

# Impact of Information Technology in Investment Banking

Akansha Tiwari<sup>1</sup>, Manisha Kumbhar<sup>2</sup>, Shobha Sachendra Mishra<sup>3</sup>

<sup>1</sup>Manager, Deutsche Bank Operations India

<sup>2,3</sup>Sinhgad Institute of Management, Pune-41

**Abstract-** Information Technology (IT) has always had a noticeable impact on their various fields of human life. This paper focuses on the impact IT has left and is expected to leave on banking more specifically Investment Banking (IB) industry. The paper gives a brief introduction of the Banking industry discussing its historical traces to the growth the industry has achieved today. The growth of banking industry has spurred out a new face known as IB. The paper thus discusses the arriving of IB era and how the IB firms have adapted to the ever changing business world hand in hand with IT. The paper then defines the objectives to study the impact of IT with Content Analysis being the research methodology. To study the impact better the paper bifurcates into the technology which is already in place or has attained maturity on the business development cycle and the technology which is futuristic or is about to take over. This is where the languages, software's and apps are discussed, giving an insight for the job seekers about the in demand language. The futuristic technology is where the paper discusses the new concepts of Artificial Intelligence extending to BOTS, OCR, IVR, Crypto currencies (the infamous controversial Bit coin) and blockchain. After this in depth analysis of data from various sources on each technology, we present our conclusion and infer the impact of IT on business specific to Banking industry.

**Keywords:** Information Technology, blockchain, investment banking etc.

## I. INTRODUCTION

The activities performed by Banks today range from personal banking to Corporate Banking, Consumer Finance, Investment Baking, Transaction Banking, Insurance, Consumer Finance, Trading. While the role IT has played in making these activities possible will never be enough to talk about. This paper concentrates on the impact of IT in one of these functions i.e. Investment banking. An investment bank extends from a typical Bank by extending in the financial services arena. Investment banks specialize in large and complex financial transactions, such as underwriting, acting as an intermediary between a securities issuer and the investing public, facilitating mergers and other corporate reorganizations, and acting as a financial advisor for institutional clients. Few examples of these would be: Barclays, B of A Merrill Lynch, Goldman Sachs, Deutsche Bank, JP Morgan, Morgan Stanley, UBS, Credit Suisse, Citi bank.

When we talk about Investment banking, the Industry saw its birth in the early 19th Century and has been growing leaps and bounds since then. Investment banking not only offers one of the highly paid jobs but has always intrigued people and has drawn attention of the money makers one of the reasons of this tremendous growth of the industry is the way it has adapted to the growing technological advances. The industry has always embraced the use of technology to serve the client's faster and to add on to their efficiencies.

Below is a screenshot from news.efinancialcareers.com which depicts J.P Morgan's prediction for 2016 and beyond for the investment banking industry. The graph clearly depicts the boom IB witnessed by the year 2009 in comparison to year 1999. Post 2009 the industry though stuck by the infamous Sub-prime crisis has still managed to stay above it's position in 1999 and is expected to re-grow from now A Bank in it's purest form is a body which accepts deposit from people and creates credit i.e. where people can deposit and borrow money from. Banking is an occupation which has had its roots from ancient times, around 2000 BC where the idea and concept of credit and lending existed. During this time merchants extended grain loans to farmers and traders moving across then there was the 14th Century, Italian Renaissance and archeological evidences from India, China and Greece also show the proof of money lending activity. The development of banking spread from northern Italy throughout the Holy Roman Empire, and in the 15th and 16th century to northern Europe. This was followed by a number of important innovations that took place in Amsterdam during the Dutch Republic in the 17th century and in London since the 18th century. During the 20th century, developments in telecommunications and computing caused major changes to banks' operations and let banks dramatically increase in size and geographic spread. The financial crisis of 2007–2008 caused many bank failures, including some of the world's largest banks, and provoked much debate about bank regulation.

Business models unlike pre-war times have grown to be consumer centric and banking or investment banking is not isolated from this model. Since, maximum revenue can be generated from the strong relationship an institution is

able to maintain with its clients; strong relationships are the key ingredient of IB growth. IT is a magician which helps grow these relationships even stronger with the communication aid, the visual aid and the increasing efficiency prospects. With a sea change in the political environments in the US and Europe, the financial services industry is entering a period where the burden of regulation and compliance will lessen in the coming times. As deregulation progresses and more capital become available to be deployed elsewhere, financial institutions will take a harder look at financial technologies in which to invest. The major areas of investment for the industry are: Blockchain, artificial intelligence and technology focused on regulatory compliance.

