SENTIMENT ANALYSIS ON ADOPTION OF BLOCKCHAIN

IN DIFFERENT SECTORS

IN INDIA

TEAM MEMBERS:

FT201080 - Shubhi Aron

FT203015 - Ankesh Jha

FT203035 – Gautam Devadiga

GUIDE:

Dr. Shameem S

> ## ABSTRACT

Block chain, essentially a virtual ledger capable of recording and verifying a high volume of digital transactions, gained a strong foothold with its emergence as the basis of cryptocurrencies such as Bitcoin in 2008. But it is believed that banking is not the only sector which this history-altering technology might transform. Block chain initiatives have been increasing rapidly and emerging countries like India have already started building their block chain ecosystems.

With India's increasing focus towards digitization, the scope of Blockchain adoption in India only seems to be growing. Post demonetization, the Indian economy has been witnessing a paradigm shift – from cash to cashless. Also, Indian citizens have already opened up to advanced, efficient and reliable transaction mechanisms such as UPI, Paytm, and Google Pay. While some of the players in different industries are collaborating to realize the collective benefits of Blockchain technology at an industry level, some others are exploring the potential of Blockchain along with their subsidiaries and partners.

We through empirical research aim to find out what is the sentiments of mainstream sectors like banking and finance, public sector, manufacturing and logistics and supply chain etc. when it comes to implementing blockchain technology. We indent to use text mining and sentiment analysis to understand the current scenario in the different sectors and how can we go about achieving higher penetration of blockchain technology and also find out the challenges we currently face in implementing the same.

> ## THEORY

Why Blockchain?

Blockchain technology is a distributed database of records where all the transactions of sending and receiving of digital assets are shared with all the participants of the network and each transaction is validated by the agreement of all the participants called Consensus. Hence, it potentially reduces the role of middleman and allows people to transfer of digital property or data in a safe, secure and incontrovertible manner. Since block chain operates through a transparent, decentralized platform requiring no central supervision, making it resistant to fraud, its uses can be endless. For example, in ride-sharing companies, the drivers and riders can create the more user-driven and value-oriented marketplace with the help of the distributed ledger. In the education sector, the block chain solutions can manage the verification procedures and secure students' data. Block chain can check the possible fraud and reduce an ample amount of paperwork and errors in the field of real estate.

Factors Affecting Consumer Acceptance

Lack of consumer awareness, the overall hype built around its dependent system of cryptocurrencies does not allow the user to directly experience the technology itself. Moreover, the decentralized nature of blockchain poses a drastically different advantage / disadvantage combination from previous electronic commerce implementations.

Therefore, there is a need to build measurements of perceived usefulness, risk, reputation and intention to transaction order to allow research on blockchain technology acceptance to continue. This was intended to develop the items needed to quantitatively evaluate and identify user perceptions and attitudes towards a factor.

Blockchain Reputation

Since Blockchain is an underlying technology which is meant to support existing systems and brands, it is difficult for blockchain to establish a reputation for the technology on its own without a brand name or independent from the cryptocurrency (S. Gainsbury and A. Blaszczynsk,2017). Hence reputation could affect user attitude towards the technology ultimately affecting its acceptance.

Blockchain Perceived Risk

Given the main advantages and offerings of blockchain technology are the increased security and privacy offerings that it offers its users in relation to conventional transaction mechanisms. The paper to focused on items involving overall transaction risk of blockchain (BRI) and the risk of blockchain as a business model and system of daily use (D. Folkinshteyn and M. Lenno,2019). This is owning to the laying that blockchain technology suffers from a lack of recourse in the case of fraudulent transactions or stolen account. Hence, Insecurity and discomfort could have a negative impact on acceptance of blockchain. Moreover, the current issues plaguing

blockchain relate heavily to government regulation and efficiency concerns regarding power consumption which threatens its standing as a long-term sustainable system.

Blockchain Perceived Usefulness

Energy, internet of things, finance, government and healthcare areas all stand to benefit from the technology which includes greater control over your own information, removal of intermediaries, high speed of data transfers, low costs of data transfer, high security, international scope and improved trust among all the stakeholders. While there have been previous us research on Perceived Usefulness of other technologies, the disintermediation and global effect of blockchain does not lend itself to conventional benefit characteristics (S. Gainsbury and A. Blaszczynsk, 2017). Now with few blockchain technology being implemented in few of the projects we intend to gauge whether perceived usefulness has a positive effect on his or her BI to use the blockchain technology and also whether perceived usefulness has a positive effect on his or her attitude toward using the blockchain technology

Blockchain Transaction Intentions

Traditional research methods would incorporate an aspect of pre and post purchase or transaction of an item in order to identify the overall attitude in using the technology itself. However, due to the nature of the blockchain technology it is currently inseparable from cryptocurrencies, the use and trade of which is likely subject to immense regulation and scrutiny. Hence a measure of actual transactions and purchases is not possible, more so given the decentralized and anonymous nature of cryptocurrencies and blockchain based systems (B. Suh and I. Han, 2003).

Industry Reports on Blockchain Adoption in India

Blockchain is widely explored and being experimented with multiple use cases across various industries. While most of the use cases have many stakeholders in the value chain at multiple industry levels, there are also use cases like loyalty and Know Your Customer (KYC) processing which are specific to a certain organization. Though financial services providers are emerging as the leaders in identifying Blockchain use cases, other industries are catching up. Retail, travel, healthcare, telecommunications and public sector industries being the front-runners among them. Some major use cases of the features of Blockchain in these industries are decentralized data storage, data immutability and distributed ownership. Blockchain has been tested in the areas of Trade Finance, Cross-border Payments, Supply chain financing, and Digital Identity by a lot of Indian players. Among the pioneers for exploring Blockchain in India are some of the Indian banks, business conglomerates, and one stock exchange. (Deloitte, 2017)

Many organizations concur on blockchain's potential to revolutionize economic, social behaviors and ultimately become a foundation of modern digital society. However, Gartner predicts that only 10% of firms will achieve some radical transformation with the use of blockchain technologies, by 2022. The other 90% will continue to struggle with where to begin with

blockchain. Over the next couple of years, CIOs from organizations exploring blockchain will be joining one or many consortia to gain knowledge and pilot targeted use cases that require the cooperation of several participants. For this participation to be productive, two key challenges must be overcome one, 'Organizational commitment to blockchain' and the other 'The ability to cooperate with competitors and set mutual, achievable goals'. Blockchain initiatives cannot succeed without an organization's willingness to share and align its digital ambitions with the ecosystems of businesses and customers (Gartner, 2019).

Nearly 50% of the states in India have initiated blockchain projects to address different elements of citizen service delivery. While most projects are in the pilot stage, the state governments have taken a progressive approach to ensure start-ups and niche providers have a conducive framework to participate in these initiatives. Not only the public sector, but the private firms across all industries in India are also identifying different applications of blockchain. The BFSI sector of the nation has seen the highest adoption, but other industries, including healthcare, retail and logistics are also accelerating rapidly.

Indian start-ups have failed to tap into the global investment surge towards blockchain, cornering only 0.2% of the investments. There is an urgent need for a conducive government procurement policy environment to accelerate start-up growth and also to drive the sector forward.. Many blockchain solutions have been implemented across major banks and insurance companies. Countries have taken different regulatory approaches; India has a cautious approach towards shaping the blockchain ecosystem (Nasscom, 2019).

Adoption of Blockchain in Supply Chain & Logistics

The line of various points involved in producing and delivering goods, from the procurement stage to the end customer is defined as Supply chain. It can consist of various stages and locations. Hence, it has become more difficult to trace events in the entire chain. Moreover, due to the lack of transparency in the supply chain, it has become hard for the buyers and customers to be sure of the true value of the products and services. There are also challenges related to illegal events whose accountability is hard to investigate due to which the world faces problems of counterfeiting, forced labor and poor conditions in factories.

Moreover, lack of transparency is not the only challenge for logistics. The huge amount of data associated with products or documentation can easily be lost across the entire supply chain network. Parties do not share information concerning the place of origin of an asset to determine quality. Organizations tend not share all relevant information with other participants. As blockchain ensures transparency and security, it can be a good solution for fixing supply chains. Recording the transfer of products on the digital ledger as transactions, allows to identify the main data which is relevant to manage the supply chain.

The key features of blockchain would be very useful for application in the supply chain are Public availability gives the opportunity to track products form the place of origin to the end customer. It gives an opportunity for the participation of all parties in the supply chain due its

decentralized structure. Cryptography-based and immutable nature gives high assurance of security. Walmart, Everledger, Provenance have already started projects to implement blockchain technology and consequently make their supply chain more efficient. (Krystsina Sadouskaya, 2017)

Adoption of Blockchain in Property Rights / Land Registry System

Over the past couple of years, India has witnessed rapid economic growth, with the GDP growing 7.6% in the last fiscal year. The current government must capitalize on the current economic momentum and use this to accelerate its reform agenda. One of the areas requiring regulatory attention in India is the property market.

India must establish a standardized property rights regime if it aims to be an economic powerhouse. To bolster current systems, a decentralized, open, and transparent method of record-keeping needs to be instituted. Also, it must be supplemented by a legal framework capable of guaranteeing and enforcing property rights.

A possible solution to the current recordkeeping issues is blockchain technology. Particular attention is being paid to how blockchain can be used for registries. A blockchain is an instrument that ensures veracity, making it the perfect recording system for anything closely. (Meghna Bal, 2017).

Adoption of Blockchain in Health Care

Blockchain has also gathered interest as a platform to improve the authenticity and transparency of healthcare data through several use cases, from maintaining permissions in electronic health records (EHR) to streamlining claims processing.

