolved from being a luxury afforded by financially thriving and successful organisations, into a necessity for future proofing the organisation.

Within the banking space, innovation centres are typically set up to address any or all of the below aspects:

- Product and service portfolio enhancement
- Operational improvement
- Training and education for employees on modern technology
- Accelerating digital agendas
- Development, improvement and deployment of new innovations
- Real time and dynamic experimentation
- Real time interactions with clients and senior management, for their buy-ins
- Establishment of think tanks
- Performing POCs for innovations

As such centres of innovation serve not only the strategic purpose of keeping an organisation updated, current and relevant for the customers and competitors, but also aid in transforming their harbouring organisations into those which are agile and responsive to change.

There are several needs and challenges sensed by Indian banks, which innovation centres could possibly address and resolve. These include the below areas, however, are not limited by them:

1. To define and articulate detailed goals and objectives of the innovation centre which could range from being customer experience centric, to internal process refinement or could even encompass both of these aspects.
2. To help identify disruptive forces and technologies at an early stage and to equip the bank/organisation to be able to handle them
3. To craft a creative environment to encourage burgeoning of concepts, ideas and innovations for continuous and sustainable development



Brief history

Innovation is a continually morphing and mutating term, which has come a long way since its inception. It has completed a journey where its meaning has been transformed from initially holding negative connotations, to symbolising positivity, in today's era.

The modern day definition of innovation encompasses any new idea, method, product, etc. which could be employed for generating a more desirable output than the already existing ones.

Some interesting instances of innovations include money, printing press, electric light, computers, internet, 3D printing, etc. Thus, it is now the hope and expectation that such fantastic and fascinating innovations would be generated and formulated in innovation centres.

3. KPMG in India's opinion and analysis basis below links, 21 December 2016
<https://thefinancialbrand.com/521777-of-the-coolest-innovation-labs-in-banking/>; accessed on 20 December 2016
<http://bfsiitsummit.com/>; accessed on 20 December 2016

<https://www.accenture.com/in-en/accenture-technology-labs-index>; accessed on 20 December 2016
 REQUEST FOR PROPOSAL (RFP) FOR Consultancy Services for Setting up an IT INNOVATION cum CUSTOMER EXPERIENCE CENTRE on a Build, Operate and Transfer Basis For State Bank Group, Issued by SBI 25 November 2016; accessed on 21 December 2016

Present day applications

Organisations across sectors ranging from manufacturing to banking, are closely looking at the prospect of innovation centres and the potential benefits to their respective businesses. In global banking, this concept has picked up significant traction and momentum since 2010 without any

signs of slowing down. In fact, the interest levels have only increased and is setting its roots in developing economies. Some leading banks/financial organisations and their innovation centres/hubs/labs have been enlisted below, for reference:

Innovation centre description	Bank
This centre consists of a high-tech testing facility along with 'free-thinking rooms' that allow staff and customers alike to undergo a trial for new innovations and provide instant feedback.	A South African Bank
The labs are present across 3 locations in the U.S.A with a total of over 100 employees who are called 'entrepreneurs' by the bank. Their purpose is to accelerate enterprise-wide digital agendas, generate disruptive ideas, rapid prototype execution and pilot test products.	U.S.A based bank
The bank has 2 labs for innovation, with plans for more coming soon. The objective is to act as idea incubators and accelerators focussed on developing new products, services and solutions in collaboration with customers, partners, start-ups and industry experts.	Australian bank
The labs, present in five major cities, help in expediting solutions, connecting innovation teams with clients, revealing new innovations to the staff as well as getting management buy-ins on new projects.	U.S.A. based bank
An innovation centre is designed to provide an immersive experience for clients, partners and corporate executives, where they can interact and explore new ideas. The space has been engineered to facilitate dynamic interaction and real-time experimentation.	A financial company based in U.S.A.

Source: <https://thefinancialbrand.com/521777-of-the-coolest-innovation-labs-in-banking/>; accessed on 20 December 2016; websites of respective banks were also accessed (details not disclosed to avoid brand bias) on 20 and 21 December 2016

A few noteworthy steps have been taken in the field of innovation centres in India. Few players in technology and payment processing sector have set up their innovation labs/centres with the aim of continuous enhancement of their offerings.

Not to be left behind, banks in India are now beginning to appreciate such innovation hubs and advance their performance by establishing their own innovation centres. This move holds great promise for the future of the BFSI sector in India, as the pioneering players get set to undertake this new challenge.

DBS bank, which launched India's first mobile-only banks with its offering – Digibank, is looking to

set up a 2000 capacity innovation lab to explore emerging technologies such as augmented reality, big data analytics, internet of things, artificial intelligence (AI) and machine learning.

An Indian Bank has set up an innovation lab to test concepts and launch them as commercial products. One of the key aspects of innovation labs and centres are to improve business performance, build innovations that benefit business and not be a standalone experiments lab.

Some of the Indian banks and foreign banks based in India have their own innovation labs and accelerators to help start-ups beta-test their ideas, find funding and access clients.

Probable snags⁴

Just as is the case with many undertakings, innovation centres too, involve risks worthy of consideration.

Capital investment is often a deterrent for several organisations, which despite having the drive and willingness to set up their own innovation centres, could be blocked or dissuaded by the more conservative and risk averse proponents within the senior management. A Proof of Concept (POC) can be a means to satisfy the concerns and apprehensions of the sceptics. A smoothly executed POC can go a long way in quelling several doubts and helping ensure the value of the innovation centre is not overshadowed by the large capital.

The effort and time involved of the bank's/organisation's stakeholders during the process of formulation and laying of the foundation for the innovation centre, certainly seems like an area demanding attention.

Innovation is meant for improving the business and might not directly or immediately translate to increase in the business. Those individuals who believe that increasing business is more important than improving the business, tend to consider innovation in lower regard.

This roadblock could be addressed, subject to case-by-case scrutiny, by performing a projected benefit analysis for the to-be state when the innovation centre is to be established.

Future scope

It is now reasonably safe to claim that innovation centres have proved their worth to the global audience, which can be observed from the quick expansion of innovation networks across international banks and organisations. There are a few banks in India which have already expressed keen interest in setting up their own innovation centres.

Today innovation labs are beginning to generate a lot of interest within India, and represent an exciting and challenging work space for many. Centres of innovation are making their way into many organisations that wish to remain modern, updated and future-proof apart from being trend setters and early adopters who are paving the path for others.



4. KPMG in India's opinion and analysis basis below links, 21 December 2016
<https://thefinancialbrand.com/521777-of-the-coolest-innovation-labs-in-banking/>; accessed on 20 December 2016
<http://bfsiitsummit.com/>; accessed on 20 December 2016
<https://www.accenture.com/in-en/accenture-technology-labs-index>; accessed on 20 December 2016
 REQUEST FOR PROPOSAL (RFP) FOR Consultancy Services for Setting up an IT INNOVATION cum CUSTOMER EXPERIENCE CENTRE on a Build, Operate and Transfer Basis For State Bank Group, Issued by SBI 25 November 2016; accessed on 21 December 2016

Emerging technologies

Biometrics

Emergence

As the world becomes increasingly more digital, remembering passwords has become cumbersome for the customers. The need to improve the security of accessing accounts and desire to enhance the user experience has paved way for biometrics in the BFSI sector.

Banks, both globally and in India, are moving to an omni-channel environment, adopting new channels and exploring alternate payment methods. This has been the result of the growing mobile phone subscriber base in India which stands at 1.034 billion as of March 2016⁵. Out of which smartphone availability, currently over 200 million, is expected to grow to 700 million by 2020⁶. Statistics say that mobile payments industry would be able to create a market of more than 450 million users worth USD721 billion by 2017⁷.