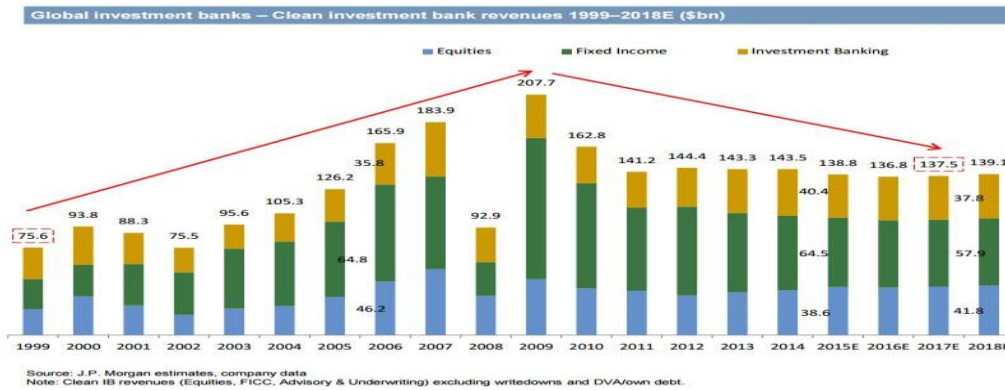


Figure 1 Global Investment banks-Clean investment bank revenues 1999-2018E

## II. OBJECTIVE

- To study the existing and budding technology in the IB industry
- To analyze the impact the technology is offering to the industry

## III. RESEARCH METHODOLOGY

Content Analysis: The method is taken up to analyze content from various sources of data.

### 3.1 IT currently in place - IB:

IT is already in place in forms of various software and applications which are specific to each organization. Few of the Technology giants have made customized products as well which are commonly used across the industry for data management, processing, communication, payments and many more functions. Some of the commonly available applications and software's are JIRA (by Atlassian), Bancs (from TCS), SWIFT. The last revolution IB underwent was in the 90s with the Internet. The next revolution is with SMAC social, mobile, analytics and cloud), Digital & Robotics.

In the present global work culture, IB needs technological assistance right from Trading to trade processing, settlement, risk management, sales and many more functions. These functions involve activities like transactions, bookings, settlements – payments, delivery which needs to be carried out without any delay. To facilitate such crucial high speed activities almost all major IBs have developed their own in-house software. High performance and low latency are a must for the systems and networks. Electronic trading platforms are further automated and use algorithmic trading. Furthermore, there are software being developed to read the investor moods and alert the traders about the expected bullish or bearish trends on their respective stocks apart from technical analysis.

Technology can be divided into two parts:

1. Application & Software Development: Teams are divided to make new business developing application and providing support like an Android/ IOS app.
2. Server Technology: Maintenance of the network and hardware.

In order to develop and work upon the said technologies, the major skill required is that of programming languages. Taking a look into the most in demand languages Goldman Sachs has programming language Java as the number one of any skill-set found in the bank and 25% of its staff have software development skills, far greater than at any of its peers.

This is according to analysis of the Dice Open Web, a tool created by Work Digital Ltd, which brings together data from over 130 different social websites on past and present employees, aggregates it and presents it in an easily digestible manner for recruitment purposes. On a per company basis, skills are ranked against one another and then normalized with the top skill receiving maximum points.

As per a survey from efinancial careers.com while Java was the number one tech skill across all investment banks, at Goldman Sachs it ranked top across the entire bank. It's less important than other skills across most investment banks – at J.P. Morgan it ranked 30th, for example, while it was 15th at Morgan Stanley and Bank of America Merrill Lynch and 19th at Barclays. Tech skills therefore appear to be a lot more central at Goldman Sachs than elsewhere.

“Java has a lot going for it,” says Paul Elworthy, senior manager at IT in finance recruiters iKas International. “We see it used for core trading platforms, reconciliations, PnL attrition and risk management platforms. It's well-entrenched in investment banking so there's a cost benefit for its reusability and there's also a lot of resource available, so recruitment for Java developers is comparatively easy.”

But don't write off C++ in investment banking just yet. “For pricing and risk, Python and Java (and the Polyglots) are now the go to languages, but all banks have legacy systems that use C++ and they need constant maintenance and upgrading,” says Nathan Francis, CEO of recruiters NJF Search. “High Frequency Trading is still dominated by C++. What's more, there are a very few really world class Java developers that can make an engine run as fast as you can in C++.”

Java, C++ and C# are among the more established programming languages, but a relative new kid on the block is Python. Previously, just Bank of America Merrill Lynch and J.P. Morgan used Python – within their Quartz and Athena programmes respectively – but it's now becoming more prominent at banks such as BNP Paribas, Morgan Stanley and Citigroup.

“Everyone at JPMorgan now needs to know Python and there are around 5,000 developers using it at Bank of America,” said Kirat Singh, the former head of global risk systems responsible for Quartz at BAML, who now runs his own firm Washington Technologies. “There are close to 10 million lines of Python code in Quartz and we got close to 3,000 commits a day. It's a good scripting language and easily integrated into both the front and back ends, which was one of the reasons we chose it in the first place.”

