REVIEW OF LITERATURE

The study of technical analysis uses past prices and trading volume to predict future direction of prices. Being the oldest and simple technique for analyzing the financial markets, technical analysis is widely used by traders and trading advisors (Smidt, 1965; Tayler and Allen, 1992; Billingsley and chance, 1996; Bankhofer and Hilbert, 1999). Despite its widespread usage, it has been an issue of conflict between trading community and academic world as the later considers it as "voodoo finance" and Malkiel (1996) concludes that "under scientific scrutiny, chart-reading must share a pedestal with alchemy." It faces strong criticism from the proponents of market efficiency as they believe that it is impossible to earn abnormal returns with technical analysis, which depicts the weak form of market efficiency.


The study of technical analysis uses varied tools to analyze price movements. They include candlestick patterns, price patterns, elliott wave tools, gann tools, mathematical indicators like moving averages, MACD (moving average convergence and divergence), ADX (average directional index), RSI (relative strength index), stochastics etc. Large amount of work has been done on the modern technical tools but it was found that very less number of academicians have focused on traditional technical tools especially candlesticks and chart patterns. Hence, the present study
focusses exclusively on few but most popular traditional tools of technical analysis i.e. candlestick charting patterns and head & shoulders price pattern. Considering the criticism of academicians towards technical analysis and their strong emphasis on passive investing being the best tool for investment, the study also focusses on the performance of various stock market indices in India. Focusing on these objectives, the review of literature has been categorized into three parts:

- Studies analyzing the use and profitability of technical analysis.
- Studies analyzing the performance of price patterns with special focus on head and shoulders price pattern.
- Studies analyzing the performance of candlestick patterns.
- Studies analyzing the performance of various stock market indices across the globe.

2.1 STUDIES ANALYZING THE USE AND PROFITABILITY OF TECHNICAL ANALYSIS

Alexander (1961) examined the performance of filter rules in security prices using daily data of S&P Industrials average and Dow Jones Industrials average from 1897 to 1959. A filter rule implies that one should buy the stock at a price exactly equal to the subsequent low plus X percent and sell at the subsequent high minus X percent. He found that the small filter rules ranging from five per cent to thirty per cent generated larger gross profits than the buy-and-hold strategy. Also, it was unlikely that they would be eliminated by commissions. He concluded that stock price movements are non-random in nature and trend exists in them as when the stock price rises by X percent, it tends to keep rising until it fall by X percent.

Fama and Blume (1966) extended the work of Alexander (1961) by testing the same filter rules on the thirty stocks comprising Dow Jones Industrial Average. Twenty four different filter rules ranging from 0.5 percent to 50 percent were tested on daily closing values of the above selected stocks from January 1956 till September 1962. They found that all the filters below 12 percent and above 25 percent produced negative returns. The filters between 12 percent and 25 percent generated positive returns but
were less than average buy and hold returns. Also, they separately analyzed the returns obtained from long and short positions and found that they failed miserably in yielding higher returns. While long positions produced positive returns which were less than average buy and hold returns, the short positions gave negative returns. Hence, they concluded that filter rules failed to generate any superior profits for the traders.

Levy (1967) analyzed the performance of relative strength trading rules in US markets using weekly closing prices of 200 stocks listed at New York Stock Exchange from October 24, 1960 till October 15, 1965. The stocks were ranked on the basis of different criteria like relative strength, volatility and divergence with market and then, their profitability was tested. He found that selection of stocks on the basis of these criteria resulted in generating superior returns over buy and hold strategy, leading to refutation of random walk theory.

