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## DIGITAL MEDIA AND SOCIETY IN INDIAN CONTEXT

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## ABSTRACT

*The word "internet" refers to "communication media," as well as the structures and organisations in which people operate (the newspaper, theatre, television, publishing, and so on), as well as the cultural and material products of those institutions. Print and electronic media denotations moved from analogue (print and electronic) to digital media, encompassing media integration and separation. With the advent of the Internet in the 1990s, the media sphere was significantly restructured, ranging from the point of media creation to the mechanisms by which content and media images are transmitted, accessed, and absorbed by its viewers, as well as how the media is governed and owned by the state or the market. However, with the transition from analogue to digital in the 1980s, digital media originated as a term. Nonetheless, the influx of new media has transformed the media landscape as well as the technological, political, economic, and cultural realms of life. As a result, when researching digital media in culture, we investigate and examine the new dynamics of digital media in the social, educational, political, and economic spheres, all of which comprise society as a whole.*

## KEYWORDS

digital media, effects, youth, virtual space.

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## INTRODUCTION

The manifestation of digital media has resulted in a dual identity in media logic, while previously media in general consisted of print and the audio-visual format. Via cultural, technological, and political cycles, the heritage of media as a single body has disintegrated and re-integrated to pave the way for new media. As a result, the fulcrum between conventional and digital media is skewed in terms of output, usage, and source habits. Because of the breakdown of space and time as well as a means of development, media as an entity has become a space of converging and diverging spaces with contrasting characteristics of conventional media and digital media. Television news sources, as well as online news outlets, have expanded the discourse and distribution habits of news in the arena of news, journals, and magazines. This is apparent in all aspects of life and culture. To grasp the magnitude of the growth of digital media in society, it is necessary to briefly trace the contextualization of digital media as well as the scope of growth and progress. To get a complete picture of new media, we'll need to consider its characteristics. Furthermore, we will examine how norms, myths, and principles relevant to digital media emerge in contemporary culture. The term "digital media" refers to the fact that all content or data in these media is stored in numbers, the most important of which is binary code of 0 and 1. Thus, technology is the distinguishing dimension of the media, since it witnesses the transition from storing information digitally on a computer to storing information physically on a computer. physical object, such as a USB hard drive, digital files, MP3, and so on. The vague existence of new media as a concept, which mainly relies on subjectivity, and the limited understanding of online media, which focuses solely on internet-based media, causes one to focus on digital media in this Unit in convergence with the facet of online media that the Internet has improved.

## CHARACTERISTICS OF DIGITAL MEDIA

**Digital:** All data in a digital media process is translated into numbers. Digital knowledge becomes programmable, alterable, and susceptible to algorithmic manipulation as it is represented numerically. It can be compressed and decompressed using algorithms, allowing vast volumes of data to be easily processed and transmitted.

**Immediacy:** The urge of media viewers to be in direct contact with reality, seemingly unmediated and transparently This can be seen on social media, Twitter, and in the comments section of web content.

**Interactivity:** Jensen (1998) defines interactivity as "a measure of the media's capacity and willingness to allow the individual to exert control on the meaning and/or form of the mediated communication." Interactivity can be viewed as a value-added function in interactive media in this sense.

**Proliferation:** Since digital media formats and goods are quickly made and replicated, there are often new types of texts in new media. Online and viral media are recent examples.

Hypertext is a type of text that is made up of nodes or blocks of text that form the content, links between these blocks of content, and buttons or tags that enact the link from one node to another. Thus, in a digital media process, hypertext incorporates conventional text with immersive branching to produce non-linear text, allowing for data synthesis and retrieval at a later date.

**Dispersion:** In this context, dispersion refers to the dissemination of new media, as opposed to mass media, at the level of distribution and distribution, with the multiplication of sources and segmentation, and the resulting individualization of media use.

**Virtual:** The concept of virtuality arose as a result of the integration of digital imaging technology with older types of analogue media as well as computer-mediated telecommunications networks. The 'virtual' part of visual technology focuses on the Internet and the World Wide Web, as well as interactive, 3D, and stunning image technology, as well as screen-based graphics and animation.

**Telepresence:** The use of digital technology has the ability to change our sense of presence. We achieve the capacity to live in two separate spaces at the same time as a result of interactive media: the physical world in which our body is situated and the mental or interactional area of which we are present by the use of the medium.

Digital media has broken down communication walls, built decentralised communication channels, and enabled anyone to have a voice and participate. It allows students and other people with similar interests to collaborate on joint community ventures outside of class. It promotes innovation and engagement with a diverse spectrum of commentators on a variety of topics such as education, the environment, governance, race, sexuality, relationships, and so on. While it has provided many advantages, such as helping us to quickly communicate with friends and relatives all over the world and breaking down geographical border, social division and cultural barriers.

## REVIEW OF LITERATURE

According to Williams et al. (2008), in A study of online social media profiles by teenagers, social networking profiles include individuals building and managing personal Internet pages that enable writers and other users to upload content, thus personalising digital platform. According to Lenhart and Madden (2007) in Adolescent social networking, social networking has "rocketed from a fringe hobby into a movement that engages tens of millions of Internet users" in the last

five years. The study proposes that adolescent online social networking accounts include personal, frank, and visible self-disclosure and peer engagement that can be evaluated to create an overall image of adolescent activity, highlight particular areas that need additional analysis, and discuss consequences for parental supervision and intervention.

Whereas, according to Boyd (2007), gender tends to affect engagement on social networking sites. Younger boys are more likely than younger girls to participate (46 percent vs. 44 percent), but older girls are much more likely to participate than older boys (70 percent vs. 57 percent). Older boys are half as likely as girls of their age to use the platforms to flirt and marginally more likely to use the sites to meet new people. Older girls are much more likely than younger people or boys of their age to use these platforms to chat with peers they see in person. According to Wintour (2009), in the article titled Facebook and Bebo risk Dehumanizing the Human Mind, social networking sites such as Facebook are jeopardising attention span. Wintour is referring to Baroness Greenfield, who argues policymakers have not yet considered the extensive psychological and cultural impact of on-screen relationships through Facebook, Bebo, and Twitter. She has told the House of Lords that early childhood experiences on social networking sites "are absent of coherent vision and long-term significance, and as a result, the mid-21st century mind could almost be in a state of disarray."

According to the Mumbai Mirror Daily (2006), many terrorists and underworld figures have become linked through Orkut, including Dawood Ibrahim, Chotta Shakkil, and many other underworld figures. Hatred groups - with spreading abuse among the people- India court accuses Google's Orkut of spreading hatred, Times of India (2006). According to the article, the Aurangabad bench of the Bombay High Court has asked the Maharashtra government to send a notice to Google for the alleged dissemination of hate against India through its social networking services. According to the paper, the petition has resulted in an image of a burning national tricolour with anti-India messages being posted on www.orkut.com, as well as the development of a group called, We Hate India on the web.

## IMPORTANCE OF THE STUDY

The introduction of cyber legislation, controversies about net neutrality, the smartphone revolution, digital literacy, and gaming are all examples of how digital technology has driven the emergence of developments that have fully changed the dynamics of the communication, political, and social circles.

**Cyber Law:** Most developed countries, especially Western countries, have developed stringent cyber laws focused on the norms of privacy and protection of their citizens. Cyber laws in India are enshrined in the Information Technology Act, 2000 (IT Act) and subsequent amendments, which went into effect on October 17, 2000. The Act's primary goal is to give legal recognition to electronic commerce and to make it easier to file electronic documents with the government.

**Net Neutrality:** In the year 2002, the word "network neutrality" was coined. The idea arose in reaction to the Federal Communications Commission's (FCC), a US regulatory agency, attempts to compel telecommunications companies to share networks with rival firms. Countries such as the United States, Japan, Brazil, Chile, Norway, and others have a kind of law and order or regulatory mechanism in place that impacts net neutrality. In India, the Telecom Regulatory Authority of India (TRAI) introduced net neutrality rules in July 2018. According to India's net neutrality rules, internet access providers should be regulated by a policy that prohibits any kind of discrimination or intervention in the treatment of content, including activities such as blocking, degrading, slowing down, or awarding preferential speeds or access to any content.

**Mobile Revolution:** In the modern world, mobile technology has become inextricably linked to our daily lives. Mobile phones have provided us with the rare opportunity of transcending the confines of space and place, helping us to engage with others no matter where we are. In doing so, they have transformed our understanding of space and shattered the barriers we had erected between private and public space, as well as between working life and social-private life. With the introduction of mobile devices, the new increasingly mobile, personalised, atomized, hybrid work-social life has totally altered the social, cultural, and political complexities of our way of life.

## STATEMENT OF THE PROBLEM

The ramifications of new technology have an influence on culture at both the micro and macro levels. When discussing the implications of digital technology, we must address issues such as cybercrime, protection, privacy, surveillance, online hatred, deception, misinformation, and digital addiction.

**Security and Cybercrime:** Although the invention of digital technology has significantly altered our personal and professional lives, it has also unleashed a slew of digital-related crimes, such as cyberattacks, identity theft, cyber theft, internet scams, and so on, impacting both individuals' personal security and the national security of various nations. Although internet scams, identity theft, and cyber theft pose a major risk to individuals trading identities on social media networks and e-commerce websites, cyber warfare and national-level cyber-attacks have had a larger impact on governance.

TABLE 1: TOP 20 INTERNATIONAL VICTIM COUNTRIES (excluding USA)

RANK	COUNTRY	No. of Cases
1.	United Kingdom	2,16,633
2.	Canada	5,399.
3.	INDIA	2,930
4.	Greece	2,314
5	Australia	1,807
6.	South Africa	1,754
7.	France	1,640
8.	Germany	1,578
9.	Mexico	1,164
10.	Belgium	1,023
11.	Brazil	951
12.	Philippines	898
13.	Italy	728
14.	Spain	618
15.	Netherlands	450
16.	Nigeria	442
17.	Pakistan	443
18.	China	442
19.	Colombia	418
20.	Hong Kong	407

Source: FBI, internet crime report 2020

According to the Internet Crime Report for 2020, issued by the Federal Bureau of Investigation's Internet Crime Complaint Centre (IC3). According to the survey, outside the United States, the United Kingdom tops the list followed by Canada and India.

The Digital India Mission and growing cybersecurity challenges have turned this region into a multibillion-dollar market, with a current valuation of \$4.5 billion and a projected value of \$35 billion by 2030. In India, the government, information and technology services, and banking are the three industries that are heavily engaged in cybersecurity efforts. The Government of India issued the National Cyber Security Policy in 2018, after consulting with all related parties, consumer agencies, and the general public. The policy aims to facilitate the development of a protected computing environment, as well as to allow adequate trust and confidence in electronic transactions, as well as to guide stakeholders' activities for cyberspace security.

According to the 2019 Forrester Global Map of Privacy Rights and Regulations, “regulations that enable governments to access citizens' personal data continue to undermine the overall privacy safeguards that many countries give their citizens.”