“There's been a huge spike in demand for Python developers in investment banking,” agrees Elworthy. “We've also seen increased demand for HTML and JavaScript for the front end of banks' systems.”

Here is a break off of the top software development and hardware/embedded software skills, presented together with an overview of the top sectors across each firm. (ref. news.efinancialcarres.com)

Skill-set	Skill-set rank												
	Bank of America	Merrill Lynch	Barclays	BNP Paribas	Citigroup	Credit Suisse	Deutsche Bank	Goldman Sachs	HSBC	J.P. Morgan	Morgan Stanley	Nomura	UBS
Java	1	1	1	1	1	1	1	1	1	1	1	1	1
C++	2	2	2	2	4	2	2	2	2	2	2	2	3
HTML	3	3	3	3	2	3	3	6	3	3	5	4	4
C#	4	4	4	4		6	7	10	10	6	8	6	10
Python	7			6						8			
Linux	9	7	10		5	4	6	3	5	10	4	3	5
Unix	10		5	5	6	5	4	9	4	9	6	5	2
JavaScript		10			3	10	8	7	7	7	10	9	7
XML	5	6		8	9	9	5	8	6	4	7	7	6
Microsoft SQL	8	8			8	7							8
Perl					10		9	4			3	10	8
C				7	7	8		5		5	9		
Solaris													9
Visual Basic				9					8				
.Net	6	9					10		9				

Figure 2 Skill-set rank

### 3.2 Upcoming Technology:

Here we discuss the technology which is expected to cause the next revolution in IB. These technologies have already taken their shapes and are to achieve a high paced growth for the IB world along with them. Below are the talk of town in IB, when it comes to technical growth:

- AI
- BOTS
- IVR
- OCR
- Crypto
- Blockchain

### 3.3 Artificial Intelligence (AI):

Artificial Intelligence in simple words is intelligence displayed by machines, in contrast with the natural intelligence displayed by humans and other animals. Artificial Intelligence is the talk of the town in the present times, especially when Sophia got to be the first Robot to get citizenship in Saudi Arabia. Though AI in itself is quite a vast field with

it's implications in almost every field of life and study, we would be focussing on the impacts it has on Financial Industry.

Artificial Intelligence (AI) has been touted as the next major disruptor of the financial services sector. Shankar Narayanan, Head of UK & Ireland at Tata Consultancy Services (TCS), reflects on how the novel technology is transforming the banking landscape.

Today, there is one innovation, above all else, that is shaping the future of the financial services (FS) sector through the entire value chain, whether a retail bank or a global financial institution – and this is Artificial Intelligence (AI). It's difficult to read any analyst or trends reports about the future of banking and FS without mentions of AI innovation. In many respects, this is because AI is a tool that's already having a significant impact. Take Swiss Bank UBS, which recently announced that it is using robots on the trading floor in an attempt to boost traders' performance. With AI set to continue changing the financial services landscape, it's essential that business leaders think carefully about where AI can be integrated and how developments in this space are set to impact the banking and FS sector.

### *3.3.1 AI: Driving innovation, securely*

According to a recent TCS study into AI across 13 sectors, 86% of business leaders in the banking and FS sector said they were already using this technology. Fast forward a few years and almost every executive responding believed they will have incorporated AI into their operations at some point along the value chain by 2020. It seems clear that AI will play an increasingly important role in driving change in the financial services sector.

The sector has often been on the front foot when it comes to adopting new innovations and operating models, whether in the retail space with the introduction of the world's first cash machine in London as far back as 1967, or the launch of contactless payments in more recent times. In the 1980s, the UK's 'big bang' saw the deregulation of the sector, along with the introduction of electronic trading that fed rapid expansion and growth. But more recently, the wider FS sector has seen areas such as blockchain drive further change.

According to the management consultancy firm Oliver Wyman, one of the major ways in which technology is changing the FS industry is through automation. In a study launched at this year's Davos, it claimed that automation would allow the sector to cut costs as a proportion of revenues by 15%. And AI was cited as central to this development.

Take how AI is being used to improve customer service at Barclays Bank. Staff are developing an AI system not too dissimilar to Apple's iPhone personal assistant, Siri, to let customers talk to a device and get information they need for vital transactions. And when it comes to the tough decision of whether a bank can lend to customers, AI can help here too. One quarter of banking leaders responding to our study, said that AI would increasingly be used to help them decide who to extend loans to and even where to invest.

Venture capital firm Circle Up uses AI and machine learning to determine which companies to fund. Its crowd funding online platform – Classifier – has evaluated more than 10,000 potential deals carried out by the firm's analysts in the last five years. Since March 2014, the system has helped the firm's investment analysts screen deals, dramatically increasing the number of possible deal evaluations. And the numbers speak for themselves. With Classifier, a team of less than 10 analysts can review 500 opportunities per month, versus the 500 evaluations done per year by the average private equity firm.