Physician credentialing: With the use of Blockchain, a trustworthy network of verified credentials can be obtained. Many healthcare organizations are negatively affected by physician-credentialing which can be resolved by using the distributed ledger to have a centralized database of employment history artefact of every physician. Organization can check the frequency of an individual's artefact been used previously before hiring him/her. This speeds up the credentialing process to a huge extent.

Payment contracting: Payment in healthcare is a laborious process. Blockchain brings value-based initiatives to the table which allows organizations to design contracts accordingly. Blockchain ledger continuously tracks data from trusted sources inside and outside the clinical setting and determines who owes what to whom and when it is due. Instead of providing rebates, charge backs and bundled payment programs, Blockchain ledger creates incentives for timely-delivery, behavior and reward results (Bass, J., 2019).

Adoption of Blockchain in Finance and Inclusion

Although the potential of Blockchain is widely claimed to be at par with early commercial Internet, banking firms needs to understand the key features of the technology and how it can be

used to solve the current business issues. While Internet enables exchange of data, Blockchain can involve exchange of value. Banks need to seek opportunities, determine feasibility and impact, and develop proof of concepts. Blockchain will face a hurdle in widespread adoption by financial institutions if the government regulation status remains unsettled (Tejal Shah, Shailak Jani 2017).

Finance is essentially about money, and much of the financial system can run more easily on the blockchain if fiat money (dollars, euros, and rupees) could be transacted directly on the chain. However, the questions around regulations and the policies will have to be resolved through focused discussions with competent regulatory authorities and incorporation of their thought-process. They concluded that regulators should engage, intervene at early stage and shape the innovation (Jayanth Rama Varma, 2019).

Blockchain can help achieve financial inclusion in India as well as any economy of the world. The biggest and obvious fact about Blockchain is that it's a digital technology. But if the willingness to adopt mobile applications by bank users be increased in India, a Blockchain based financial solution can be achieved. The nature of distributed ledger governed via consensus protocol removes the need of third parties to facilitate transactions and hence transaction costs are reduced. Another advantage of this technology is that it reduces the transaction time substantially from days (traditional banking) to just a few minutes. This further help in adoption of digital technology when immediate money transfers are needed. Apart from imitating current financial practices, Blockchain, an immutable ledger, serves as a reliable source of credit history.

All these attributes of Blockchain makes it an unrestricted financial solution since it is distributed across all its participants, be it urban or rural. Rural Indians will start buying overseas goods, exporting their produce overseas, or doing digital work with the ability to make and collect cross-country payments.

Blockchain is going to bring a significant transformation in the Banking Sector. It has the potential to disrupt the standard business models and make the existing systems obsolete. A secured database of client information should be developed and shared by different banks which can help in reducing time, effort, and cost in interbank transactions. In a bid to evolve towards cashless society, this can be an appropriate time for initiating suitable efforts towards digitizing the Indian rupee through Blockchain technology. Fintech and startups should closely work with government agencies and regulators to make sure that the legal and regulatory framework supports the use of Blockchain applications. Industry needs should be accessed and customized Blockchain solutions should be developed to handle current inefficiencies and problems. Adoption of Blockchain has some challenges like security, privacy, and scalability which needs to be tackled to deem it commercially viable. Awareness of Blockchain should be spread through various trainings, workshops, and by incorporating it within the curriculum in educational institutions. Extensive Research and pilot projects must be undertaken to commercialize the Blockchain solutions at large scale. In the years to come, Blockchain will evolve as a disruptive force in transforming Indian banking sector by making banking transactions safer, faster, transparent, and cost effective. We can strongly recommend that the present time is apt for adoption of Blockchain in India (Abhishek Gupta, 2018).

HYPOTHESES

H1: Perceived ease of use positively affects one's sentiments towards using Blockchain Technology

H2: Perceived usefulness positively affects one's sentiments towards using Blockchain Technology

H3: Perceived risk negatively affects one's sentiments towards using Blockchain Technology

H4: Transparency positively affects reputation of Blockchain Technology

H5: Lack of regulations positively affects perceived risk of Blockchain Technology

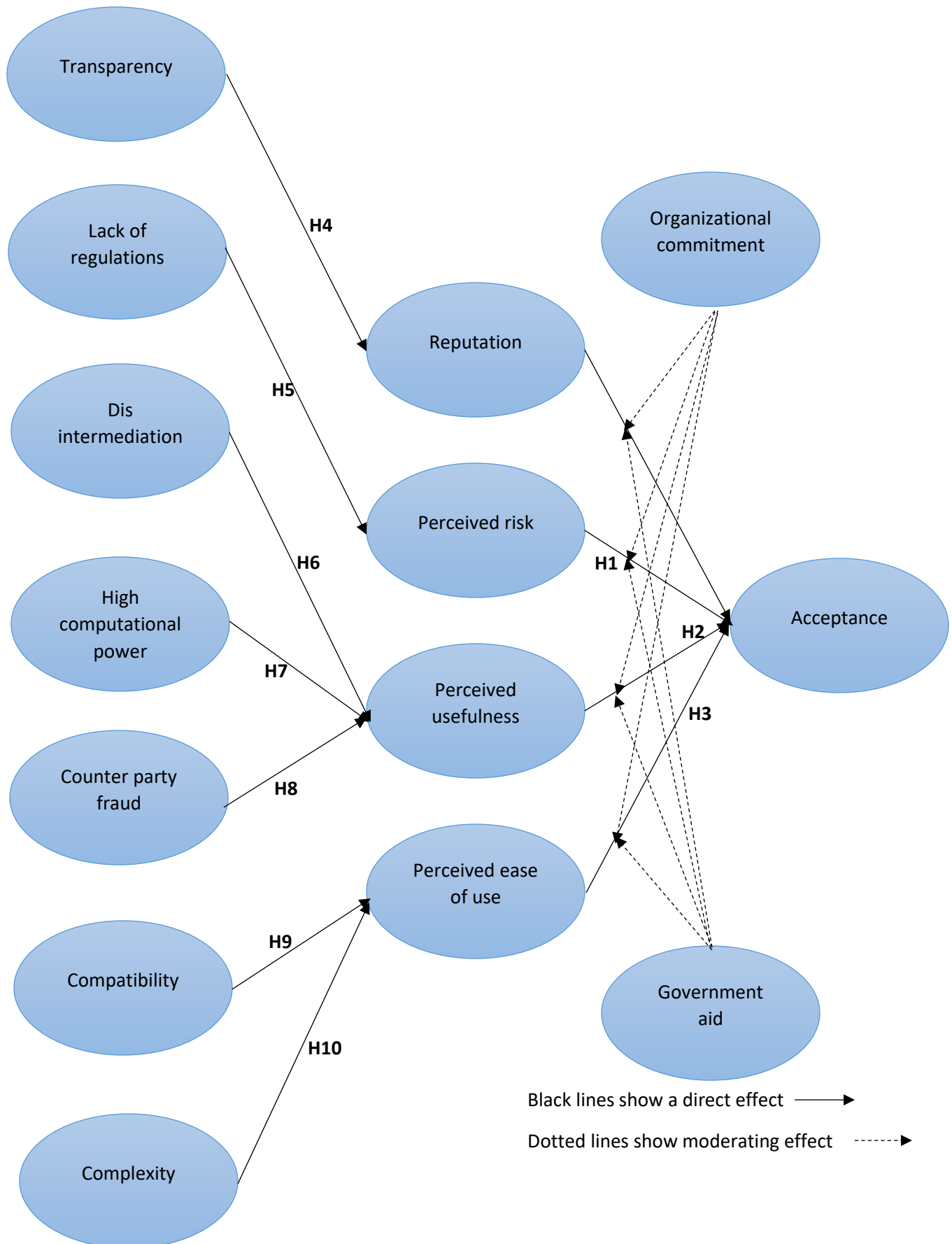H6: Disintermediation positively affects perceived usefulness of Blockchain Technology

H7: High computational power negatively affects perceived usefulness of Blockchain Technology

H8: Counter party fraud positively affects perceived risk of Blockchain Technology

H9: Compatibility positively affects perceived ease of use of Blockchain Technology

H10: Complexity positively affects perceived ease of use of Blockchain Technology

GREAT LAKES
INSTITUTE OF MANAGEMENT, CHENNAI

Transparency

Lack of
regulations

Dis
intermediation

High
computational
power

Counter party
fraud

Compatibility

Complexity

Reputation

Organizational
commitment

Perceived risk

Perceived
usefulness

Acceptance

Perceived ease
of use

Government
aid

H4

H5

H6

H7

H8

H9

H10

H1

H2

H3

Black lines show a direct effect

Dotted lines show moderating effect

➢ PROPOSED METHOD

We aim to do *text analysis* to understand Blockchain's impact on Indian industries right now. Our sources of data would be the consulting reports of big 4 and other consulting firms, certain industry reports, etc.

Text analysis identifies important information within the text itself. That is how it is qualitative in nature unlike text analytics. While text analysis includes many methods and techniques under its umbrella, our focus is on *word frequency* and *sentiment analysis*.

Word frequency can be used to list the words/terms or ideas that appear most often in a given text. For example, this can be helpful for us in identifying the terms or phrases that consumers of Blockchain technology use most often. This is done using a *word cloud*, essentially. Since we will segregate our data industry wise first, these words can lead us to the factors affecting Blockchain's adoption in each of them. After obtaining the most used words, we can find the *correlation* between each of them to understand if they occur in pairs or if any other prominent pattern exists. All these steps will lead us to topic analysis which will help us understand what a given text is talking about.