Horne and Parker (1968) investigated the profitability of technical trading rules in U.S. market using the daily closing values of randomly selected thirty stocks among all the securities listed on New York Stock Exchange for a period of six and half years from January 1, 1960 till June 30, 1966. A trade based on technical rule was assumed to be taken by using combination of moving average crossover and filter rules. A long position was assumed to be made, when the stock closed above the selected moving average by X per cent for two consecutive days. Similarly, a short position was entered, when the stock closed below the selected moving average by X per cent for two consecutive days. The study focused on filter rules of 0 per cent, 2 per cent, 5 per cent, 10 per cent and 15 percent and three moving averages i.e. 100, 150 and 200 days. Both weighted and simple moving averages were used but analyzed separately. Using various combinations of technical trading tools, thirty variations of technical trading decision rules were tested. It was found that the profitability of the weighted moving average trading rules was less than that of the simple moving average. Out of 480 trading positions taken, 55 long positions and 36 short positions realized a profit more than the buy and hold strategy. The total profits generated from long and short positions combined together, were found to be consistently lower than that from the long position only, thereby leading to conclusion that the technical trading decision rule could not beat the profits generated by buy and hold strategy.
Jensen and Benington (1970) replicated the two trading rules of relative strength given by Levy (1967) on the securities listed at New York Stock Exchange from 1931 to 1965. They divided the whole period into seven non-overlapping subperiods and randomly selected 200 stocks in each subperiod. Their findings contradicted the results of Levy (1967) as despite being more risky, the strategies based on trading rules generated significantly lesser returns than buy and hold strategy. Thus, they supported the theory of efficient market hypothesis.

Treynor and Ferguson (1985) addressed the issue as how an investor would know whether the market has already discounted the non-public information which he had obtained privately. They made use of the past prices in resolving this issue. If an investor received the information before the market and made an appropriate position, then he could expect profit from the change in prices that would come when the market would receive the information. If the investor received the information after the market obtained the same, then he would not take any position. In their model, they used the movement of past prices to compute the probability whether the market had already incorporated the information or not. They measured profitability using Bayes’ theorem conditioned on past prices. They found that if technical analysis was combined with non-public information that may change the price of a stock, then it could be useful in generating profits in the market. They focused on the fact that the investor’s profit could be generated by the private information which is unknown to the market. Past prices might only help in exploiting the information in an efficient manner.

Neftci (1991) investigated the statistical properties of technical trading rules on the monthly data series of Dow Jones industrial average from 1792-1976. The study focused on the different technical trading rules namely trend line breakouts, moving average crossovers and chart patterns. The trading rules were formalized using notion of Markov times. However, only moving average crossovers could be well-defined by Markov times. The predictive power of technical analysis is compared with the standard econometric models. It was found that technical analysis is useful over standard econometric models only, when the observed data is a non-linear process. It was also found that moving average trading rule of 150 days had a significant predictive power for a period 1911-1976 but its results were insignificant for 1795-1851 and 1852-1910.
sub-periods. Thus, it was able to capture some information ignored by weiner-kolmogorav prediction theory.

**Brock et al. (1992)** tested the profitability of two popular technical trading strategies on the daily data of Dow Jones Industrial Average from 1897 till 1986. The two most widely used trading strategies evaluated were moving average crossover and trading range breakout. The moving average crossover rule involves initiating the long (short) position as the short period moving average rises (falls) above the long period moving average. The popular moving average crossover combinations tested were 1-50, 1-150, 5-150, 1-200 and 2-200. The trading range breakout rule involves buying (selling) when the price rises (falls) above (below) the resistance (support) level. The resistance and support levels were determined using the maximum and minimum values of 50, 150 and 200 days. The profitability of each trading strategy was evaluated using one day and ten day holding period returns and tested using standard statistical test and bootstrap methodology. The returns obtained upon trading signals were compared with returns obtained from the simulated series generated through various models like random walk with a drift, AR(1), GARCH-M and E-GARCH. It was found that the returns generated from technical trading strategies were significantly different and superior over those obtained from various statistical models. Also, buy signals consistently generated higher returns and were less volatile than sell signals.