Privacy and Surveillance: Along with countries with high-level government monitoring, such as China, India has been identified as a country with limited limits on data privacy and security, where government surveillance is a matter of caution. According to industry observers, one of the key explanations for the high degree of government surveillance may be a lack of statutory protections that enable oversight of government activities.

Cyberbullying: Cyberbullying, hate speech, and online sexual harassment are both examples of online hate that are common among youth and teens around the world. Young people create, are subjected to, and fight hate speech online as they rapidly incorporate various types of social media into their personal, social, and political lives. Furthermore, they do so in a sense in which hate speech and bigotry are vital aspects of online engagement and discursive interaction. Cyberbullying is a form of abuse that involves the use of electronic means of communication. Bullying can include spreading rumours about a child, making threats, making lewd remarks, sharing the victim's personal information, or using hate speech. Victims of cyberbullying have poorer self-esteem, suicidal thoughts, revenge, and mental breakdowns, and are more likely to feel upset, furious, or depressed. Numerous studies have shown that cyberbullying can be almost as dangerous as conventional forms of bullying. All those involved, including the government, youth, and parents, must keep online hatred in mind and take reasonable measures to stop it.

**OBJECTIVES**

1. To study the impact of digital media on Indian society.
2. To investigate the problems of using digital media for the good of society.

**RESEARCH METHODOLOGY**

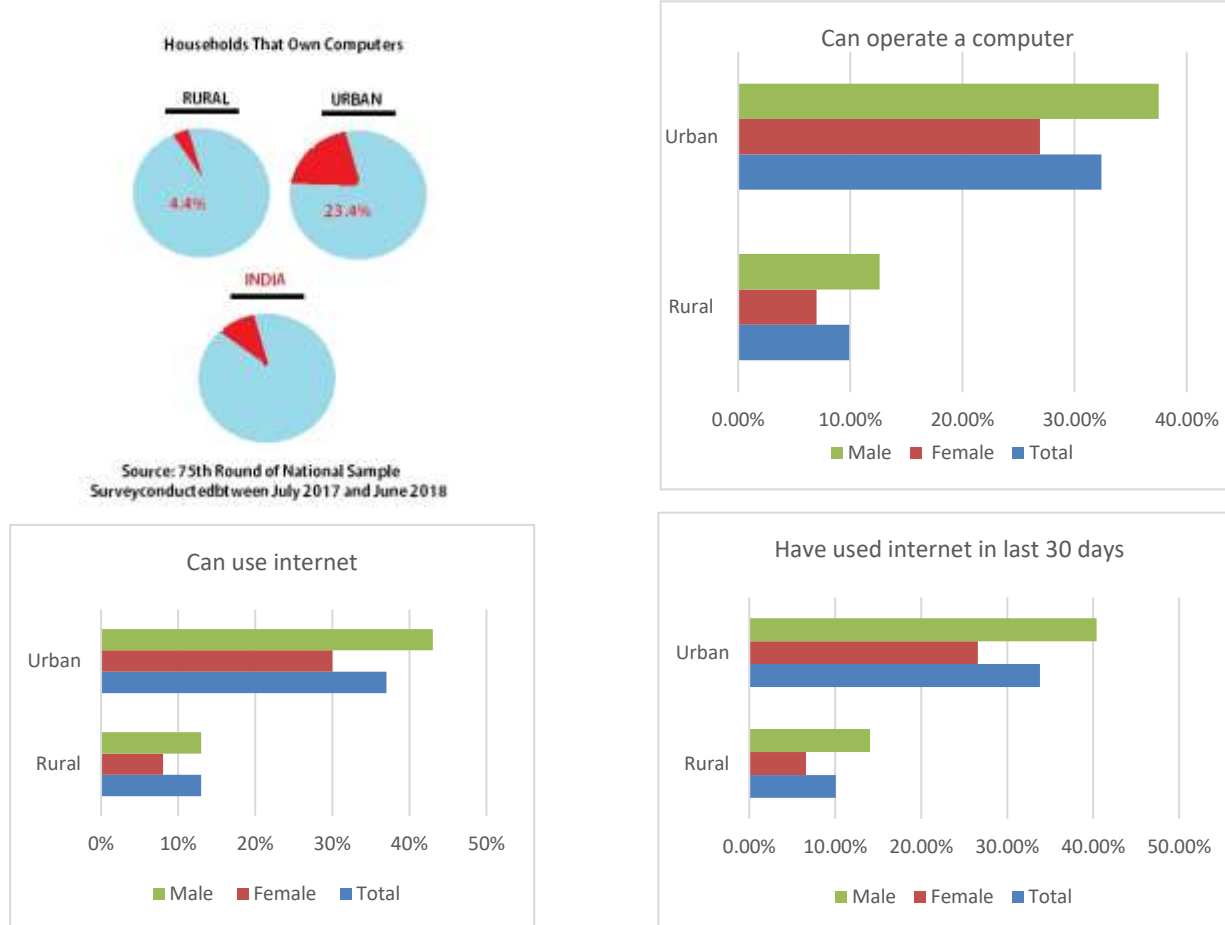
The study uses the qualitative research approach combined with quantitative analyses to gain a comprehensive understanding of the effect of digital media on society in India. For the study, the years 2010 to 2020 are considered. This research approach is used to draw replicable and true inferences by reading and coding textual material. Qualitative data have been translated into quantitative data by consistently analysing texts such as letters, oral speech, and graphics.

**DISCUSSION**

The digital networked networking movement has spawned a new wave of social innovations, including tools for the creation and maintenance of interpersonal relationships. The Internet's global scope not only enables collaboration among members of established dispersed communities and teams, but it also serves as a tool for the creation and cultivation of new relationships by offering nearly immediate access to thousands of possible contacts with similar interests and spheres of expertise. Urbanisation and industrialisation have culminated in a mass population in the urban context with increasingly fractured social relationships. According to Linda Harasm (1993), social networking is a primary component of Computer Mediated Communication (CMC) and is capable of organising thoughts on the use of CMC around social conditions rather than working areas. Despite the fact that CMC enables enormous knowledge sharing capacity, it has flaws. One notable disadvantage, as cited by the majority of CMC researchers, is that CMC exists mostly in cyberspace with letters and sentences. This textual correspondence removes demographic and socioeconomic knowledge about the individual, such as gender and social class, limiting contextual context.

**Digital inequality** is the most recent connotative definition correlated with the digital divide, which describes the unequal allocation, access, and inclusion of digital technology in society. The term 'digital inequality' refers to two concepts: digital refers to computational infrastructure related to Information and Communication Technology (ICT), and inequality refers to unequal access to and participation in ICT resources. In a similar way, we should return to one of the Organization for Economic Cooperation and Development's (OECD) commonly cited meanings of the digital divide to understand its relevance.

CHART 1 to 4



Source: 75<sup>th</sup> Round of National Sample Survey conducted between July 2017 and June 2018

For THE LAST DECADE, administrations have attempted to boost the country's internet connectivity. The BharatNet project was launched in 2011 with the aim of connecting 0.25 million panchayats via optical fibre (100 MBPS) and connecting India's villages. Its introduction only started in 2014. The original deadline was March 2019, but since only 0.12 million panchayats had been linked by then, it was pushed back to August 2021. The government unveiled the National Digital Literacy Mission and the Digital Saksharta Abhiyan in 2014. In January 2019, the Standing Committee on Information Technology stated that all systems were identical in concept and execution, with enough room for recipients to get confused. The government unveiled several schemes in 2015 as part of its Digital India initiative to bind the entire nation. This includes the Pradhan Mantri Gramin Digital Saksharta Abhiyan, which was introduced in 2017 with the aim of bringing digital literacy to 60 million households in rural India. It has a budget of Rs 2,351 crore, but only Rs 500 crore has been allocated so far. In January 2019, the Standing Committee on Information Technology concluded that the government's digital literacy policies are far from adequate.

## CONCLUSION

As technology advances, digital media has become a part of everyone's daily life, and people are becoming more hooked to it. The effect of various fields on people varies. Students' collaboration efficiency and pace have improved as a result of social media. Company uses social media to improve an organization's success in a variety of ways, such as achieving business goals and increasing the organization's overall revenue. Every day, children are seen interacting with these newspapers. Social networking offers many benefits, but it still has some drawbacks that have a negative impact on society. Fake news and information can contribute to the collapse of the school system; in an organisation, incorrect marketing can reduce productivity; social media can exploit society by invading people's privacy; and certain pointless blogs can manipulate children, causing them to become abusive and to engage in immoral behaviour. Social networking may be useful, but it can be done with moderation to avoid being addicted.

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**MONTE CARLO SIMULATION METHOD Vs. BACK PROPAGATION METHOD ANN: A COMPARATIVE STUDY  
USING VOLATILITY INDEX OF INDIA**

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**ABSTRACT**

*Stock forecasting is one of the complex process involved in investments. There are many past studies and working papers are based on effective forecasting methods and techniques. The more the accurate prediction would help the investors and the financial advisors to take appropriate investment decision in the field of investment. This paper is an endeavour to find out whether the Artificial Neural Network method can accurately predict the option price comparing to conventional method (Monte Carlo simulation). Daily data from Volatility Index were considered for the study from January 2019 to December 2019. Both the models are compared and the accuracy of these two models are measured using Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE).*

**KEYWORDS**

stock forecasting, forecasting methods, investment decisions.

**JEL CODE**

G11

**1.0 INTRODUCTION**

The primary aim of the financial analyst in the recent past in the financial analysis and stock market analysis, tried to analyse the stock movements. Further there are lot of studies made an attempt to find out the best suitable models in the field of time series analysis. However, accurate prediction of stock prices gave us the most challenging task for both investors and for the financial analyst. Many studies pertaining to stock price movements and identifying the patterns are also carried in the recent past. Stock Market forecasting has long frequently sparked the interests of academics. Despite Multiple scientific attempts, no mechanism for reliably predicting stock price movement has been discovered. The complexities of modelling market dynamics add to the complexity of forecasting. There have been some minor successes despite the lack of reliable prediction methods. The phrase "stock market analysis" refers to the study of the stock market. Fundamental and technical approaches to stock market analysis are two fundamental trading philosophies. Stock market price fluctuations are thought to be derived from a security's relative data in fundamental analysis. Fundamentalists predict the future using numerical data such as profits, ratios and management effectiveness. The majority of current financial text mining literature relies on a predefined collection of keywords and machine learning techniques. Keywords are usually assigned weights in proportion to the movement of a stock price in these systems. These types of analyses have demonstrated a definite, but limited, ability to predict share price direction.

For this analysis, the research uses the back propagation tangent sigmoid function to compare to the Monte Carlo Simulation model to see which one outperforms the other in terms of predicting the time series data.