Hence, Text Analysis will cover:

- o Word Frequency
- o Correlation
- o Topic Modeling
- o Sentiment Analysis

Sentiment Analysis is the method of deciding 'computationally' whether a piece of writing is positive, negative or neutral. It is achieved by incorporating natural language processing (NLP) and machine learning techniques to assign weighted sentiment scores within a sentence or phrase to persons, subjects, themes and categories. Sentiment Analysis is also known as opinion mining, which extracts a speaker's viewpoint or behavior. It is the automated process that uses machine learning to classify text-based subjective data.

Since it has many practical applications, Sentiment Analysis is currently a subject of great interest and growth. Because information on the Internet is constantly growing publicly and privately accessible, a large number of opinions-speaking texts are available in review sites, forums, blogs and social media. Companies use Sentiment Analysis to analyze data such as tweets, survey responses, and product reviews, gain key insights, and make decisions based on data. Analysis of sentiment helps large business data analysts gauge public opinion, perform complex market research, track brand and consumer credibility, and interpret customer experiences.

Typically, in addition to identifying the opinion, such programs derive attributes from the expression for example:

- Polarity: Whether the speaker expresses a positive or negative opinion
- Subject: the matter being debated
- Opinion holder: the individual or entity expressing the opinion

Taking the help of the above mentioned analyzed data and results, we can understand the difference in opinion (if any) and find out its root causes. It can give us a better idea in terms of where Blockchain currently stands in its technology acceptance lifecycle in both the markets which will ultimately help in drawing inferences as to whether Blockchain's implementation in Indian industries can be improved or not.

For sentiment analysis, our sources of data would be news articles and statements of important personnel, etc. along with the data used for text analysis.

We are conducting our analysis on R and the following is our workflow:

1) As mentioned above, our first step is to segregate the data from industry reports sector wise into different .csv files for each sector.
2) Second step is to convert the data into corpus, which is essentially a list of all textual data.
3) Next step is to clean the data before mining as the text has issues like junk URLs, abbreviations, numbers, explicit words, etc in raw form. Looking at the source of data, we need to assess how much cleaning needs to be done. This activity is highly contextual to source and objective.

Breakdown of cleaning process:

- Bring the whole data to lower case.
- As URLs don't give any context, we delete them.
- Next we remove stop words like is, of, a, an, the, almost, and, as, at, just, most, its etc.
- Remove numbers, white spaces, punctuations, any reference to abbreviations.
- Remove certain and specific words as needed. This step is extremely crucial as well as iterative. Based on our understanding of the topics, we are able to add specific words to consider for stop words. These are purely dependent on context and understandable after only after a few iterations.

4) Once the data is cleaned, it is ready for Maths- frequency, correlation, topic modelling, emotional variance analysis. But since these operations can't be done on corpus, we create a new object called tdm (term document matrix)/dtm (document term matrix). Tdm is transpose of dtm. This dtm/tdm is fed to Maths.
5) To obtain Word cloud, we set different cap or thresholds of frequency which is again contextual and codependent with the word removal process explained above.
6) Now we basically find correlation of one word with other words with the correlation strengths set by us (say 0.2), where 1 corresponds to high correlation and 0 to no correlation. This process will give us the understanding of words which are used in pairs, if any, for example- blockchain and security.
7) Then we proceed with an unsupervised learning technique- Topic Modelling. There are many algorithms for the same like LDA, SLDA, LSA, etc. We will use LDA. Topic

Modelling will detect word and phrase patterns within the text and clusters word groups with similar expressions.

8) Lastly we come to Sentiment Analysis, also known as Emotional Variance Analysis. tdm/dtm is not required and it is done using *syuzhet* package. It detects about ten emotions- Positive, Anger, Anticipation, Disgust, Fear, Joy, Sadness, Surprise, Trust and Negative.

Following is the R CODE used for Text and Sentiment Analysis:

 # importing the libraries required
```
library(SnowballC)
library(tm)
library(ggplot2)
library(RColorBrewer)
library(wordcloud)
library(topicmodels)
library(data.table)
library(stringi)
library(dplyr)
library(syuzhet)
library(plyr)
library(grid)
library(gridExtra)
library(qdap)
library(qdapTools)
```

################################ TEXT MINING ######################################

################################ CLEAN UP ######################################
#Sets the working directory and reads the the file from that path
```
setwd("E:/GLIM/EMPIRICAL/Sectors")
tweets.df <- read.csv("Banking.csv")
```

 # Convert char date to correct date format
```
tweets.df$created <- as.Date(tweets.df$created, format= "%d-%m-%y")
tweets.df$text <- as.character(tweets.df$text)
str(tweets.df)
```

 # Remove character string between < >
```
#tweets.df$text <- genX(tweets.df$text, " <", ">")
```

 # Create document corpus with tweet text
```
myCorpus<- Corpus(VectorSource(tweets.df$text))
```

#convert to lower case
```
myCorpus <- tm_map(myCorpus, content_transformer(stri_trans_tolower))
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#remove the url links
```
removeURL <- function(x) gsub("http[^[:space:]]*", "", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeURL))
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#remove @ in user name
```
removeUsername <- function(x) gsub("@[^[:space:]]*", "", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeUsername))
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#Remove anything except the english language and space
```
removeNumPunct <- function(x) gsub("[^[:alpha:][:space:]]*", "", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeNumPunct))
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#Remove Stopwords
```
myStopWords<- c((stopwords('english')),c("also"))
myCorpus<- tm_map(myCorpus,removeWords , myStopWords)
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#Remove Single letter words
```
removeSingle <- function(x) gsub(" . ", " ", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeSingle))
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#remove extra white space
```
myCorpus<- tm_map(myCorpus, stripWhitespace)
writeLines(strwrap(myCorpus[[30]]$content,60))
```

#removing similar words and replacing with single word
```
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("bank", "banks", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("transaction", "transactions", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("securities", "security", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("blockchains", "blockchain", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("systems", "system", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("systemss", "system", x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("bankss", "banks", x)))
```

```
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("transactionss", "transactions",
x)))
myCorpus <-tm_map(myCorpus, content_transformer( function(x) gsub("banksing", "banking", x)))
```

#copy of mycorpus
```
myCorpusCopy<- myCorpus

df = data.frame(myCorpusCopy)
```

#Creating a term document matrix
```
tdm<- TermDocumentMatrix(myCorpus, control= list(wordLengths= c(1, Inf)))
tdm
```

################################# WORD CLOUD #################################

#creating a word cloud with words having minimum frequency of 5 and maximum number of words in world could equal to 150
```
word.freq <-sort(rowSums(as.matrix(tdm)), decreasing= F)
pal<- brewer.pal(8, "Dark2")
wordcloud(words = names(word.freq), freq = word.freq, min.freq = 5, random.order = F, colors = pal,
max.words = 150)
```

################################# CORRELATION #################################

 # finds all the words with having correlation greater than 0.3 with the word blockchain and plots a bar graph
```
list1<- findAssocs(tdm, "blockchain", 0.3)
corrdf1 <- t(data.frame(t(sapply(list1,c))))
corrdf1
barplot(t(as.matrix(corrdf1)), beside=TRUE,xlab = "Words",ylab = "Corr",col = "blue",main =
"blockchain",border = "black")
```

 # finds all the words with having correlation greater than 0.3 with the word banks and plots a bar graph

```
list1<- findAssocs(tdm, "banks", 0.3)
corrdf2 <- t(data.frame(t(sapply(list1,c))))
corrdf2

barplot(t(as.matrix(corrdf2)), beside=TRUE,xlab = "Words",ylab = "Corr",col = "blue",main =
"banks",border = "black")
```

 # finds all the words with having correlation greater than 0.3 with the word security and plots a bar graph

```
list1<- findAssocs(tdm, "security", 0.3)
corrdf3 <- t(data.frame(t(sapply(list1,c))))
corrdf3

barplot(t(as.matrix(corrdf3)), beside=TRUE,xlab = "Words",ylab = "Corr",col = "blue",main =
"security",border = "black")
```

##################################### LDA ###

```
dtm <- as.DocumentTermMatrix(tdm)

rowTotals <- apply(dtm , 1, sum)

NullDocs <- dtm[rowTotals==0, ]
dtm   <- dtm[rowTotals> 0, ]

if (length(NullDocs$dimnames$Docs) > 0) {
  tweets.df <- tweets.df[-as.numeric(NullDocs$dimnames$Docs),]
}
# finds 10 topic
lda <- LDA(dtm, k = 10)
# first 10 terms of every topic
term <- terms(lda, 10)
(term <- apply(term, MARGIN = 2, paste, collapse = ", "))
```

#################################### SENTIMENTS #######################################

```
mysentiment<-get_nrc_sentiment((tweets.df$text))

# Get the sentiment score for each emotion
mysentiment.positive =sum(mysentiment$positive)
mysentiment.anger =sum(mysentiment$anger)
mysentiment.anticipation =sum(mysentiment$anticipation)
mysentiment.disgust =sum(mysentiment$disgust)
mysentiment.fear =sum(mysentiment$fear)
mysentiment.joy =sum(mysentiment$joy)
mysentiment.sadness =sum(mysentiment$sadness)
mysentiment.surprise =sum(mysentiment$surprise)
mysentiment.trust =sum(mysentiment$trust)
```

mysentiment.negative =sum(mysentiment$negative)

 # Creates the bar chart
yAxis <- c(mysentiment.positive,
      + mysentiment.anger,
      + mysentiment.anticipation,
      + mysentiment.disgust,
      + mysentiment.fear,
      + mysentiment.joy,
      + mysentiment.sadness,
      + mysentiment.surprise,
      + mysentiment.trust,
      + mysentiment.negative)

xAxis <- c("Positive","Anger","Anticipation","Disgust","Fear","Joy","Sadness",
      "Surprise","Trust","Negative")
colors <- c("green","red","blue","orange","red","green","orange","blue","green","red")
yRange <- range(0,yAxis)
barplot(yAxis, names.arg = xAxis,
     xlab = "Emotional valence", ylab = "Score", main = "Blockchain sentiments",
     sub = "Banking and Finance", col = colors, border = "black", xpd = F, ylim = yRange,
     axisnames = T, cex.axis = 0.8, cex.sub = 0.8, col.sub = "blue")

