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# A Comprehensive Study of Blockchain and Artificial Intelligence in Financial Technology

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**Abstract** - *Fintech is a fast-growing industry in the digital world and it has become an essential part of all human lives to perform seamless digital transactions and various financial operations. Also, various innovative measures are being applied in the finance industry in the recent years to stimulate growth to provide efficient solutions. Blockchain and Artificial Intelligence being the pillars of innovation have proved n number of times that the solutions they offer present signs of progress which has paved way for various applications in the financial industry as well. This paper aims to bridge the gap between Blockchain, Artificial Intelligence and the Fintech industry and how these emerging technologies actually interact with each other on a high level and how these technologies are on road to becoming an integral part of both the consumer and corporate world. This review would help in understanding the fundamentals of the emerging technologies and how they are implemented in the Financial World and how Fintech can disrupt the traditional system.*

***Key Words***: Finance, Ledger, Neural Networks, Digital, Transactions, Smart Contract, Network, Transparent.

## 1. INTRODUCTION

Artificial Intelligence (AI) is a much-publicized topic in the technology locale nowadays. The central idea of AI is to implement human intelligence into a machine whether that is learning, reasoning or self-correction. It analyzes the different situations present and attempts to deliver the most plausible solution to achieve a particular goal. Whenever the term "Artificial Intelligence" comes along people typically think it is all based on robots, doing the human work, which is not quite true entirely. Apart from robots, AI has diversified into many aspects like business Analytics, healthcare, and many more to name.

## 2. HISTORY OF ARTIFICIAL INTELLIGENCE

From researchers' perspectives, AI is not a new terminology. In the 1939 movie Wizard of Oz the globe first saw the Tin-man, a non-human, heartless entity who can enact all the human activities, and subsequently, many movies adapted the thought of "Robots" or Mechanical men. Furthermore, there are convictions of Mechanical men in historical Greek and Egyptian folklore.

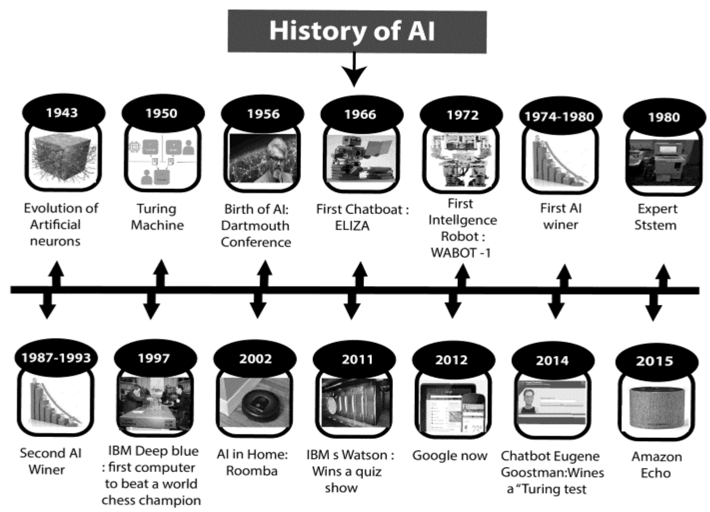


**Fig -1:** Evolution of AI

In the year 1943, Warren McCulloch and Walter Pits came up with a model of an artificial neuron, which is acknowledged as the first work in artificial intelligence. Alan Turing, a British mathematician, and logician published "Computing Machinery and Intelligence" where he suggested a test called "Turing Test". The test is a simple procedure to arbitrate a machine's ability to acquaint human-like behavior. "Turing Test is employed to determine whether or not a computer (machine) can think intelligently like a human?".