**1.1 MONTE CARLO SIMULATION METHOD**

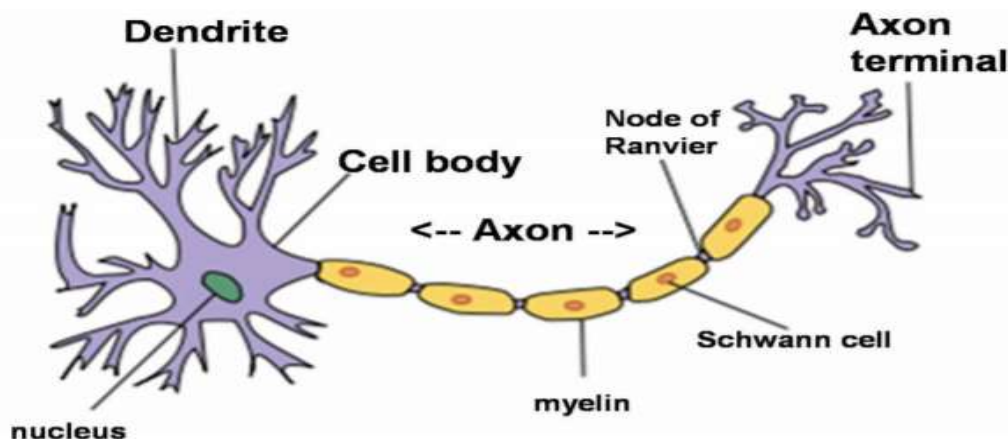
In general, a Monte Carlo Technique can be described as any technique that solves a problem using random numbers. It can be used to solve both probabilistic and mathematical problems (James,1980). Halton (1970) has defined Monte Carlo Technique for representing a problem as a parameter of a hypothetical population and generating a sample of the population from which statistical estimates of the parameter can be derived using a sequence of numbers. As a result, simulation in general is often referred to as a computational method for performing computer based experiments involving random sampling from probability distributions. The law of Large Numbers and the Central limit theorem are at the heart of the MC Definition. The Law of Large Numbers state that as the sample size becomes bigger, the sample mean is pushed to get similar to the population mean (BelginSert,2011). The Central Limit theorem states that as the sample size grows, we can assume a normal distribution of data. Monte Carlo approaches are computational approaches that are capable of addressing a complicated mathematical or statistical problem. The rationale behind MCs is to create random number sequences in order to conduct mathematical simulation of creating new configurations of a system of interest over long periods of time (Rollett and Manohar, 2004). Furthermore, even though Convergence is sluggish, the primary feature of MCs is to reduce variance by integrating the outcomes of a large number of samples (Lafortune, Simulation facilitates solving many problems in financial engineering, which focus on estimating a certain value such as: pricing derivative securities, computing price sensitivities, and evaluating portfolio risks. Consequently, MCs is a stochastic method that is often applied to approximate expectations. In fact, MCs is applied by three essential steps: generating sample paths randomly, evaluating the payoff along each path, and calculating an average to attain estimation (Chen & Hong, 2007).

**1.2 ARTIFICIAL NEURAL NETWORK**

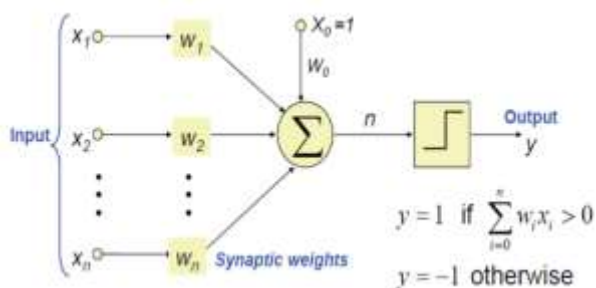
Basic element of the human neural network is a neuron. Neuron stores and processes the information. Typical structure of a neuron is shown in Fig.3.1. Neuron has Dendrites, Soma (Cell Body), Axon, Axon Terminal, Myelin, Schwann Cell, Nodes of Ranvier and Synapses as the basic elements.



PICTURE 1



An Artificial Neural Network (ANN), often just called a neural network, is a set of interconnected links that have weights associated with them. The concept of ANN was derived from biological neural networks. Neural networks open up a new foray into the field of making efficient and usable predictions in order to optimize profits. Artificial Neural Networks are being used in numerous areas, as it is an irrefutably effective tool that aids the scientific community in forecasting about probable outcomes. Any ANN can be thought of as a set of interconnected units broadly categorized into three layers. These three layers are the input layer, the hidden layer and the output layer. Inputs are fed into the input layer, and its weighted outputs are passed onto the hidden layer. The neurons in the hidden layer (hidden neurons) are essentially concealed from view. Using additional levels of hidden neurons provides increased flexibility and more accurate processing. However, the flexibility comes at the cost of extra complexity in the training algorithm. Having more hidden neurons than necessary is wasteful, as a smaller number of neurons would serve our purpose just fine. On the other hand, having less hidden neurons than required would cause reduced robustness of the system, and defeat its very purpose.



**1.3 BACK PROPAGATION MODEL ANN**

To overcome the limitation of perceptron, in 1986, Rumelhart et al. had describe a new supervised learning procedure known as Back Propagation Neural Network (BPNN) which is used for linear as well as non-linear classification. BPNN is a supervised algorithm in which error difference between the desired output and calculated output is back propagated. The procedure is repeated during learning to minimize the error by adjusting the weights through the back propagation of error. As a result of weight adjustments, hidden units set their weights to represent important features of the task domain. BPNN consists of three layers: 1) Input Layer 2) Hidden Layer and 3) Output Layer. Number of the hidden layers, and number of hidden units in each hidden layer depend upon the complexity of the problem. Learning in BPNN is a twostep process.

**Step 1 (Forward Propagation):** In this step, depending upon the inputs and current weights, outputs are calculated. For such calculation, each hidden unit and output unit calculates net excitation which depends on:

- Values of previous layer units that are connected to the unit in consideration.
- Weights between the previous layer unit and unit in consideration.
- Threshold value on the unit in consideration.

This net excitation is used by activation function which returns calculated output value for that unit. This activation function must be continuous and differentiable. There are various activation functions which can be used in BPNN. Sigmoid is widely used activation function. It is defined as following.

$$s_c(x) = \frac{1}{1 + e^{-cx}} \dots\dots\dots$$

**Step 2 (Backward Propagation of Error):** During this step, error is calculated by difference between the targeted output and actual output of each output unit. This error is back propagated to the previous layer that is hidden layer. For each unit in the hidden layer N, error at that node is calculated. In the similar way, error at each node of previous hidden layer that is N-1 is calculated. These calculated errors are used to correct the weighs so that the error at each output unit is minimized. Forward and backward steps are repeated until the error is minimized up to the expected level.

**1.4 REVIEW OF LITERATURE**

**Dima Waleed Hanna Alrabadi and Nada Ibrahim Abu Aljarayesh**, in the year 2015, tested the use of Monte Carlo Simulation in Forecasting Stock Market Returns in Amman Stock Exchange. The accuracy of the results was measured by Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE) and Theil Inequality Coefficient (U). The test revealed that Monte Carlo Simulation is the most accurate forecasting technique and also stated that Amman Stock Exchange seems to be inefficient at the weak level, given that the technical analysis approaches enable investors to predict stock market returns.

**Masimba E. Sonono and Hopolang P. Mashele**, in the year 2015, have examined the accuracy of Time Models in the Prediction of Stock Prices. The Research consists of a Comparative Analysis of continuous time models like, General Brownian Motion (GBM) and Variance Gamma (VG) in predicting the accurate price levels and it's direction using Monte Carlo methods like, Quasi Monte Carlo (QMC) and Least Squares Monte Carlo (LSMC). The models were evaluated using, Hit

Ratio and Mean Absolute Percentage Error (MAPE). The findings state that, both GBM Model or VG model in any Monte Carlo Method can be used to determine the direction of Stock Price Movement. In terms of predicting the stock price values, the findings reflect that, GMB Model functions efficiently in QMC Method and the VG Model performs well in the LSMC Method.

**Reve D. Estember, Michael John R. Marana**, in the year 2016, attempted to Forecast the Stock Prices using Brownian Motion in the Philippine Stock Exchange. The research examined the potential of Brownian Motion method as an effective forecasting method compared to Artificial Neural Network (ANN). The number of days the volatility and drift are moved were also determined and this was used to perform the forecasting of stock prices of holding companies registered with the Philippine Stock Exchange and also compared to the ANN method. The findings state that the average percentage error of the GBM method was 6.21% or an accuracy of 93.79% while the ANN method generated an accuracy of 91.71%, showing that GBM method is a much more reliable method in terms of forecasting compared to the ANN method.

## 1.5 RESEARCH METHODOLOGY AND DESIGN

### 1.5.1 Research Gap

From the above-mentioned literatures, we see that many past studies have focused on conventional methods. Studies have witnessed that Monte Carlo has the ability to predict compared to other models. Very few studies were carried out in this area to find whether models have the capability to predict. Back Propagation Method has not been used by most of the researchers. This led to the comparison of the results of both methods in the study in terms of their accuracy. ANN is the hybrid models which is not used extensively in the area of stock forecasting. Hence this study is an attempt to find out whether ANN can predict the Options prices effectively and efficiently, Monte Carlo Simulation Method.

### 1.5.2 Statement of the Problem

Despite many tools and techniques to study the Stock Price Movements being pre-existential in order to find out the Trade Signals and Patterns, the best investment decision with lower risk that is to be determined is becoming a complex task. The study mainly attempts to resolve the problems of determining secure investment signals in order avoid risky investments in Index Options that are complex in nature.

### 1.5.3 Research Objective

- To analyse whether Monte Carlo Simulation model could outperform ANN (Back Propagation)
- To analyse the option prices using simple moving average and exponential moving average.

### 1.5.4 Research Hypothesis

H<sub>0</sub> – Monte Carlo does not outperform compared to Artificial Neural Network (Back propagation)

H<sub>a</sub> - Monte Carlo outperform compared to Artificial Neural Network (Back propagation)

### 1.5.5 Scope of the study

As the world of Stock Market is perceived to be a Risky stream by many potential investors to manoeuvre their economic activities, this study attempts to find out the most reliable method of Technical Analysis that can be used by Investors to make their Investment Decisions. The study mainly concentrates on the Methods of Forecasting in terms of their Accuracy as a result of which, the accurate Forecasting Model can be used by investors to make lucrative investment decisions that includes safety for their investments

### 1.5.6 Data Collection

For the present study the closing price of Volatility Index of India (VIX) were considered from January 2019 to December 2019. Since there are huge volume traded, this index was considered for the study.

