

Analysis of Natural Language Processing in the FinTech Models of Mid-21st Century

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Abstract

FinTech is a digital innovation technology that aims to educate and enable the world on how to create utility values in every activity. Natural language processing is one of the umbrella systems that has unite other innovative technologies behind FinTech. Technological system drivers regarded as "ABCDE" of FinTech consist of Artificial intelligence, Blockchain, Cloud computing, big data, and the internet of things. As communication took the lead in the second half of the 21st century, most companies are moving remotely, leading to much-needed innovation in FinTech. The study presents how natural language processing enables different technologies and advances the technology behind FinTech. The study aims to identify areas of the modern world that can be transformed into a source of finance using the FinTechs drivers of "ABCDE".

The study observed FinTech as a digital Economics that integrates with different aspects of modern technology to create utility values. The study uses the 5 C's of credit as the source of finance for innovative ideas and the 5 P's of marketing as innovative network to reach ultimate FinTech utility values. Results based on the demand and supply analysis indicate that a combination of 5 C's and 5 P's is the bond behind FinTech with the support of the drivers of "ABCDE". Also that the increased demand for goods and services in every economy indicates a fall in the request for credit and vice versa. The study concluded that a well-structured 5 C's and 5 P's is the best route to FinTech technology which is financial freedom to the world.

Keywords: FinTech technology, Natural Language Processing, Cloud computing, artificial intelligence, blockchain, 5 C's of credit, 5 P's of Marketing.

1. Introduction

FinTech is a financial technology that locates creative values, positive energy, talents, rich potential, and innovations in the world to create utility values in its entirety. FinTech is a rich culture of modern technology that enables people to get to the top in what they do best using FinTech's drivers of "ABCDE" [8, 9, 10]. Today natural language processing has made the world become more of a global village and has united different technologies into innovative solutions called financial technology. Thanks to NLP that language is no longer a barrier to business incentives but talents and potential. NLP has helped centralize the world in a great way that communications can flow without the need for translators [11, 12, 13]. The 5 pillars of FinTech technology identified in this paper are the various technologies that natural language processing has united to the platform FinTech [14, 15, 16]. The 5 pillars are artificial intelligence, cloud computing, blockchain, big data, and the internet of things. These five pillars of FinTech are detailing explain under methodology and how they have to change the technology behind FinTech. The 5 C's of credit identified in this study are character, capacity, capital, collateral, and condition [17, 18]. The study observes that the increased request or demand for credit is usually characterized by low sales. In the market or an economy with increased purchasing power there is usually little or no demand for credit. The 5 C's determine the activities of 5 P's in marketing. The 5 P's of marketing for financial services are people, products, place, price, and promotion [19, 20]. The increased application of 5 P's indicates an increased demand for credit. So 5 P's are dependent on the functionality of 5 C's of credit.

FinTech technology is one of the best things that has happened to humanity. The level of dependency in the world has reduced. Talented people now make more meaningful use of their talents and skills. There are advanced services that people do use to obtain their earnings. In the era of financial technology, it is common to see readily available funds available to advance ideas for a reward in return. Financial institutions are now available to search for new ideas to fund and develop startups. In this era, nobody has left behind no matter the situation. Financial technology has made it clear from the services and opportunities offered that if you decide to become rich and famous you will and no government or leader can stop.

One of the major winning strategies in FinTech technology is the ability for customers to estimate changes in the market. The prices of goods indicate the attitude of buyers. When prices go beyond expectations, it is a clear fact that the demand for credit requests increases.

The credit application is not just for consumers but for both consumers and suppliers. During a period of excess production for a consecutive period, the buffer stocks usually trend to a level where little intervention is required. When little subsidies are offered to producers, they always turn to financial institutions for credit. Thanks to Fintech technology, the process of credit is no longer a barrier to stability in the economy.

Smart services like promotional loans, grants, scholarships, internships, treasury bills, stock buying, and many more have become widely available to the generated public [69]. In the early days students and parents used to struggle a lot to finance their children to school. Thanks to Fintech technology, the process of obtaining a loan, especially an education loan, has become easier. In the financial technology era, students can attract him or for free studies. Today, many learning institutions can provide their students with scholarships. This has motivated students to learn faster to secure more scholarships [70].

Thanks to FinTech technology, skills are acquired on the job training [71]. In the past, a lot of facies were placed on experience to obtain a job. But due to financial technology, internships have become a way for many people to gain the necessary skills required to kick start their careers. Some employers can show off their talents at internship fairs [63]. Also, a lot of career fairs are widely organized to educate employees on the requirements needed to land a job offer.

Today, thanks to financial technology, acting has become very popular. The era where acting was solely for entertainment industries has gone by. YouTubers have shown the world that talent doesn't have a home or a particular location or industry. Young stars are seen showcasing their talents via many blogs and social media. This open opportunity for young talented people has earned them good positions in the entertainment industry. Financial technology has made the selection process of their top best easier than before when performance was onsite.

Thanks to financial technology, young people can create employment for themselves. In the world, today youngsters have become widely industrious with their talents and innovative ideas. Today, the services of counseling that usually require professional and trained personnel are obtained now almost free of charge. Talented people now run online channels and online TV shows where these services are provided for free. Smart systems like farming simulators that usually require a lump sum to showcase are no longer so. Young people are now able to present this service in their blogs. Some professionals now use some of the freely available ideas as references to educate, show examples, and prototype. Since

the coming of digital services, consumer choice has tremendously improved. Customers no longer buy products just because their alternative was not available. Goods are dispatched from anywhere in the world. New services such as logistics Blockchain systems become available offering smart shipping services. The study in general studies how 5 C's of credit have changed and what are the advantages that come with them. How accessible are the 5 C's of credit nowadays? Then the conclusion is that the 5 C's are essentially one of the advanced payment systems developed in innovative solutions to support talents and give financial freedom to the global economy.

The study observed that more credits are demanded at higher prices. Also, the study observed that increased requests for credit are identified automatically during fewer buyers in the market. Fewer sales indicate few money in circulation and increased requests for credits. The more the demand for credit the more active use of the 5 P's of marketing. The table below details how FinTech technology has grown over time [21, 22, 23, 24]. The table also explains that some of the 5 P's of marketing options were not available. For example, in 1866, there were no available services of advertisement as in today's world. Many conservatives were traditional. The table tried to match the 5 P's of marketing that is changing the world today into different eras of FinTech involvement.

1.1 Three achievable phases of FinTech in the 21st century

The three paragraphs detailed what FinTech has developed in the world since its creation.

First Phase: FinTech has built information network technologies to help businesses develop advanced financial institutions by gathering, processing, analyzing, and supplying the right data to customers using natural language, big data, cloud computing, machine learning, Blockchain technology and artificial intelligence.

Second Phase: FinTech has leveraged information network technologies to improve the efficiency, security and effectiveness of financial services and operations processes with the help of mobile payment, automated investment advisor, blockchain technology, biometrics, and predictable machine learning techniques.

Last Phase: FinTech has provided open access and source data for designing, developing and building digital innovative financial services based on information or technology.

1.2 Evolution of FINTECH Technology

This a period in a time when many mature industries have been fundamentally transformed by disruptive innovations and prominent services [72]. This is a period of prove applying financial interactions after all financial institutions [73]. It is a period between 1600-1914, [74].

Table 1. Evaluation of FinTech technology

Era	Date	Events	5 P's of marketing	Transition Causes
FinTech 1.0	1866-1967	Industrial Revolution	People->products	Fall of slave trade
FinTech 2.0	1967-2008	Internet/digital process	Products->Place (Markets)	End of cold war/rise of decolonization
FinTech 3.0	2008-2013	Smart Phones, Social media platforms and new financial market services	Place-> Price (Online markets)	2008 financial crisis
FinTech 4.0	2013-2019	Industry 4.0/Machine learning/ Emerging markets	Price-> Promotions (innovative Online & Paperless systems)	COVID-19
FinTech 5.0	2019-Date	Advance financial markets, circular economies, development of innovations, smart cities, Cloud base systems, Big data, and internet of things.	Promotion->Smart contracts (advancements in Online & Paperless systems)	-

Table 1 above indicates the stages and events activities in each stage that has occurred throughout the life cycle of financial technology. The detailed explanations of the happenings are provided in table 1 are explained below.