"The first artificial intelligence program", famously known as Logic Theorist, was written by Allen Newell, Cliff Shaw, and Herbert Simon in the year 1955, five years later after Turing's test. It was sponsored by Research and Development (RAND) Corporation. The program was engineered to accomplish automated reasoning and was been able to prove 38 of the first 52 theorems of Principia Mathematica by Whitehead and Russell. It was presented at the Dartmouth Summer Research Project on Artificial

Intelligence (DSRPAI) in 1956 conducted by John McCarthy and Marvin Minsky. The word “Artificial Intelligence” was established by John McCarthy, American Computer scientist. Since then, many applications and programs were released within the AI field like IBM’s Watson (2011), Google’s “Google Now” (2012), chat-bot “Eugene Goostman” (2014), “Project Debater” (2018) by IBM.

## 3. CLASSIFICATION OF AI:

There are two circumstances in which AI can be classified. One is based on capabilities, while the other is based on performance.

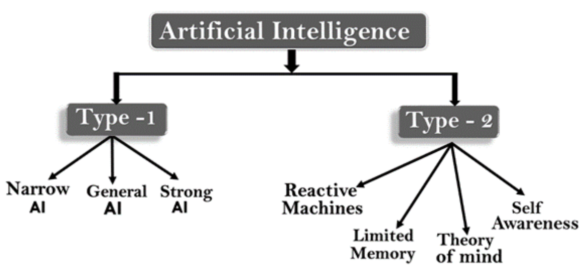


**Fig -2**: Types of Artificial Intelligence

### 3.1 First Type: Depends on capabilities

### 3.1.1 Narrow AI or Weak AI

Narrow AI is the most approachable and accessible sort of AI in the field. It is designed to carry out a definite task. When the conditions are off-limits, Narrow AI fails to perform. Due to this drawback, it is termed as Weak AI. Watson from IBM and Siri from Apple are some of the common examples of Narrow AI.

### 3.1.2 General AI

General AI is that type of AI that can perform any task, just like a human, without any restrictions. As of now, there is no such type of machine in the market, and scientists and researchers are keenly looking to develop such systems.

### 3.1.3 Strong AI or Super AI

Super AI or Artificial Super Intelligence (ASI) can overpower the human brain in every possible scenario. In simpler words, this type of AI performs better than a human brain. This is a hypothetical conceptualization in the AI field and is still in the research phase.

### 3.2 Second Type: Depends on functionalities

Based upon the functionalities, AI is primarily divided into four types, which are as follows

### 3.2.1 Reactive AI

This is the most fundamental form of AI. It does not possess any memory of the past to act on any future operations and takes action by focusing on the current situation only. Example- Deep Blue (IBM), AlphaGo (Google).

### 3.2.2 Limited Memory AI

Limited Memory AI can store past information and experience for a little while. Whenever there are any decisions to make, the previous experience and information, stored in the memory is taken into consideration. Example- autonomous vehicles.

### 3.2.3 Theory of Mind AI

The Theory of Mind concept intends to break the barricade between humans and machines. To put in simple words, the machine would be able to accomplish all the human activities, interact, think, feel emotions, and will be able to socialize just like us. Scientists have made a considerable amount of progress, but there is still a long way to go for this sort of AI.

### 3.2.4 Self-Aware AI

Self-Awareness AI is still a speculative idea and does not have existence in reality. The most ultimate goal of AI is to implement this kind of machine, which will know about its existence in the world and will be ready to make judgments. In the future, this kind of AI might exist but as of now there is no such development as such.

## 4. SUBSETS OF AI

Computer-based intelligence is an expansive field. Each subset of AI has its own assignments and potentialities. These subgroups collaborate to create an AI-assisted task. Mainly, there are three significant subsets of AI which are as per the following-

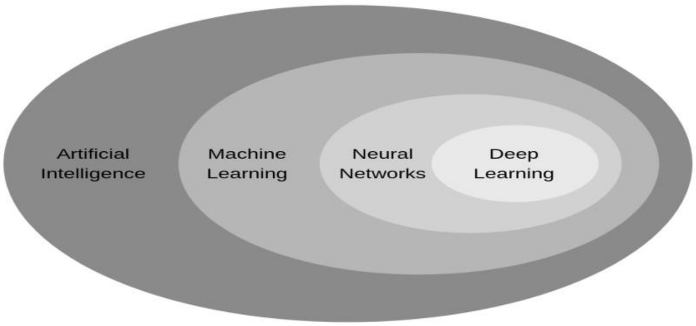


**Fig -3**: Subsets of Artificial Intelligence

## 4.1 Machine Learning

Machine Learning (ML) is a subset of AI. ML follows the most basic motto of AI, acquiring knowledge from experience, instead of instructions. In ML a set of data is given as an input to the machine It automatically learns from the data given and makes decisions, without any human involvement.