### 1.5.7 Tools and Techniques

The forecasting techniques that we use in this study are: Monte Carlo simulation (MCs) through excel. ANN: Multi- Layer Perceptron through MATLAB was used to forecast the option prices. The tools and techniques for both Monte Carlo and ANN is discussed in the below paragraphs along with the formulas:

## 1.6 RESEARCH DESIGN

### 1.6.1 Monte Carlo Simulation Model

### 1.6.2 Simple Moving Average Method

Moving average method is one of the most popular methods of technical analysis. A moving average is calculated as an average of observations from a number of subsequent time periods. It smoothes out the irregularities in the data series. A SMA is the average of price series over a selected time period which gives an equal weight to each period price. The mechanism of SMA includes the market movement forward in time; the oldest price is removed from the average calculation and replaced by the most recent price (Mendelsohn, 2000). Hence, we calculated the simple moving average for the present data set using the below equation:

$$f = 1/n \sum_{i=0}^{n-1} A(n-i)$$

### 1.6.3 Exponential Moving Average

The exponential moving average (EMA) solves the equal-weight problem of the simple moving average (SMA). In specific, the SMA gives the same weight for every data point. On the other hand, the EMA gives greater weights to more recent data; thus, the weight of the past data declines exponentially (Brooks, 2006).

$$Ft + i = (1 - \alpha) A t + \alpha f t$$

Where f: is the forecasted value, is the smoothing constant ( $0 < \alpha < 1$ ), the larger the  $\alpha$ , the more weight is given to recent observation (damping factor), and A is the actual value. We apply the EMA with two values of damping factor ( $\alpha$ ), 20% and 30% Limitations.

### 1.6.4 Monte Carlo Simulation

To predict the stock prices using MCs, the steps to be incorporated are:

1. Calculate the Average Daily returns, Standard Deviation of the returns according to your selection of the time period of the data.
2. Estimate Random Numbers over the study period on a daily basis
3. Follow a Stochastic Process, with the help of which we sum the average return with a random return shock which can be calculated by multiplying the Standard Deviation that involved random value estimation in the second step.
4. The concluding step is to calculate the forecasted price of Day (t+1). This can be completed by multiplying the actual price of the trading day by the exponential value of the sum that is calculated in the third step. The Forecasted returns are further calculated following (Choong, 2012) using excel.

$\ln(p_t/p_{t-1}) = \mu + \sigma z$

Where

$\mu$ : being the constant (deterministic component) calculation of daily mean on a monthly basis.

Z: being the "pseudorandom number" (stochastic component).

$\sigma$ : being the monthly volatility, expresses the random shock stochasticity.

### 1.6.5 Comparison Techniques of Forecasting Accuracy

The Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) are the forecasting accuracy metrics used in the analysis. The RMSE is a measure of the average squared difference between the predicted and actual values.

It is denoted by the equation:

$$RMSE = \sqrt{\sum \frac{e_i^2}{n}}$$



The MAE is an error statistic that averages the forecasted values' absolute deviation from the original values. It can be calculated using the formula:

$$MAE = \frac{\sum |e_i|}{n}$$

MAPE accounts for the average absolute error figure, which tends to perpetuate the impression of unreliable predictions. MAPE has properties that are similar to MAE properties. It can be determined using the formula:

$$MAPE = \frac{1}{n} \cdot \sum \frac{|e_i|}{A}$$

$$U = \frac{\sqrt{\frac{1}{n} \cdot \sum (A_i - f_i)^2}}{\sqrt{\frac{1}{n} \cdot \sum f_i^2 + \frac{1}{n} \cdot \sum A_i^2}}$$

The closer the four error measures to zero the better is the forecast.

**1.6.6 Monte Carlo Simulation on Excel**

Based on the extracted data, the Monte Carlo simulation was performed using MS-excel functions. The following are the clear steps how the simulation was carried out. Option data was extracted on daily basis. For the present study only, the call option closing prices was used for the analysis. There are six steps involved in this formula: Following are the steps in detail.

**Step 1:** Calculation of Daily Changes- The First Step involved the calculation of daily changes. The formula mentioned below was used.

$$= \text{Today's Price} \div \text{Yesterday's Price}$$

**Step 2:** Random Number Generation – the second step involved is to find out the random number generation to see the possible outcomes in the given trading days eg. 364 days. The formula mentioned below was used.

$$= \text{Randbetween(First day, Last day)}$$

**Step 3:** Random Change Determination- The third step in the simulation involved the determination of Random Change using a Random Number in the prices of the Options to find out the changes that have taken place over the history and the formula mentioned below was used.

$$= \text{Small}(\$ \text{First Change} \$ : \$ \text{Last Change} \$, \text{Random Number})$$

**Step 4:** Price Simulation- The Fourth Step involved the simulation of future prices using the present-day price. Future Price was calculated by multiplying the exponential of the Random Change with Present Day Price and the formula mentioned below was used.

$$= \text{Today's Price} * \text{exp(Random Change)}$$

**Step 5:** Combined Price Simulation- The Fifth Step is to make a combined price simulation. The Random Change as well as the Random Number was combined with the future price to obtain the Combined Price Simulation. Hence, the formula mentioned below was used.

$$= \text{Today's Price} * \text{exp}(\text{Small}(\$ \text{First Change} \$ : \$ \text{Last Change} \$, \text{Randbetween(First Day, Last Day)}))$$

**Step 6:** Creating Multiple Simulations- The Sixth step involved the creation of Multiple Simulations by Copying the Combined Price Simulation and pasting it in the adjacent column. '\$' symbol was added to both row and column in the formula.

The following table A depicts the simulation.

TABLE A

1	Date	Close	Daily Changes	Price	Price	Price
2	28-Dec-18	10859.90	0.007403	10859.90	10859.90	10859.90

**1.7 DATA ANALYSIS AND INTERPRETATION**

**1.7.1 Descriptive Statistics**

TABLE 1: SUMMARY OF DESCRIPTIVE STATISTICS

Variable	Mean	Median	Max	Min	SD
Index	16.55318	15.92375	28.6575	10.525	3.37543
Actual	-0.0002	-0.00425	0.121963	-0.29775	0.047251
2 Days SMA	0.32799	0.26325	3.08870	0.01661	0.33418
3 Days SMA	0.03280	0.02898	0.16547	0.00534	0.02177
5 Days SMA	0.03828	0.03447	0.14546	0.00777	0.02049
10 Days SMA	0.04100	0.03714	0.11703	0.01636	0.01844
20% EMA	0.05015	0.04440	0.23950	0.00256	0.03239
30% EMA	0.04861	0.04346	0.22796	0.00645	0.03126
MCS	0.1239	0.1225	1.5879	0.2665	0.01587

Source: Calculated from the primary analysis

**Interpretation**

Table 1 shows the summary of the Descriptive Statistics of the Daily Data from the Volatility Index. Daily Market Volatility Index Value, Actual Market Returns and Forecasted Stock Market returns that are calculated using three forecasting techniques namely, Simple Moving Average (SMA), Exponential Moving Average (EMA) and Monte Carlo Simulation (MCs) are depicted in the above table.

**1.7.2 The Descriptive Statistics Results:** The Descriptive Statistics cover the period of 1 year (January 2019 to December 2019) and the observed values of Mean, Median, Maximum, Minimum and Standard Deviation of the Daily Market Volatility Index value are, 16.55318, 15.92375, 28.6575, 10.525, 3.37543. The Observed values for the Actual Market Returns under the Descriptive Statistical techniques are, -0.0002, -0.00425, 0.121963, 0.29775, 0.04725.

**1.7.3 Simple Moving Average** was calculated for 2, 3, 5 and 10 days to find out the equal weightage of the Daily Market Volatility Index prices for the selected number of days and the descriptive statistical values for 2, 3, 5 and 10 Days SMA are, 0.32799, 0.26325, 3.08870, 0.01661 and 0.33418; 0.03280, 0.02898, 0.16547, 0.00534 and 0.02177; 0.03828, 0.03444, 0.14546, 0.00777 and 0.02049; 0.04100, 0.03714, 0.11703, 0.1636 and 0.01844.

**1.7.4 Exponential Moving Average** with damping factors of 20% and 30% were used to smoothen the irregularities of the data and also to determine the presence of greater weightage in the selected data. The Descriptive Statistical values of 20% and 30% EMA are, 0.05015, 0.04440, 0.23950, 0.00256 and 0.03239; 0.04861, 0.04346, 0.22796, 0.00645 and 0.03126.

**1.7.5 Monte Carlo Simulation:** It is simulation used to determine the outcomes using the idea of generating random variables to measure the uncertainties related to a particular study. Monte Carlo Simulation was performed for the Actual Returns of the Daily Market Volatility Index prices. Descriptive Statistics of the Monte Carlo Simulation are, 0.1236, 0.1125, 1.5879, 0.2665

**1.7.6 Simple Moving Average:** It is a Technical Analysis that aids in determining the average value of a given price over a given time span. It is a methods of analysing data points by calculating a series of averages for the subsets of the entire data. Simple Moving Average was calculated for the Actual Returns of the Daily Market Volatility Index prices for 2, 3, 5 and 10 days.

TABLE 2: SUMMARY OF DESCRIPTIVE STATISTICS FOR 2 DAYS SMA

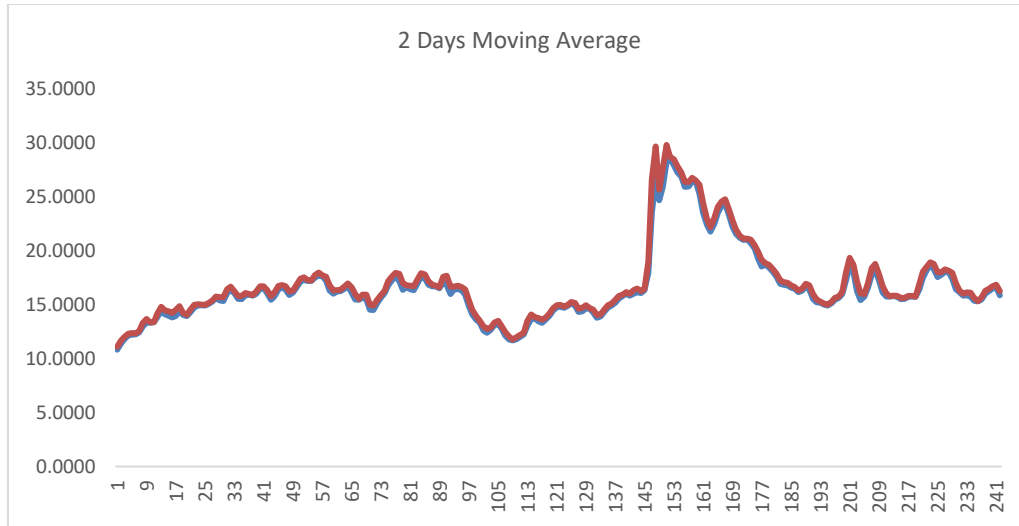
SMA for 2 Days	
0.271526357	
Mean	0.32799
Median	0.26325
Standard Deviation	0.33418
Minimum	0.01660
Maximum	3.08870

Source: Calculated from the primary analysis

**Interpretation**

Table 2, summarises the Descriptive Statistics calculated from the Simple Moving Average for 2 Days. The values of the Descriptive Statistics are, 0.32799, 0.26325, 0.33418, 0.01660 and 3.08870. The SMA of Actual Returns for 2 days given in Table 2 is, 0.271526.

FIGURE 1: GRAPH DEPICTING THE FLOW OF SMA FOR 2 DAYS



**Interpretation**

Figure 1, depicts the Simple Moving Average for 2 days which was calculated from the Actual Returns from the Daily Market Volatility Index.