Customers are accessing financial services from various platforms, making identity management increasingly complex and expensive consequently exposing them to potential risks such as cyber-attacks, social engineering, etc. Bankers are facing an increasing challenge in deciding the genuineness of the person transacting. It is paramount that biometrics play a pivotal role in key innovations on mobile payments and other transactions.

Brief history

Throughout history, many characteristics have been used as a mean of recognition such as face, handprints, fingerprints, voice and gait recognition.

Biometrics technology makes use of biological data and behavioural characteristics that differentiates one human being from another. Biometrics is acting as a catalyst in the digital innovation journeys of many financial institutions, helping them develop new-age identification controls to enhance customer experience, security, operational efficiency and address identity theft related challenges.

Fingerprint scanner on Apple iPhones which has made consumers comfortable and familiar with biometrics has paved way for industry-wide biometric technology adoption. Statistics say, by 2016, 30 per cent of organisations would be using biometric authentication on mobile devices.⁷



5. India Infrastructure research report, October 2016
India Infrastructure Publishing Pvt. Ltd.(for internal use of KPMG Advisory Services Private Limited. Site Licence(Mumbai)

6. <http://www.gartner.com/newsroom/id/2504915> , 4 June 20132

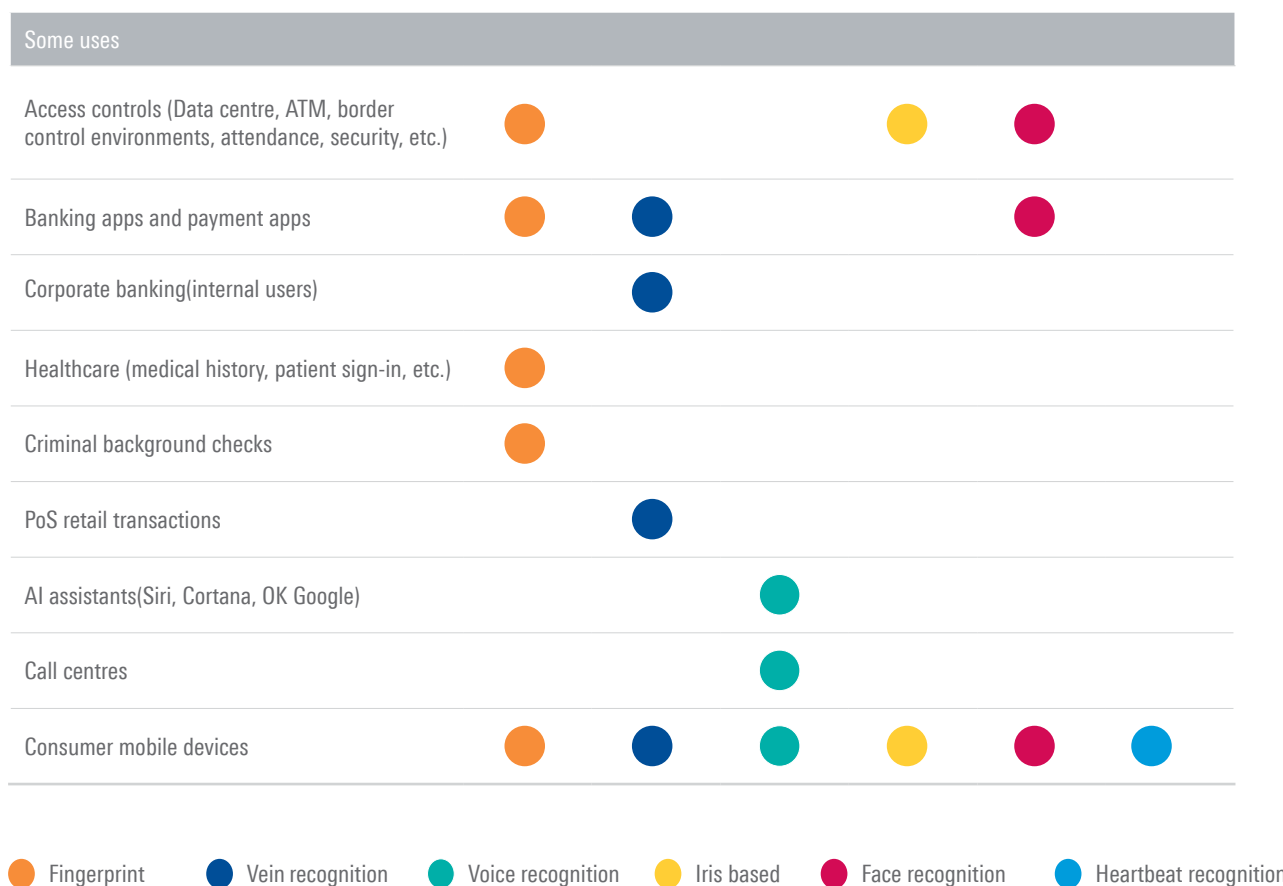
7. <http://www.gartner.com/newsroom/id/2661115>, 4 February 2014
<http://www.biometricupdate.com/201501/history-of-biometrics>

Present day applications

Biometrics type	Example (Global implementation)	Example (Indian implementation)
Fingerprint	Great Britain based bank introduced Touch ID for its iPhone users wherein customers use Apple's new Touch ID fingerprint sensor to access the mobile banking app within seconds.	UIDAI (Unique Identification Authority of India) uses fingerprints as one of the means to issue Aadhaar numbers (12 digit unique number issued by Govt to every Indian resident). (September 2010 – issued first UID) A PSU bank has installed single finger capture and authentication biometric device at select branches to prevent manipulation of its core banking solution platform such as increasing the credit limits of customers and wrongful debits to customer accounts. The bank started payment to NREGA beneficiaries through a biometric smartcard that captures thumb impressions for secure withdrawals from the account
Finger and palm vein recognition	A British bank's biometric reader developed with uses a combination of vein biometric and highly secure digital signature for providing convenience of easy access to online bank accounts and authorise payments within seconds	
Voice recognition	An American financial services provider has integrated with a biometric tech for a multi-biometric pilot which uses simultaneous face and voice biometric authentication on its mobile platform. (August 2015) The financial services provider had first rolled out voice recognition for its wealthiest clients (0.3 million), after a successful pilot test it was offered to 12 million retail banking customers	A private bank has introduced voice recognition which is based on speed, accent and pronunciation, to transact smoothly through the bank's call centre
Face recognition	A multinational Spanish banking group, has tied up with Facephi which specialises in face recognition technologies to implement a facial recognition system for pensioners and users to increase its digitisation process and become the first fund and pension administration entity in Bolivia to use a biometric recognition system	Federal bank has introduced zero balance selfie account which uses an app, scanned PAN, Aadhaar details and a selfie to open an account instantly
Iris-based	AA foreign telco company and a handset maker have launched a smartphone that uses iris scan for authenticating mobile payments.	UIDAI also uses iris scan along with fingerprints to generate aadhaar numbers. (September 2010 – issued first UID)
Heartbeat recognition	A British bank has tried heart monitoring technology to authenticate its customers via account security systems through Nymi Band, a wearable technology. (March 2015)	

Source (all the sources were accessed on 22nd December, 2016):

<https://letstalkpayments.com/biometrics-in-banking-who-is-killing-the-passwords-in-2016/>
<http://www.techworld.com/news/ux/halifax-bank-trials-heart-rate-technology-authenticate-customers-3601753/>
<https://www.home.barclays/news/2014/September/barclays-first-in-uk-to-launch-new-biometric-reader-for-customer.html>
<http://www.biometricupdate.com/201506/facephi-brings-its-facial-recognition-technology-to-bolivian-banking-sector>
<http://www.planetbiometrics.com/article-details/3334/desc/wells-fargo-integrates-speechpro-tech-for-biometric-pilot/>
<http://www.thehindubusinessline.com/money-and-banking/state-bank-plans-to-install-authentication-biometric-devices/article2991710.ece>
<http://timesofindia.indiatimes.com/city/lucknow/SBI-starts-payment-through-biometric-card/articleshow/4115005.cms>
<http://www.cio.in/feature/indian-banking-sector-bets-big-biometrics>