**Hudson et al. (1996)** replicated the work of Brock et al. (1992) in UK market by using the daily data of Financial Times Industrial Ordinary Index from July 1935 till January 1994 to test the profitability of moving average crossover and trading range breakout rules. They found that these technical trading rules generated superior returns over buy and hold strategy but fail to do so when actual trading costs were considered.

**Sullivan et al. (1999)** extended the work of Brock et al. (1992) by using the daily data of Dow Jones Industrial Average from 1897 till 1998 by using a different methodology i.e. reality check bootstrap methodology given by White (1999). They found this method to be better over traditional bootstrap methodology given by Efron (1979) because it corrects the effect of data snooping bias. They analyzed various technical trading rules like filter rules, moving average crossover rules, trading range
breakout, channel breakout and on balance averages. They found that the trading rules
give similar profitable results from 1897 till 1986 as revealed by Brock et al. (1992).
Also, some trading rules outperformed as compared to those tested by Brock et al.
(1992). However, all the trading rules failed miserably for next ten years i.e. 1987 till
1996 as they were unsuccessful in generating superior returns. This resulted in doubt on
the future efficacy of the technical analysis as they concluded that markets might have
become more efficient due to availability of cheaper computing technology, higher
liquidity and lower transaction costs which might have helped further in removing
possible short-term patterns in stock returns.

Gunasekarage and Power (2001) tested the predictability of moving average
crossover rules using the stock market indices data of four emerging south Asian
markets i.e. India, Sri Lanka, Indonesia and Pakistan for 10.25 years from January 1990
till March 2000. The various combinations of short term and long term moving averages
used were (1, 50), (1,100), (1,150), (1,200), (2,100), (2,150) and (2,200). They found
that trading rule based on moving average crossover could be used to predict the stock
returns in three south Asian markets i.e. Sri Lanka, Indonesia and Pakistan, which could
further be used to earn excess returns by the traders. However, Indian markets failed to
generate excess returns.

Papadamou and Tsopoglou (2001) tested the profitability of technical analysis
on the daily spot exchange rates of German Mark and Great British Pound for the
period from January 3, 1989 to December 31, 1996. The sample was divided into two
sub-periods i.e. January 3, 1989 to December 31, 1992 and January 1, 1993 to
December 31, 1996. They examined three technical trading rules based on Moving
Average Crossover, Momentum and Moving Average Convergence Divergence
(MACD) using different parameters. The profitability of these three trading systems
was calculated separately for the whole period and sub periods. Then, these profits were
compared with the returns generated from buy and hold strategy. The monthly returns
were computed and statistically tested using Gaub test. It was found that all the variants
of the technical trading systems were profitable in case of German Mark. However,
only 86 per cent of technical trading systems generated profits for Great British Pound.
Among all the trading systems, MACD was most profitable. However, the returns
generated through profitable technical analysis were not statistically significant compared to buy and hold strategy.

**Mitra (2002)** conducted a study to find a profitable technical trading strategy in Indian Stock Market. The sample covered four stocks i.e. ACC, Reliance Industries, State Bank of India, TISCO and a market index, Sensex. The study was done using the daily closing prices from January 1, 1996 till December 31, 1998. The technical trading strategy was determined using moving average crossover technique and filter rules. 120 different combinations were tested. It was found that trades were profitable in 79 cases. The trading strategy based on moving average crossover rule \((2,10)\), where a long (short) position is initiated when two day moving average crosses 10 day moving average from below (above), generated maximum profit. Almost, all the low filters generated profits. The filter of 1\% was found suitable for all the series.