TABLE 3: SUMMARY OF DESCRIPTIVE STATISTICS FOR 3 DAYS SMA

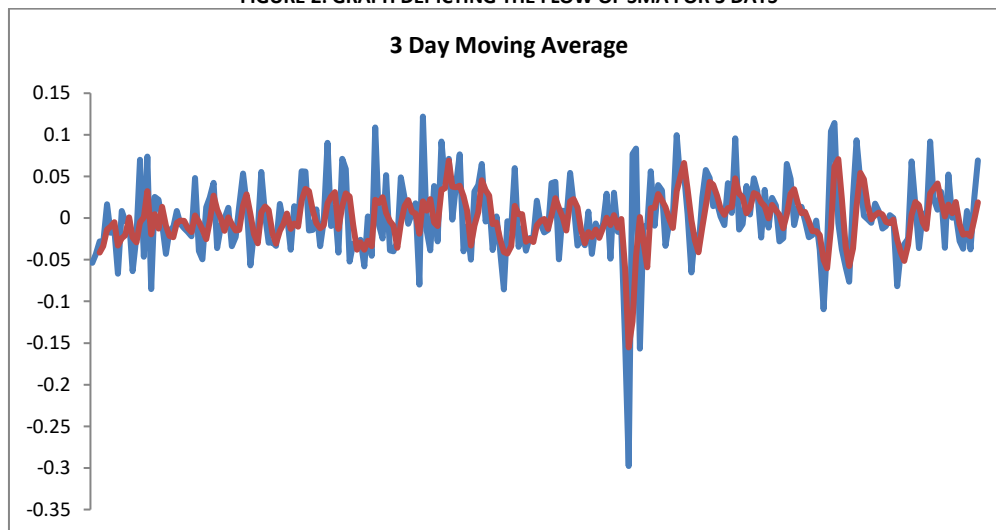
SMA for 3 Days	
0.019365201	
Mean	0.032800
Median	0.028984
Standard Deviation	0.021772
Minimum	0.005335
Maximum	0.165471

Source: Calculated from the primary analysis

**Interpretation**

Table 3 summarises the Descriptive Statistics calculated from the Simple Moving Average for 3 Days. The value of the Descriptive Statistics is, 0.0328, 0.028984, 0.021772, 0.005335 and 0.165471. The SMA of Actual Returns for 3 days in Table 3 is, 0.019365.

FIGURE 2: GRAPH DEPICTING THE FLOW OF SMA FOR 3 DAYS



**Interpretation**

Figure 2, depicts the depicts the Simple Moving Average for 3 days which was calculated from the Actual Returns from the Daily Market Volatility Index.

TABLE 4: SUMMARY OF DESCRIPTIVE STATISTICS FOR 5 DAYS SMA

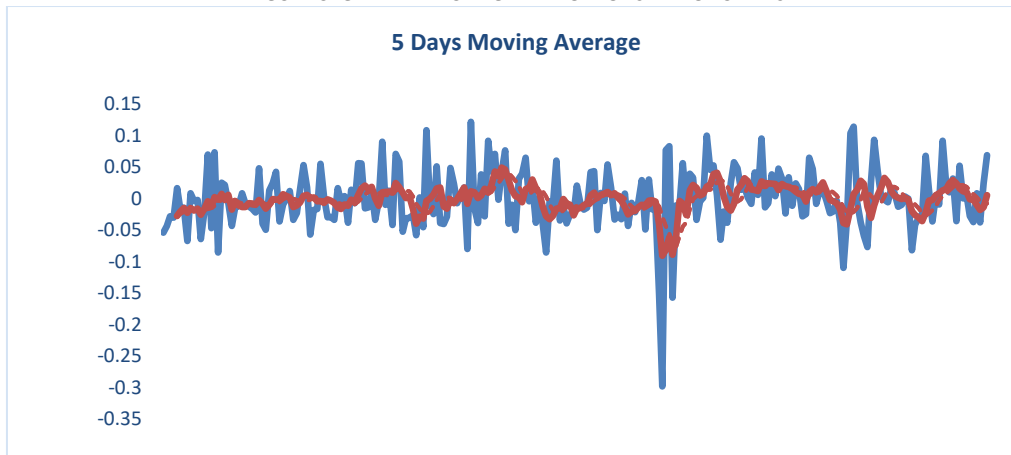
SMA for 5 Days	
0.029981568	
Mean	0.038278528
Median	0.034468481
Standard Deviation	0.02048571
Minimum	0.007767263
Maximum	0.145461029

Source: Calculated from the primary analysis

**Interpretation**

Table 4, summarises the Descriptive Statistics calculated from the Simple Moving Average for 5 Days. The values of the Descriptive Statistics are, 0.38278, 0.034468, 0.02048, 0.00776 and 0.14546. The SMA of Actual Returns for 5 days from the above table is, 0.029987

FIGURE 3: GRAPH DEPICTING THE FLOW OF SMA FOR 5 DAYS



**Interpretation**

Figure 3, depicts the depicts the Simple Moving Average for 5 days which was calculated from the Actual Returns from the Daily Market Volatility Index.

TABLE 5: SUMMARY OF DESCRIPTIVE STATISTICS FOR 10 DAYS SMA

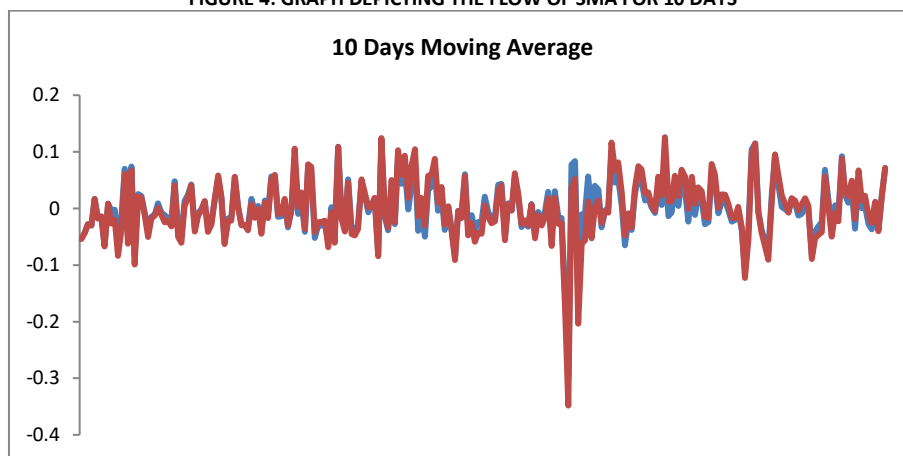
SMA for 10 Days	
0.047867825	
Mean	0.040998957
Median	0.037144719
Standard Deviation	0.018439687
Minimum	0.016362303
Maximum	0.117034464

Source: Calculated from the primary analysis

**Interpretation**

Table 5, summarises the Descriptive Statistics calculated from the Simple Moving Average for 10 Days. The values of the Descriptive Statistics are,0.04099, 0.37144, 0.01843, 0.01636 and 0.117034. The SMA of Actual Returns for 10 days from the above table is, 0.04786.

FIGURE 4: GRAPH DEPICTING THE FLOW OF SMA FOR 10 DAYS



**Interpretation**

Figure 4, depicts the depicts the Simple Moving Average for 10 days which was calculated from the Actual Returns from the Daily Market Volatility Index.

**1.7.7 Exponential Moving Average**

Greater weight and significance on the most data points that are recent can be placed with the help of Exponential Moving Average. The price of an investment can be through the technical chart indicator. Exponential Moving Average with 20% and 30% Damping Factors were used to smoothen the irregularities of the data set.

TABLE 6: SUMMARY OF EXPONENTIAL SMOOTHING AT 20% DAMPING FACTOR

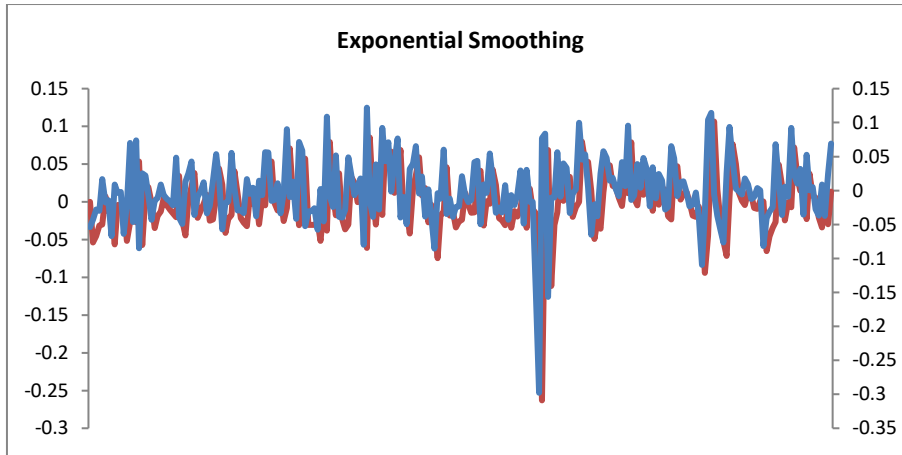
Damping Factor at 20%	
0.011821302	
Mean	0.050150006
Median	0.044399362
Standard Deviation	0.032392911
Minimum	0.002555924
Maximum	0.239496957

Source: Calculated from the primary analysis

**Interpretation**

Table 6, summarises the value of Exponential Smoothing at 20% Damping Factor of the Returns from the Volatility Index as, 0.011821. The descriptive Statistics as shown in the above table are. 0.05015, 0.04439, 0.032392 and 0.00255, 0.23949.

FIGURE 5: DEPICTS THE EMA AT 20% DAMPING FACTOR



**Interpretation**

The above Figure, shows the Exponential Smoothing calculated from the Actual Returns of the Daily Market Volatility Index at 20% Damping Factor.

TABLE 7: SUMMARY OF EXPONENTIAL SMOOTHING AT 30% DAMPING FACTOR

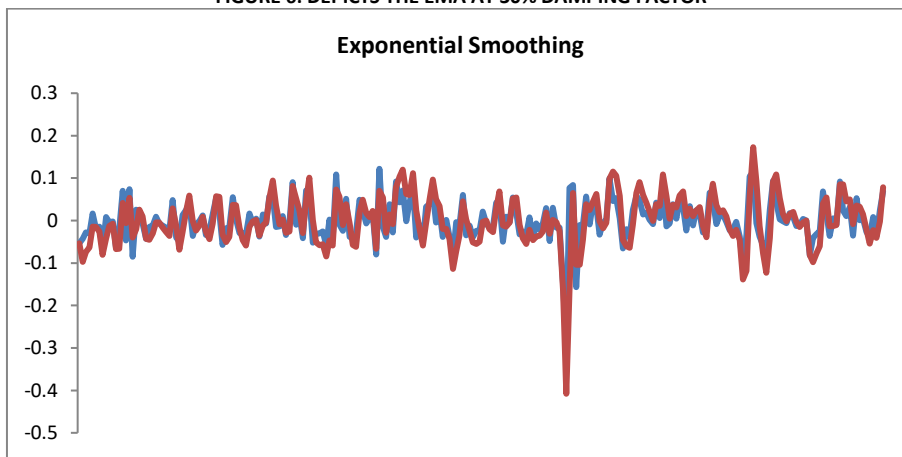
Damping Factor at 30%	
0.012483845	
Mean	0.048606
Median	0.043457
Standard Deviation	0.031255
Minimum	0.006454
Maximum	0.227964

Source: Calculated from the primary analysis

**Interpretation**

Table 7, summarises the value of Exponential Smoothing at 30% Damping Factor of the Returns from the Volatility Index as, 0.012483. The descriptive Statistics as shown in the above table are, 0.04860, 0.43457, 0.031255, 0.00645, 0.22796.