FinTech 1.0 Era: This era started from 1866 to 1967. The historical event during this period was the industrial revolution. In this era, trading was mainly between people and products. Even though money was already in use, there weren't regulatory mechanisms as the case today. The major event that transition a change into the birth of FinTech 1.0 was the fall of the slave trade.

FinTech 2.0 Era: This era started in 1967 to 2008. The major event during this era was the coming of the internet and the start point of the digital process. In this era, the market was introduced and people could now assemble in the market to fulfill their sales, and request

credit. The major event that leads to the birth of FinTech 2.0 into FinTech 3.0 was the end of the cold war and the rise of the decolonization of states, especially in Africa.

FinTech 3.0 Era: This era started in 2008 to 2013. The activities that were observed in this era were the coming of smartphones, social media platforms, and new financial markets. In this era, there were markets, products, and standard pricing for most countries. The event that mark the end of FinTech 2.0 into FinTech 3.0 was the financial crisis in the USA.

FinTech 4.0 Era: This era started in 2013 to 2019. The activities that developed during this era were the industry 4.0, the development of python programming that is widely used today. Coming into existence machine learning. The event that led to the end of FinTech 4.0 into FinTech 5.0 is COVID-19. Also, the Ukrainian invasion is part of the transition into FinTech 5.0.

FinTech 5.0 Era: This era started in 2019 till day. The activities observed in this era are the advance financial markets, circular economy, development of innovations, Smart cities, advanced cloud computing into virtual systems, big data technologies, and advanced internet of things. In this era, there is financial freedom, advanced advertisement, and innovative ideas. The event that will mark the end of this era is not yet known.

2. Related Studies

2.1 Definition of Key Terms

FinTech: It is a changing environment that ensures a high-force, fast-open system to the world and a growing fast and efficient buy-and-sell demand processing systems [59]. FinTech is a multi-disciplinary field that mixed Finance, Technology appliance and Innovation Management [60]. Financial technology is a unique system of a financial institution used in ensuring strength and a smooth transfer of financial services into the wider space [61]. Financial Technology is a growing system that is adopting portable financial services like the banking services, bill payments, and cash management [62].

Natural language processing: It is the computerized application use in analyzing textual content that depend on both set of theories and a set of techniques [64]. It is a means of exchanging words using various Languages helps in understanding the world in a way to

get a proper insight of the world [66]. It is the system of embracing computer techniques aim at learning, getting to know, and advancing human language content [65].

NLP is a computerized method that analyzes text based on both a set of theories and a set of techniques [67]. NLP is a computer application for learning to function, promoting, and simulating human language that offers a synthesis classification that representations algorithms [68]. Natural Language Processing is a branch of artificial intelligence helps computer analyze as a whole with the prime aim of training the computer and digital devices to understand natural language [25, 26, 27, 28]. NLP finds various technological applications that support the technology behind FinTech regarded as the "ABCDE" of FinTech across different channels. NLP with the help of natural language understanding and natural language generation helps bring different technologies together to advance the network of FinTech. Natural language understanding enables the 5 pillars of FinTech systems of "ABCDE" of artificial intelligence, big data, cloud computing, Blockchain, and the internet of things to bring together different investment sectors under the system of FinTech.

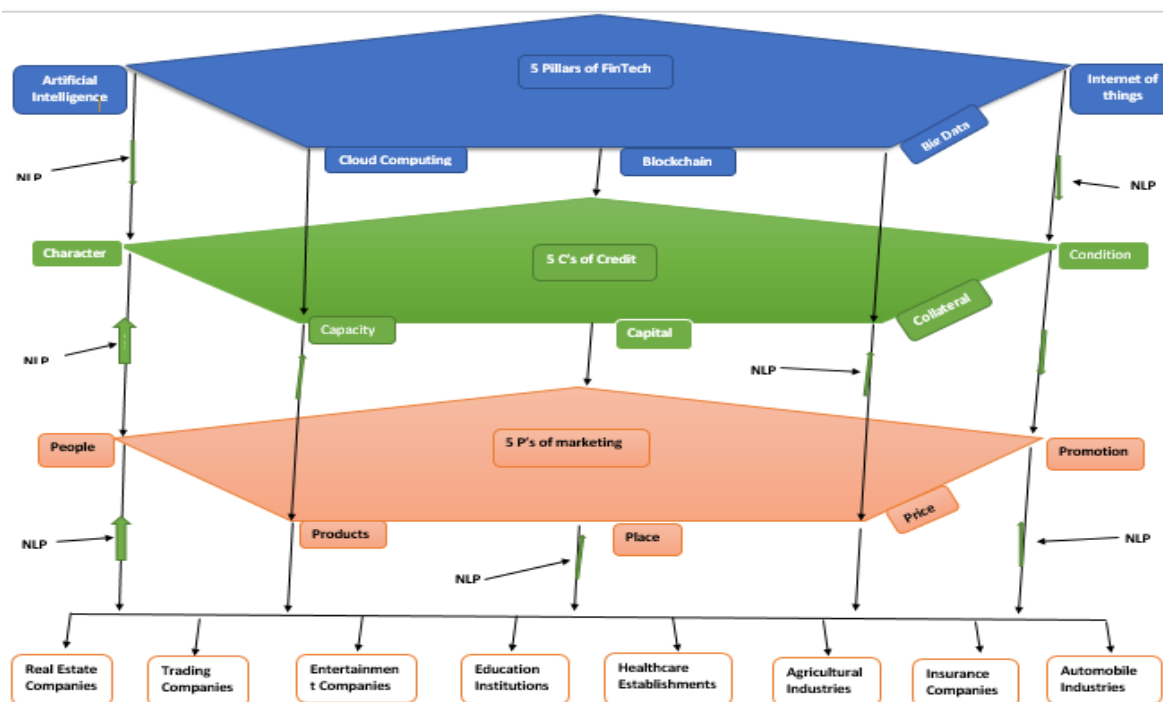


Figure 1. Application of NLP with 5 pillars, 5 C's of credit and 5 P's of marketing in FinTech

Figure 1 above detail the areas FinTech technology can be applied in. The figure also shows the application of 5 C's and 5 P's as per the first item to the last items. Figure 1 indicates how NLP connects with different items of FinTech technology.

Application of NLP using 5 pillars of FinTech: NLP as an umbrella guide to the 5 pillars of FinTech finds and enables the relationships between the "ABCDE " of FinTech on different levels using, Trading, banks, insurance, healthcare, education, real estate, and agriculture companies are service providers where natural language processing work perfectly with the support of 5 pillars of FinTech. The following paragraph below detail the functions of natural language processing to FinTech technology.

Risk Assessment: Business in its entirety is full of risk. There's a popular statement that no risk no money The investment and financial companies extract the relevant information from customers' documents using named entity recognition and assessment system of natural language processing. The risk analysis examines the customer profile in terms of loan risk based on the insights gained via natural language processing Document categorization and the established criteria for assessing risk. Basic application documents for risk analysis examined via natural language processing include applicant account history, applicant credit history, applicant employment, and education. This model help fasten the analysis process and provide a bigger picture and scope of the customer.

Sentiment analysis: As pressure mounts on customer satisfaction, many companies have turned to employ the service offered by natural language processing applications to meet up with the demand. Language Processing with the help of the 5 pillars of FinTech enables computer software to understand human emotion based on the content provided. Natural language processing enables the breaking down of document content of unstructured data into tokens known as tokenization. This process of tokenization helps banks, insurance, trading, healthcare, agricultural, and educational industries and institutions make proper decisions. The tokens derived from texts and Document content by the NLP application are trained using algorithms linked with a combination of different emotions to understand customers' needs. Natural language processing makes use of customer data by processing it in a way that customers content can be served and used for advanced analytics to achieve customer satisfaction

Fraud Detection: Natural language processing algorithms are mounting the pressure on fraud stars as they help the fraud detection department of investment and financial companies. Thanks to automated services that provide the means and process of reviewing loan applications. Financial institutions like banks, trading, and investment establishments are now able to identify relevant information in documents provided by customers thanks to NLP. Financial institutions can monitor and track areas of their services and products such as

credit history, account activity history, loan transaction details, and income history. Once an unusual process is noticed, banks and investment institutions quickly alert the owner to confirm if everything is alright. Once any questionable move is identified the bank customer service quickly alerts the law enforcement bodies. The system software keeps track of how financial transactions are run and through this obtain the system understands the emotional intelligence activities of the customer. Once there's a change it is possible to understand the real situation and a follow-up is sent to the scene.