**Sehgal and Garhyan (2002)** evaluated the power of technical trading indicators in generating abnormal returns in Indian stock market. The sample size covered the daily price and volume data of 21 large capitalized companies actively traded from April 1996 to March 1998. The BSE Sensex was used as a market proxy. The study covered thirteen technical indicators namely Commodity Channel Index, Directional Indicator, Force Index, Linear Regression, Moving Average Convergence Divergence, Momentum, OnBalance Volume, Price Oscillator, Q-sticks, Rate of change, Relative Strength Index, Stochastics and Williams’ oscillator. To evaluate the performance, six returns measures were used in the study namely mean unadjusted return, mean return adjusted for market trends, mean return adjusted for market trends and risk, mean return
adjusted for market trends, risk and transaction costs from brokers’ perspective, mean return adjusted for market trends, risk and transaction costs from institutional investors’ perspective and mean return adjusted for market trends, risk and transaction costs from individual investors’ perspective. It was found that technical indicators generated extra-normal returns in the Indian capital market. Of all the indicators, On Balance Volume (a volume indicator) proved to be the most powerful indicator over different phases of the market. The study confirmed that the Indian stock markets are not efficient in the weak form.

**Fernando Rubio (2003)** investigated the returns generated by technical analysis in Spanish and US markets. The study was based on the monthly returns and prices of all the 111 stocks traded at Madrid stock exchange, Dow Jones Industrial Average index and Spanish IBEX35 over the period Jan 1990 to October 1999. Also, Total index of Madrid stock exchange was considered. The study also took daily values of the Dow Jones Industrial Average index between 1928 and 2002. The technical indicators and studies used for the purpose of determining the investment strategy are simple moving average, trading range breaks, momentum, relative strength index, Lane’ stochastic and Williams oscillator. His investigation concluded that the investment strategies provided excess returns over indexing in case of long positions only w.r.t Spanish stock market. However, investment strategies surpass the return of the market index from 1928 and 2002 but it failed in the period of 1990’s. Thus, the technical indicators provide positive but smaller returns compared to those of indexing.

**Sehgal and Gupta (2005)** conducted a survey to determine the attitude of market participants towards technical analysis in India. The sample size consisted of twenty five respondents having an average experience of nine years in stock market and seven years with technical analysis. The respondents included technical traders, brokers, fund managers and investment analysts. Every respondent was using at least one technical analysis software. It was found that the respondents had great belief in technical analysis in generating superior returns. Majority of respondents applied technical analysis towards equity segment and used it along with fundamental analysis. The respondents had great preference for classical technical studies namely chart patterns, fibonacci tools, Elliott wave, trend analysis, moving averages, candlestick
patterns etc. rather than modern technical tools (indicators). Also, it was found that there was negligible use of time series econometric tools for technical analysis.

**Atmeh and Dobbs (2006)** explored the performance for various combinations of moving average crossover rules in Jordanian stock market using the daily data of General index of Amman stock market from January 1, 1992 till July 30, 2001. They tested various combinations of moving average crossover rule. The smaller day moving averages used were 1 and 5 days and longer day moving averages were 2, 5, 10, 25, 50, 100, 150 and 200 days. A buy signal was generated when the smaller day moving average crosses longer day moving average from below and sell signal was generated when the smaller day moving average breaks longer day moving average from above. The returns obtained from the moving average crossover rules are analyzed using standard statistical tools and bootstrap methodology. It was found that significant profits could be made upon using these rules in Jordanian stock market. However, these profits went away after considering transaction costs but still sell signals for few combinations remained profitable, thereby leading to the conclusion that technical analysis helped in predicting price movements.

**Sundhar and Kakani (2006)** tested the profitability of simple and displaced moving averages to comment upon the efficiency of Indian Equity markets. The sample consisted of S&P CNX Nifty, BSE Sensex and fourteen selected large capitalization stocks. It covered a period of 15 years from July 1990 to December 2005. The data was adjusted for splits and bonus announcements. The statistical techniques used for research include mean return, standard deviation, Sharpe ratio, skewness, kurtosis and Z-tests. It was found that moving average crossover rules were successful in generating significant positive returns from the market. Of the two types of moving averages, displaced moving average generated far better returns. Also, short-term moving averages generated more returns than long-term moving averages. Thus, they concluded that Indian equity markets were not efficient in the weak form.