FIGURE 6: DEPICTS THE EMA AT 30% DAMPING FACTOR



**Interpretation**

The above Figure, shows the Exponential Smoothing calculated from the Actual Returns of the Daily Market Volatility Index at 30% Damping Factor.

TABLE 8: SUMMARY RESULTS OF THE ACCURACY MEASURES

Variables	RMSE	MAE	MAPE
2 SMA	0.0165	0.0248	0.0148
3 SMA	0.0152	0.0289	0.0123
5 SMA	0.0087	0.2782	0.0215
10 DSMA	0.0074	0.2647	0.0266
20% EMA	0.0127	0.0146	0.0271
30% EMA	0.0177	0.2164	0.0211
MCS	<b>0.0048</b>	<b>0.2011</b>	<b>0.6124</b>
ANN	<b>0.0084</b>	<b>0.3124</b>	<b>0.9421</b>

**Interpretation**

The above table represents the Accuracy Measures of all forecasting Techniques namely, Mean Absolute Percentage Error, Root Mean Squared Error, Mean Absolute Error. The table represents the values of (SMA for 2,3 and 5 Days, EMA with 20% and 30% Damping Factor). The RMSE, MAE and MAPE for Monte Carlo is, 0.0048, 0.2011, 0.6124. The RMSE, MAE and MAPE for Artificial Neural Network is 0.0084, 0.3124, 0.9421.

**1.8 FINDINGS AND CONCLUSION**

This study investigates the accuracy of the forecasting abilities of the Monte Carlo Simulation and Artificial Neural Networks, considering the Daily Data of the Volatility Index of India from the period of January to December of 2019. According to the Analysis and Interpretation, comparing the numbers of both the models, the study indicates that the traditional methodology of Monte Carlo Simulation outperforms the Artificial Neural Networks and is more reliable than Artificial Neural Networks in terms of the accuracy in predicting the stock prices as the error terms from RMSE, MAPE and MAE of Monte Carlo Simulation is lesser compared to error terms of Artificial Neural Networks. Further studies can also be conducted in similar ways. However, the study includes the comparison of two models, advance techniques can be incorporated using econometric models using a larger data set as this study includes only the daily data of Volatility Index of India for 1 year. Henceforth, there could be a possibility where the Artificial Neural Networks can be a better option and might as well outperform the traditional methodology of the Monte Carlo Simulation when the study is conducted with the inclusion of a larger data set.

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## LONG RUN FINANCIAL PERFORMANCE ANALYSIS OF BSE ESG CONSTITUENTS

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## ABSTRACT

The Objective of this paper is to Study Comparative long run performance of the SRI and Non-SRI Stocks. Study is based on Top 10 BSE ESG Constituents (SRI Stock) and its peers by taking the daily stock prices from 2014-15 to 2018-19. AARs and CAAR is computed and checked statistically at 5% level of significance. In short run Average Daily stock prices return generates good economic return than the market. But overall performance of Securities (CAAR) is not giving good return in short run 2 months period. For the holding period of 2 years study found positive consecutive return. [SRI Stock CAAR-8.35(14-15), 8.83(15-16)-Non SRI Stock 6.14(14-15), 5.33(15-16)]. Whereas in long run CAAR values of both SRI & Non-SRI stocks also gives positive return. SRI stocks CAAR shows more positive return in 5 years (8.35, 8.83, 3.97, 2.43, 5.46) as compared to Non-SRI (6.14, 5.33, 1.89, 1.96, 2.24). So, like other studies on long run security prices return this study even proves that in long run BSE ESG Constituents generates Positive return and it is advantageous to invest in it. The computed figures here only show the market adjusted abnormal return without considering certain company specific factors like size, profitability, investment in total assets etc. This limitation can be overcome in the future research.

## KEYWORDS

SRI (socially responsible investment), CAAR (cumulative average abnormal return).

## JEL CODES

G11, G12, G19.

## INTRODUCTION

The Concept of Sustainability is on rise in today's Economic world. The increasing awareness on global warming Proper maintenance and balances of ecosystem, human rights & economic development of the business is increasingly becoming a challenging task for the management of the business. In this light UNDP, international conference on Sustainable development held at Rio de Janeiro in 2012 has introduced the 17 SDGs which is to be followed by all the countries across the world on voluntary basis. The attempts are made by the different states on the achievement of these goals. Currently India is working on SDG 12 i.e., Sustainable consumption and Sustainable Production. Under the achievement of this goal government under its think tank "Niti Aayog" has started several remedial measures like "Amrut, Digital India, Make in India, Swachh Bharat Abhiyan etc. In Developed Nations under the sustainable development the concept of Green business and Green economy has been emerged. Businesses have started working on producing environmentally friendly products and services and equally giving weightage to human rights and accordingly framing the business strategy.

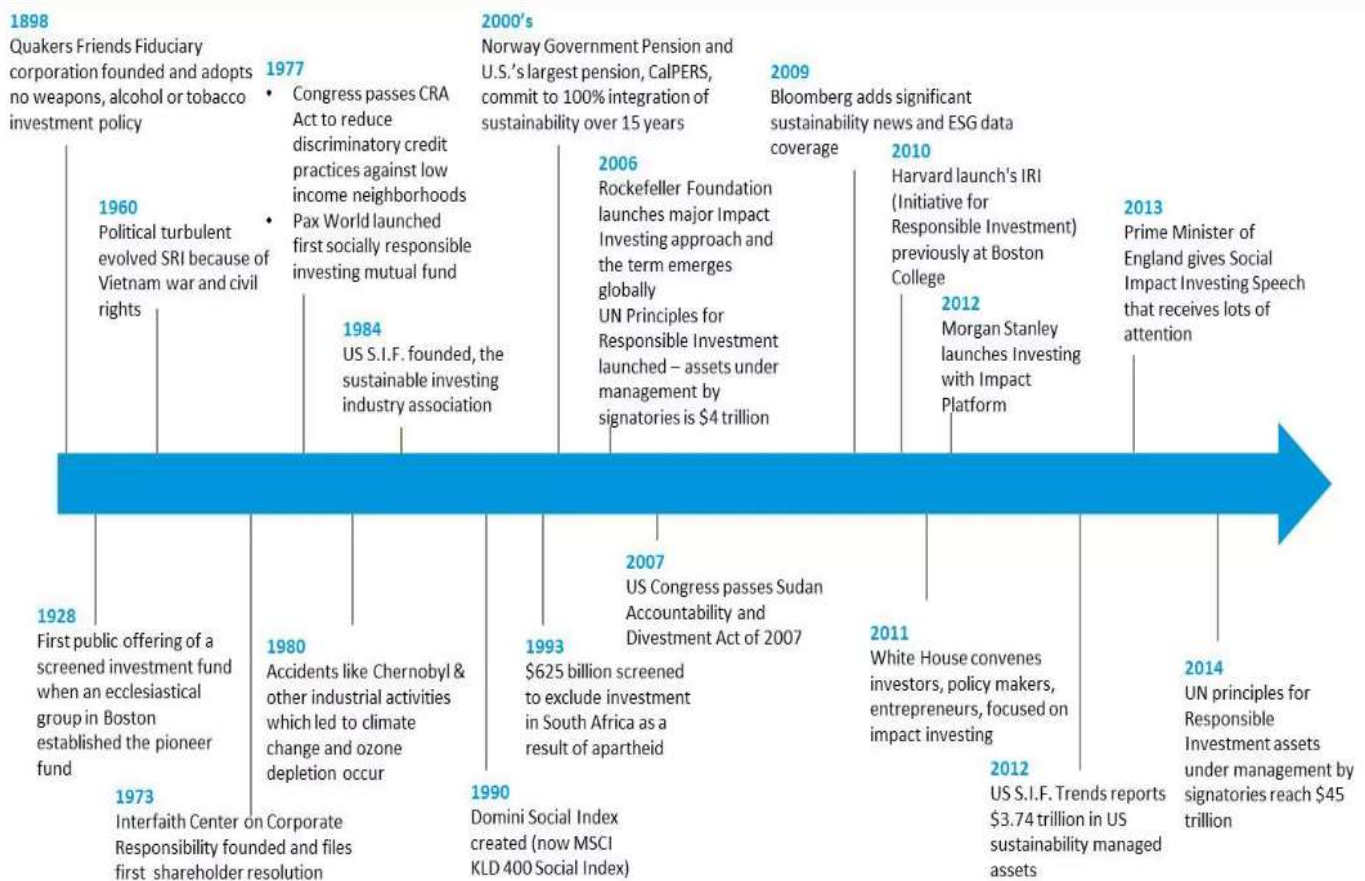
In order to promote the concept of Green business and Green economy capital market of the different countries have started producing sustainable indices by considering the certain ESG criterion. And the introduction of certain green financial products like green bonds, Green Mutual funds etc. Even banks have started giving credit to certain priority sectors on analyzing their ESG Criterion. The emergence of such kind of financial Products and investment therein are called the sustainable investment, impact investing, socially responsible investing, or ESG investing. It has been emerged in the year 2005 under the landmark study report on "Who Cares Win" in the U.S under the aegis of Ivo Knoepfel. (Kell, 2018) The basic objective of the report was to integrate the ESG Factors to capital market and make good business senses about ethical investing and sustainable markets and giving better outcomes for the society. ESG investing incorporates all the three factors viz., Environmental, Social and governance score of the business. Covering the different dimensions like environmental resource-depletion, renewable energy, clean technology, Pollution, Climate change, Social human rights, Workplace conditions, discriminations, community relations, and governance compliance, transparent reporting and managing conflicts. The success of United Nations Principles for Responsible Investment (UNPRI)—which calls for the incorporation of ESG factors in investment and ownership decisions—is a significant indicator of the growth of sustainable investment. (<https://www.unpri.org>, 2018).

The integration of ESG Factors to the capital market started in the year 1990 with the introduction of the MSCI KLD 400 Social index and till date there are more than 14 sustainable indices developed across the globe. In India we have 6 Major, 13 Sectorial, and 3 thematic indices. These include BSE Carbonex, BSE Greenex and BSE ESG.