As well as helping the banks that like to say yes, AI can help with banks that have to say no. Goldman Sachs recently invested in a startup called Kensho that uses AI to decipher unstructured data such as online articles and social media to spot trends. This can lead to banks being able to identify potential customer financial problems that might force the bank to withdraw credit.

Finally, with security being an ongoing concern for banking customers, it will come as no surprise to learn that 70% of FS executives are using AI technology to detect and deter security intrusions, according to data from our study. Perhaps more than ever before, with hackers using increasingly advanced tools, it is technology's turn to strike back. Ahain, AI is a vital part of the battle.

The view from the boardroom: AI in the black

Investment in AI can bring support for innovative customer solutions and operational improvements, but what about its effect on profit margins? Can it drive revenue and growth? The answer is yes. In fact, based on the TCS research, banking and FS executives found that investment in AI helped them reduce production costs by 13%. Additionally, executives reported a 17% average revenue increase in the area of their AI initiatives.

It comes as no surprise that financial services staff are reaping the rewards of AI. In 2015, the average bank or FS firm spent \$77 million on AI initiatives. Remarkably, four companies that TCS surveyed spent at least \$1 billion. Beyond cost savings and investment, the industry must address AI's impact on jobs. This isn't unique to banking and FS, of course, but interestingly, executives reported in our study that AI investment will in fact lead to

significant job creation. Companies will have to add new jobs in order to develop and manage these developing technologies, which will necessitate new skills and approaches.

The banks we surveyed said AI resulted in an average increase of 10% in jobs in 2015 in the departments using the technology. They projected that the number should increase to 13% new jobs on average by 2020, and 16% by 2025 – many of which don't yet exist today.

The future

There is no doubt that AI is driving the banking and FS markets of tomorrow. This is according to executives who said that AI will be crucial to their ability to compete in the coming years. 59% said that this technology was highly important to drive competitiveness.

Yet, there are also challenges that must be addressed. For example, banking and FS executives admitted that managing the security risk of AI systems is of paramount importance. Other issues like the challenge of developing AI tools that were able to improve decision-making were also reported as potential buffers to the technology's development.

Investing in the right AI technology can have a major impression on operational efficiency, but its success boils down to the customer impact above all else, and like any technological innovation, the best results will be realized only if they are improving the end user's experience. So if AI can save time by pointing a consumer in the direction of the most appropriate financial product, then great. However, if it gets in the way of a seamless experience and frustrates end users, then there's a problem.

Ultimately, perhaps the best lesson to take from the TCS study is that the technology's long term success will be defined by how AI enhances a customer experience or enables a banking employee to service a customer better. The good news is that it looks like AI has the capacity to do this in spades.

**BOTS:** BOTS (Short term for Robots) is simply a software application that runs automated tasks (scripts) over the Internet. Typically, bots perform tasks that are both simple and structurally repetitive, at a much higher rate than would be possible for a human alone. The largest use of bots is in web spidering (web crawler), in which an automated script fetches, analyses and files information from web servers at many times the speed of a human. More than half of all web traffic is made up of bots.

With AI becoming integral to nearly every industry, it's no surprise that banking is increasingly automated. Chatbots like BankBot and Nao are slowly taking us one step further than digital banking, but there are still privacy risks that come with feeding both banks and their bots more information.

BankBot is an app prototype designed by the Polish digital design and communication agency K2. BankBot itself is a robotic bank teller, financial advisor, and personal assistant all in one. The automated sidekick provides a conversational text-based interface, but users can also use their voices instead of typing.

"It understands natural language, so you can ask BankBot to transfer money, open a new account, cancel a credit card, et cetera," Maciek Lipiec, K2's user experience director told Motherboard.

BankBot has the user's transaction history readily available. Users tell BankBot the amount to send and the recipient's name to pay bills or transfer money. Then it functions via artificial intelligence—using natural language processing and a growing knowledge base. "This is important not only for financial institutions, but for e-commerce as well," the company wrote on its website.

BankBot also provides financial advice. It reminds users of when to pay off their credit cards, when to do their taxes, or suggests better options for interest or investments. "What is really important for us is that BankBot is proactive, unlike Siri, for example," Lipiec said. "It reminds users of necessary information on its own initiative.

BankBot is not the only robotic bank teller out there. For instance, the Bank of Tokyo Mitsubishi UFJ introduced a human-like robotic bank teller into its branches last year. Nao, the robot, could answer customers' questions about banking services. Unlike BankBot, Nao exists in real life, around 23 inches tall, as opposed to within a digital platform.

Other banks in the United Kingdom are also beginning to implement robotic tellers that mimic empathy and otherwise help the bank cut costs on paying human workers. The robot Luvo, for instance, at the Royal Bank of Scotland, is meant to be a human-like AI that answers questions online, such as queries about lost credit cards or pin numbers.