Potential benefits:

Convenience to customers	Operational efficiency	Secure transaction
<ul style="list-style-type: none"> Unbanked(financially illiterate and lacking govt. issues credentials) population gets access to financial products and services No need to remember codes or passwords Saves time Maintains customer trust Enhanced end-user experience – reducing burden on customer to explicitly prove their identity by using a combination of biometric and other authentication measures 	<ul style="list-style-type: none"> Increased customer base for microfinance offerings Accelerate customer onboarding (eKYC) Automated process with minimal human intervention Strengthens internal checks and controls for banks Savings on call centre costs for password reset requests Expediting bank-customer interaction and hence yielding positive customer feedback More time to bank teller to concentrate on level of service provided to the customer 	<ul style="list-style-type: none"> Reduced identity theft and online frauds Security at customer facing touch points such as ATM, mobile banking, internet banking, call centre, PoS, etc. Increased authenticity for all financial transactions

Probable snags⁸

1. **Operational loopholes:** Fingerprints could be spoofed or replicated and one's voice could be recorded for conducting fraudulent transactions. Robust systems need to be in place to detect the slightest change and raise an alarm. A minor cold could change the voice quality and may pose problems in speech authentication. People who work in labour intensive jobs could have damaged fingerprints.
2. **Cost not translated into business benefit:** The instruments and the peripheral infrastructure required for conducting biometric authentication are expensive (a basic fingerprint scanner costs around INR4000) and a visible RoI is needed to justify the cost to the management.
3. **Poses risk to individual privacy:** According to a PIL (Public Interest Litigation) against UIDAI, biometric data collection is an invasion of a citizen's right to privacy, protected under the Fundamental Right to Life. The entire Aadhaar process at the field level is in the hands of private enterprises known as enrollers operating freely without government supervision. The biometrics are initially stored and collected by privates before it is transmitted to the UIDAI Central ID Repository (CIDR) via a memory stick or courier or by direct uploading. The loose framework which handles such sensitive information poses a risk to the data collected which could be analysed to draw unintended conclusions without the individual's consent and for purposes the individual did not mean for it to be used.
4. **Potential fallibility:** Biometric technology captures sensitive information about individuals which in case of any breach or compromise could jeopardise the entire system. It might be easy to replace a swiped credit card or change a password, but it is next to impossible to change the patterns on your iris or your fingerprints.



Future scope⁹

1. Significant opportunity for financial institutions to tap the unbanked population effectively and promote financial inclusion. It is a beneficial situation for both banks and end customers as banks get a wider customer base while the customer with lack of identity documentation could experience banking facilities. Smooth incorporation of identity solution with the bank's infrastructure – customised to the bank's needs.
2. Multifactor authentication with biometrics at the forefront could help curb frauds and help ensure higher assurance authentication.
3. ISO 19092:2008 which describes the security framework for using biometric authentication in financial services strengthens the future of biometric technology.
4. Behavioural biometrics, still in inception, could provide an extra degree of protection to enhance banking security in the future.

Source (all the sources were accessed on 22nd December, 2016):

8. <http://www.biometricupdate.com/201212/public-interest-litigation-in-india-challenges-the-legal-basis-of-unique-identity-authority>

9. http://www.iso.org/iso/catalogue_detail?csnumber=50145
<http://www.infosecurity-magazine.com/news/hatwest-implements-behavioral/>

Automation via robotics and AI

Emergence

Emergence of automation can be traced back to the advent of machines. Chess fans may recollect that some of the most dramatic matches were between world champions and supercomputers. The realisation that machines can do myriad of tasks simultaneously, quickly, and cheaply led to the emergence of automation. Automation enables a job to be done smartly, and more accurately, with lesser human intervention. At the same time, John McCarthy, who coined the term 'artificial intelligence' once quoted, 'As soon as it works, no one calls it AI anymore', to highlight how AI's accomplishments become mainstream as time passes.

Automation through robotics and Artificial Intelligence (AI) offers the ability to absorb and process large chunks of data, thereby offering a major value proposition to financial services markets to utilise the same for business transformation.

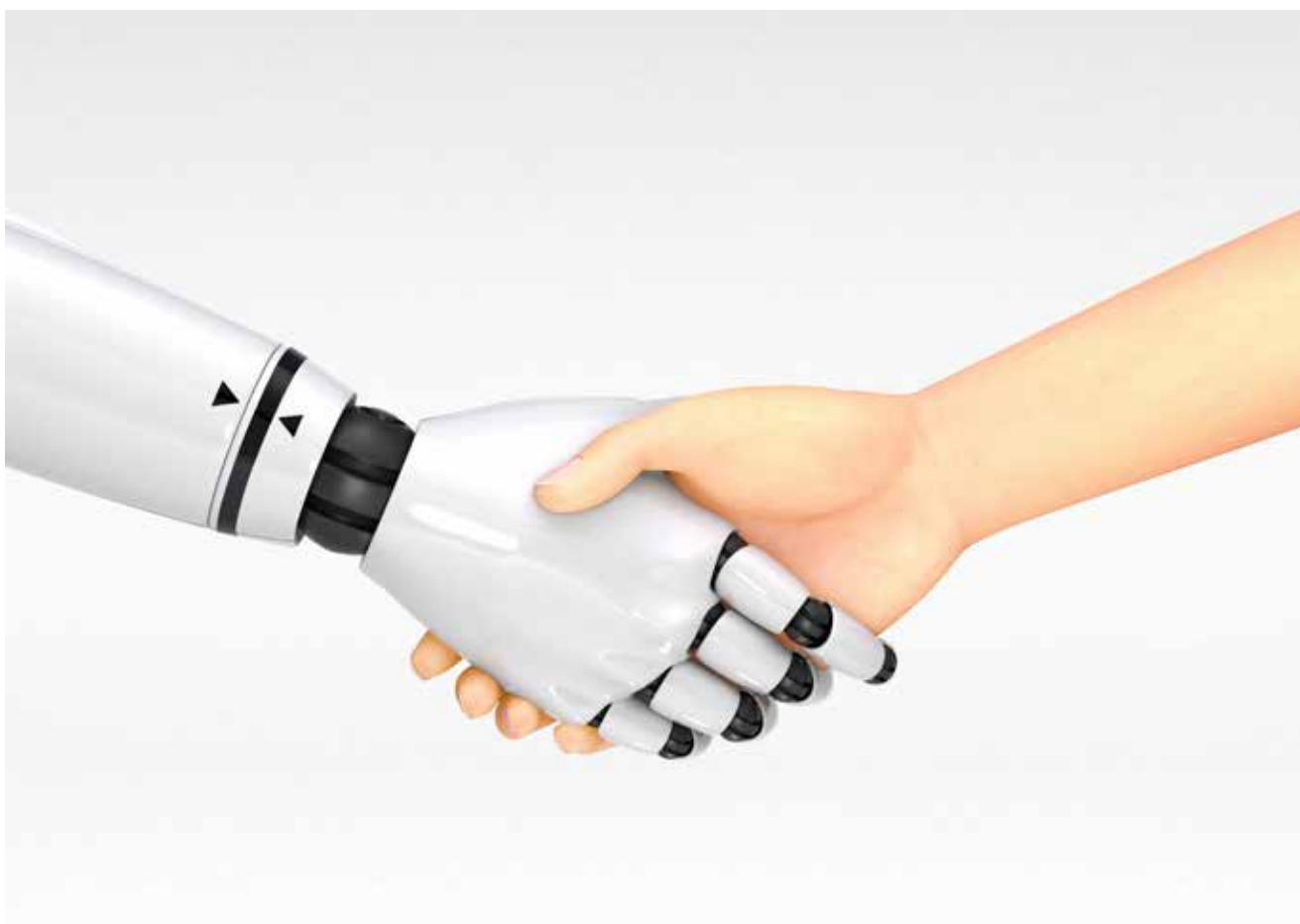
Brief history

The first Autorobot, named Elektro, dates back to 1939¹⁰. It was a relay-based robot that responded to voice commands and delivered pre-recorded quips. It could move its arms and head.