Semantic: Natural language processing techniques enable investment and financial institutions' customer services to solve their problems faster and easier. With the technique of semantic search, NLP brings the traditional search to the next level by determining the intent and context of a document. The natural language processing process of intent and context is used to support recommendations in applications and websites. Natural language processing exposes the portfolio of the banks to potential customers which helps them easily identify what they want from the company. Semantic search improves customer experience with chatbots and frequently asked questions (FAQs).

Morphologies, Morphology is a linguistics branch that focuses on how words are formed. Two types of morphemes exist namely lexical morphemes and grammatical morphemes. Natural language processing uses morphologies to rearrange tokenized words to make more meaningful use of it. When a text or document content is categorized, the morphology knowledge is applied to build it up to meaningful use. Morphological analysis is a sub-task in natural language processing that is very important because it uses for tokenization, lemmatization, normalization, and stemming.

Unstructured data: Natural language processing helps companies like banks, real estate, insurance, trading, education, and healthcare to find relevant information across unstructured resources. Natural language processing is a blessing for the institutions and companies that sign long-term contracts with many branches throughout a given year. Natural language processing helps keep track of changes within system implementation, update existing rules and follow up the settlements made via different channels such as emails, text, and calls.

2.2 Five (5) Pillars of Fintech

Financial technology is a relationship base system with multiple friends. Without these friends, the institution will not be able to fulfill its goals in a timely and accurate

manner. The financial technology uses big data to process large datasets, uses cloud computing to operate on various platforms, uses the internet of things to enable connectivity between systems devices to users and objects, uses artificial intelligence to capture vital information about customers, and uses Blockchain to enhance security amongst its platform and system [29, 30, 31, 32, 33, 34].

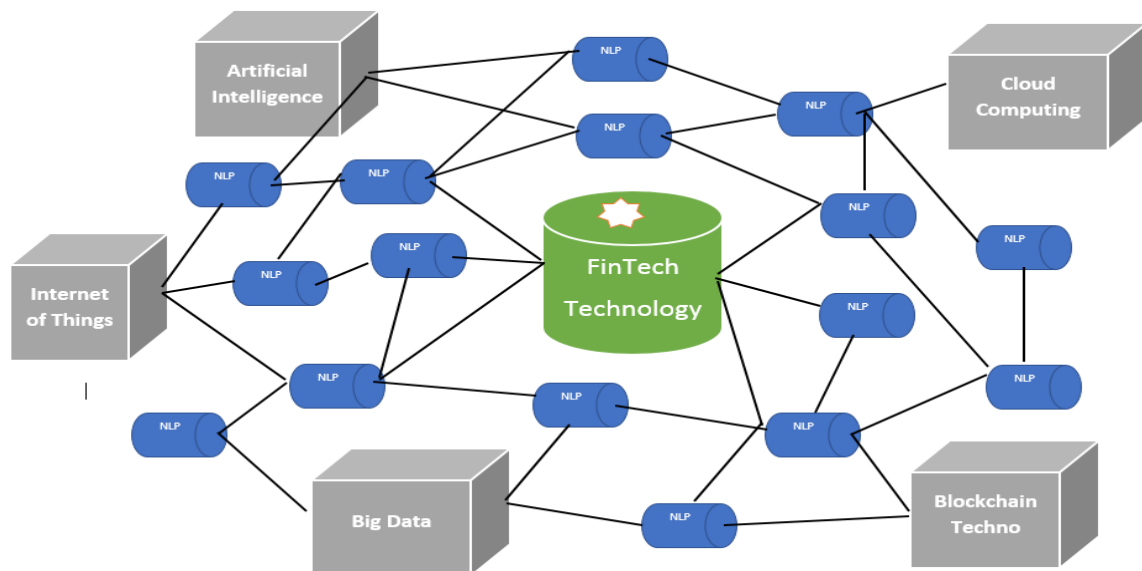


Figure 2. Five pillars of FinTech technology

Figure 2 above represents the five technologies that power the technology of FinTech. The detailed paragraph below explains the function of each and how each technology supports the system of financial technology.

Cloud Computing and FinTech: The art of using remote network servers to store, manage, and process data, rather than a local server or a personal computer hosted on the internet [35, 36]. Most financial institutions operate various spreadsheets and mobile applications. The network and technology embedded within cloud computing host these services. Thanks to natural language processing, the hosted information within the cloud system can be communicated with customers using computer programs and mobile devices. Cloud computing operates on three levels: infrastructure, platform, and application. As popularly referred to as anything that involves delivering hosted services over the internet, there's the host and there's the owner of the information. To connect devices and humans the host required natural language processing to enable computers to understand human language. Cloud base computers increase security, easy access, remote maintenance, cost-effectiveness, quick data recovery, and flexibility in usage.

Big data and FinTech: It is a fast internet software designed to analyze, Process, and Extract information from extremely complex and large data sets [37, 38, 39]. Big data technology multimedia systems that function across multiple entities, platforms, systems, applications, and servers. Big Data technology consists of all aspects of human activity such as scientific research, Systematic designs, production of digital services, and product delivery. Cloud computing provide network connectivity platforms for automation of all processes in data collection, storing, processing, utilization, and visualization.

Artificial Intelligence and FinTech: It is the imitation of human intelligence processes via simulations by electronics and machines, especially computer systems and mobile devices [40, 41, 42]. Artificial intelligence focuses on developing intelligent systems capable of doing tasks and activities that were normally required to be done by human intelligence. Artificial intelligence provides support to Fintech technology using natural language processing in three broad areas.

- Learning Processes
- Reasoning Processes
- Self-correction Processes

Artificial intelligence helps customers and employees of companies to learn from their day-to-day activities. Understandably, no particular day at work is the same as the previous. The artificial intelligence systems help companies improve their services using previews. The ability to preview is provided by artificial intelligence systems. This service of previewing provided by artificial intelligence helps employees to focus and device new solutions than referring to past activities. Artificial Intelligence uses natural language processing to identify major issues, specific areas, and keywords.

The process of tokenization and semantic analysis broadens the scope of employees' knowledge of customers' needs and wants. Since the advanced use of natural language processing, the level of customer service and employees inside a company have tremendously improved. In the past, documents, customer details, and finding about a product were randomly accessed. Thanks to the advanced use of natural language processing companies do easily understand the content of documents. Self-correction is becoming very popular and most importantly an asset within system administration. Thanks to the advances in natural language processing and artificial intelligence. Natural language processing which deals with users' information, text, and documents enables artificial intelligence to easily learn a user.

Artificial intelligence keeps track of a user's activities on each device. The way we type and manipulate our mobile phones and machines has reached artificial intelligence. Once the users of a particular device change, the artificial intelligence is also upgraded. For example, certain words will always appear before typing a word. The process of prediction is an artificial intelligence making suggestions based on experience with that same device.

Blockchain and FinTech: FinTech is one of the most developed advanced tech-oriented industries evolving into almost all other technologies. Fintech is a systematic innovation that makes up almost half of the share in the blockchain market [43, 44, 45, 46]. The FinTech blockchain market is expected to reach \$36.04 Billion by 2028. As a decentralized financial technology, FinTech is an emerging financial technology that has advanced on blockchain networks with advanced services that have reduced the control of banks on financial services and money.

Increased investment in blockchain for financial services through R&D for business purposes has given Blockchain another phase. Due to increased investment in Blockchain technology for financial services, many have now realized Blockchain is not only a technology for bitcoin but also for other sectors like healthcare, education, and agriculture. Increased research and publications about Blockchain have reinforced the fact that finance and blockchain companies are more widely used for other sectors and not just bitcoin. Blockchain is known for its decentralized, immutable, distributed, and transparent digital ledger technology which has earned Blockchain the name of the era of financial freedom and security.

Internet of Things (IoTs) and FinTech: The Internet of things is one of the most advanced ecosystem services among the pillars of the FinTech system. IoTs have given the FinTech industry an interesting boost, especially when it comes to security and payment processing [47, 48, 49, 50]. The Internet-of-Things can be found acting as mobile point-of-sale systems, as well as cybersecurity tools that safely process and encrypt payment information. The IoTs have provided the FinTech industry with an interesting boost in the domain of security and payment processing. The Internet of Things is found to be the most used mobile point of sale point of FinTech in the second half of the 21st century. The cybersecurity tools that safely process and encrypt payment information are enabled by IoTs systems. Internet of Things interconnects humans with devices to collect data and transmit it over wireless networks into virtual servers. Thanks to the internet of things, automatic payment machines can deposit and pay customers money safely and securely.