However, with all this automation in your personal finances, security issues may come up when robots have so much information about individuals' accounts and other personal information. There have been multiple reports of bank hackers just in the past year, from Ecuador to Bangladesh. And robots and AI systems are hardly immune to security breaches.

Chatbots, computer programs that typically use text-based live chat as an interface to carry out tasks for customers on behalf of the business, are emerging as an inexpensive way to introduce artificial intelligence (AI) in banking.

New digitally savvy companies have found success attracting consumers with user-friendly offerings, while legacy banks are finding it difficult to invest in and adopt innovative products. To remain competitive, these large banks will have to adapt their traditional services by incorporating more robotics in banking that will attract more tech-savvy customers. Deutsche Bank has launched its own BOT colleague IRIS which is based on software that can do things like open emails and attachments, log into applications, fill in forms, read and write to databases, perform calculations, follow if/then decisions and collect data. In future she will provide dynamic, predictive analytics e.g. using database logic to support strategic decision-making.

**Chatbots in Banking:** Chatbots in banking are a digital solution that is relatively inexpensive to develop and maintain. For starters, chatbots require less coding than standalone banking apps. And the current growth in popularity of messaging platforms saves banks the cost of developing their own channels, as well as saving on data storage thanks to chatbots' cloud-based systems.

Companies such as Cleo, Stripe, and Wealth front are giving traditional banks a run for their money. However, for these players it is more difficult to meet the demand of key bank products (such as loans) due to less restricted regulations that force their customers to spend heavily on compliance and maintain large capital cushions.

DBS uses Kasisto's Kai, the underlying technology of MyKai, to allow customers to conduct transactions such as transfers and bill paying. Furthermore, they can ask about their personal finances using messaging applications such as Facebook Messenger and eventually WhatsApp and WeChat, all of which are the top messaging applications used across the world.

In 2016, Swedbank launched on its website and mobile application Nuance's NINA, who helps answer customer inquiries more quickly by sourcing information relevant to their query using intuitive analysis.

**Chatbots in Finance:** The finance industry is built on processing information, which makes it an ideal industry for automation and reduction of salary expenditure, according to a new report from PwC. However, two-thirds of US financial services respondents said that they're limited by operations, regulations, budgets, or resources to make the investment in such innovative development.

Fintech companies such as Plum, Digit, and Cleo use chatbots that drive microsaving by putting small amounts into savings each day for their users. These companies' chatbot is their core product, unlike legacy banks that use it to supplement a core product.

These companies are improving various financial services that provide their customers more than just automated savings. Chatbots can provide wealth management for the masses, underwrite loans and insurance, provide data analyses and advanced analytics, and detect and notify of fraudulent behavior, all through an automated virtual assistant.

Bank of America uses ERICA to give customers key and real-time updates on their finances using a channel of their preference. Her predictive analytics and cognitive messaging helps customers make payments, pay down debts, and check their balances.

**Chatbots Set to Grow:** Exclusive Data from BI Intelligence - Although chatbots have been around for a long time, recently the underlying AI technology has made waves in the market.

BI Intelligence, Business Insider's premium research service, has found that the technological advancements in AI has made leaps and bounds in recent years in financial services.

The growing popularity of messaging apps have made them reliable hosts for chatbots, and the increasing public acceptance of chatbots have created more trustworthy relationships with users, particularly for millennials, whom banks are trying to target.

### *3.4 IVR (Interactive Voice Response) :*

IVR is a telephony technology in which someone uses a touch-tone telephone to interact with a database to acquire information from or enter data into the database. Interactive voice response (IVR) is a technology that allows a computer to interact with humans through the use of voice and DTMF tones input via a keypad. In telecommunications, IVR allows customers to interact with a company's host system via a telephone keypad or by speech recognition, after which services can be inquired about through the IVR dialogue. IVR systems can respond with pre-recorded or dynamically generated audio to further direct users on how to proceed. IVR systems deployed in the network are sized to handle large call volumes and also used for outbound calling, as IVR systems are more intelligent than many predictive dialer systems.[1]

DTMF decoding and speech recognition are used to interpret the caller's response to voice prompts. DTMF tones are entered via the telephone keypad.

Other technologies include using text-to-speech (TTS) to speak complex and dynamic information, such as e-mails, news reports or weather information. IVR technology is also being introduced into automobile systems for hands-free operation. TTS is computer generated synthesized speech that is no longer the robotic voice traditionally

associated with computers. Real voices create the speech in fragments that are spliced together (concatenated) and smoothed before being played to the caller.

An IVR can be deployed in several ways:

1. Equipment installed on the customer premises
2. Equipment installed in the PSTN (public switched telephone network)
3. Application service provider (ASP) / hosted IVR

An automatic call distributor (ACD) is often the first point of contact when calling many larger businesses. An ACD uses digital storage devices to play greetings or announcements, but typically routes a caller without prompting for input. An IVR can play announcements and request an input from the caller. This information can be used to profile the caller and route the call to an agent with a particular skill set. (A skill set is a function applied to a group of call-center agents with a particular skill.)