➢ **RESULTS**

Taking three sectors namely Public, Banking and Finance and Supply Chain and Logistics, we did Text Analysis and following are the individual results obtained:

Each sector's result constitutes of its word cloud, few words with highest correlation and its explanation, Topic Modelling and lastly, sentiment analysis.
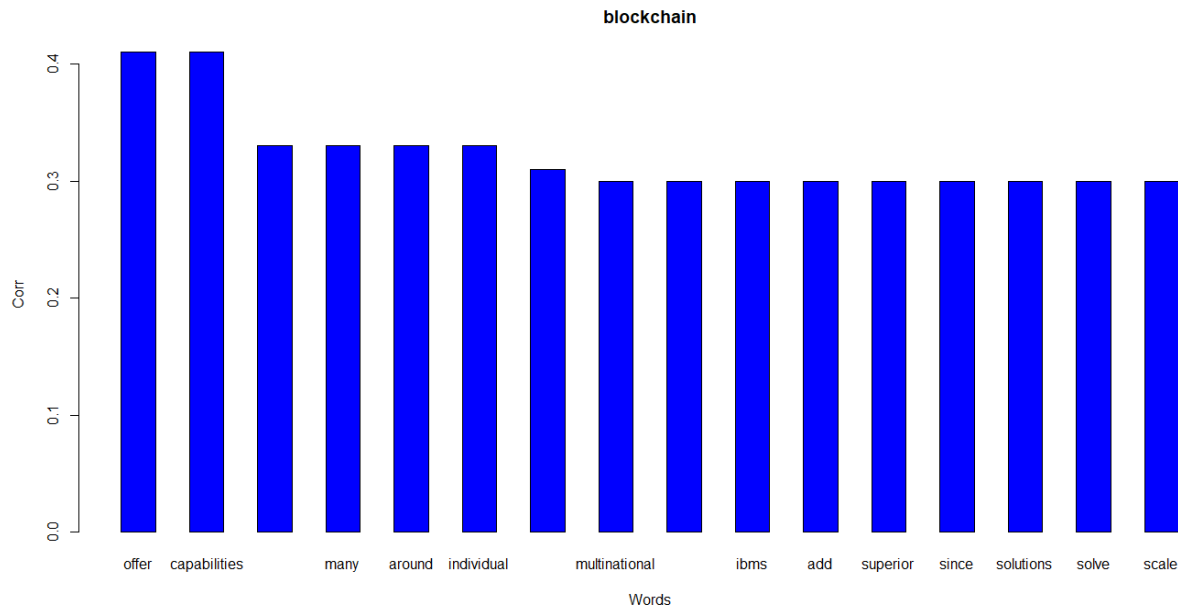
I. **Banking And Finance**

• **Word Cloud:**
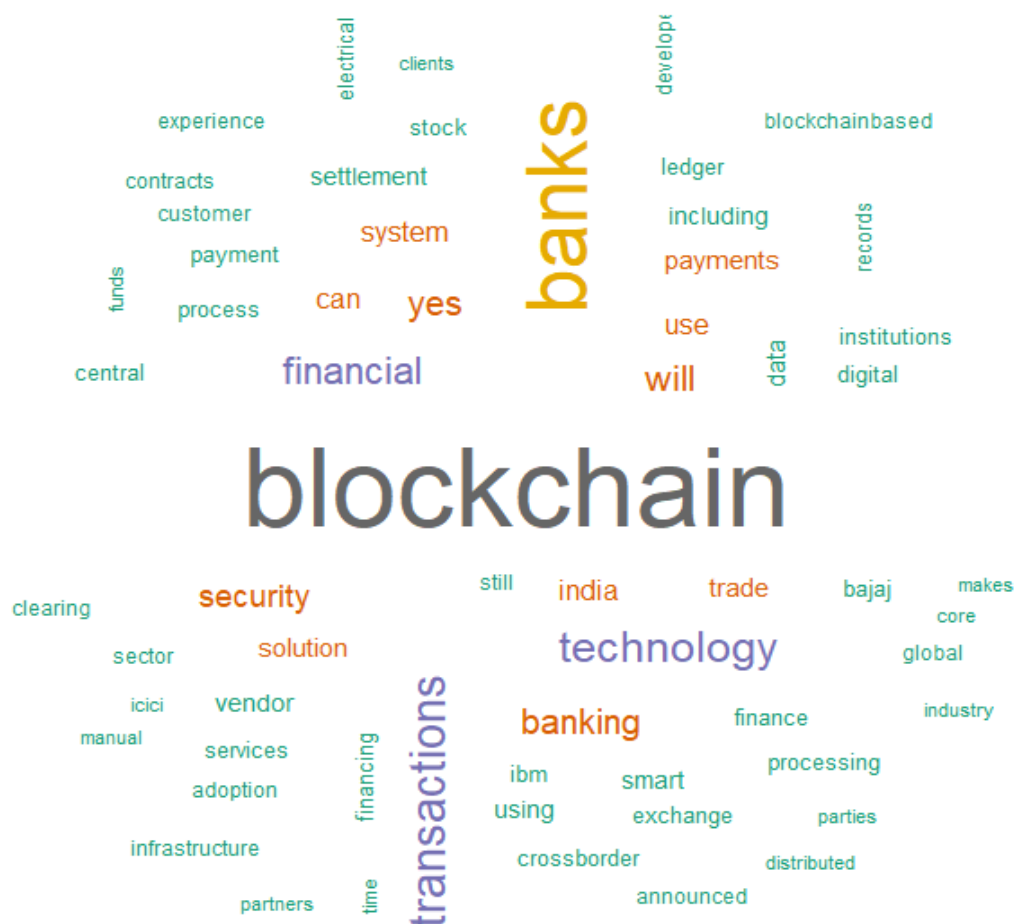
- **Correlation:**

1. **Blockchain**

blockchain

The word **blockchain** has high correlation with **offer** and **capabilities.**

YES bank CEO and MD mentions using blockchain **capabilities** to solve the current challenges in Vendor Financing solutions.

Nasdaq was one of the first multinational financial services companies to begin using the blockchain **capabilities** in a non-currency manner.

Blockchain **offers** automated processing of transactions with almost zero manual intervention in Vendor financing by reducing process cycle for bill discounting, increased transparency, end-to-end digital process eliminating paper trail which is being used by YES bank with the help of **IBM** for its vendors Bajaj Electricals.

Blockchain based solution for trade finance requirements that digitizes trade finance business processes and **offers** functionality including bill collection, letters of credit and invoice financing was discussed in 'India Trade Connect' consortium led by Infosys which was joined by Axis Bank, ICICI Bank, IndusInd Bank, RBL Bank, Kotak Mahindra Bank, South Indian Bank, and Yes Bank.

Other words which are correlated with blockchain like **superior, many, solutions, solve** indicates its superior technology which useful in solving issues related to cross border payments, vendor financing etc.

The word **scale** indicates the difficulty in adoption of blockchain in a large scale due to high computational power required and hiring of data scientists or blockchain experts which is costly.

2. Banks

banks

The above correlation with respect to **banks** tells us which companies in the banking and finance sector are implementing blockchain or exploring its capabilities for an efficient process.

Banks like **Axis, HDFC, ICICI** are implementing blockchain for its KYC and trade finance procedures.

The seven banks including **ICICI Bank, Axis Bank, Federal Bank of India, Yes Bank** will collaborate with JP Morgan's Blockchain Interbank Information Network (IIN) which will help them improve the movement of funds and cross border payments.

Few banks like **Axis Bank, ICICI Bank, IDFC Bank, Kotak Mahindra Bank,** and **Yes Bank** have carried out pilot runs for vendor financing and international trade finance using Blockchain.

Border word indicates the steps that banks are taking to implement blockchain technology to address the challenges banks face in **cross-border payments**.