3. Applied Method

In this section, we use the evolution of FinTech and match it with the 5 P's and C's. Each element indicates the era and how it works and has advanced to date. With the help of a graph demonstration of demand and supply, we were able to demonstrate how different 5 C's credit has been working since 1866 till date. We used the demand and supply graph here because in every economic activity the forces of demand and supply determine the trend of activities and how well that system works. An increase in demand for goods indicates a fall in the request for credit and a fall in demand for goods indicates a rise in demand for credit.

People borrow in every economy because there is no money to buy. Without looking deep into how customers interact with price changes, it will be difficult to understand how FinTech influences the modern world. The study, therefore, uses the 5 P's of marketing (Product, price, place, promotion, and people) and 5 C's of credit (capital, capacity, condition, character & collateral) to demonstrate the innovation behind Fintech. Here we arranged the 5 P's according to changes in the world from 1866 to the present day and how access to funds that is 5 C's was. The study understands that different historical era has their way around the 5 C's and that forces of demand and supply indicate the demand for credit.

Stages of credit worthiness: The stages detail changes in the lifecycle of FinTech technology. The stages of financial freedom and growth.

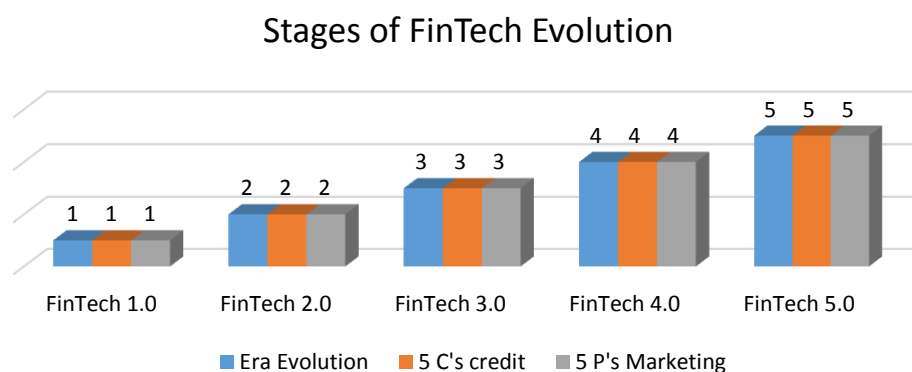


Figure 3. stages of FinTech evolution

Figure 3 above provide the summation and statistic here is developed base on the standard procedure layout for obtaining credit known as 5 C's [1, 2, 3, 4, 5, 6, 7]. The following 5 C's appear according to ascending order. The fluctuations in the demand and supply curve indicate a fluctuated request for credit. Increased demand for goods also indicates a fall in the credit request.

Table 2. Ascending order of 5 C's credit

Range according	1	2	3	4	5
5 C's	character	capacity	capital	collateral	condition

Table 2 above present 5 C's of credit according to the evolution of FinTech technology. The alignment will be uses to explain the importance of Fintech from invention till present day and how to engage the financial freedom era.

Table 3. Evaluation of FinTech and 5 C's of credit

Era	Date	Events	5 P's of marketing	5 C's of Credit				
FinTech 1.0	1866-1967	Industrial Revolution	People->products	1	2			
FinTech 2.0	1967-2008	Internet/digital process	Products->Place (Markets)	1	2	3		
FinTech 3.0	2008-2013	Smart Phones, Social media platforms and new financial market services	Place-> Price (Online markets)	1	2	3	4	
FinTech 4.0	2013-2019	Industry 4.0/Machine learning/ Emerging markets	Price-> Promotions (innovative Online & Paperless systems)	1	2	3	4	5
FinTech 5.0	2019-Date	Advance financial markets, circular economies, development of innovations, smart cities, Cloud base systems, Big data, and internet of things.	Promotion->Smart contracts (advancements in Online & Paperless systems)	1	2	3	4	5+

Table 3 above detail the evolution and application of 5 C's throughout the lifecycle of financial technology. FinTech system applied the net-profitability level (NPL) to source for potential customers to sponsor. To measure the success level of FinTech uses the following system applies. The NPL factors determine the success of the 5 C's following (Liquidity, Activity, Profitability, Potential, and Accessibility). The 5 C's factors are Character, Capacity, Condition, Collateral, and Capital. While the syntaxes and lexicons of natural language processing (comprehensiveness, cultures, connectivity, communication, and

communities) determine the 5 P's of marketing (People, Product, Price, Place, and Promotion). Changes in 5 C's determine changes in 5 P's of marketing and syntaxes and lexicons of natural language processing.

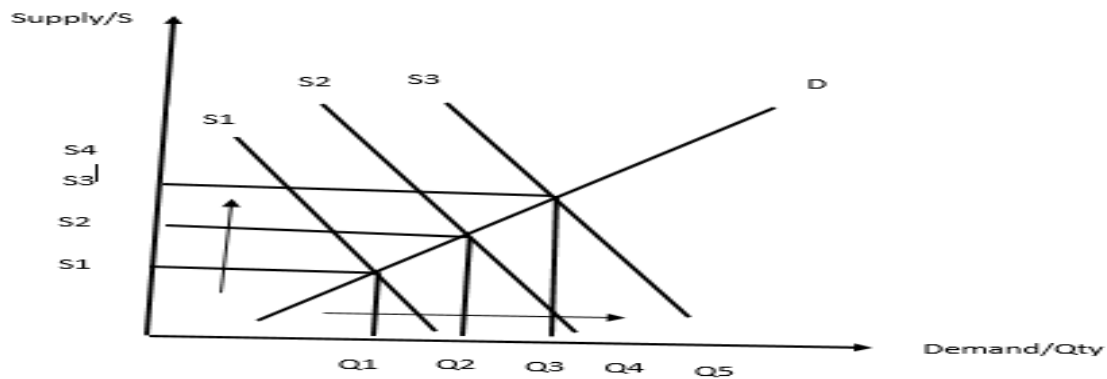


Figure 4. Direct relationship between supply and demand

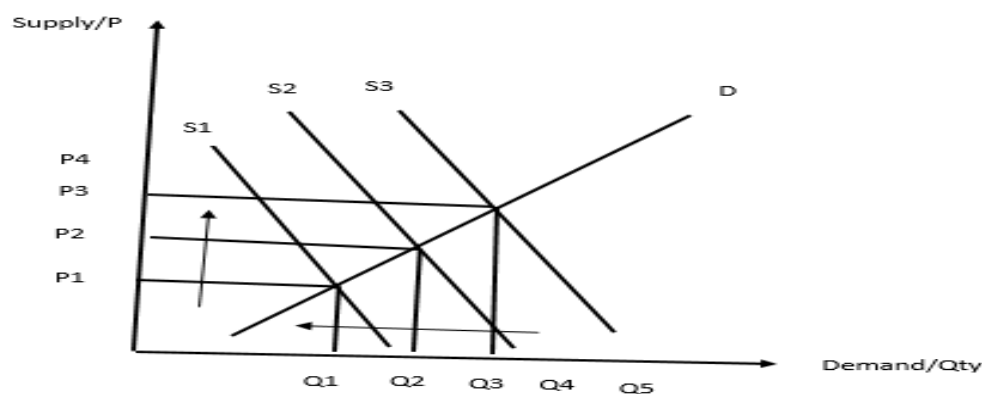


Figure 5. Inverse relationship between supply and demand

Figure 4 represents an economy with a direct relationship between suppliers, and buyers and without a unique price. In this economy where there is a marketplace, the demand and supply curves are based on the availability of products. FinTech in this society where interaction coexists between people. From the evolution of FinTech technology known as Fintech 1.0, we can observe from figure 4 that during this period there were no financial institutions and digital platforms as the case today. Figure 4 above, shows an economy where only products, customers, and buyers exist without a price for commodities. The supply of products determines the situation in the market. When supply increases from S1-S2-S3, the demand increases from Q1-Q2-Q3, and when there is a reduction in supply from S3-S2-S1, the quantity demanded drops from Q3-Q2-Q1. In this era, of FinTech 1.0 there was a lot of monopoly power during a shortage in supply. With fewer supplies, only the strong and rich buy. The rich usually scare the poor away. This situation still happens today in some parts of

Africa and the Middle East. In these areas, there is no road network, no electricity, no access to quality education, no finance, and no standard markets and policies. In this type of economy, there is no perfect timing by suppliers, there is regulatory mechanisms and there are no buffer stock systems.