In financial services, automation of work flows and processes could be traced way back in time, but via robotics and AI it is yet to see boastful implementations. Recently, in April 2016, Nao—a customer-facing robot, which could speak in 19 languages—was employed by The Bank of Tokyo-Mitsubishi UFJ¹¹. Automation via AI saw its first mass usage in wealth management in financial services.

Present day applications

Today, automation via robotics and AI is prevalent in repetitive and transactional financial activities as these activities can be enhanced and standardised.

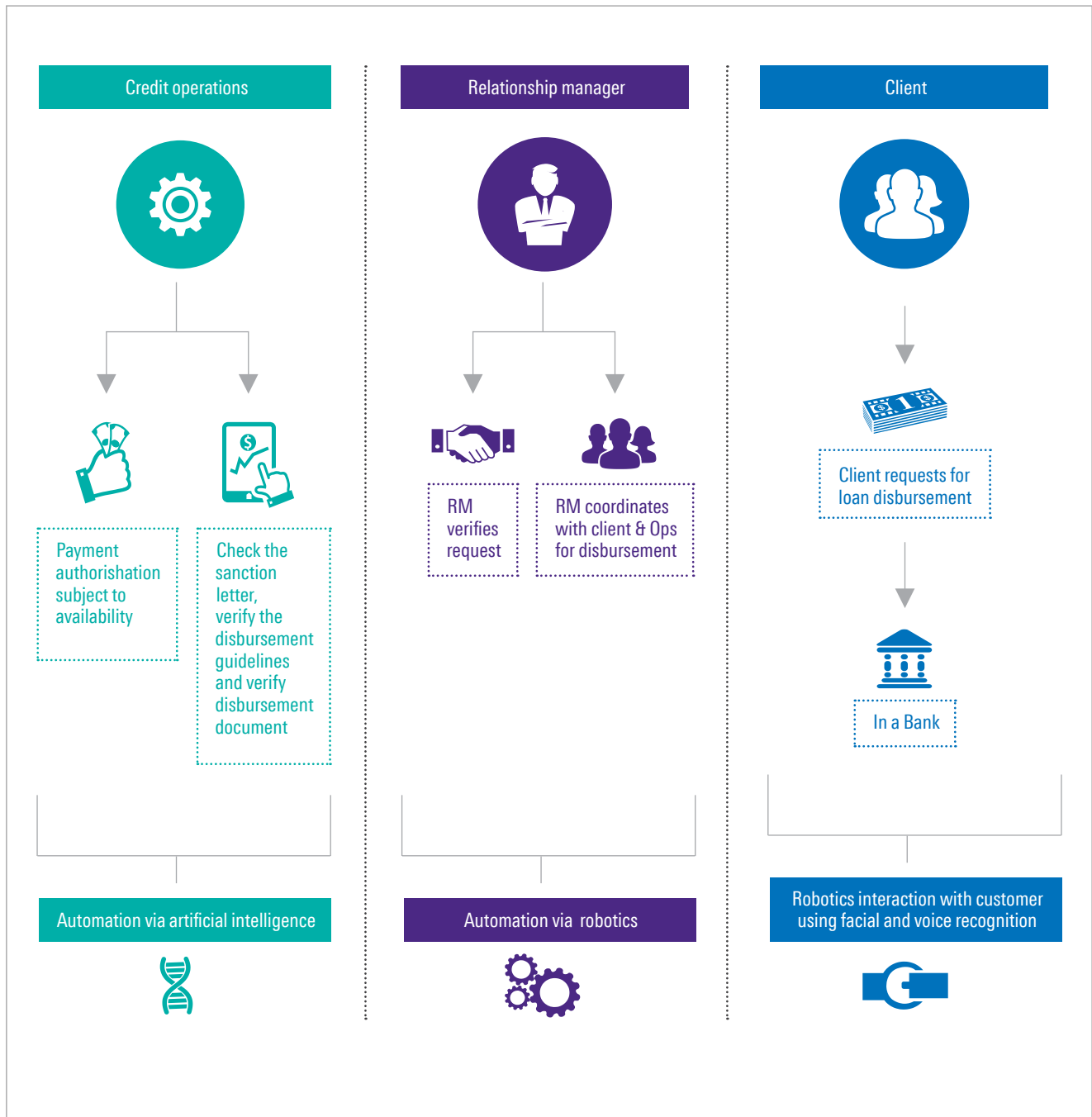


10. (source:<http://www.computerhistory.org/timeline/ai-robotics/>)

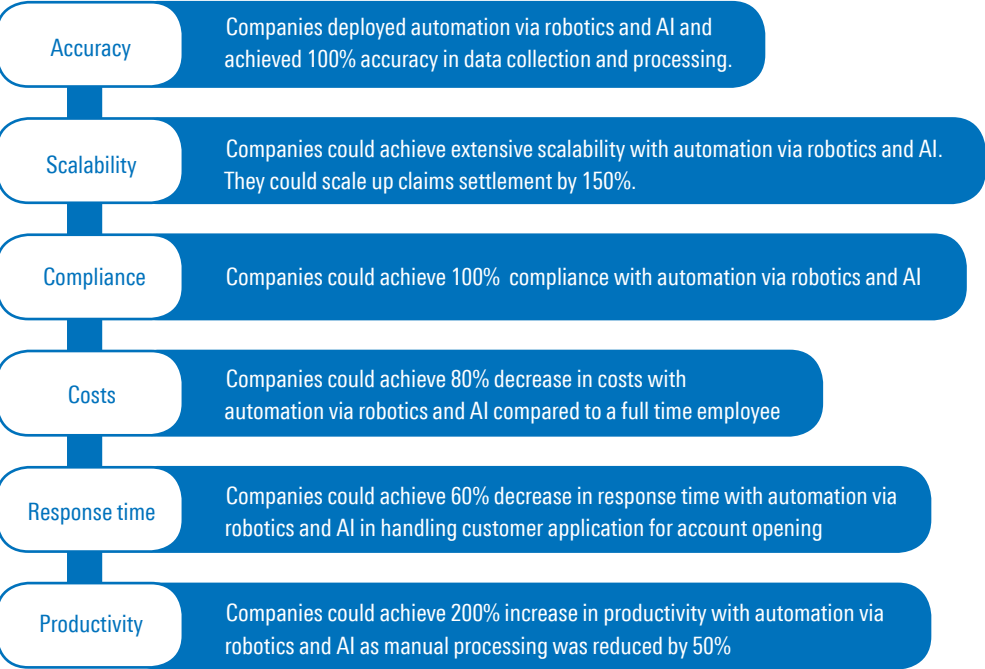
11. (source:<http://www.bankingtech.com/474852/clever-banking-with-artificial-intelligence>)

Illustration:

The following diagram depicts the use of automation via robotics and AI in a banking scenario where the customer requests for a loan disbursement.