Interactive voice response can be used to front-end a call center operation by identifying the needs of the caller. Information can be obtained from the caller such as an account number. Answers to simple questions such as account balances or pre-recorded information can be provided without operator intervention. Account numbers from the IVR are often compared to caller ID data for security reasons and additional IVR responses are required if the caller ID does not match the account record.

IVR call flows are created in a variety of ways. A traditional IVR depended upon proprietary programming or scripting languages, whereas modern IVR applications are generated in a similar way to Web pages, using standards such as VoiceXML, CCXML, SRGS and SSML. The ability to use XML-driven applications allows a web server to act as the application server, freeing the IVR developer to focus on the call flow.

IVR speech recognition interactions (call flows) are designed using 3 approaches to prompt for and recognize user input: directed, open-ended, and mixed dialogue.

A directed dialogue prompt communicates a set of valid responses to the user (e.g. "How can I help you? ... Say something like, account balance, order status, or more options"). An open-ended prompt does not communicate a set of valid responses (e.g. "How can I help you?"). In both cases, the goal is to glean a valid spoken response from the user. The key difference is that with directed dialogue, the user is more likely to speak an option exactly as was communicated by the prompt (e.g. "account balance"). With an open-ended prompt, however, the user is likely to include extraneous words or phrases (e.g. "I was just looking at my bill and saw that my balance was wrong."). The open-ended prompt requires a greater degree of natural language processing to extract the relevant information from the phrase (i.e. "balance"). Open-ended recognition also requires a larger grammar set, which accounts for a wider array of permutations of a given response (e.g. "balance was wrong", "wrong balance", "balance is high", "high balance"). Despite the greater amount of data and processing required for open-ended prompts, they are more interactively efficient, as the prompts themselves are typically much shorter.

A mixed dialogue approach involves shifting from open-ended to direct dialogue or vice-versa within the same interaction, as one type of prompt may be more effective in a given situation. Mixed dialog prompts must also be able to recognize responses that are not relevant to the immediate prompt, for instance in the case of a user deciding to shift to a function different from the current one.

Higher level IVR development tools are available to further simplify the application development process. A call flow diagram can be drawn with a GUI tool and the presentation layer (typically VoiceXML) can be automatically generated. In addition, these tools normally provide extension mechanisms for software integration, such as an HTTP interface to a website and a Java interface for connecting to a database.

In telecommunications, an audio response unit (ARU) is a device that provides synthesized voice responses to DTMF keypresses by processing calls based on (a) the call-originator input, (b) information received from a database, and (c) information in the incoming call, such as the time of day. ARUs increase the number of information calls handled and provide consistent quality in information retrieval.

Used to servise high call vlomues - A common misconception refers to an automated attendant as an IVR. The terms are distinct and mean different things to traditional telecommunications professionals—the purpose of an IVR is to take input, process it, and return a result, whereas that of an automated attendant is to route calls.

### 3.5 OCR (Optical Character Recognition):

OCR or Optical Character Recognition is an operation with the help of which one can convert scanned document files into machine readable format files. The scanned documents after entering the computer's hard drive in the form of an image format lacks the ability of being searched. OCR provides this ability to the file with the support of a set of software and hardware devices. This technology is not new and has been applied in various fields today. OCR for the banking industry, legal industry and educational establishments are just some of its many uses. Each of these fields have benefited tremendously as OCR continues to make life easier for all.

OCR for the banking industry has not just simplified all banking processes but also made it much faster. It should not be surprising to know that OCR for the banking industry was the first to harness the technology way back in the late 50s. Early versions of OCR were helpful in the processing of checks due to their capability to read the check numbers printed in the bottom of the check. This is the reason why most check numbers were printed in a unique font. Bank of America was the first bank to make use of OCR tools.

As the OCR technology improved, the applications of OCR for the banking industry flourished consequently. Bank pass books began to be scanned using a scanner and with the help of OCR, the last entry update can now be recognized. Accordingly, the pass book printer will print entries for the account after the last entry. This minimized human intervention and the possibility of any errors. All the bank employee has to do is place the pass book under the scanner and let OCR do the rest.

The more OCR advances, the lesser is the need for any manual work. OCR can now even recognize hand written text which is working wonders for the banking industry. Besides being able to read the account number, check number and figure, OCR for the banking industry is now capable of scanning signatures on checks too.

Applications of OCR for the banking industry have made it so much more convenient than before, helping not just banks but also customers because of the increase in the pace of getting things done.