Note: The absence of price here doesn't mean there was no price at all. There were prices but with no uniqueness as in today's world per unit items.

Figure 5 above represents FinTech 2.0. In this system, there exists an inverse or opposite relationship between suppliers, buyers, and a price. In the era of FinTech 2.0, market policy was available. In these are, when the prices increase the quantity demanded falls, and when the prices fall quantity increases. That is when supply drops it is an indication that prices have increased from P_1 - P_2 - P_3 and the quantity demanded dropped from Q_3 - Q_2 - Q_1 . When prices decrease from P_3 - P_2 - P_1 then the quantity demanded increases from Q_1 - Q_2 - Q_3 . The drop in quantity indicates a market where there is no advertisement to persuade people to buy during shortages in supply which is usually characterized by increase in prices.

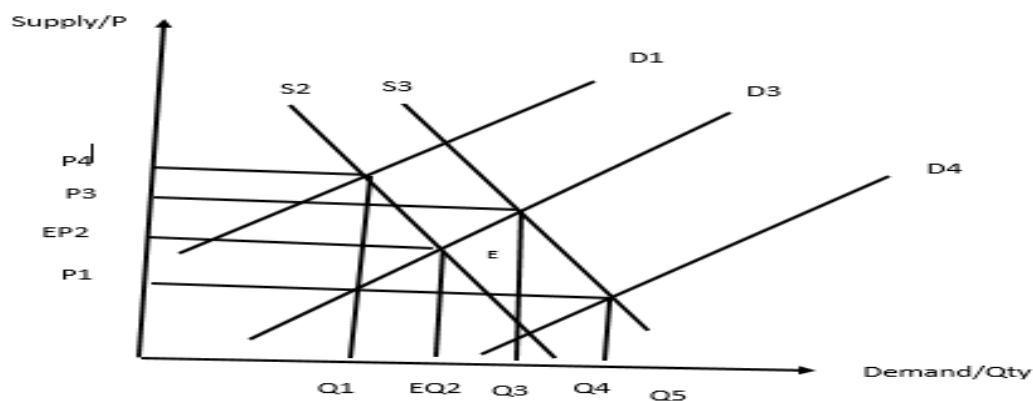


Figure 6. Regulatory economy

Figure 6 represents a FinTech 3.0 and FinTech 4.0. In this era of regulatory digital systems were already available. Promotions are available. In this era, digital platforms help inform customers about the changes in the market. In an era of FinTech 3.0, price fluctuations quickly balance with an increase in demand. Search engines could help customers obtain goods and services easily and the customers are very sensitive to the changes in the market. In FinTech 4.0, the function of advertisement comes in to add to digital services and the government regulations through prices and buffer stocks. The service of digitalization further promotes a close relationship between price, supply, and demand. In FinTech 4.0 persuasive advertisement forces customers to buy regardless of the price of goods. In FinTech 3.0 and

4.0, the market operates on a stable price of EP2 and quantity EQ2. This type of system regulates what enters and leaves the market. But still there exist black marketing where instead of a regulatory price of P2 and at Q2 the suppliers provide their good at a price of P3 and a quantity Q3. At the price of P3 customers are been cheated as goods are sold above the standard price. Also at a price of P1 the quantity demanded is Q4. This price also indicates another black market where goods are auctioned at a price far below standards. Economist Intelligence also identified the types of goods sold far below standards price as either inferior goods or expired goods. The last situation observed in this type of market is excessive pricing. This usually occurs when there's a shortage in the market. At a price P4, the quantity is Q1, normally according to regulatory market mechanisms, P1 price was supposed to be equal to Q1 demanded but it's not so. This situation usually happens during a war situation. For instance, the war in Ukraine has skyrocketed the prices of bread in Cameroon leading to a black market. Suppliers now sell at a very high price due to shortages in the market supplies of flour.

This type of economy required a strict implementation of natural language processing to get inside into suppliers to help the customers against excess pricing. Also, the implementation of natural language processing in this type of market system will help reduce backdoor business activities.

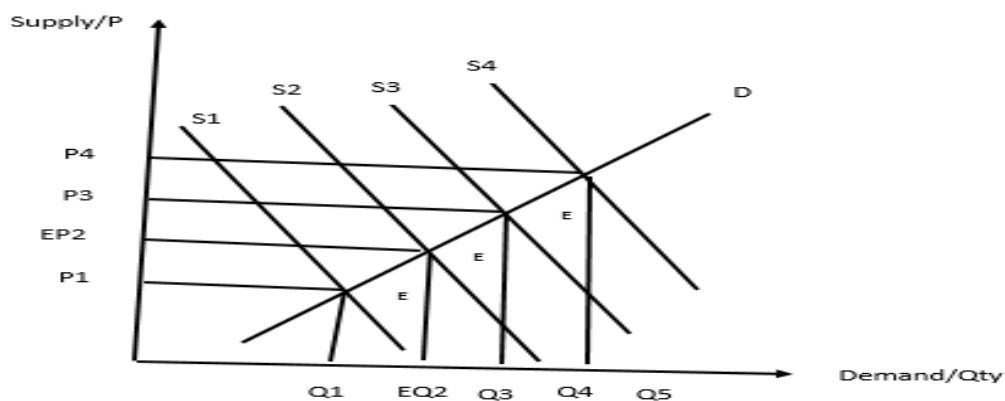


Figure 7. Innovative FinTech 5.0 economy of financial freedom

Figure 7 represents the economy of FinTech 5.0. In this system, all forces and elements of an open, free, command economy, and mixed economy are put together. There is a possibility of a more balanced system than in the previous eras. This economy is referred to as economic financial freedom. This era is composed of motivation for innovation and development. From the demand curve, EQ2 represents the standard equilibrium for trading at the equilibrium price of EP2. The graph, later on, presents a system where the regulatory

mechanisms self-adjusted from the standards EP2 price downward to P1 and at quantity Q1. This represents an entertainment market where more demands for services grow with increased innovative ideas. Also represents a trading market where trading is relief based on the rates available in the market. The opposite movement also holds for an increase above equilibrium from EP2- EP3 and quantity demanded increases from EQ2-Q3. In this type of situation, we called inelasticity in supply and demand. Changes in prices don't affect the quantity demanded. The equilibrium keeps adjusting based on the desires of the buyers and suppliers. There are no exploitations in this type of market. The intrusive value of the services and goods determines how much a buyer is willing to pay.

Fintech 5.0 represent financial freedom economy. It represents an economy where talents are openly rewarded. A market where hard work pays. In this type of economy, there's a need to implement a natural language processing system to keep track of customers and suppliers for the sake of safety. Natural language processing systems will enhance responsible behavior through system alerts, regulatory reminders, and friendly notifications.

To sum it all up, the more the demand for goods the less the demand for credit. In every economy, when supply exceeds demand there is always a general increase in demand for credit. Excess supplies show that fewer buyers exist in the market. Also, excess prices sent away buyers. In a scenario where buyers can't afford, then turn to apply for more credits. In FinTech 1.0 there is a moderate demand for credit than in FinTech 2.0 where the frequent rise in price is predominant.

4. Discussion on Areas of Applicability and Implementation

This section explores the areas where FinTech technology is already active and can be advanced implemented. The following sectors heavily depend on FinTech services to achieve customer satisfaction. As the need for online banking grows, most customers are demanding faster and quick responses from their suppliers, it has put so much pressure on human resources. Figure 8 above represents the various sectors of the economy where FinTech technology is already applied. The following paragraphs below explain in detail how each sector has improved thanks to FinTech technology.

Real Estate Companies: FinTech creates effective ways for real estate investors to cope with redundant intermediaries and brokers in real estate transactions [51]. FinTech helps to reduce costs, reduce uncertainty, and improve investment opportunities throughout a property evaluation and purchase process. It's easier to run transactions with FinTech

technology as it uses Blockchain technology of encrypted datasets and the fastest growing payment system. For instance, the prop-Tech-lending system. This approach of transaction occurs when a FinTech company issues credit to an individual firm with the principal aim of purchasing a property.