3. Security
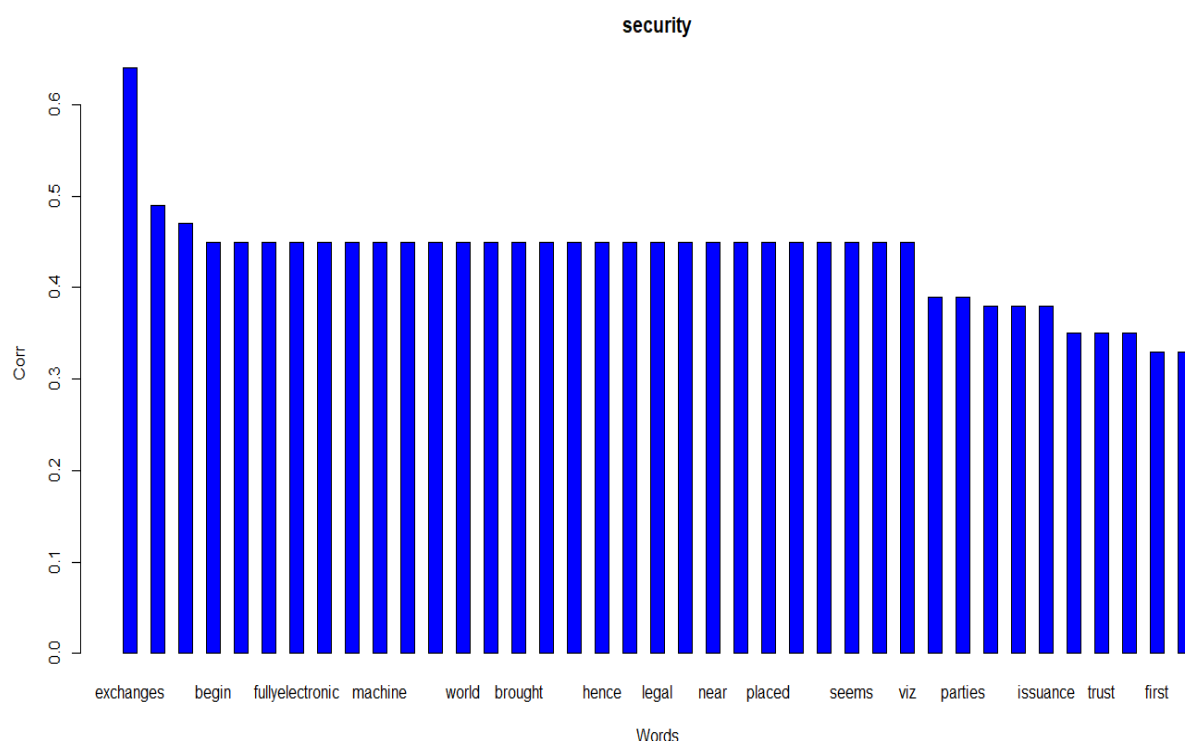
security

Below are some of the negative views of the industry with regards to security (trust) of blockchain:

India, along with most of the countries, has its existing legal system set up with a **securities regulator** and **regulated exchanges** as the core parties. Hence, a new decentralized technology cannot by itself disrupt this legal model.

At least in the near term, it seems likely that **trust** will continue to be placed in central parties viz. the securities regulator and stock exchanges, unless **legal** amendments are brought in.

Below are some of the positive views of the industry with regards to security (trust) of blockchain:

Since on blockchain is immutable and can be used as a **trusted** third party for financial transactions.

Major fintech application where blockchain can be deployed are in Cross border payments which under the current system is time consuming , costly and requires a presence of a **trusted** third party. Blockchain can solve this since it can be used as a **trusted** third party.

The consensus system improves the transparency of decisions and **trust** among all stakeholders.
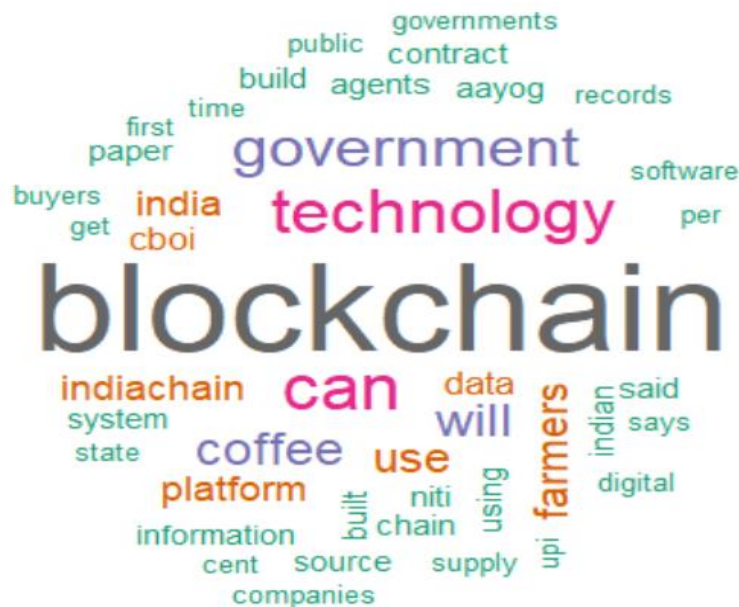
- **Topic Modelling:**

Topic	Keywords	Label
Topic 1	blockchain, banks, will, banking, technology, adoption, developers, partners, yes, ibm	Yes Bank and IBM, leading partners of blockchain adoption in banking
Topic 2	blockchain, financial, banks, trade, services, use, finance, digital, security, management	Financial trade security with blockchain
Topic 3	blockchain, transactions, will, payments, banks, can, crossborder, payment, smart, ledger	Crossborder payments with smart ledgers
Topic 4	blockchain, technology, financial, banking, system, infrastructure, institutions, processing, clearing, settlement	Institutions clearing financial settlements with blockchain technology
Topic 5	banks, blockchain, yes, exchange, transactions, vendor, stock, india, bajaj, financing	Indian banks exchanging transactions using blockchain.

- **Sentiment Analysis:**

Blockchain sentiments
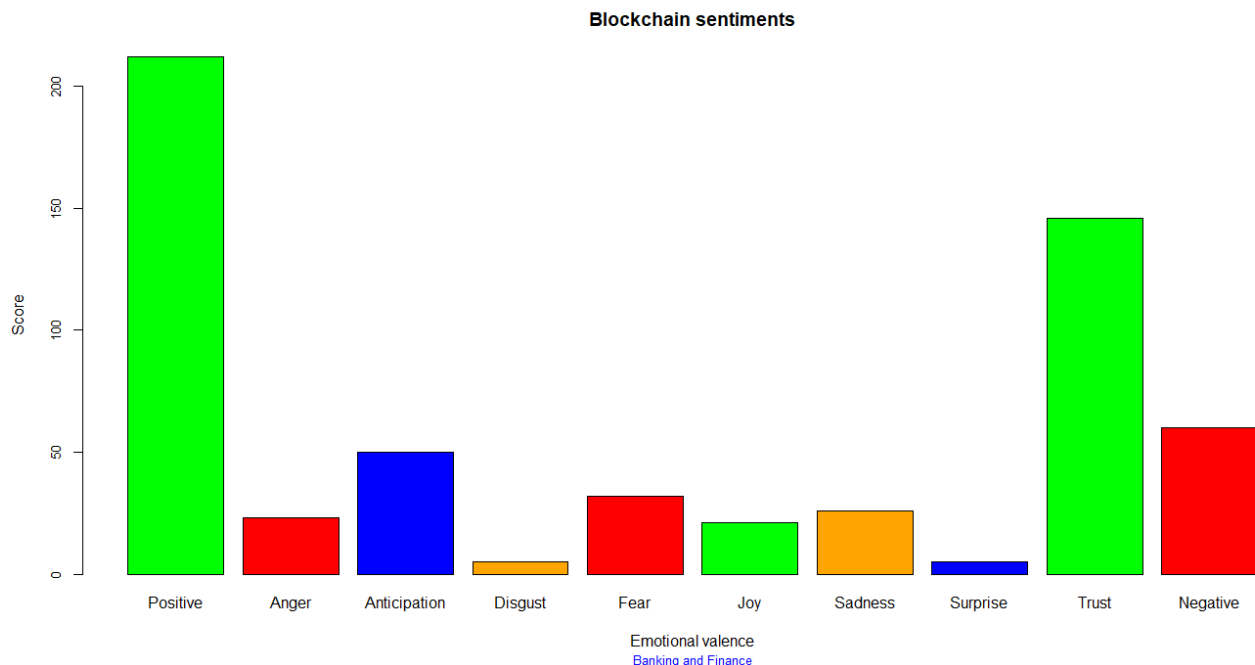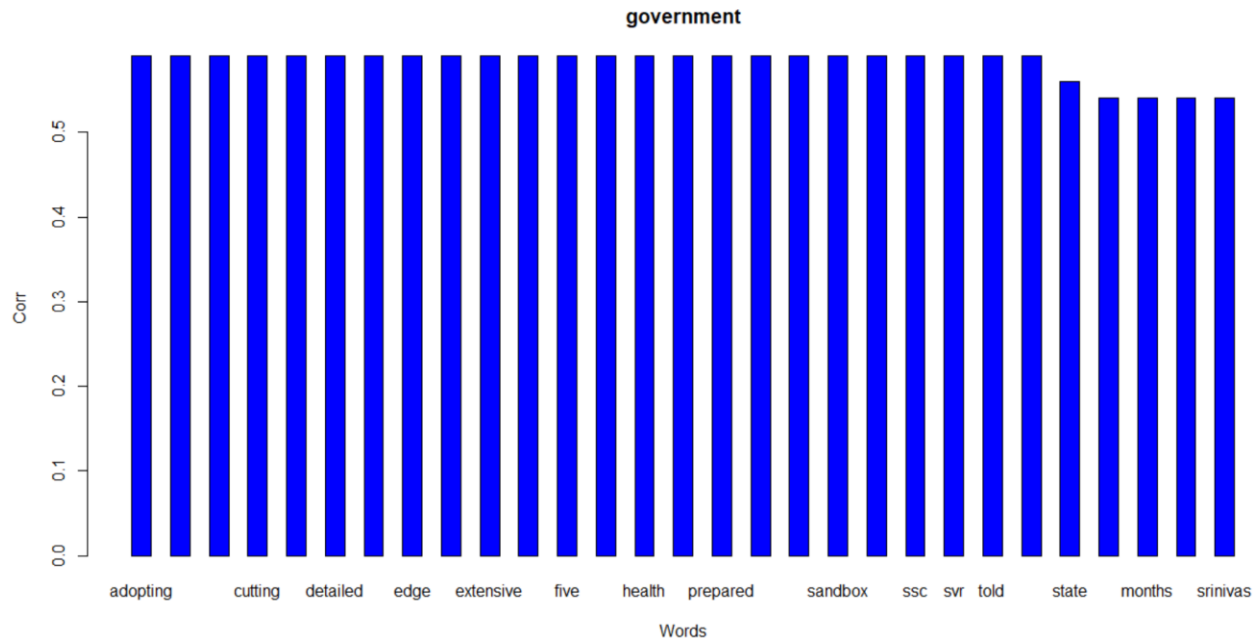
Overall, there is a **positive** sentiment around blockchains application in banking and finance sector with many companies who have either implemented or looking to implement it in their operations. Vendor financing, KYC, trade financing, cross border payments are some of the areas where the technology has been implemented. ICICI Bank, Axis Bank, Federal Bank of India, Yes Bank, JP

Morgan, HDFC, IndusInd Bank, RBL Bank, Kotak Mahindra Bank and South Indian Bank are some of the companies having a understood the capabilities of the technology and its uses in their operations, have positive sentiments over its application.