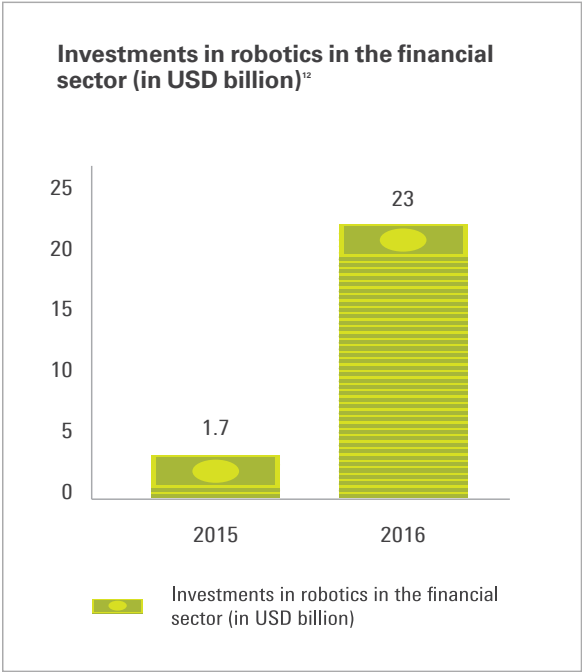


Extensive adoption at backend business processes gives financial companies strength to scale up across the following KPIs:



Recent trends in financial services have also seen adoption of automation via AI in financial asset management, claims management, stock analysis, and reporting. Financial companies are adopting robotics at a faster than expected pace as reflected by the multifold increase in the investments in robotics in this sector. This higher investment not only reflects adoption at the backend but also in client-facing business processes.

Confidence of the financial sector in automation via robotics and AI is reflected by expected investments in the next three years.¹³



12. KPMG Finance-Robotics Feb 2016) http://www.bankingtech.com/474852/clever-banking-with-artificial-intelligence/source:http://www.huffingtonpost.com/thack-brown-/digital-finance-in-2017-a_b_13656662.html

13. KPMG Tech Innovation Survey Year-End 2015) http://www.bankingtech.com/474852/clever-banking-with-artificial-intelligence/source:http://www.huffingtonpost.com/thack-brown-/digital-finance-in-2017-a_b_13656662.html

Financial sector potential to garner investments in the next 3 years	Global	U.S.	China	Japan	ASPAC	EMEA
Automation via AI	8%	7%	8%	3%	8%	8%
Automation via robotics	4%	4%	6%	0%	3%	5%

Companies in the financial sector are moving ahead in the peer competition race by using automation via robotics which gives users visual delight, in addition to operational efficiency, improved performance and cost control. Innovators in this space are:

1. Companies in the financial sector are moving ahead in the peer competition race by using automation via robotics which gives users visual delight, in addition to operational efficiency, improved performance and cost control. Innovators in this space are:
 - Retail banking operations
 - Agri-business
 - Trade and forex
 - Treasury
 - Human resources management

2. In September 2016, a Britain based bank has tested an AI based customer service assistance to serve customers in the future.

3. In April 2016, Swedish Bank-Swedenbank deployed Nina a web assistant which has the capability to deal with 350 customer service related questions and answers. Swedenbank achieved:

- An average of 30,000 conversations per month
- First-contact resolution of 78 per cent in its tenure of three months. Nina has a repository of over 350 different customer questions and answers which it can query down without human intervention.

Probable snags¹⁴

While considering replacing human intelligence with robotics and AI, the financial services sector needs to be aware of the below functions that cannot yet be performed by the current evolution of these technologies:

- Processes involving judgement and intuition
- Processes which are unstable and fluctuating
- Processes which do not exhibit capabilities to input digital data
- Proof of Concept or Ideation where foresight is required and potential of practicality of an idea is calculated
- Differentiation between products and services
- Perceptual impact - 43 per cent of executives in the financial sector have an opinion that complex technologies complicate interpersonal communication.



¹⁴. source: <http://fsroundtable.org/cto-corner-artificial-intelligence-use-in-financial-services/>

Future scope

In financial advisory where humans were once considered indispensable as the tasks required deep thinking and learning, executing jobs involving conclusive, intuitive thinking and to an extent social intellect has presented a challenge for long to be implemented via automation. Automation in these fields have happened through deep learning—a branch of machine learning based on a set of algorithms that attempt to model high level abstractions in data—which looks for patterns and independent data parameters to identify equations by giving weightages to

qualitative dependents, thus has the potential to replace humans in work force. By 2020, autonomous software agents via robotics and AI are expected to work outside of human control and may enable or induce 5 per cent of all global economic transactions¹⁵.

It cannot be concluded that humans can be replaced completely in financial advisory but can rely on automation to be more accurate and efficient.

Blockchain

Emergence

Blockchain is a revolutionary technology that is slowly spreading its wings over the financial world. A blockchain is a data structure that is used to create a digital ledger of transactions and share it among a distributed network of computers. The science used behind this is cryptography, wherein each participant on the network is allowed to manipulate the ledger in a secure way without the need for a central authority.

From an accounting perspective, the transactions made are immediately validated by the network and they are cryptographically sealed the moment they are entered into the blockchain. Auditors do not have to confirm transactions between companies and then enter them into a centralised ledger, as other participants of the network confirm the credibility of the transactions. Furthermore, despite the shared decentralised ledger, transactions between two parties are visible to them only.

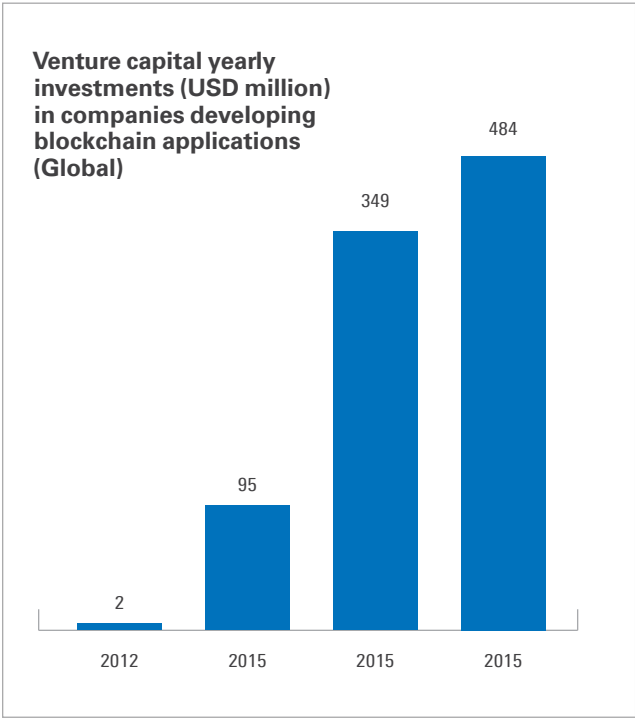
Some of the major strategic objectives of the financial sector include:

- Reducing cost
- Tamper proof digital assets
- Secure and reliable transactions
- Save time on trade applications

Blockchain could help address these issues and many more. In India, the first blockchain-based trade payment was carried out by a private bank using a custom made blockchain network to settle an export transaction in minutes as opposed to the usual three days. This could revolutionise trade finance in a way which could not have been imagined a few years ago. Hence, the future of this radical technology looks promising for the banking industry.

A growing number of both, corporate and institutional officials are showing interest in the possible

implementation of blockchain and the pace of investment in blockchain companies increasing with USD95 million invested in 2013, USD350 million invested in 2014 and USD484 million invested in 2015.