Real-time property data system: This is an innovative approach where real estate professional investors keep track of what buyers are willing to pay based on real-time purchases.

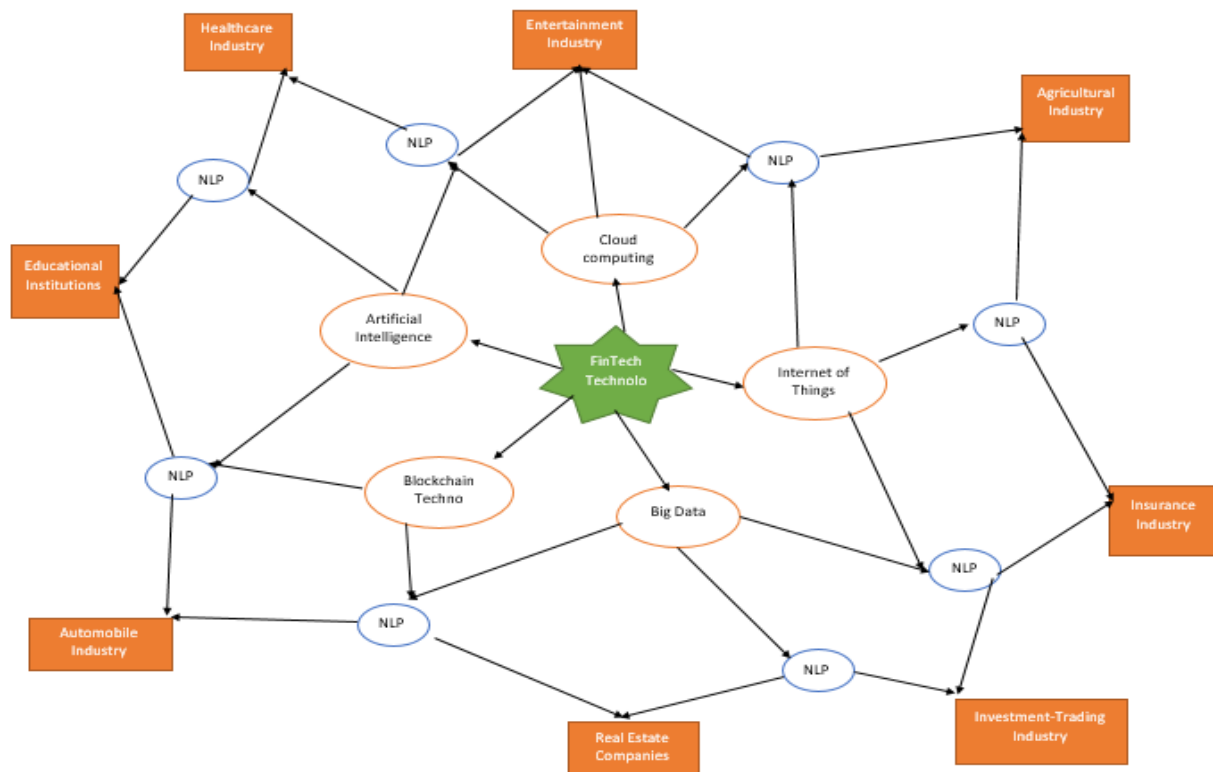


Figure 8. FinTech technology with various economic sectors

Trading Companies and FinTech: Fintech technology originated to advance the use of computer technology by applying a system of back office banking to support trading firms. Fintech system technology can predict and inform traders about the behavior of sales and purchases. Traders used analytics, and data-driven marketing to determine when and where to trade. FinTech system technology has a keen adaptor system of automated customer service technology that uses chatbots and artificial intelligence interfaces to assist traders with basic tasks [58]. FinTech system technology helps traders cut down staffing costs. Financial technology is the major area that FinTech have dwell on. FinTech technology is all about financial evolution for industrial, educational, and institutional growth. The term FinTech is

simply banking services embedded technologies for open access and integration with other sectors of the economy without limit to its nature.

Entertainment Industry and FinTech: One of the innovative technologies that create a transformative user experience and driving force of human existence by enabling a reward for talents is FinTech. Today new services like YouTubers and bloggers are making a lot of money thanks to Fintech technology. Fintech enhances customer experience within the entertainment Industry by creating genuine loyalty with exclusive offers [57]. The relationships between the entertainment industry and its thousands of national, regional, and local merchants' followers are measured in monetary terms. This function ensures entertainment Industries get high-performing offers to keep their share of earnings.

Education Institutions and FinTech: The FinTech system technology is one strong avenue that connects educational institutes with students. Educational institutions fulfill the need for cash flow management and working capital by offering courses at affordable prices. Based on the tuition fees charged by a learning institution, students can make a choice based on their preferences. Fintech technology has also greatly engaged students through research. As Technology still developing, many students have embarked on finding solutions that will improve and advance the modern innovative system. Thanks to Fintech technology, educational institutions now offer students loans, grants, scholarships, internships, and summer jobs [56]. Today the European Union offers one of the most advanced ecosystem services among the nations of the world. Erasmus programs enable third-country nationals to come for studies in its zone. Fintech technology enables students to understand the importance of digital technology and how innovative systems can be developed.

Healthcare and FinTech: A substantial number of care entities are now leveraging FinTech as a playbook to solve key parts of healthcare problems. FinTech system technology has introduced new and improved digital service models within the healthcare sector that has given more attention and a drive for e-health services. E-health services are more efficient and convenient for most patients thanks to Fintech technology [55]. Customers now make orders online using e-health services. The system interface of e-health services allows patients or customers to carry out their consultations, prescribed medications, and book visits to the hospitals. Thanks to Fintech technology, most payments are digital within the healthcare industry.

Agriculture Industry and FinTech: Thanks to FinTech with system software, farmers now have easy access to farming loans. It is nowadays easier for small and large-

scale farmers to access funding through FinTech. Applications for loans have been shortened to fewer days right down to ours. The system technology behind FinTech is capable of using drones to assess farmers' products as requirements for a loan. FinTech has enabled easy access to the market for most farmers [54]. It has opened up a new digital platform for selling farm products. With new methods of payment, FinTech has created a very close means of marketing farm products. Some buyers buy their products directly from the farm and make payments digitally.

Insurance Company and FinTech: Fintech systems have enhanced applications and machines that open access to animals, crops, and equipment at very affordable rates and with excellent policies [53]. Insuring products is becoming more common to small-scale farmers through the FinTech industry. Global challenges have necessitated higher needs for insuring properties and live stocks. As the world battle with climatic issues live shocks and other agricultural sectors are directly affected. Fintech technology has greatly helped farmers insure their products.

Automobile Industry and FinTech: Thanks to FinTech technology, cars are now bought and shipped to the owner. In the past, the process of buying a car usually took years to achieve. Since the advanced payment system developed, many people can afford their cars with relative ease [52]. Car parts are now ordered online thanks to FinTech technology. Before the coming of financial technology, the process of owning a car was a luxury due to the process involved. Since the birth of FinTech, having a car now is a necessity. The prices of cars have relatively become cheaper than before where many brokers are usually involved in the process.

4.1 Challenges of financial technology

The following paragraphs present some of the difficulties face by financial technology. The listed challenges are general and not specifically identified with a particular market or economy. However, the study understand that different economies face different situations.

- **Identifying market gap:** The process of developing a FinTech app is probably the most challenging. To obtain a great and unique idea for hedges is very difficult.
- **Shaky ideas:** There exist a lot of shaky ideas that can single-handedly slow down business growth. This is very common in areas where lack of a market need in startup

failure support. The existing upside measures of finding a FinTech idea with strong market demand is lacking.

- **Planning proximity:** Focusing on a few key problems is much more effective than tackling 50 issues at once. It allows you to spend more time and effort polishing your app's core features. There are a lot of features that makes the planning more complex, negatively impacting and providing ill-user experience.
- **Evaluation timing:** The process of evaluating each problem depends on its urgency. It is foremost concerned with individual schedule and market needs but most customers and users rely on general soundness of the market that doesn't suit their needs. The problems encountered should be solved based on individual approach and not generally.
- **Designing good users versus experience:** The most challenging issue with FinTech is that they need to simplify complex financial processes and terms based on experience and learning models. The key user flow is lacking as new users find it difficult to meetup and usually turn to think naive on the services.
- **Inadequate engineers:** The shortage of professionals is one of the real dangers faced by financial technology. The leakage of sensitive information has significantly erode the trust from users. There is a need for engineers to encrypt users' data so that hackers can't capitalize on any data they manage to steal.