This concept of Sustainable investing is gradually taking root in India. Still it is in its nascent stage, not replaced with main stream investment. Majorly this SRI seems in Portfolio products like Mutual funds, Pension funds, ETFs etc. Yes bank in 2015 has issued its first green bond, and few more in list are Axis bank, NTPC Ltd, IREDA, L&T Ltd etc have contributed in green investment. In May 2018, SBI Funds Management Ltd renamed its Magnum Equity Fund as Magnum Equity ESG Fund. In April 2007, ABN AMRO mutual fund, now BNP Paribas Asset Management India Ltd, launched India's first SRI (socially-responsible investment) fund. Considering this Responsible investing as contemporary topic in financial management and less researched topic in. India Researcher has made an attempt to know the long term performance of sustainable indices constituents and its peers.



CHART 1: EVOLUTION AND EMERGENCE OF GREEN INVESTMENT



Sources: Thomson Reuters, "History of socially responsible investing in the U.S.", August 2013, and Envestnet research.

**LITERATURE REVIEW**

Long run financial performance analysis is a vast and widely researched topic in India. Mainly in literature long run financial performances is studied to check impact of different corporate events and its financial implications. Like Post IPO, Share buyback, Merger and Acquisition stock market return of the sample firms. This analysis is being performed with different models like BHAR Model, CAAR Model, CAPM & Arbitrage Pricing Model, Fama & French (1993, 2015) three, four and five factor model to assess long run Portfolio output with different company specific factors. Today there is a shift in the motive of capital employment of business and all its stakeholders. Psychology & Objective of investment shifting from Economic (Profitable investment) to Responsible investment (Considering ESG Criteria)

**Jeroen Derwall (2005)** "Eco Efficiency Premium puzzle" has studied the relative economic value of two equity portfolios that differed in eco-efficiency. Based on Innovest Strategic Value Advisors' corporate eco-efficiency scores, high-ranked portfolio provided substantially higher average returns than its low-ranked counterpart over the 1995-2003 period. And it is found that SRI produced superior return. (Jeroen Derwall, 2005)

**H. Camilla Stenström, J.T (2007)** "Evaluating the performance of the Socially responsible investment Funds; A holding Data Analysis." has investigated on the performance of SRI Mutual Funds to traditional one. This is with @ Micro level - Firm level performances of Portfolio and @ Macro level- fund management performance. And the results from this study shows that at an overall fund performance level, SRI funds do not outperform regular funds. Additionally, Evidence show that the replicating portfolios perform better than the regular funds, suggesting that certain socially responsible practices affect firm level performance positively. On a fund management level, the results indicate that the fund management of regular funds is better than SRI funds.

**Rajib Bhattacharya (2013)** "Effect of Going Green on Stock Prices: A Study on BSE-GREENEX" studied on the Comparative financial performance of the BSE Greenex to BSE Sensex and BSE 500. Computing quarterly cumulative mean daily returns and its S.d. it is found that BSE Greenex is giving superior return over BSE Sensex and BSE 500.

**Gunnar Friedea, T. B. (2015)** "ESG and financial performance: aggregated evidence from more than 2000 empirical studies" has found that roughly 90% of studies find a nonnegative ESG-CFP relation. There is a positive ESG impact on CFP appears stable over time. **Anupam Dutta, P. D (2015)** has invested on the long run security price performance and has reviewed a large number of long-run event studies and fined that the analysis of long-run abnormal performance is perfidious. In addition, an empirical example is given to compare several measures of long run stock price performance to check significance and authenticity of return as per different models. The empirical analysis shows that a recently proposed calendar time portfolio method has better performance than the conventional approaches.

**Skagestad (2017)** "A comparison of sustainable and conventional mutual funds in emerging markets" has studied the difference in financial performance of the conventional and sustainable mutual funds under three different economic cycle steady development, Recession and recovery. The results of the study reveal that there is no significant difference in risk adjusted return of the sustainable and conventional mutual funds.

**George kell (2018)** article on "Remarkable rise of ESG" mentions the increasing importance of incorporating non-financial data in annual reports of the companies by using the standardized and most widely used (80% of top 500 companies as per Forbes list) GRI framework, recently developed IIRC Framework and TCFD etc. Moreover, many portfolio products like mutual funds, pension funds, ETF, insurance products etc is receiving premium market performance by incorporating ESG factors.

**Edelweiss securities ltd (2018) Report on "Seeking Growth the ESG Way."** has found that investors and markets reward companies that score highly on ESG parameters. For instance, MSCI ESG Indices for India and overseas have consistently outperformed their respective broader benchmarks delivering superior risk-adjusted returns.

**Donath, L.E., Ioan, R., Mandimutsira, T. (2018)** has studied the comparative financial performance of the SRI MF to Non-SRI MF by employing Sharpe and Markowitz model to determine Market value of sample assets. It is found that in short run SRI Funds performed better than Non-SRI and in long run vice-a-versa.



**SP Global rating agencies article (2019)** on The ESG Advantage: Exploring links to Corporate Financial Performance has found that companies which are focusing on ESG issues have achieved reduced costs, improved in worker productivity, mitigated risk potential and created revenue generating opportunities.

## STATEMENT OF THE PROBLEM

As mentioned earlier in the literature review many empirical studies available on long run analysis of the stock market based on different event-based post period analysis. Indian capital market has integrated the impact of different environmental, Social and Governance aspect of the business in the various financial products and started promoting the concept of Sustainable investment. But seeking the Growth ESG way in long run is yet questionable so researcher has tried to find long run Stock market return of certain ESG constituent from BSE ESG 100 index.

## RESEARCH OBJECTIVE

To study Comparative performance of BSE ESG Constituents and its peers in short and long run.

## RESEARCH HYPOTHESIS

From the above literature it is found that investors and market reward companies better which scores high on ESG Parameters. Based on this it is hypothesized that:

**H0:** SRI (ESG) Stocks outperform Non SRI in long run.

**H1:** In long run there is no difference in performance of SRI & Non-SRI Stock

## RESEARCH METHODOLOGY

The present study is empirical and analytical one consisting of top 10 **BSE ESG 100** Constituents and its peers as control firms. Study has employed **CAAR** methodology (Iqbal Thonse Hawaldar1, 2018) by taking daily stock prices for all the trading days between **2014 to 2019**. Study has evaluated total **23930 observations** based on the **10 sample<sup>1</sup>** companies and 1210 trading days ( $10 \times 1210 = 12100$  Observations) and **10 Control<sup>2</sup>** firms and 1183 trading days ( $10 \times 1183 = 11830$  Observations), For the significance of the results study has used **t-statistics** value at 5% level of Significance.

### METHODOLOGY TO EVALUATE LONG RUN PERFORMANCE

Present study uses cumulative average abnormal return (CAAR) to evaluate the long run performance of Stocks. Daily returns are computed using the adjusted closing price starting from the listing day. The daily raw return for security  $i$ , is computed as under:

$$R_{it} = P_{it} - P_{it-1} / P_{it-1} \dots (1)$$

Where,  $R_{it}$  is the return on security  $i$  for day  $t$ ,  $P_{it}$  is the adjusted closing price of security  $i$  on day  $t$  and  $P_{it-1}$  is the adjusted closing price of security  $i$  on day  $t-1$ .

The market return for the same period is computed as under:

$$R_{mt} = I_t - I_{t-1} / I_{t-1} \dots (2)$$

Where,  $R_{mt}$  is the market returns on day  $t$ ,  $I_t$  is the closing index level on day  $t$  and  $I_{t-1}$  is the closing index level on day  $t-1$ .

**Abnormal Return** for the Same Period is computed as follows.

$$AR_{it} = R_{it} - R_{mt} \dots (3)$$

Where,  $AR_{it}$  is the benchmark-adjusted return for stock  $i$  on day  $t$ ,  $R_{it}$  is the return for stock  $i$  on day  $t$ , and  $R_{mt}$  is the return on S&P BSE 100 used as the benchmark return for the same period. The average benchmark-adjusted return (average abnormal return) on a portfolio of  $n$  stocks for day  $t$  is the equally weighted arithmetic average of the benchmark-adjusted returns:

$$AAR_t = \frac{1}{n} \sum_{i=1}^n AR_{it}$$

where,  $AAR_t$  is the average abnormal return (benchmark-adjusted) on a portfolio of  $n$  stocks for day  $t$ ,  $n$  is the number of stocks in the portfolio on day  $t$  and  $AR_{it}$  is the benchmark-adjusted abnormal return for stock  $i$  on day  $t$ . The cumulative benchmark-adjusted aftermarket performance (cumulative average abnormal return) from day  $u$  to day  $v$  is the summation of the average benchmark-adjusted returns or AARs:

$$CAAR_{u,v} = \sum_{t=u}^v AAR_t$$

Where  $CAAR_{u,v}$  is the cumulative average abnormal return from day  $u$  to day  $v$  and  $AAR_t$  is the average abnormal return on a portfolio of  $n$  stocks for day  $t$ .

### Parametric significance test

In testing the long run performance of BSE ESG Constituents, the CAAR provides information about the average price behavior of securities during the Study period. If markets are efficient, the AARs and CAARs should be close to zero. Parametric "t-test" is used to assess significance of AARs and CAARs. The 5% level of significance with appropriate degree of freedom is used to test the null hypothesis of significant abnormal returns of SRI Stocks over Non SRI in long run. The conclusions are based on the results of  $t$ -values on AARs and CAARs of the study period. The  $t$ -test statistics for AAR for each study day is calculated as under:

$$t(AAR_t) = AAR_t / SE(AAR_t)$$

Where  $AAR_t$  is the average abnormal return on day  $t$  and  $SE(AAR_t)$  is the standard error of average abnormal return on day  $t$  which is computed as under:

$$SE(AAR_t) = SD(AAR_t) / \sqrt{n}$$

Where,  $SD(AAR_t)$  is the standard deviation of average abnormal return on day  $t$  and  $n$  is the number of stocks in portfolio  $p$  on day  $t$ .

The  $t$ -test statistics for CAAR for each Study day is calculated as under:

$$t(CAAR_t) = CAAR_t / SE(CAAR_t)$$

Where,  $SE(CAAR_t)$  is the standard error of CAAR on day  $t$  which is computed as under:

$$SE(CAAR_t) = SD(CAAR_t) / \sqrt{N}$$

$SD(CAAR_t)$  is the standard deviation of CAAR on day  $t$  which is computed as under:

$$SD(CAAR_t) = SD(AAR_t) * \sqrt{N}$$

Where,  $N$  is the total number of days for which AAR is cumulated.