## 4.2 Neural Networks

Neural Networks are the subset of ML, as well as AI. The term "Neural" is adopted from the biological neurons. The operation of the Neural Network is also similar to the neurons of the human body, processing information from one tier to another. Because neural networks can adapt to changing input, they can produce the best possible outcome without requiring the output criteria to be remodeled.

## 4.3 Deep Learning:

Deep Learning is achieved through neural architecture hence also called a deep neural network. The networks within deep learning have the ability to learn from the unsupervised data, which are unorganized. Some of the applications of Deep Learning are visual recognition, malware and fraud detection, natural language processing (NLP), virtual assistants, etc.

# 5. AI IN SPAIN'S FINTECH SECTOR

Fintech is a mix of words "finance" and "technology", and it refers to any company in which financial services and processes can be improved and automated using technology. It is comparatively new and rapidly evolving technology that enables customers and financial institutions to get financial services in new and faster ways than previously possible. Spain's national AI strategy, revealed by Prime Minister Pedro Sanchez, will see $720 million in public investment in the field between 2021 and 2023.

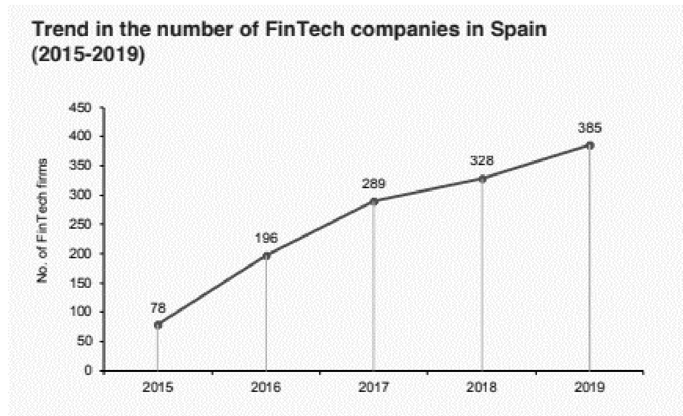


**Chart -1**: Trend in the number of Fintech Companies in Spain

In recent years, the Fintech sector in Spain has seen significant expansion in terms of both the number of companies and the amount of private investment it has received. To be more precise, the number of Fintech companies in Spain has increased by 5% (78 in 2015 to 385 in 2019). Personal finance management, investments, payments, and credits are the four main divisions of the industry.