### 3.6 Cryptocurrency:

A cryptocurrency (or crypto currency) is a digital asset designed to work as a medium of exchange that uses cryptography to secure its transactions, to control the creation of additional units, and to verify the transfer of assets. Cryptocurrencies are classified as a subset of digital currencies and are also classified as a subset of alternative currencies and virtual currencies.

Bitcoin, created in 2009, was the first decentralized cryptocurrency. Since then, numerous other cryptocurrencies have been created. These are frequently called altcoins, as a blend of alternative coin. Bitcoin and its derivatives use decentralized control as opposed to centralized electronic money and central banking systems. The decentralized control is related to the use of bitcoin's blockchain transaction database in the role of a distributed ledger.

### 3.7 Blockchain:

At present, middle and back-office functions remain mostly antiquated, slow and not very efficient. IB firms are still dealing with overly complex procedures involving multiple counterparties, manual processes and third-party service providers.

Blockchain is a disruptive technology platform that uses cryptography and a distributed messaging protocol to create shared ledgers among counterparties. Originally, blockchain technology was used by cryptocurrencies whose popularity gave rise to the idea of blockchains as a means of building consensus. Since then, banks have begun exploring ways to apply blockchain-distributed technology to payments. In the context of capital markets, blockchain distributed ledgers enable open-source, decentralized, replicated, shared and cryptographically secure operations that are validated by mass collaboration and can be applied to many financial instruments.

Unlike traditional ledgers in banks, which use central authorities to manage transactions (see Figure 1), distributed ledgers built on blockchains validate transactions through a protocol managed by the user community via a consensus mechanism (see Figure 2). This decentralized approach changes the power dynamic within the financial system, shifting power from institutions to users.

Asset transfers can be facilitated without third-party intermediaries through the use of “smart contracts” – programmed code that replicates conventional commercial agreements by digitizing business transactions between parties and validating them through a blockchain. Practically speaking, this means blockchain-enabled networks have the potential to increase trading efficiency, improve regulatory control and eliminate unnecessary intermediaries.

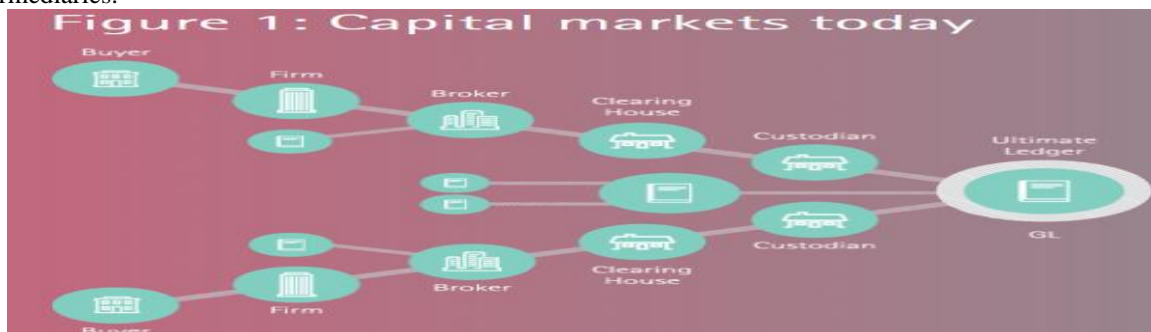




Figure 3 Capital Market Today



Figure 4 Capital Market in 2025

3.7.1 Blockchains are most valuable when:

- They are used to keep track of complex things,
- There is no well-established authority in place.
- Transactions involve finite or countable resources.
- A cryptographic audit trail is required.

3.7.2 How Can Block chain Help?

Reduce total cost of ownership by offering a robust and verifiable alternative to traditional proprietary stacks at a fraction of the cost.

Clear and settle transactions faster by transitioning from overnight batch processing to intra day clearing.

Manage system-of-record sharing: Blockchain technology makes it possible to give various parties (e.g., clients, custodians and regulators) access to their own live copies of a shared system of record.

Create self-describing electronic transactions: Smart contracts can use blockchain’s programming language to create context-aware transactions for complex arbitration. For example, a credit default swap could pay out automatically according to pre-agreed logic that watches market data feeds.

Many firms are in an exploratory phase, testing out the technology in their own technology labs and innovation centers. Despite numerous technical and regulatory uncertainties, blockchain technology has many possible applications in capital markets. For example, suggested use cases in testing mode today may include Know Your Customer/Anti-Money Laundering (KYC/AML) data-sharing, trade surveillance, regulatory reporting, collateral management, trading, settlement and clearing.

Firms that want to assess the viability of blockchain technology for specific financial instruments, such as syndicated loans, should consider a number of factors, such as anticipated reduction in settlement days, current clearing and settlement costs, digitization potential, product volume, cost of capital avoided and implementation costs. The next step is to clearly identify risks and challenges. Only then should a firm begin developing a detailed blockchain roadmap, determining product and asset class adoption and creating an implementation schedule.