(Iqbal Thonse Hawaldar1\*, 2017)

DATA ANALYSIS AND FINDINGS

TABLE 1: SHORT TERM 60 DAYS PERFORMANCE OF TOP 10 BSE ESG CONSTITUENTS

Days	AAR	t-Statistics	CAAR	t-Statistics	Days	AAR	t-Statistics	CAAR	t-Statistics
1	-0.0119	-2.1636*	-0.0119	-0.0540	31	0.0052	0.8254	-0.0787	-4.7551
2	0.0115	2.1296	-0.0004	0.5353	32	0.0049	0.4298	-0.0738	-5.2737
3	0.0039	0.7959	0.0035	0.1433	33	-0.0087	-1.8913*	-0.0825	-5.9743
4	-0.0026	-0.5098*	0.0009	-0.6658*	34	-0.013	-2.766*	-0.0955	-5.7587
5	-0.0051	-1.0408*	-0.0042	-0.9696	35	0.0029	1.1154	-0.0926	-5.319
6	-0.0018	-0.3462*	-0.006	-0.0776	36	0.0059	1.0727	-0.0867	-4.6166
7	0.0055	1.8333	-0.0005	-0.8097	37	0.0095	2.2619	-0.0772	-3.5253
8	-0.0048	-1.3714*	-0.0053	-0.2563	38	0.0152	2.1714	-0.062	-4.1671
9	0.0036	1.2414	-0.0017	-1.1120	39	-0.0127	-1.7887*	-0.0747	-4.4357
10	-0.0059	-2.0345*	-0.0076	-1.5504	40	-0.0049	-1.0426*	-0.0796	-4.4519
11	-0.003	-0.9375	-0.0106	-1.0057	41	-0.0003	-0.15*	-0.0799	-4.6250
12	0.0036	1.0286	-0.007	-0.6865	42	-0.0031	-0.7381*	-0.083	-5.0712
13	0.0022	0.4151	-0.0048	-0.0560	43	-0.0086	-1.7551*	-0.0916	-5.0514
14	0.0044	0.8627	-0.0004	0.8609	44	0.0003	*0.0469	-0.0913	-4.5399
15	0.0068	1.1333	0.0064	0.9839	45	0.008	1.5385	-0.0833	-3.1253
16	0.0009	0.2368	0.0073	1.5212	46	0.0215	1.6929	-0.0618	-2.6349
17	0.0041	1.2059	0.0114	1.9282	47	0.009	2.6471	-0.0528	-2.3749
18	0.0031	1.3478	0.0145	1.6252	48	0.005	0.6579	-0.0478	-2.5618
19	-0.0022	-0.5789*	0.0123	0.8987	49	-0.0038	-0.8636*	-0.0516	-2.8654
20	-0.0053	-2.3043*	0.007	1.7597	50	-0.0063	-1.1667*	-0.0579	-1.8252
21	0.0035	1.129	0.0138	-0.3805*	51	0.0192	2.3133	-0.0387	-1.4854
22	0.0033	1.4348	-0.003	-0.3121	52	0.007	1.4286	-0.0317	-1.5883
23	-0.0168	-2.1*	-0.003	-1.8721	53	-0.0022	-0.7586*	-0.0339	-1.2672
24	-0.0178	-4.8108*	-0.0208	-2.6153	54	0.0067	1.4565	-0.0272	-1.7166
25	-0.009	-1.2329*	-0.0298	-2.8939	55	-0.01	-2.9412*	-0.0372	-1.3418
26	-0.0032	-0.4571*	-0.033	-3.9272	56	0.0079	1.2951	-0.0293	-1.0012
27	-0.0148	-2.3871*	-0.0478	-4.8545	57	0.0073	2.6071	-0.022	-0.7669
28	-0.0143	-1.4592*	-0.0621	-5.9415	58	0.0051	0.7183	-0.0169	-0.7670
29	-0.0267	-2.6176*	-0.0888	-5.5389	59	-0.0006	-0.15	-0.0175	-0.7940
30	0.0049	1.3611	-0.0839	-5.1274	60	-0.0021	-0.7778*	-0.0196	-0.5778

(Source: Author's own compilation-Daily stock prices and BSE ESG 100 Market data sourced from www.yahoofinance.com)

Note: Parametric t-test Values are shown in Parenthesis Significant at 5%Level.

From the Table 1 above it is found that in short run out of 60 days 32 AARs were positive and only one 44<sup>th</sup> day AAR is Significant at 5% level. And the remaining 28 AARs were negative and significant. In terms of Cumulative return only 9 days CAAR out of 60 days shows the Positive return and only 2 CAAR out of 9 Positive were significant at 5%. It means in short run Average Daily stock prices return generates good economic return than the market. But overall performance of Securities (CAAR) is not giving good return throughout the Short-term Study Period.

LONG RUN ANALYSIS

FIGURE 1: 5 YEARS AAR & CAAR OF TOP 10 BSE ESG FIRMS

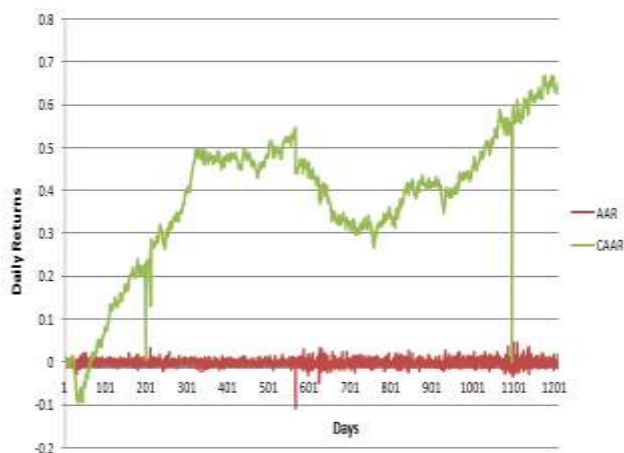
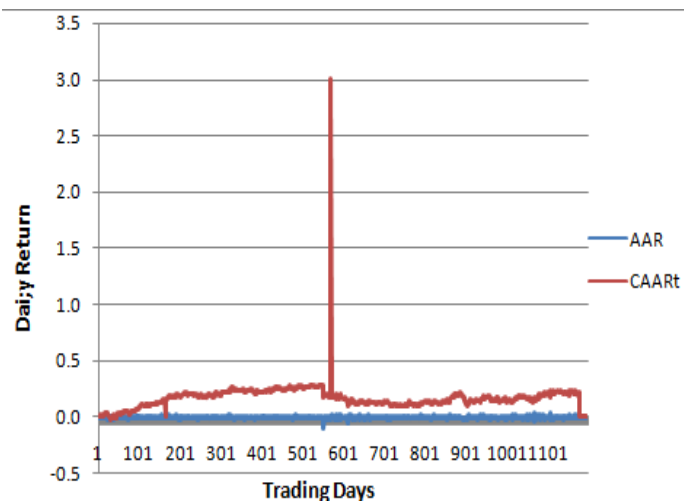


FIGURE 2: 5 YEARS AARS & CAARS OF BSE ESG PEERS



Source: Author's own Compilation

From the figure 1 above it is found that AAR ranges between -0.1 to 0.1 for all the trading days under study. Giving negative returns in mid of the 2015-16 and 2017-18 but improved the position again in the year 2018-19. So Overall Daily Security performance of ESG Constituents is Significant & in the short-term investor will gain from this ESG investment. CAAR values shows increasing trend for the first half of the study period and then declines in mid of 2016-17 and 17-18 (approximately near 780 trading days) and then again showing increased positive return till the end of 5<sup>th</sup> (2018-19-1210 trading days) year. So, like other international studies on long run stock prices return here also it is proved that in long run SRI Stocks gives significant good economic return and it is advantageous to invest for long term in BSE ESG Securities.

In Comparison to BSE ESG, from the figure 2 it is found that BSE ESG peers are also showing the same trend as BSE ESG in terms of Daily stock return (AARs) for short term investment and (CAAR) for long run investment. But Control firms returns were slightly less as compared to BSE ESG Constituents.

From the above analysis it is suggested long term SRI investment is preferable for the Aggressive investor and for Conservative, Non-SRI Stocks (Control Firms) as in long run it gives steady & positive return. Moreover, as per table 02 given below BSE ESG Control firms CAARs are Significant for the year 2016-17 to 2018-19. So, overall long-term investment is advantageous for both SRI stocks as well as its peers.

TABLE 2: LONG RUN ANALYSIS OF ESG CONSTITUENTS AND ITS PEERS

Sample/Control Firms	2014-15 (231 TD)	2015-16 (475 TD)	2016-17 (766 TD)	2017-18 (966 TD)	2018-19 (1210 TD)
BSE ESG Firms CAAR	0.3024	0.4468	0.3131	0.4333	0.6397
t-values	8.3568	8.8341	3.9790	2.4630	5.8781
Control Firms CAAR	0.1967	0.2451	0.1360	0.1591	0.2201
t-values	6.1407	5.3313	1.8953	1.9623	2.2569

Source: Own Compilation

Note: Parametric t-test Values are shown in Parenthesis Sig. at 5%Level.

From the Table 2 it is observed that in long run all CAAR values turn positive for both SRI & Non SRI Stocks. As Compared to Non-SRI Stocks SRI Stocks CAAR is much higher in all the years of the study but not significant at 5% level of significance. As Per CAAR figures SRI Stocks out performs Non-SRI in long run but statistically it is not significant. So we reject the null hypothesis i.e., in Long-run SRI Stocks out performs the Non-SRI.

## LIMITATIONS AND FUTURE SCOPE OF THE RESEARCH

The present study has used top 10 BSE ESG 100 index Firms based on market capitalization which is not representing all SRI Constituents. Future studies can be performed on the all BSE ESG Constituents, BSE Carbonex, & BSE Greenex Constituents to measure the overall performance of all the Sustainability indices constituents in long run. Sectorial sustainable performance evaluation is also a potential area of research to check sectorial performances of all Sustainable firms. Importantly this study is based on the assumption that considering other things being constant (i.e., without considering Size, Sales Turn over and other factors affecting the financial performance of the firm.) Stock prices return (i.e., AAR & CAARs) shows the actual financial performance of the firms. So future long term financial performance studies can apply the Fama and French three factor and Five factor model (which is considering Size, Sales Turn over and other factors affecting the financial performance of the firm.) & also Calendar Time and Portfolio Model which is less studied, widely applied in developed countries can be used for the better accuracy of the results. (Dutta, 2012)

## CONCLUSION

Over the past few years, sustainability has emerged as a crucial aspect of investment. The increasing no. of ESG Equity indices across the major stock exchanges is only reflective of this expansion. In India also, the concept of Sustainable and Socially responsible investment is on rising mode. The introduction of various SRI based portfolio products like bonds, ESG MF, ESG insurance & Sustainable investment loans to certain priority sectors and development of the sustainable indices By BSE like BSE Greenex, BSE ESG, BSE Carbonex in the year 2012 is an indication of boosting Green investment and giving weightage to social and governance aspect in investment. So, to check the financial performance of these indices researcher has computed CAAR of Top 10 BSE ESG constituents for the time period 2014-15 to 2018-19 and compared it with its peers. In analyzing data, it is found that in long run both the stocks BSE ESG and Non-ESG stocks gives positive return but BSE ESG Stocks shows rising trend & it is advantageous to invest in these stocks. So, the construction of such kind of indices is way forward of stock exchanges contribution to promote sustainable investment and investors privilege to attain both social and economic purpose.

## FINANCIAL IMPLICATIONS

The present study is useful guide to different categories of investors like retail Socially Responsible investor, Fund managers may use to create ESG Portfolio, investment advisers, Insurance companies in incorporating ESG Based product for their product performance analysis. The Present study may enable all different types of investors in building up their socio-economic investment strategies that maximize their returns and minimize loss.

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