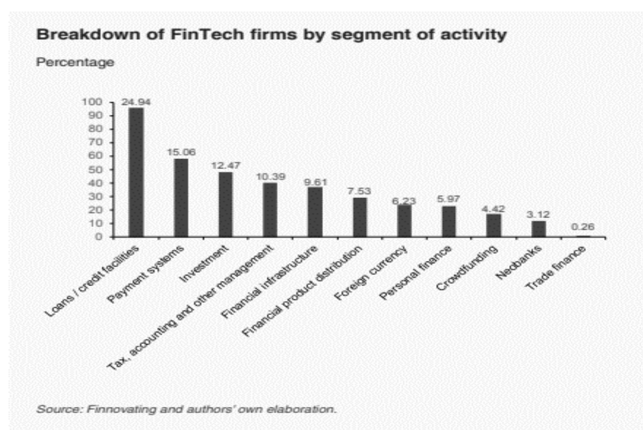


**Chart -2**: Breakdown of Fintech firms by segment of activity

Caixa Bank's (Spain) use of AI is an example of how digital transformation at banks extends beyond chat-bots or replacing repetitive manual tasks with robotic process automation software. BBVA Spain's second-biggest bank, prioritized a consumer-centric platform as well as technical expenditure. The platform is customizable, scalable, and real-time allowing mobile users to receive the service they expect. An Artificial Intelligence technology has been developed by the Bank of Spain (Central Bank of Spain) for sorting banknotes among suitable and unsuitable for flow. AI is also being used to forecast price movements in the real estate market and foresee future liquidity issues at financial institutions. A digital loaning platform, ID Finance offers credit-scoring-based loans. To deliver financial services to the under subsidized, the company uses ML-based credit scoring and risk management tools.

## 6. THE ROLE OF BLOCKCHAIN

The Blockchain makes use of the distributed ledger methodology which enables information to be stored on various servers universally. Blockchain has become a key integral part of the digital world with its ever-expanding potential which has already begun disrupting various industries and on course for a digital revolution. It was created in 2008 with Bitcoin, a cryptocurrency, basically as a peer-peer digital payment structure to allow users to perform transactions by eliminating the need of intermediation by a central agent like a banking institution thus preventing the problem of double-spending. The blocks are connected by chains and hence known as "Blockchain", and these chains represent cryptographic algorithms. It is a peer-to-peer network and connected by various nodes that ultimately forms the chain. The properties are similar to that of a distributed and transactional network database. As the information is verified by every single node in the network, it is sent to the other nodes in the network with the help of their public keys.

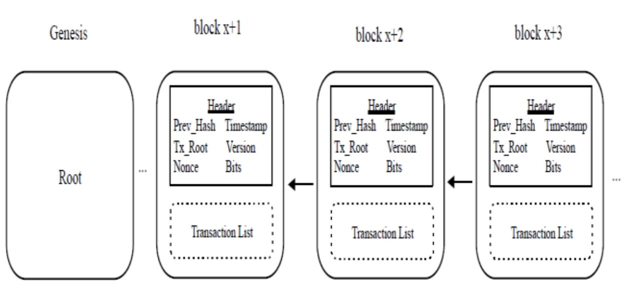


**Fig -4:** The Blockchain Body Network

As we can see in the Figure 1, all the blocks which are connected has unique identification hash value which creates a reference indication belonging to the previous block. The users present can make use of a public or private key and can gain access into the network and make use of the information exchange which takes place inside the network.

## 7. FINTECH

The Financial Technology which is known as FinTech in the digital and technological industry refers to the utilization of various computer programs and developing technology to aid various use cases and provide fool proof solutions to the financial industry. The Fintech sector has been growing a lot since the late 2013 and the early 2014 and has become a sensation among regulators, customers, industrialists and the growing financial institutions. The various actors of the financial industry and the institutions are giving a green signal to the underlying nature of the Financial Technology (FinTech) and how crucial it is to implement it in the digital world mainly because it is backed up by a very strong technology known as the Blockchain. The development of FinTech throughout history can be divided into three main eras:

### 7.1 Fintech 1.0 (1866–1967)

During this early stage, finance started developing in agricultural states.

The use of currency, with its main advantage being the transfer of its value, started facilitating

financial transactions. Developments within the 19th century of railroads and therefore the invention of the telegraph facilitated connections across borders. After the nice War, technology started quickly developing, laying the foundations of the following FinTech era.

### 7.2 Fintech 2.0 (1967-2008)

This era is characterized by the rapid expansion of electronic payment

systems. In 1968, the Inter-Bank Computer Bureau was founded within the UK, cementing what today is thought because the Bankers' Automated Clearing Services. Regulations in the FinTech world started happening, mainly because of the collapse in 1974 of Herstatt Bank. The results of the collapse of the exchange in 1987 (also called Black Monday), established the doubt that universal markets were industrially allied. Throughout the 1990s, technological advances were made in risk management systems and therefore the development of online consumer banking. The creation of digital banking (back then banks were the only authorized monetary institutions) attracted more attention by regulators because it created new risks.