3.8. Inference

Now that we have collected all the data on where and how It is impacting the banking industry. The bottomline remains the fact that IT has been the talk of the town since it’s inception i.e the early 19th century when internet, telecommunication and technology in it’s very form took a new flight making the business world more efficient and more robust. Yes, the complexity of business world has increased with the globalization that has been a gift from technology. Globalization and ease of cross border business is directly credited to the technological advances that have made communication and transactions easy, quick and reliable, even across opposite ends of our planet. Hence, IT has not only impacted but has made it’s place in the very existence or survival of business world. By the numerous examples given in this paper, it is quite evident that all those who had to thrive in the fight of survival had to adapt to changing market demands of IT. Those who joined hands with technology survived and those who have put in extra efforts to excel by embracing this new trend have come out as clear winners.

As no business can survive without customers. Though, Banking has been there since ages, it has taken new shape and structure by stretching itself in various domains providing variant and better services to clients. These new bodies are commonly known as investment banks.

ATM, website portal, e-banking, mobile banking are few advancements which are now old, thanks to the forever innovating world of IT. Extending from these, Banking firms are now looking for engraving digitalization in their very core. With the current era of de-regulation and changing political forces thus changing rules and demands, banks are investing a good part in IT.

Every IB firm has its own IT department, who is not only responsible for the maintenance of their server, data and systems but is now working on developing new apps and softwares to help them improvise on repetitive processes, adding on to the efficiency and mitigating human errors at the same time. These apps and software are based on programming languages which are discussed in the paper in depth.

Moving forward, the upcoming or we can say the sizzling area which is driving the maximum attention is Artificial Intelligence (AI). Leave mere scripts, apps or softwares AI has introduced a live Robot Sophia (not to mention she was looking for investors in her last interview with the media). AI is all set to drive the industry to all new ventures and is expected to completely change the shape of the industry for better.

With its few forms as BOTS, IVR, OCR, Crypto and Blockchain, AI is expected to remove all the worries of those long waiting queues, waiting for settlement of your trade or payment. Customer is going to be the most happy king who will be able to get banking done in the blink of an eye and without any ugly surprises.

Yet, there are always two sides of the coin or as they say, everything comes for a price. Here is an analysis of the pros and cons of the impact of IT on the industry.

#### IV. ADVANTAGES

Automation will lead to zero human errors along with much quicker work ways.

Fewer workforces required, cutting costs for firms.

Mobile banking, internet banking, OCR and IVR IT are few friends who have provided Ease of access. Thanks to them, long queues and an age long waiting time are the things of past.

New jobs created for innovative and creative skills. No more reluctance to change can make you survive, technological up gradation is a must to add on the skill sets.

Crossborder communications as well as transactions are easy with technology.

Cryptocurrency is quite amazing, fancy and catchy when it comes to the secure, easy and multiple platform usability it provides.

#### V. CONCLUSION

Automation will come to a halt if there is even a slightest change in the usual course, hence it is a challenge to be developed for dynamic processes.

Automation can come out to be a threat if there ever comes a down time where the system gets stuck or breaks down.

Due to automation people will not be trained on manual workarounds causing a big time threat for an entire process to come to a halt till the system does not retrieve.

Job loss for the skills that are no more required.

OCR might get you stuck in case of a new challenge and you are in need of specific human help.

A hike in crossborder activities has increased the complexity of business.

Increasing security costs - With technological advances come the increasing threat of hacking, online theft and online robbery - eg. Hence, better protection against malicious activities is needed.

Cryptocurrency - the base of Bitcoin has made a decentralized system, which is a virtual market. Bitcoin is expected to be the next bubble burst which is going to bring the next doom's day after the sub-prime crisis.

Hence, as always said Science is a good servant but a bad master. Those who are able to fight the Cons and cash upon the Pros are expected to be our next generation Stars. IT has always had an irreplaceable impact on business, more for good. If cashed upon, IT can make the fate of any firm to go places and grow leaps and bounces.

#### VI. REFERENCES

- [1] [www.accenture.com/us-en/insight-investment-bank-challenges-blockchain-technology](http://www.accenture.com/us-en/insight-investment-bank-challenges-blockchain-technology)
- [2] [www.mergersandinquisitions.com/future-of-investment-banking-2015/](http://www.mergersandinquisitions.com/future-of-investment-banking-2015/)
- [3] [economics.emory.edu/home/documents/workingpapers/fohlin\\_14\\_16\\_paper.pdf](http://economics.emory.edu/home/documents/workingpapers/fohlin_14_16_paper.pdf)
- [4] [www.capgemini.com/2016/04/the-growing-impact-of-technology-on-the-insurance-and-banking](http://www.capgemini.com/2016/04/the-growing-impact-of-technology-on-the-insurance-and-banking)
- [5] [www.efinancialcareers.com](http://www.efinancialcareers.com)