The immutable nature of blockchain makes it a trusted third party hence in areas like cross border payments where you need a trusted third party to carry out the operations blockchain can be solution. Plus, the industry believes the consensus system improves the transparency of decisions and **trust** among all stakeholders. This is in line with study (Atzori, M. ,2017).

Lack of governance, non-scalability, and regulatory compliance risks are three of the major blockchain limitations for this sector. Possible misaligned motives of the members participating in a blockchain-powered financial transaction, high computational power required to process the transactions and lack of regulations around using cryptocurrencies or smart contracts for transfers are some of the reasons for **negative** sentiments. This is in line with study (Dirk A. Zetzsche , Ross P. Buckley and Douglas W. Arner, 2017)

## II. Public sector

- **Word Cloud**

- **Correlation**

1. **Government**

The word **government** has high correlation with many words like **adopting, cutting, edge, enhance, extensive** and **departments.**

Government's project IndiaChain has the capability of transforming **record-keeping** mechanisms, distribution of subsidiaries and tax monitoring. Nearly half of Indian states are involved in new Blockchain-based initiatives and states like Telangana and Goa co-hosted International Blockchain congress 2018 with NITI Aayog, aiming to bring Blockchain revolution in the country. Maharashtra is bidding on Blockchain to **enhance** service delivery.

Government has allocated Rs 4 crores of funds in 2019-20 for the **adoption** of this **cutting-edge** technology and it is believed that this **platform** will allow both government and private entities to bring scalable solutions. Officials said Blockchain is unhackable, leakage-proof and secure.

Information Technology department says the government has already launched pilot projects in the fields of health, documents, supply chain and SCC certificates and is coming forward with report on **extensive** use of Blockchain in other **departments**.

2. **Farmers**
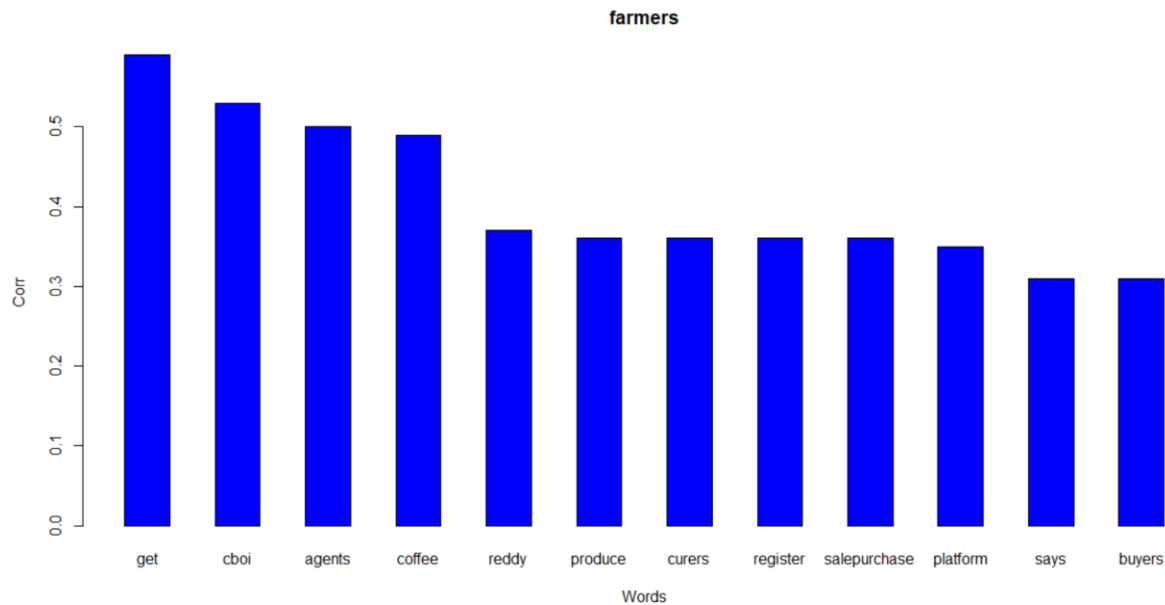
farmers

The above correlation with respect to **farmers** tells us about Coffee Board of India (CBoI)'s venture of blockchain-based electronic-market platform for transparent and efficient sale of coffee produced by Indian farmers.

Initial response to this blockchain project by CBoI was very dull as **building trust** among farmers was a major issue but within months it gained momentum with huge no. of farmers, exporters, curers, roasters and international buyers registering on it. Another concern was the usage of cryptocurrencies for financial transactions which CBoI refrained from, as it is illegal in India.

Not only it provides farmers a better price of their produce but completely eliminates the use of **intermediaries**, i.e., the traditional channel of selling through **agents**. Etherium based blockchain application called **smart contract** connects farmers directly to buyers and allow them to draw sale-purchase contracts.

- **Topic Modelling**

Topic	Keywords	Label
Topic 1	technology, will, coffee, blockchain, farmers, government, get, state, indian, cboi	Indian government aiding coffee farmers via blockchain
Topic 2	can, blockchain, coffee, platform, indiachain, blocks, sidechains, use, data, build	Sidechains on Blockchain platform
Topic 3	blockchain, can, use, technology, contract, government, agents, chain, supply, agriculture	Government using blockchain technology for agriculture supply chain
Topic 4	blockchain, technology, government, built, using, project, public, india, use, transactions	Indian government public projects on blockchain
Topic 5	blockchain, will, paper, india, aayog, niti, government, indiachain, indian, platform	Indiachain, a Niti Aayog blockchain platform