Source: (all the sources were accessed on 4th January, 2017):
<https://www.digitalerra.com/watch-list-a-look-at-disruptive-technology-from-around-the-world/>, Nov 8, 2016
<http://www.coindesk.com/state-of-blockchain-q1-2016/>, May 11, 2016
 Report: Blockchain And Financial Services-Industry Snapshot And Possible Future Developments, Locke Lord LLP and Innovaue, July 2015

15. <http://www.gartner.com/newsroom/id/3143718>

Brief history

In October 2008, Satoshi Nakamoto released his white paper, wherein he revealed his idea of purely peer-to-peer version of electronic cash. The world's first bitcoin market was established in February 2010.

A German digital bank was the first bank to experiment with virtual currencies and blockchain. In October 2013, it partnered with a currency exchange firm* to create a

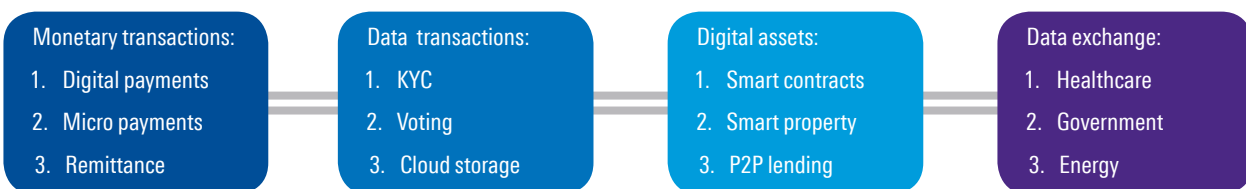
digital currency exchange in Europe, working with bitcoin Deutschland GmbH in Germany.

There are many financial institutions globally who have been partnering with new age start-ups to experiment with blockchain technology in order to disrupt the banking landscape. Although at an inception stage in India, the technology has been welcomed with open hands by the banking fraternity.

Present day applications¹⁶

A large number of financial institutions have been investing in blockchain to discover new opportunities and possible applications which could transform the banking landscape as we know it.

Some applications in the market:



Financial transaction

Blockchain can provide real time payments with almost immediate clearing and settlement. One of the first initiatives taken to enable micro payments on the web was by a digital asset exchange organisation; they implemented zero-fee micro-transactions utilising blockchain. Today there are upcoming firms which are developing exchanges and platforms for digital currency transactions and are gathering traction in the market.*

Data transaction

Blockchain can be used as a trusted P2P network for document storage. A blockchain start-up has developed a way to store personal information of customers using blockchain, hence, simplifying the KYC process in financial institutions. Technology firms across the globe are building systems to store any type of documentation like audit archives, government information, financial reports and healthcare records using blockchain.

Digital assets

Blockchain makes transactions of any information more efficient and tamperproof. It permits property ownership to be transferred in a safe, quick and transparent manner without any intermediary. Leading bitcoin platforms provide P2P lending without requiring a bank account.

Blockchains can contain a large amount of data, including entire contracts. Smart contracts eliminate the middleman,

such as a legal firm, as payment happens based on certain criteria being met.

Data exchange

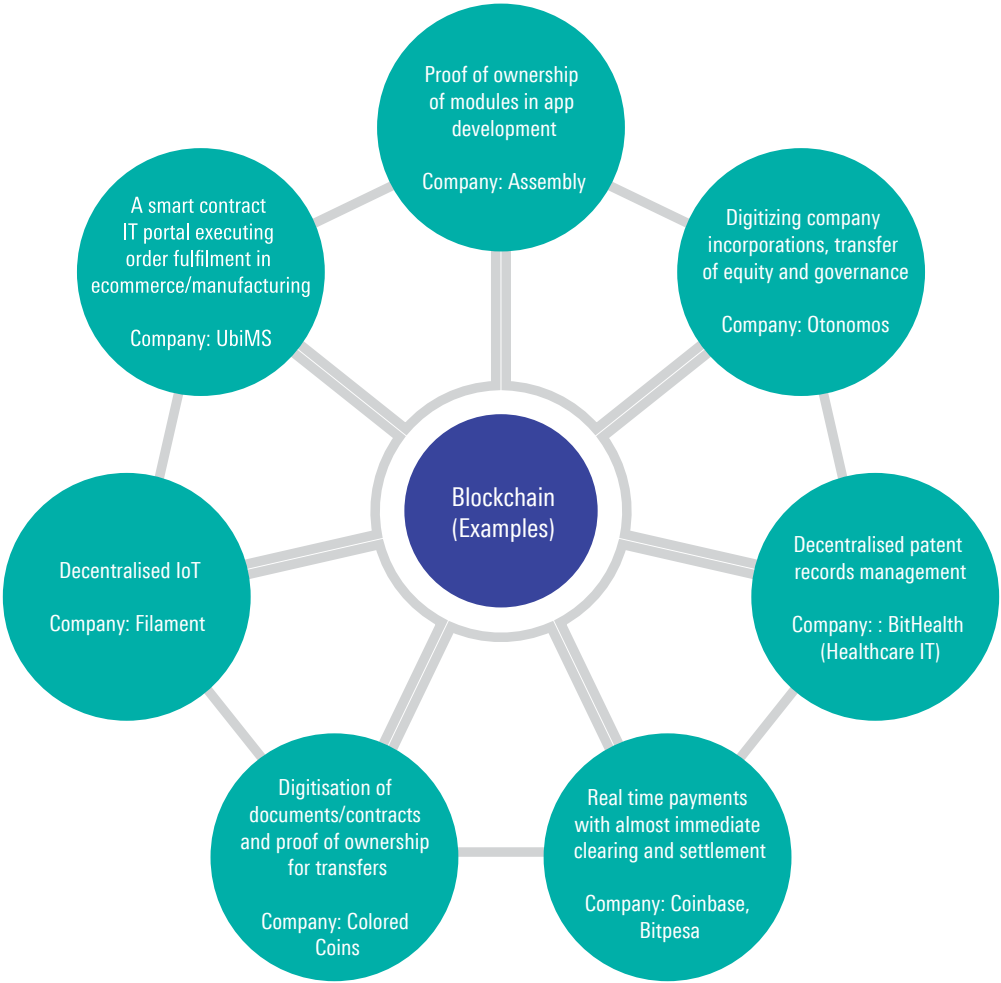
In the healthcare segment, using digital signatures on blockchain-based data that allows access only when approved by multiple people could regulate the availability and maintain the privacy of health records. By being a part of the overall blockchain, various stakeholders like hospital staff, doctors, patients, and insurance companies, can help in reducing fraud in healthcare payments.

The delay in exchange of information between various government departments lead to negatively impacting citizen services. In such a scenario, linking the data between departments with blockchain can help ensure that data is released in real time, when both the departments and the citizen consent to sharing data has been obtained.

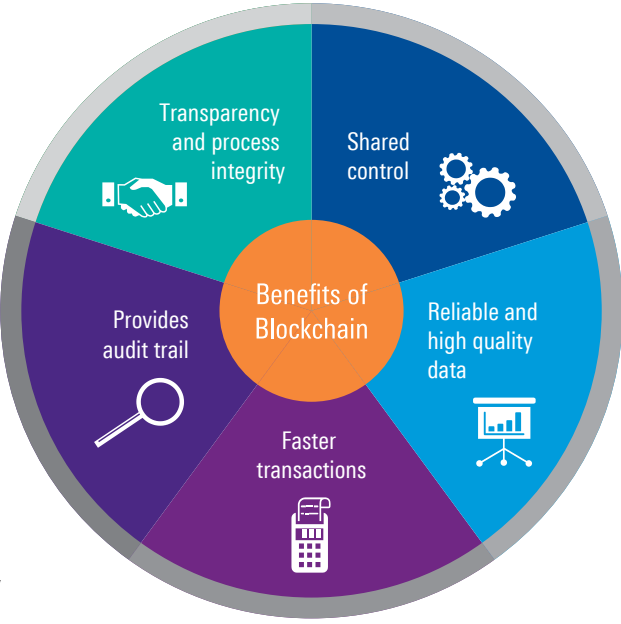
New energy initiatives such as home power generation and community solar power are filling in gaps of power supply across the world. As micro-generation adds to traditional power suppliers, it fosters creation of an energy market. Smart meters can record produced and consumed electricity in a blockchain, which allows for consumption of the surplus energy in a different location, providing credits or currency to the original producer. The credits can then be redeemed against the grid when the micro-generator needs additional electricity from the grid. The blockchain enforces these contracts in real time or near-real time, allowing for a utility market to be created with decreased red tape.