5. Conclusion

Findings indicates that FinTech technology is one of the best things that has happened to humanity through its innovations, The level of dependency in the world has reduced as talented people now make more meaningful use with their talents and skills with advance services enable by FinTech technology. FinTech for finance services advanced services that people do use to obtain their earnings. One of the major winning strategies in FinTech technology is the ability for customers to estimate changes in the market. Study analysis indicates that the prices of goods determine the attitude of buyers. When prices go beyond expectations, it is a clear fact that the demand for credit requests increases. The application for credit is not just for consumers but for both consumers and suppliers. During a period of excess production for a consecutive period of time suppliers go for credit. It is common to see ready available funds available to advance ideas for a reward in return. Financial

institutions are now available to search for new ideas to fund and develop startups. Thanks to Fintech technology that nobody is left behind no matter the situation is. As communication took the lead in the second half of the 21st century, most companies are moving remotely, leading to much-needed innovation in FinTech. The study presents how natural language processing enables different technologies and advances the technology behind FinTech. The study aims to identify areas of the modern world that can be transformed into a source of finance using the FinTechs drivers of "ABCDE". The study observed FinTech as a digital Economics that integrates with different aspects of modern technology to create utility values.

Declaration Conflict of Interest

We certify that we have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript. We have no financial or proprietary interests in any material discussed in this article.

Declaration of material used

All data underlying the results are available as part of the article and no additional source data are required or reserved somewhere.

References

- [1] Patingo, Mary Rose E. "The Use of C's of Credit in Extending Bank Loans to Micro and Small Food Enterprises." In *Ascendens Asia Journal of Multidisciplinary Research Conference Proceedings*, vol. 2, no. 2. 2018.
- [2] Panggalo, Ludia. "ANALISIS PRINSIP 5 C'S TERHADAP PEMBERIAN KREDIT PADA PT BANK RAKYAT INDONESIA TBK, CABANG TIMIKA (STUDI KASUS PADA UNIT SIMPANG LIMA SP 2)." *JURNAL ULET (Utility, Earning and Tax)* 1, no. 1 (2017): 4-4.
- [3] Barrymore, John. "The 5 Cs of credit analysis."
- [4] Baiden, John E. "The 5 C's of Credit in the Lending Industry." *Available at SSRN 1872804* (2011).
- [5] Rizyamesa, Agiananta, and Raden Aswin Rahadi. "A CONCEPTUAL MODEL OF CREDIT SCORECARD IN PRODUCTIVE LOAN."

- [6] Srinu, Nidamanuri, T. Swathi, N. Raviteja, D. Beebi, and T. Amrutha. "Credit Management System."
- [7] Turvey, C. G., He, G., Kong, R., Ma, J., & Meagher, P. (2011). The 7 Cs of rural credit in China. *Journal of Agribusiness in Developing and Emerging Economies*.
- [8] Lee, I., & Shin, Y. J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. *Business horizons*, 61(1), 35-46.
- [9] Mention, A. L. (2019). The future of fintech. *Research-Technology Management*, 62(4), 59-63.
- [10] Sironi, P. (2016). *FinTech innovation: from robo-advisors to goal based investing and gamification*. John Wiley & Sons.
- [11] Madinga, N. W., & Lappeman, J. (2022). Social Media Sentiment Analysis: Online versus 'Brick and Mortar' Retailers in South Africa. *Journal of African Business*, 1-18.
- [12] Dina, N. Z., Triwastuti, R., & Silfiani, M. (2021). TF-IDF Decision Matrix to Measure Customers' Satisfaction of Ride Hailing Mobile Application Services: Multi-Criteria Decision-Making Approach. *International Journal of Interactive Mobile Technologies*, 15(17).
- [13] Amanatidis, D., Mylona, I., Kamenidou, I. E., Mamalis, S., & Stavrianea, A. (2021). Mining textual and imagery instagram data during the COVID-19 pandemic. *Applied Sciences*, 11(9), 4281.
- [14] Arner, D. W., Buckley, R. P., Zetsche, D. A., & Veidt, R. (2020). Sustainability, FinTech and financial inclusion. *European Business Organization Law Review*, 21(1), 7-35.
- [15] Loo, M. K. L. (2019). Enhancing financial inclusion in ASEAN: Identifying the best growth markets for fintech. *Journal of Risk and Financial Management*, 12(4), 181.
- [16] Sy, M. A. N., Maino, M. R., Massara, M. A., Saiz, H. P., & Sharma, P. (2019). *FinTech in Sub-Saharan African Countries: A Game Changer?*. International Monetary Fund.
- [17] Purwatiningsih, A., Suprayitno, A., & Haryono, A. (2022). Assessment of MSMEs Working Capital Loans at Bank Mandiri Malang Branch, Indonesia. *International Journal of Research in Social Science and Humanities (IJRSS)* ISSN: 2582-6220, DOI: 10.47505/IJRSS, 3(1), 13-25.
- [18] Anwar, M., Nidar, S. R., Widiyanto, S., & Layyinaturobaniyah, L. (2021). Lending Rationale of Financial Institution and Fintech on the Perception of Borrowers: A Qualitative Study. *JDM (Jurnal Dinamika Manajemen)*, 12(2), 291-309.

- [19] Andriariza, Y., & Agustina, L. (2020). Perkembangan Dan Tantangan Industri Teknologi Finansial Indonesia Di Era Ekonomi Digital. *Masyarakat Telematika Dan Informasi: Jurnal Penelitian Teknologi Informasi dan Komunikasi*, 11(2), 116-127.
- [20] Aseng, A. C. (2020). Factors Influencing Generation Z Intention in Using FinTech Digital Payment Services. *CogITo Smart Journal*, 6(2), 155-166.
- [21] Zhuang, L., Zhou, H., & Chen, T. (2022). An Evolution Model of Fintech Supports Technology-Based SMEs Innovation and Growth. *Discrete Dynamics in Nature and Society*, 2022.
- [22] Goel, P., Kulsrestha, S., & Maurya, S. K. (2022). Fintech Unfolding: Financial Revolution in India. *Thailand and The World Economy*, 40(2), 41-51.
- [23] Jain, A., & Dhaliwal, A. (2022). A STUDY ON EVOLUTION OF FINTECH IN THE FINANCIAL INDUSTRY: A CASE STUDY OF RINGMONEY. *Towards Excellence*, 14(2).
- [24] Garrido, J., Liu, Y., Sommer, J., & Viancha, J. S. (2022). Keeping Pace with Change: Fintech and the Evolution of Commercial Law. *FinTech Notes*, 2022(001).
- [25] Ruffolo, M. (2022). The Role of Ethical AI in Fostering Harmonic Innovations that Support a Human-Centric Digital Transformation of Economy and Society. In *Harmonic Innovation* (pp. 139-143). Springer, Cham.
- [26] Mei, L. (2022). *Fintech Fundamentals: Big Data/Cloud Computing/Digital Economy*. Stylus Publishing, LLC.
- [27] Xu, J. (2022). FinTech Innovation and Strategy. In *THE FUTURE AND FINTECH: ABCDI and Beyond* (pp. 1-36).
- [28] Dale, R. (2022). \$ NLP: How to spend a billion dollars. *Natural Language Engineering*, 28(1), 125-136.
- [29] Qi, Y., & Xiao, J. (2018). Fintech: AI powers financial services to improve people's lives. *Communications of the ACM*, 61(11), 65-69.
- [30] Haider Syed, M., Khan, S., Raza Rabbani, M., & Thalassinou, Y. E. (2020). An artificial intelligence and NLP based Islamic FinTech model combining Zakat and Qardh-Al-Hasan for countering the adverse impact of COVID 19 on SMEs and individuals.
- [31] Huttunen, J. E. N. N. I. F. E. R., Jauhiainen, J., Lehti, L. A. U. R. A., Nylund, A. N. N. I. N. A., Martikainen, M., & Lehner, O. M. (2019). Big data, cloud computing and data science applications in finance and accounting. *ACRN Journal of Finance and Risk Perspectives*, 8, 16-30.