### 7.3 Fintech 3.0 (2008–present)

The start of this era was characterized by the financial turmoil

of the years 2007–2008. Trust within the industry began to be lost, and technological

firms began to operate through peer-to-peer networks outside the regulatory framework (in

China alone over 2000 platforms were developed). Today, these technological firms and plenty of

start-ups are shifting banks at a stride on no occasion seen before. Flexible regulations that stimulate entrepreneurship is commencing to be adopted by some countries.

## 8. BLOCKCHAIN BANKING

It's not serendipitous that blockchain technology was first introduced as some way to breathe some fresh air into the financial sector. Originally created at the peak of the 2008 global financial crisis because the operational backbone of Bitcoin, blockchain's Distributed Ledger Technology (DLT) could be a safe and secure method to transfer and catalog data.

In short, blockchain could be a public ledger capable of recording the origin, movement and transfer of anything of import. rather than wishing on a central authority (i.e., banks), blockchain requires unanimous approval from the individual nodes within the blockchain to process a payment or transfer a decent. The ledger technology is most tasty to the financial sector because it solves many problems plaguing the industry today, namely security and efficiency. The word "disruptive" is employed only too frequently nowadays, especially within the technology space, but blockchain truly has the flexibility to shake the multi trillion-dollar financial industry to its core. The trust is gained in a Blockchain network by the implementation of a system called the Smart Contract system. This has been the most impactful application in finance because of the ability to establish a strong trust within the network. Smart Contracts are similar to the various physical contracts which are available but the stipulations of the contract are fulfilled in live time via the use of the Blockchain. Smart contracts are valuable, specifically to the finance sector, for abundant reasons. These contracts are fulfilled promptly after all conditions are met and do not require any middlemen and add sensitive levels of security. Populous is a London based fintech company which deals with invoice and trade finance and have a designated platform to perform all of these activities as well. All the activities which are performed on the platform make use of the blockchain based smart contract system. They provide various invoices with the help of contracts and they can purchase contracts from business owners in a faster and secure way than most of the traditional agreements which are present. Also, the business analytics platform makes use of Blockchain to privately view and distribute the data among the various departments. Zeppelin solutions which are headquartered in San Francisco, make use of the blockchain network by applying blockchain based infrastructure for the fast-growing smart contract system. They have implemented numerous solutions ranging from the financial sector to the digital media platform. Using this smart contract system, till date, more than $4.5 billion has been transacted with extreme level of ease and safety.

## 9. DIGITAL PAYMENTS

One of the foremost attractive applications of blockchain in fintech is its ability to process payments almost instantaneously and in a manner that protects data integrity. Since the basic idea of the DLT is to bypass centralized institutions, moving money from peer-to-peer is as simple as pressing a "send" button on a phone. Once initiated, the nodes inside the blockchain work to unanimously accept or deny the payment in a second. There is no requirement for the cash to take a seat in limbo for days while the bank processes the transaction, neither is it burdened by the different exorbitant fees which is stamped in traditional standards.

By conducting money transfers with the blockchain, both customers and banks could save an unprecedented amount of time and money. Blockchain-based currencies are universal, meaning there are nil exchange rates, international transfer fees or confusing country-by-country laws that prohibit the transfer of cryptos. Exploring a growing fintech startup in Kenya, Bitpesa has an interesting platform which abridges all the various financial transactions in the digital markets. They provide payment transfer options in Africa and also offer the cross-border payment methods, a new digital treasury tool and provide extremely flat exchange rates as well. The blockchain technology which is involved charges only around 1-3% charge on each transaction and the execution takes place in a matter of few hours. A Copenhagen based company, Makerdao, preach the concept of stability which is extremely important while transferring money in the cryptocurrency market. The Ethereum blockchain which is present have Makerdao as a decentralized organization and they aim to minimize the instability and volatility against the US Dollar with the aid of performing transactions and trading using their own crypto coin known as the Dai Coin.