**Chen and Li (2006)** examined the usefulness of technical analysis for the stock traders in china. They used daily closing prices and trading volume of 39 constituent companies of the SZSE A-share component index listed on Shenzhen stock exchange
from 15 August 1994 to 22 August 2002. They gauged the usefulness of technical analysis by analyzing return predictability which may arise from market illiquidity and market inefficiency. The problems of illiquidity and inefficiency were examined by using unadjusted and adjusted returns, considering past volume along with past returns, absolute and relative volume data. However, they did not find any strong evidence advocating the usefulness of technical analysis for stock traders in China.

Vasiliou et al. (2006) tested the performance of moving average crossover rule and moving average convergence and divergence (MACD) indicator in Athens stock market using daily closing values of Athens General Index from January 1, 1990 till December 31, 2004. The various moving average crossover combinations examined include 1-9, 1-15, 1-30, 1-50 and 1-90. The parameters tested for moving average convergence and divergence (MACD) indicator were difference between 12 day moving average and 26 day moving average with signal line being 9 day exponential moving average of MACD. The performance was analyzed using descriptives, t-test and bootstrap methodology. It was found that both the technical trading strategies were successful in generating superior returns in the Athens stock market as moving average crossover rule yielded 36.10% per annum and MACD indicator generated 55.65% per annum compared to 12% per annum return generated by the market.

Lento and Gradojevic (2007) evaluated the profitability of various technical trading strategies over traditional buy and hold strategy. The technical trading strategies tested include trading range breakout, bollinger bands, moving average crossover and filter rules. These strategies are tested on daily closing prices of S&P/TSX 300 Index (flagship index of Toronto Stock Exchange), Dow Jones Industrial Average Index, NASDAQ Composite Index, and Canadian Dollar-U.S. Dollar spot exchange rate. It was found that trading range breakout, moving average crossover and filter rules were successful in generating superior results by outperforming the buy and hold strategy but bollinger bands strategy failed significantly.

Srivastava (2007) developed two technical indicators namely Gravity Indicator and Stop Loss Channel. The gravity indicator was based on moving averages crossover rules and gave buy and sell signals. Stop Loss channel was based on Volatility which
gave levels to enter stop loss orders to avoid risks and protect profits. The purpose was to develop an indicator which worked in both trending and non-trending markets. It was found that it was better than Moving Average Convergence Divergence (an indicator used in trending markets) and Stochastics (an indicator used in non-trending markets) indicators. It was proved with two case studies i.e. NASDAQ 100 Trust (QQQQ) and March 07 US T-Bond. The study showed that Gravity Indicator was quick in response and filtered false signals.

Sehgal and Gupta (2007) tested the viability of technical analysis in the Indian stock market. They concentrated on nine technical indicators namely Exponential Moving Average (EMA), Moving Average Convergence Divergence (MACD), Volume Oscillator, Smoothed Rate of Change (ROC), Relative Strength Index (RSI), Commodity Channel Index (CCI), Stochastic, Directional Indicator and Simple Moving Average (SMA). The study aimed to verify the efficacy of technical trading strategies based solely on technical indicators and for trading strategies formed by combining fundamental and technical based information. The data on daily prices (Open, High, Low and Close) of selected 69 companies from BSE-100 Index and 180 companies from BSE-200 Index listed on Bombay Stock Exchange was collected for the period from January 1, 1999 to December 31, 2004. It was found that technical indicators generated statistically significant gross returns but the net returns (returns computed after including trading costs) were not significant. Also, the technical indicators performed better in the bull phase of the market. However, the technical trading strategies could not beat the returns generated through simple buy and hold strategy.