Source (all the sources were accessed on 23 December, 2016)

16. Report: Blockchain And Financial Services-Industry Snapshot And Possible Future Developments, LockeLord LLP and Innovalue, July 2015; <http://thenextweb.com/insider/2015/03/29/a-brief-history-of-bitcoin-and-where-its-going-next/>, Mar 29, 2015



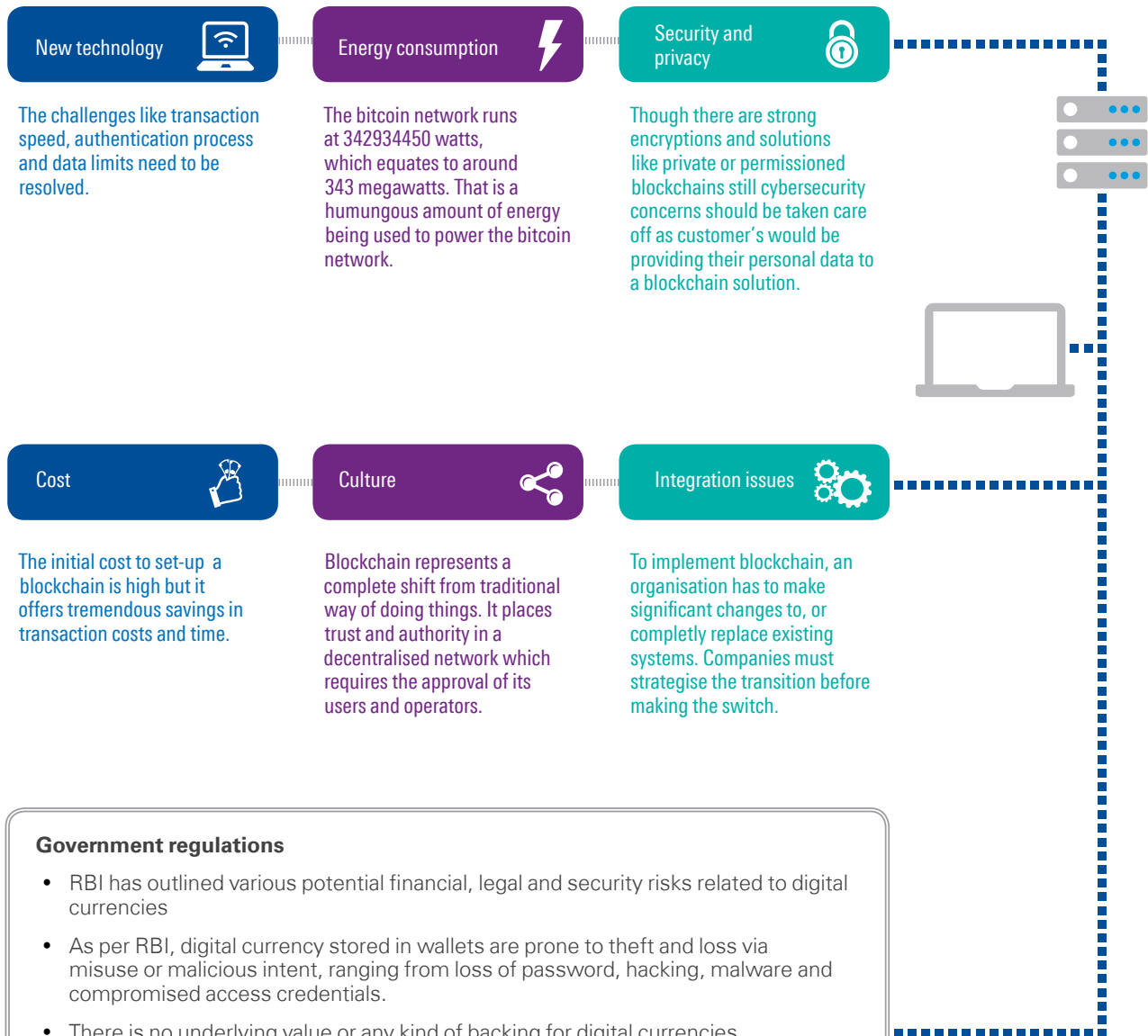
Source (all the sources were accessed on 5th January, 2017): <https://letstalkpayments.com/wp-content/uploads/2015/07/Blockchain-Usecases-and-Startups.png>



KPMG in India's depiction basis industry understanding, 2017

Probable snags

As blockchain is expected to take control over the financial industry, organisations may face new dependencies and potentially controversial array of issues



Government regulations

- RBI has outlined various potential financial, legal and security risks related to digital currencies
- As per RBI, digital currency stored in wallets are prone to theft and loss via misuse or malicious intent, ranging from loss of password, hacking, malware and compromised access credentials.
- There is no underlying value or any kind of backing for digital currencies.
- Exchange platforms are set up in various jurisdictions and in many cases their legal status is unclear. This means users of such platforms are exposed to potential legal and financial risks.
- Transactions handled in digital currencies take place on a peer-to-peer basis without an authorised central agency to regulate such payments. In such a scenario, there is no established framework for recourse to customer problems, disputes or chargebacks.

Source (all the sources were accessed on 23rd December, 2016):
<https://www.thebalance.com/how-much-power-does-the-bitcoin-network-use-391280> , Oct 17, 2016
<https://coinreport.net/coin-101/advantages-and-disadvantages-of-bitcoin/>
<http://www.coindesk.com/reserve-bank-india-issues-virtual-currency-warning/>, Dec 25, 2013

Future scope¹⁷

New technology like blockchain has the potential to reduce cyber risks by offering identity authentication through a visible ledger. Having talked about the potential benefits of blockchain, it is likely to have a great impact at the global level.

- Demonetisation in India could have been more impactful, if the Government of India had embraced this new technology. Blockchain is expected to make all government contracts transparent and cashless. Every action will be recorded on a ledger and this ledger can be made public for scrutiny and transparency. The entire voting process can be recorded on blockchain and this can ensure a transparent electoral system in the country. This disruptive technology can help India achieve a dream of cashless economy.
- NASDAQ has entered into a partnership with a leading blockchain infrastructure provider firm that would facilitate the future launch of blockchain-enabled digital ledger technology that can be used to expand and enhance the equity management capabilities offered by its Nasdaq Private Market platform.
- Blockchain is likely to be adopted by central banks and cryptographically secured currencies will be widely used by various banks. It also offers huge potential for the Indian banks to garner remittances from across the globe.
- The settlement of currency, equity and fixed income trades instantaneously through permissioned distributed ledgers creates a significant opportunity for banks to drive efficiency and create new asset classes.
- The blockchain will help save lenders up to USD20 billion annually in settlement.
- A private bank in India has successfully carried out the Proof of Concept with one of the banking groups in middle east, a relationship has been established that can be leveraged by other banks as well by obtaining mutual consent and an agreement.
- A private bank is working with one of India's leading companies in the manufacturing sector to implement blockchain for supply chain finance.
- Indian banks can use blockchain to introduce automation across trade-finance, remittances, funds transfer, open account transactions, and identity services around KYC, smart contracts and secure documents space.