- [32] Mei, L. (2022). *Fintech Fundamentals: Big Data/Cloud Computing/Digital Economy*. Stylus Publishing, LLC.
- [33] Zhao, D., & Zhang, W. (2021). *FinTech Towards Intelligent Finance*. In *Artificial Financial Intelligence in China* (pp. 1-16). Springer, Singapore.
- [34] Chishti, S. (2020). *The AI Book: The Artificial Intelligence Handbook for Investors, Entrepreneurs and FinTech Visionaries*. John Wiley & Sons.
- [35] Meng, S., He, X., & Tian, X. (2021). Research on Fintech development issues based on embedded cloud computing and big data analysis. *Microprocessors and Microsystems*, 83, 103977.
- [36] Mehrban, S., Nadeem, M. W., Hussain, M., Ahmed, M. M., Hakeem, O., Saqib, S., ... & Khan, M. A. (2020). Towards secure FinTech: A survey, taxonomy, and open research challenges. *IEEE Access*, 8, 23391-23406.
- [37] Awotunde, J. B., Adeniyi, E. A., Ogundokun, R. O., & Ayo, F. E. (2021). Application of big data with fintech in financial services. In *Fintech with Artificial Intelligence, Big Data, and Blockchain* (pp. 107-132). Springer, Singapore.
- [38] Wang, Y., Xiuping, S., & Zhang, Q. (2021). Can fintech improve the efficiency of commercial banks?—An analysis based on big data. *Research in international business and finance*, 55, 101338.
- [39] Miskam, S., & Eksan, S. H. R. (2018). Big Data and FinTech in Islamic Finance: Prospects and Challenges. In *4th Muzakarah Fiqh & International Fiqh Conference (MFIFC 2018)* (pp. 236-244).
- [40] Fernández, A. (2019). Artificial intelligence in financial services. *Banco de Espana Article*, 3, 19.
- [41] Guo, H., & Polak, P. (2021). Artificial intelligence and financial technology FinTech: How AI is being used under the pandemic in 2020. In *The Fourth Industrial Revolution: Implementation of Artificial Intelligence for Growing Business Success* (pp. 169-186). Springer, Cham.
- [42] Go, E. J., Moon, J., & Kim, J. (2020). Analysis of the current and future of the Artificial Intelligence in financial industry with Big Data techniques. *Global Business & Finance Review (GBFR)*, 25(1), 102-117.
- [43] Fernandez-Vazquez, S., Rosillo, R., De La Fuente, D., & Priore, P. (2019). Blockchain in FinTech: A mapping study. *Sustainability*, 11(22), 6366.

- [44] Fosso Wamba, S., Kala Kamdjoug, J. R., Epie Bawack, R., & Keogh, J. G. (2020). Bitcoin, Blockchain and Fintech: a systematic review and case studies in the supply chain. *Production Planning & Control*, 31(2-3), 115-142.
- [45] Davradakis, E., & Santos, R. (2019). Blockchain, FinTechs and their relevance for international financial institutions (No. 2019/01). EIB Working Papers.
- [46] Fosso Wamba, S., Kala Kamdjoug, J. R., Bawack, R., & G Keogh, J. (2018). Bitcoin, blockchain, and FinTech: a systematic review and case studies in the supply chain. *Production Planning and Control*, Forthcoming.
- [47] Maiti, M., & Ghosh, U. (2021). Next generation Internet of Things in fintech ecosystem. *IEEE Internet of Things Journal*.
- [48] Tyagi, S. K. S., & Boyang, Q. (2021). An intelligent internet of things aided financial crisis prediction model in fintech. *IEEE Internet of Things Journal*.
- [49] Pustokhina, I. V., Pustokhin, D. A., Mohanty, S. N., García, P. A. G., & García-Díaz, V. (2021). Artificial intelligence assisted Internet of Things based financial crisis prediction in FinTech environment. *Annals of operations research*, 1-21.
- [50] Nicoletti, B., Nicoletti, W., & Weis. (2017). *Future of FinTech*. Basingstoke, UK: Palgrave Macmillan.
- [51] Choi, J., Kaul, K., & Goodman, L. (2019). FinTech Innovation in the Home Purchase and Financing Market. URL: https://www.urban.org/sites/default/files/publication/100533/fintech_innovation_in_the_home_purchase_and_financing_market_0.pdf [in Eng.].
- [52] Marafie, Z., Lin, K. J., Zhai, Y., & Li, J. (2018, July). Proactive fintech: Using intelligent iot to deliver positive insurtech feedback. In *2018 IEEE 20th Conference on Business Informatics (CBI)* (Vol. 2, pp. 72-81). IEEE.
- [53] VanderLinden, S. L., Millie, S. M., Anderson, N., & Chishti, S. (2018). *The insurtech book: The insurance technology handbook for investors, entrepreneurs and fintech visionaries*. John Wiley & Sons.
- [54] Anshari, M., Almunawar, M. N., Masri, M., & Hamdan, M. (2019). Digital marketplace and FinTech to support agriculture sustainability. *Energy Procedia*, 156, 234-238.
- [55] Azeez, N. A., & Van der Vyver, C. (2019). Security and privacy issues in e-health cloud-based system: A comprehensive content analysis. *Egyptian Informatics Journal*, 20(2), 97-108.

- [56] Sung, A., Leong, K., Sironi, P., O'Reilly, T., & McMillan, A. (2019). An exploratory study of the FinTech (Financial Technology) education and retraining in UK. *Journal of Work-Applied Management*.
- [57] Lehner, O. M., & Simlinger, R. (2019). When function meets emotion, change can happen: Societal value propositions and disruptive potential in fintechs. *The International Journal of Entrepreneurship and Innovation*, 20(4), 277-288.
- [58] Dhar, V., & Stein, R. M. (2017). FinTech platforms and strategy. *Communications of the ACM*, 60(10), 32-35.
- [59] Freedman, R. S. (2006). *Introduction to financial technology*. Elsevier.
- [60] Leong, K., & Sung, A. (2018). FinTech (Financial Technology): what is it and how to use technologies to create business value in fintech way?. *International Journal of Innovation, Management and Technology*, 9(2), 74-78.
- [61] Gautam, R. S., Rastogi, S., Rawal, A., Bhimavarapu, V. M., Kanoujiya, J., & Rastogi, S. (2022). Financial Technology and Its Impact on Digital Literacy in India: Using Poverty as a Moderating Variable. *Journal of Risk and Financial Management*, 15(7), 311.
- [62] Yeo, J. H., & Fisher, P. J. (2017). Mobile financial technology and consumers' financial capability in the United States. *Journal of Education & Social Policy*, 7(1), 80-93.
- [63] Nguyen, Q. K. (2016, November). Blockchain-a financial technology for future sustainable development. In *2016 3rd International conference on green technology and sustainable development (GTSD)* (pp. 51-54). IEEE.
- [64] Liddy, E. D. (2001). *Natural language processing*.
- [65] Hirschberg, J., & Manning, C. D. (2015). Advances in natural language processing. *Science*, 349(6245), 261-266.
- [66] Chopra, A., Prashar, A., & Sain, C. (2013). Natural language processing. *International journal of technology enhancements and emerging engineering research*, 1(4), 131-134.
- [67] Liddy, E. D. (2001). *Natural language processing*.
- [68] Eisenstein, J. (2019). *Introduction to natural language processing*. MIT press.
- [69] Chishti, S., & Barberis, J. (2016). *The Fintech book: The financial technology handbook for investors, entrepreneurs and visionaries*. John Wiley & Sons.
- [70] Morse, S. C. (1995). *Scholarships and Financial Assistance*. School Year 95-96.
- [71] Nazah, K., Ningsih, A. W., Irwansyah, R., Pakpahan, D. R., & Nabella, S. D. (2022). The Role of UKT Scholarships in Moderating Student Financial Attitudes and Financial Literacy on Finance Management Behavior. *Jurnal Mantik*, 6(2), 2205-2212.

- [72] Palmié, M., Wincent, J., Parida, V., & Caglar, U. (2020). The evolution of the financial technology ecosystem: An introduction and agenda for future research on disruptive innovations in ecosystems. *Technological Forecasting and Social Change*, 151, 119779.
- [73] Farmer, J. D., & Lo, A. W. (1999). Frontiers of finance: Evolution and efficient markets. *Proceedings of the National Academy of Sciences*, 96(18), 9991-9992.
- [74] Pamuk, Ş. (2004). The evolution of financial institutions in the Ottoman Empire, 1600–1914. *Financial History Review*, 11(1), 7-32.