Metghalchi et al. (2008) inspected the profitability of moving average crossover rules in Mexican stock market. They studied the daily closing prices of Mexican Bolsa IPC index, the flagship index of Mexican stock exchange, from January 4, 1988 till February 25, 2004. The used four long term moving averages i.e. 50, 100, 150 and 200 days and one short term moving average of 1 day. The results obtained from the technical trading rules are compared with buy and hold returns and their robustness is checked using superior predictive ability test developed by Hansen (2005). They found that the moving average crossover rules yielded positive and significant profits over buy and hold returns and hence, could be used for profitable trading.
Schulmeister (2009) extensively examined the performance of trend following and contrary trading systems in US market. He tested 2580 trading models based on moving averages, momentum and relative strength on daily and thirty minute data of S&P 500 spot prices (1960 to 2007) and S&P 500 futures (1983 to 2007). Using the daily data, he found that the profitability of these models reduces considerably over time making them unsuitable for trading. However, thirty minute data gave better picture as the gross average return produced by the models was 7.2 percent per year and contrarian models performed better by generating 9.1 percent per year than trend following models which produced only 4.8 percent per year.

Ulku and Proden (2013) investigated the determinants of the profitability of a trading rule based on technical analysis. Their sample consisted of daily closing values of stock market indexes of 44 countries from 2001 till 2012. In order to find the determinants, two short term trend following trading rules i.e. moving average and moving average convergence and divergence (MACD) rule are employed. It was found that both stock market and macro-economic volatility led to increase in their profitability but the introduction of index futures significantly reduces it. This might be because with lesser leverage and low transaction costs on index futures, arbitrage opportunities were earlier left unexploited and are now eliminated.

Yazdi and Lashkari (2013) studied the efficacy of Moving average Convergence Divergence (MACD) indicator in the forex market. They analyzed hourly data of four currencies i.e. Euro, British Pound, Franc and Japanese Yen from January 2001 till December 2010. They found that despite being a very widely used technical indicator, MACD gave positive results only for EURO and yielded losses in case of British Pound, Franc and Japanese Yen.

Chong et al. (2014) tested the performance of technical trading rules based on Moving Average Convergence Divergence (MACD) and Relative Strength Index (RSI) indicator in five developed countries namely Italy, Canada, Germany, USA and Japan. The profitability was evaluated from January 1976 till December 2002 using daily closing values of their flagship indices i.e. Milan Comit General, S&P / TSX Composite, DAX 30, Dow Jones Industrials and Nikkei 225. They found that different
trading rules performed successfully in different markets for example both RSI and MACD had predictive power in Canadian, German and Italian stock markets and RSI showed superior performance in American markets. None of these trading strategies could successfully beat buy and hold returns in Japanese markets.

Wang et al. (2015) examined the performance of 7846 technical trading rules in Chinese market. The technical trading rules comprised various combinations of moving average crossover, support-resistance breakout, channel breakout, on balance volume and filter rules. These rules were tested on daily data of Shanghai Securities Composite Index (SSCI) form May 21, 1992 till June 30, 2013 and Shanghai Shenzhen 300 Index (SHSZ 300) from April 8, 2005 till June 30, 2005. The returns obtained from the technical trading rules were analyzed using Superior Predictive Ability test. They found that these rules generated superior returns before 2005 but they failed miserably after 2005. They concluded that these rules performed significantly better in the trending market while they underperformed in non-trending periods. As a result, they had superior predictive ability during the financial bubble from 2005 to 2007.

2.2 STUDIES ANALYZING THE PERFORMANCE OF PRICE PATTERNS

This section deals with the studies focusing on the performance of technical price patterns in various asset classes across the globe.

Levy (1971) tested the predictive significance of thirty-two chart patterns, where by each pattern is formed with five points. The data consisted of daily closing prices of 548 New York Stock Exchange securities covering a time period of five years from July 3, 1964 till July 4, 1969. The study found 19,077 patterns, out of which 9,383 patterns were further studied as they were followed by a breakout. The absolute returns, returns relative to market return and standard deviation of relative to market returns were computed for each pattern for one till twenty six weeks. It was found that no single pattern was successful in generating significant profits after taking trading cost into consideration.