**Fig -5**: Digital Ledger Technology

## 10. AMALGAMATION OF BLOCKCHAIN AND FINTECH

Many still believe that fintech and blockchain don't belong together. We now use phones to ask AI-powered chatbots to test our savings, but that's it. The very core of how our finances work didn't sustain with the 21st century. Despite all the tech at their disposal, financial regulators still operate precisely the same as they did decades ago. Financial entities still hold the ability to dam our transactions. We've little control during this arrangement, despite the actual fact that major assets still belong to us, not them. Most people are programmed to think that these models are the sole way of handling large amounts of cash. Nevertheless, the fintech industry has been engineering various alternatives for years. There are some amazing achievements resulting from fintech trends over a comparatively short period of your time. However, challenging the elemental establishment proved too big of a barrier to beat – a minimum of, until now. With blockchain, fintech might finally have what it must make a real dent in our obsolete financial sectors. By leveraging this new think about the financial equation, fintech companies can use properties inherent to blockchain systems to actually transform how our economy works. While Fintech and Blockchain can act as a recipe for an ideal (Financial) Storm, in a nutshell, fintech is the root of innovation operating at the intersection of economic services and technology. Whenever you go browsing to look at past transactions or use a chunk of software to manage spending, you're counting on solutions that extended from the fintech sector. The main calling card of fintech companies is enhancing traditional financial services through the utilization of applications. the most goal is to boost processes like mobile payments, money transfers, loans, fundraisings, and asset management. While its grasp ranges far beyond economics, blockchain makes for a hand-in-glove fit with what fintech hopes to accomplish. This is often because of its origins – the very first functional blockchain enabled the primary fair transactions and it's been its focus ever since.

The use of blockchain in fintech opens an entire new world of opportunities for the financial world. With a touch little bit of luck, the fintech and blockchain industry could pave the thanks to completely democratized finance. What's more, fintech blockchain apps can eliminate the ever-present issue of trust between two transacting parties operating on equal terms. Between bulletproof identity authentication protocols and smart contracts, blockchain is one among the foremost secure environment on the market. The main reason why fintech and blockchain are such a decent fit are often bottled all the way down to one single point. It's an inherent property of blockchain-powered networks – like all DLT (Distributed Ledger Technology) systems; they operate during a completely decentralized way. Obviously, this is often an on-the-spot contrast to how our current economy works. Banks and governments, the two main spearheads of FIAT currencies, are heavily reliant on centralization, which implies introducing blockchain fintech solutions would entail bringing the whole financial structure down. We'd get a chance to reform our economy from the bottom up – and that's precisely what blockchain fintech companies are attempting to try and do at once. As long as blockchain fintech companies make sure that the registration process is sound, end-users will never need to worry about who the person on the opposite end of the transaction is. There would be no risk of accidentally addressing the incorrect person, while most know-your-client and anti-money laundering procedures would be boiled right down to mere formalities. Furthermore, if we were to make a high-end blockchain fintech app, registering thereon would only need to be performed once. Every subsequent login would never require more information aside from the private key, plus it might be possible to use the identical profile on other blockchain systems (as long because the networks are connected in some form, of course).

## 11. CONCLUSIONS

Artificial Intelligence and Blockchain being the prime of the digital world have extreme level implications when they are used in the right format to revolutionize every single element of the ever-growing financial world making it highly inclusive and accessible for everyone. Making use of various algorithms and cryptographic solutions there would be an easier achievement of security, transparency and higher levels of anonymity thus eliminating traditional system problems. Emphasizing the use of the modern digital technologies with the traditional financial system would create an egalitarian society ultimately benefitting the future generations including the consumers and the corporate world aesthetics. Finance is a central part of all the industries and sectors and when it is combined with the revolutionizing technology it can be applied to improve the current market standards thereby putting us decades into the future enabling consumers to execute seamless transactions all over the world making use of various financial instruments and not creating any sort of restriction. Fintech combined with Blockchain and Artificial Intelligence is going to be a very important element in the forth coming years paving way for different investors and entrepreneurs.

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