Source (all the sources were accessed on 23rd December, 2016)

17. <http://ir.nasdaq.com/releasedetail.cfm?releaseid=919287>, Jun 24, 2015
<https://www.shapingtomorrow.com/home/alert/665529-Future-of-Blockchain>, Sep 22, 2015
<https://www.digitalerra.com/watch-list-a-look-at-disruptive-technology-from-around-the-world/>,
 8 November 2016

Future state of BFSI with diffusion of aforesaid technologies



Combined technologies could add greater value to banking institutions

KPI	Combination	Enhanced value proposition
Reduced cost and agile process	Blockchain + AI	Blockchain can help enhance core banking by eliminating the need to manage multiple databases and reconciliation structures, hence reducing IT infrastructure cost. This entire process could be automated and smoothly integrated with other applications using AI.
Security	Biometric + Robotics	Biometrics can help secure highly confidential environments with stringent access controls further secured with robotics technology so as to mitigate chances of human error.
Customer experience	AI + Biometrics	While AI can help analyse customer data better, leading to targeted marketing and customised product offerings at the bank's end, biometrics can help save time during authentication and hence, provide a pleasant experience at the customer's end.
Transparency	Blockchain + Biometrics	Blockchain allows distribution, verification and record keeping of transaction information, efficiently and effectively. Coupled with biometrics for customer authentication, the entire transaction journey could be made fraud proof, it can also help address AML issues.
Innovation	Innovation centre + Blockchain	Various cases of blockchain in areas of payments, settlement of currencies, different types of transactions, AML, KYC, regulatory reporting, etc. are already being tested in innovation centres set up by financial institutions, hence, helping them explore new opportunities that blockchain technology has to offer.



There has been an observable departure in the mindset of stakeholders, where many organisations have now started thinking in a non-traditional manner and have started developing a greater risk appetite while thinking about progress. Larger investments, in terms of both capital, as well as planning and time involvement, are being directed towards innovation efforts and technological endeavours. This modern mindset is an indication that the improvement of already sophisticated technology is inevitable, and is rapidly improving to enhance our lives and elevate our standards in forthcoming times.

Further, this futuristic mindset is adding impetus to the process of rapid infrastructure enhancement and evolution, which is necessary for building and engaging modern and advanced technologies.

The government administrators and regulators have recognised the necessity for change and advancement of technologies. This has been exemplified by the mentions of cloud technology and cybersecurity in RBI Working Documents (2011), IRDA Guidelines (2011) publications, IT Act (2011), etc.

Other technological innovations like digital banking, cybersecurity, Internet of Things (IoT) have also gained significant traction and are picking up in the Indian market.

There has been a strong incentive towards greater transparency in all kinds of financial transactions, as witnessed and experienced first-hand by the Indian population through the demonetisation drive by the Indian Government. This development suggests that blockchain technology, which essentially allows visibility and tracking of every transaction on a virtual ledger, epitomises the attribute of transparency.

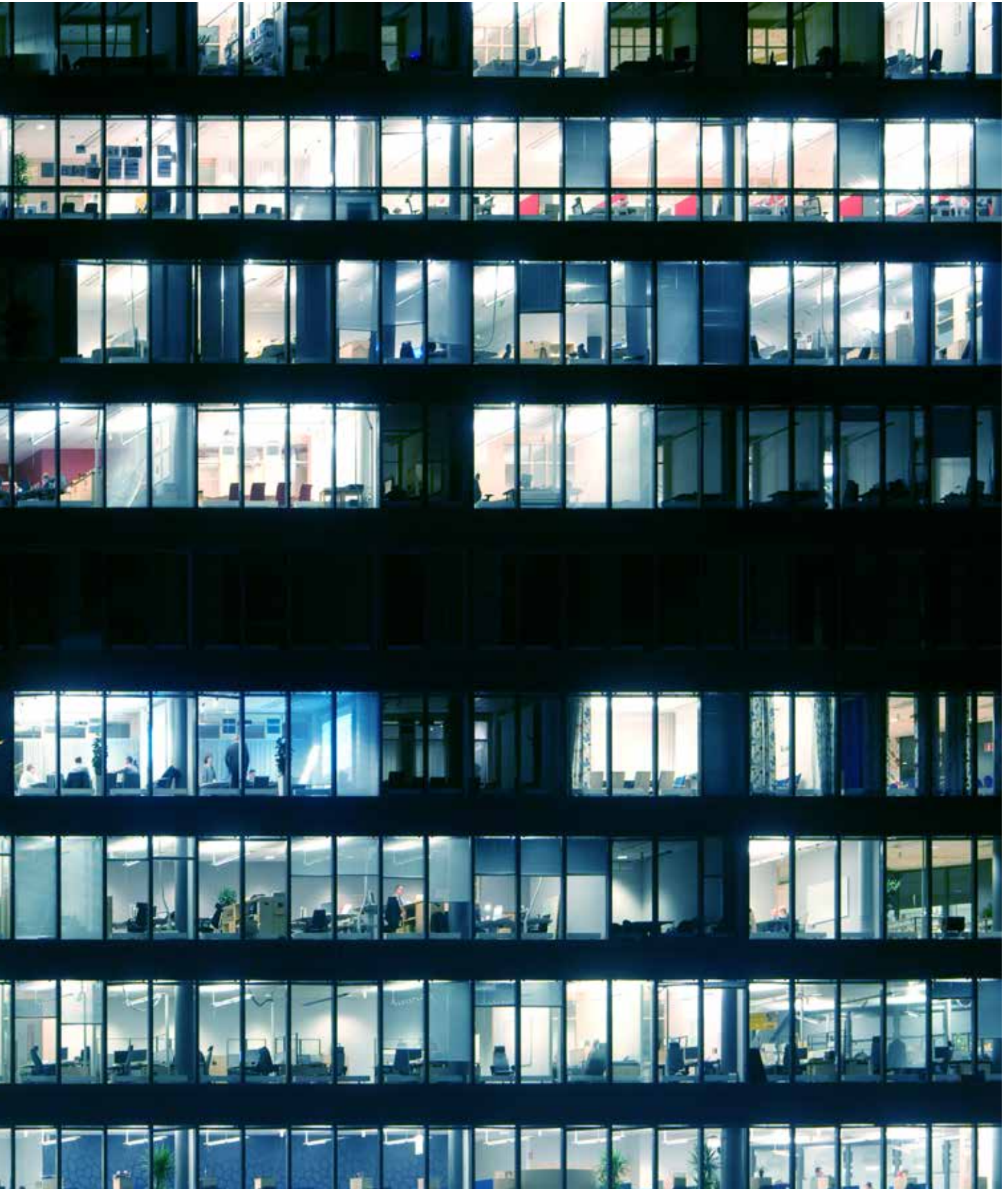
It is imperative that this modern mindset is adopted simultaneously, by all relevant parties, comprising end customers, product/service providers, administrators as well as regulators, which in turn could drive both the infrastructure and adoption rates in India especially the BFSI sector.

In the Indian banking industry, while biometrics and automation technologies are expected to be unequivocally prevalent soon, innovation centres and blockchain technologies are associated with greater risks and barriers. The latter two technological concepts need some more time for refinement and maturity.

However, those organisations which are able to bear the necessary risks today, are in a better position to be able to gain first mover advantage over their counterparts, consequentially attracting greater visibility and attention, apart from the obvious improvements which these technologies assure.

At KPMG in India, we envisage an integration and rapid adoption of technologies among both, the incumbents, as well as newer players. The newer players in particular, such as microfinance institutions, payments banks, small banks and other services reaching out to the underserved and underprivileged are heavily relying on the surging technological innovations to deliver on the promise of qualitative improvement delivering value to all consumers involved in the process.





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