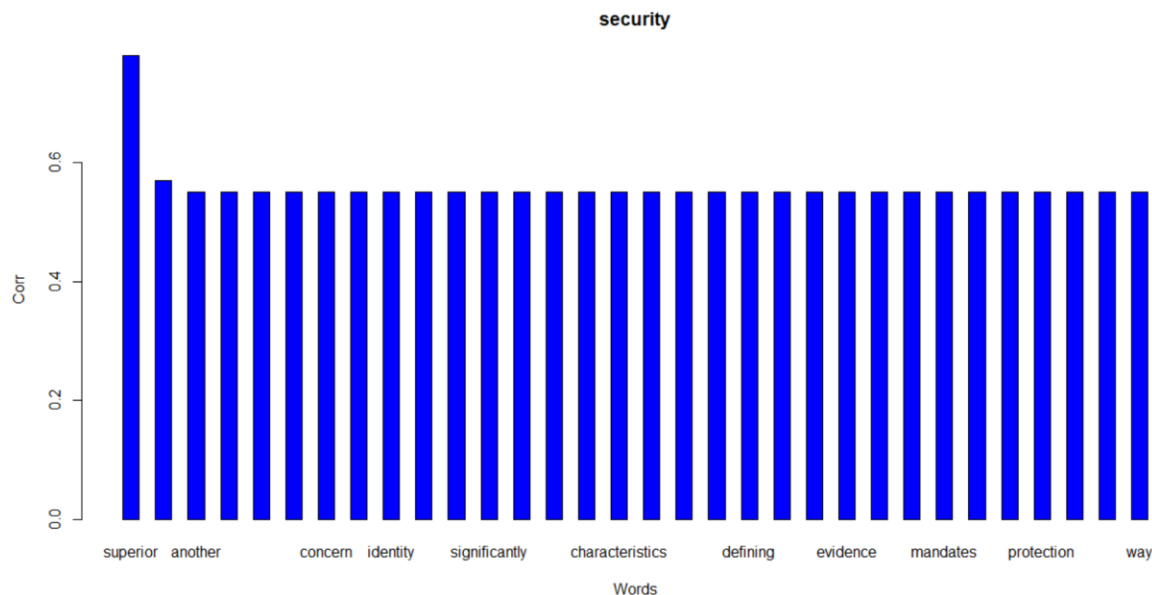- **Sentiment Analysis**

Blockchain sentiments
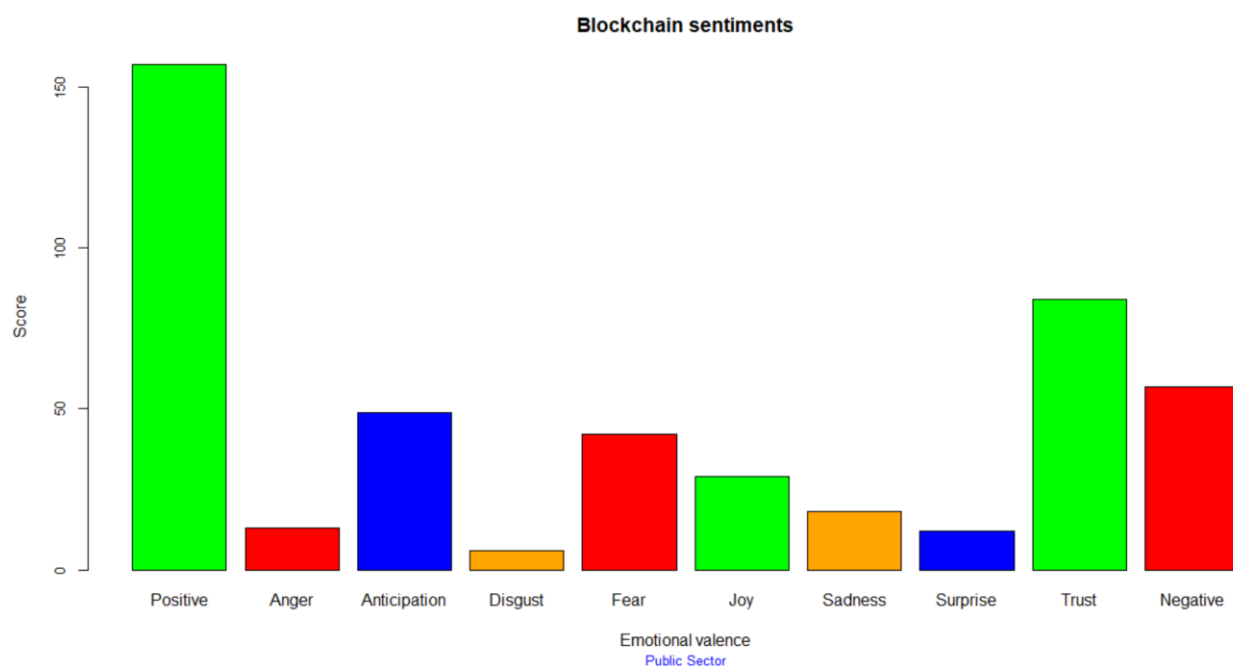
There is a **positive** sentiment and good amount of **anticipation** around blockchain-based applications in public sector with government and many states who have either implemented or looking to implement it in their operations. Blockchain can bring transparency and efficiency in public administration with government planning to step into the education sector to curb fraudulent

degrees and certifications, and healthcare sector to manage huge amount of data. This is in line with study (Gartner Ray Valdes, David Furlonger and Fabio Chesini, 2016).

State governments are ensuring progressive approach to bring out a framework to implement this cutting-edge technology, while helping startups to participate in these initiatives.

The elimination of intermediaries like agents, in blockchain, enables farmers to get a better price for their produce, and establish direct relationship with buyers via smart contracts, though the use of crypocurrencies is not yet enabled. This is in line with study (Abhishek Gupta, 2018).

Due to its immutable nature, the government called in trustworthy, secure and unhackable but found it challenging to develop trust initially among its users, like farmers, who are used to trade traditionally which might be one of the reasons for **negative** sentiments.

III.   Supply Chain and Logistics

- **Word Cloud**

- **Correlation**

1. **Security**

security

The word **security** has high correlation with many words like **superior, blockchain-enabled, automating, infrastructure, strengthen, significantly, enabling** and many more along the same lines.

Blockchain, the digital ledger technology is critical in the growth of logistics sector as it protects data and increases supply chain transparency. Aiming at the security during third party supplier interactions, a Bangalore based startup called Signzy **enables** digital drafting and signing of legal contracts using Blockchain. FreightCrate Technologies also believes that Blockchain enables safe, cheap and effective communication. Through decentralization, encryption methods and immutable record keeping, a large amount of data can be shown to all the stakeholders without compromising the data security. It further enhances the security and governance by allowing smart contracts over cloud and their **automatic** management. Cloud services also require identity and access management which is also **strengthened** with **superior** levels of security and validation through blockchain-enabled digital identity using public key **infrastructure**. It seems, the combination of Blockchain and cloud is working well for many companies and helping stakeholders collaborate in a secure environment.

2. **Ledger**
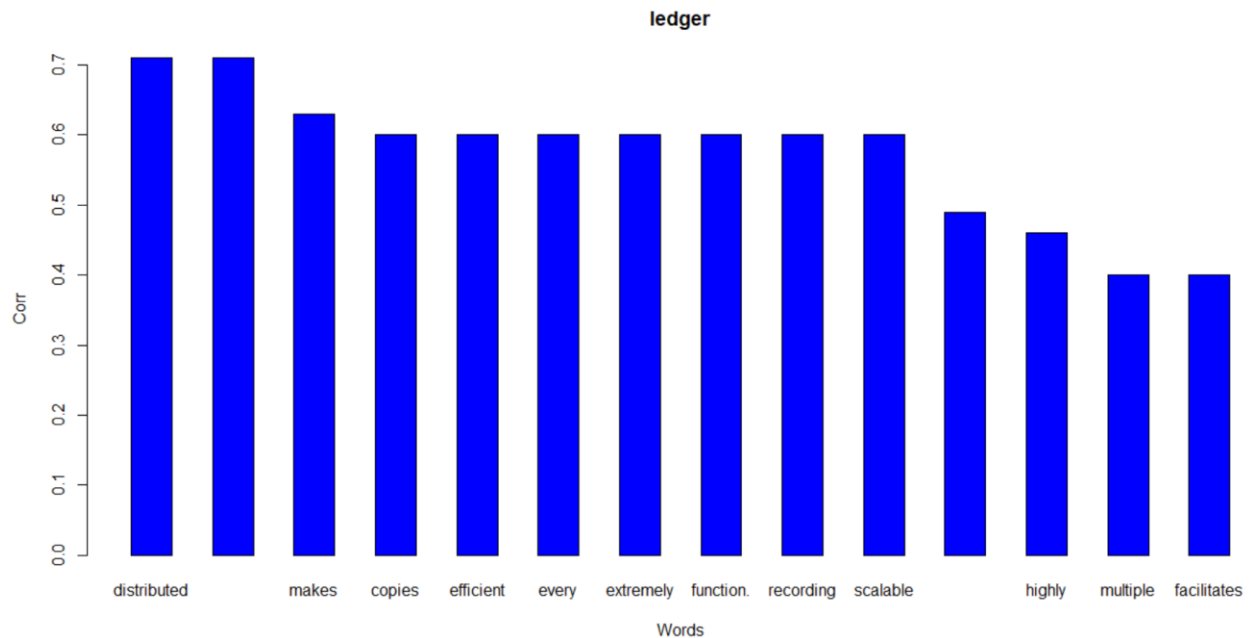
The word **ledger** has high correlation with many words like **distributed, transactions, efficient, extremely, scalable and transparent.**

Blockchain's biggest advantage seen by NITI Aayog is that it will be tamper-proof and transparent ledger that can help in fighting corruption at various levels of supply chain in businesses of India. In partnership with PwC and Intel, NITI Aayog started a pilot Blockchain application to track and streamline the fertilizer subsidy supply chain. All the supporting documents such as challans, invoices and claims are integrated in this application. A similar agricultural application by the name of eNAM is created to remove mistrust between farmers and intermediaries. Drugs are being pushed into the value chain by recording and time-stamping each transaction in the ledger to ensure safety and security. An Indian startup, OpenXcell helps its clients build customized supply chain according to the business goals which helps cater to the need of transparent multi-party transactions. India is also prone to piracy and sale of rip-offs along with scams, fraud and inefficient paper-based transactions which could change after the **effective** deployment of **distributed** ledger technology (DLT) in the sector. Not just domestic but business done with international parties can also be simplified and traceability be increased as professionals can track merchandise in the movement history. Financial issues can be resolved easily as **transactions** are **transparent**.

- **Topic Modelling**

Topic	Keywords	Label
Topic 1	supply, chain, blockchain, ledger, across, highly, transactions, transparent, sector, time	Creating supply chain transparency with blockchain ledgers
Topic 2	blockchain, supply, chain, technology, help, can, ledger, distributed, since, will	Distributed ledger booming supply chain
Topic 3	blockchain, supply, chain, can, food, walmart, management, delivery, across, data	Blockchain data helping Walmart's food delivery chain
Topic 4	blockchain, will, supply, imaginnovate, transportation, industry, stakeholders, can, chain, logistics	Innovating transportation industry with logistics on blockchain
Topic 5	blockchain, services, can, cloud, shrimp, management, technology, sector, india, key	Cloud management services with blockchain technology

- **Sentiment Analysis**

Blockchain sentiments
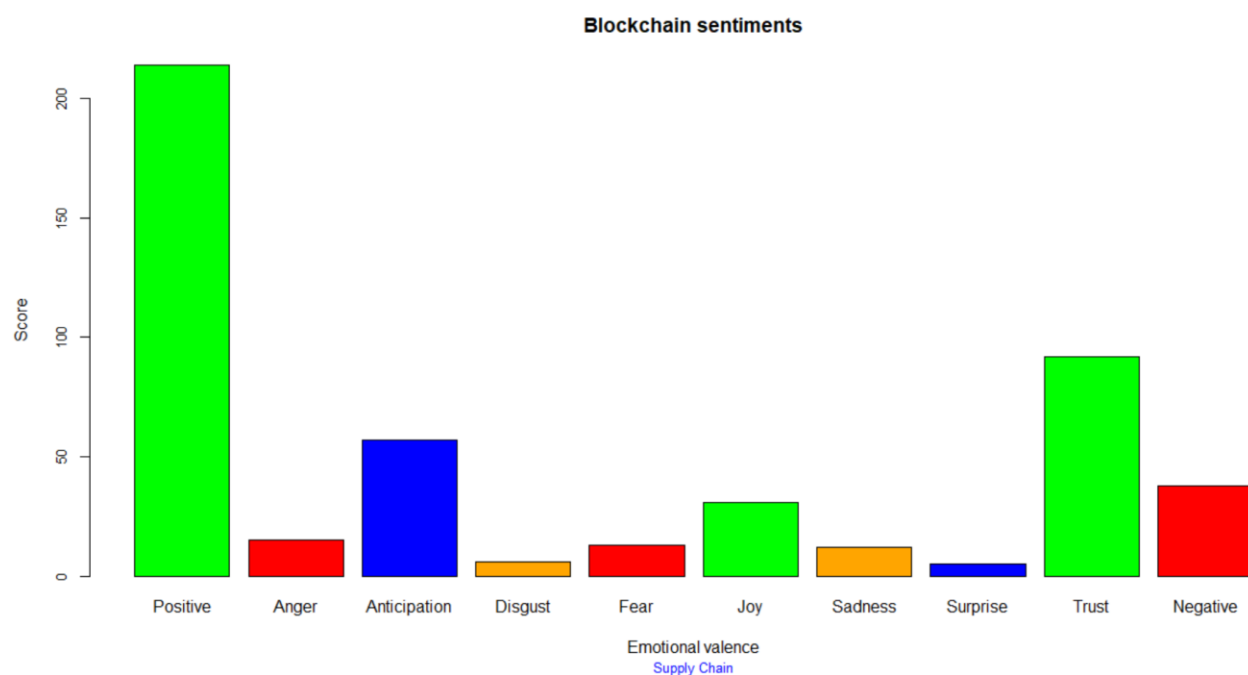
There is a good amount of **positive** sentiment, **trust** and **anticipation** around Blockchain in Supply Chain and Logistics sector as it is one of the most obvious sectors to be benefitted from Blockchain's implementation.

Companies like Primechain bring in huge anticipation with the belief that blockchain technology will be an enabler of "massive social upliftment and economic prosperity" in India and with its several projects, including BankChain, Primechain-MONEY and a number of educational programs aimed at increasing blockchain adoption on a global scale. Imaginnovate, specialised in delivering technology solutions to transportation and logistics companies, has joined Blockchain in Transport Alliance (BiTA), where both the parties will be benefitted from each other's experience and knowledge, as they believe there is huge scope of improvement in terms of transport in logisctics. Walmart plans to use a blockchain food supply chain solution for shrimp farming in India to improve the supply chain traceability. All of these applications aim to bring data **security** to enable **tamper-proof record keeping.** This is in line with study (*A. Dorri, M. Steger, S. S. Kanhere and R. Jurdak,2017)*

Blockchain's immutable nature and it being a distributed ledger providing transparency in transactions and as a result, **traceability**, are the prime factors of the above companies' trust and anticipation. Removal of intermediaries, paper-work and ineffective communication is what is expected of this digital solution the most. This is in line with study (*Meghna Bal, 2017, Bass, J., 2019*).

> ## **DISCUSSION**

Findings:

This study provides evidence that perceived usefulness, perceived ease of use, perceived risk and reputation are related to blockchain implementation sentiments (accepting hypothesis H1, H2 and H3) which is in line with studies (Florian O. Knauer and Andreas Mann, 2019; C. Christopher Lee, John C. Kriscenski , Hyoun Sook Lim, 2019).

Our results indicate that transparency positively influences reputation of blockchain technology (accepting hypothesis H4). This is line with study (Andreas Kamilaris, Agusti Fonts and Francesc X. Prenafeta, 2020).

Lack of regulation was found to have significant influence on perceived risk (accepting hypothesis H5) which is in line with study (Guych Nuryyev , Yu-Ping Wang , Jennet Achyldurdyyeva , Bih-Shiaw Jaw , Yi-Shien Yeh , Hsien-Tang Lin and Li-Fan Wu, 2020).

Our results further show that disintermediation positively influences perceived usefulness (accepting hypothesis H6) and high computational power negatively influences perceived usefulness (accepting hypothesis H7). This finding is in line with study (C. Christopher Lee, John C. Kriscenski, Hyoun Sook Lim, 2019).

Counter party fraud was found to have positive influence on perceived risk (accepting hypothesis H8). This is in line with study (Joe Abou Jaoude, Raafat Saade, 2007).

However, the effect of compatibility on perceived ease of use was found to be insignificant (rejecting hypothesis 9). We further found that the effect of complexity on perceived ease of use was insignificant (rejecting hypothesis 10). These findings deviate from previous study (Florian O. Knauer and Andreas Mann, 2019).

Managerial Implications:

There are significant managerial implications and insights from the findings of our study to better cope and coordinate the successful implementation of blockchain technology. The study helps identify important constructs for successful implementation of blockchain in Banking and Finance , Public and supply chain and logistics sectors and how the practitioner's sentiments on adopting blockchain technology is influenced.

The study also reveals that the adoption of blockchain mainly operates through perceived usefulness with many of the constructs directly effecting it. Hence for the companies implementing Blockchain technology, focus should be more on making blockchain technology more user-friendly and at the same time offering great value.

Our finding also reveals that reputation of the technology as being transparent influences its adoption. Based on how other practitioners have reacted after using the technology plays an important role in keeping a good reputation of the technology. Hence for the companied implementing blockchain focus should be on sharing success stories of different companies with the advantages of implementing of blockchain as opposed to using traditional methods.

Lack of regulations and counter party fraud was found to have a significant impact on blockchain adoption. This means that the practitioners are somewhat skeptical about using the technology due to lack of regulations which is the reason why Blockchain has not been implemented yet in large scale. Further, it also reflects that the practitioners perceive a level of distrust towards the Blockchain technology , as they do perceive potentially harmful consequences of blockchain technology.

Further, in order to accommodate the implementation of blockchain technology, respective organizations will face costs originating from: hiring subject matter experts, data scientists, educational programs etc. which are key in aiding the implementation of blockchain in an organization. Hence these factors like we have seen in our study has a significant affect and must be accounted for when determining the cost to benefit ratio of implementing blockchain technology.

➢ **REFERENCES**

Kamble, S., Gunasekaran, A., & Arha, H. (2019). Understanding the Blockchain technology adoption in supply chains-Indian context. International Journal of Production Research, 57(7), 2009-2033.

Sadouskaya, K. (2017). Adoption of Blockchain Technology in Supply Chain and Logistics.

Bal, M. (2017). Securing property rights in India through distributed ledger technology. New Delhi: Observer Research Foundation.

Deloitte (2017). Blockchain technology in India Opportunities and challenges

Gartner (2019). Customer-Driven Alliances Will Unlock Blockchain Potential

Nasscom (2019). NASSCOM Avasant India Blockchain Report 2019

Tejal Shah, Shailak Jani (2017). Applications of Blockchain Technology in Banking & Finance

Varma, J. R. (2019). Blockchain in Finance. Vikalpa: The Journal for Decision Makers, 44(1), 1–11

Bass, J. (2019). The Truth About Blockchain and Its Application to Health Care. Hfm (Healthcare Financial Management), 1–9

Folkinshteyn, D., & Lennon, M. (2016). Braving Bitcoin: A technology acceptance model (TAM) analysis. Journal of Information Technology Case and Application Research, 18(4), 220-249.

Gainsbury, S. M., & Blaszczynski, A. (2017). How blockchain and cryptocurrency technology could revolutionize online gambling. Gaming Law Review, 21(7), 482-492.

Suh, B., & Han, I. (2003). The impact of customer trust and perception of security control on the acceptance of electronic commerce. International Journal of electronic commerce, 7(3), 135-161.

Bhattacharyya, S. S., & Nair, S. (2019). Explicating the future of work: perspectives from India. Journal of Management Development, 38(3), 175-194.

Grover, P., Kar, A. and Janssen, M. (2019), "Diffusion of blockchain technology", Journal of Enterprise Information Management, Vol. 32 No. 5, pp. 735-757.

Siba, T. K., & Prakash, A. (2016). Block-Chain: An Evolving Technology. Global Journal of Enterprise Information System, 8(4), 29–35.

Sheel, A., & Nath, V. (2019). Effect of blockchain technology adoption on supply chain adaptability, agility, alignment and performance. Management Research Review.

Bhattacharyya, S. S., & Nair, S. (2019). Explicating the future of work: perspectives from India. Journal of Management Development, 38(3), 175-194.

Abhishek Gupta, BLOCKCHAIN TECHNOLOGY APPLICATION IN INDIAN BANKING SECTOR

A. Dorri, M. Steger, S. S. Kanhere and R. Jurdak, "BlockChain: A Distributed Solution to Automotive Security and Privacy," in IEEE Communications Magazine, vol. 55, no. 12, pp. 119-125, Dec. 2017.

Schuetz, Sebastian & Venkatesh, Viswanath. (2019). Blockchain, adoption, and financial inclusion in India: Research opportunities. International Journal of Information Management. 10.1016/j.ijinfomgt.2019.04.009.

Kamble, Sachin & Gunasekaran, Angappa & Arha, Himanshu. (2018). Understanding the Blockchain technology adoption in supply chains-Indian context. International Journal of Production Research. 1-25. 10.1080/00207543.2018.1518610.

Andreas Kamilaris, Agusti Fonts1 and Francesc X. Prenafeta, (2020). The Rise of Blockchain Technology in Agriculture and Food Supply Chains

Florian O. Knauer and Andreas Mann, 2019.Drivers of Blockchain Acceptance among German Consumers

Guych Nuryyev , Yu-Ping Wang , Jennet Achyldurdyyeva , Bih-Shiaw Jaw , Yi-Shien Yeh , Hsien-Tang Lin and Li-Fan Wu, 2020. Blockchain Technology Adoption Behavior and Sustainability of the Business in Tourism and Hospitality SMEs

C. Christopher Lee, John C. Kriscenski , Hyoun Sook Lim, 2019. AN EMPIRICAL STUDY OF BEHAVIORAL INTENTION TO USE BLOCKCHAIN TECHNOLOGY

Atzori, M. (2017). Blockchain Technology and Decentralized Governance: is the State Still Necessary? Journal of Governance and Regulation, 6(1), 45-62.