Osler and Chang (1995) evaluated the predictive power of the head and shoulders pattern on daily exchange rate of six currencies against dollar i.e. Canadian
dollar, Swiss franc, French franc, Great Britain pound, German mark and yen. An objective, computer based algorithm was defined to identify the head and shoulders pattern in the data. The data comprised of daily closing prices of the currencies for a period of 21 years from March 19, 1973 till June 13, 1994, in which only thirty head and shoulders patterns were observed in each currency. The profits generated were compared with the distribution of similarly derived profits from 10,000 simulated data series generated through bootstrap technique with random walk as null hypothesis. They found that profits would have been both statistically and economically significant, if one had speculated in all six currencies simultaneously. However, the pattern had significant predictive power only for German mark and yen as compared to Canadian dollar, Swiss franc, French franc and pound. However, profits remained substantial, even after making adjustments for interest differentials, transaction cost and risk. The results of the study were strikingly robust despite making changes in the parameters defining the pattern and the sample period.

Osler (1998) made an attempt to identify a source of noise trading in U.S. equities markets using head shoulders chart trading pattern, studied on daily price and volume data of 100 firms selected randomly from CRSP database over 1962-1993. She identified head and shoulders as a source of noise trading, which could represent effects of asymmetric information, liquidity costs and downward sloping demand curves. She found that the trading strategy based on head and shoulders pattern was unprofitable as the price effect of the trades disappeared slowly but completely in two weeks.

Dempester and Jones (1998) studied the profitability of the head and shoulders formation in the US Dollar/British Pound Spot foreign exchange market using tick data from 1989 till 1997 using pattern recognition algorithms. They explored the link between various attributes of each pattern and trading profit and found that the trading in the pattern resulted in loss despite using different exit strategies excluding slippage.

Lo et al. (2000) proposed a different approach using nonparametric kernel regression to recognize technical price patterns. They focused on these patterns namely head and shoulders, inverse head and shoulders, broadening top, broadening bottom, triangle top, triangle bottom, rectangle top, rectangle bottom, double top and double
bottom. Using the daily data of US stocks from 1962 to 1996, they analyzed their daily returns by applying the goodness-of-fit and Kolmogorov-Smirnov tests to evaluate the effectiveness of price patterns. They found that the patterns provided incremental information which might add value to investment process.

**Laedermann (2000)** investigated the profitability of head and shoulders in major market sectors. He analyzed the daily spot data of S&P500, US Treasury Bonds, Swiss Franc and Gold from January 1990 till October 1997. The patterns selected as head and shoulders meeting the twin criteria of a close beyond neckline and a pullback either to breakout level or the neckline were considered as tradable. Among 121 patterns found, only 79 were powerful enough to trade. The entry was placed at the breakout point or the neckline level, which ever was less ambitious. Three different profit objectives were studied and an optimum target objective strategy was suggested. The pattern was found to be profitable with average annual return of 21.07% and a profit factor of 3.03. Among the four asset classes, it was found most profitable in S&P 500 and gold with average annual return of 26.9% and 26.8 % respectively.

**Leigh et al. (2002)** explored the profitability of bull flag pattern in American markets. They used template matching technique on the values of New York Stock Exchange Composite Index from August 6, 1980 till September 15, 1999 over 40 day trading window. The profitability was tested for ten, twenty, forty and eighty day holding period using t-test. They found that bull flag pattern was successful in generating significant excess returns, concluding that American markets are not efficient in weak form.

**Lucke (2003)** investigated the profitability of head and shoulders top pattern as defined by Osler and Chang (1995) on daily spot rates of US Dollar, German mark, the British pound, the Swiss frank and the Japanese yen from 1973 to 1999. The pattern was identified using price peak and trough analysis and Bry & Broschan (1971) filtered peak and trough analysis. The statistical significance of annualized mean returns between one and fifteen days was tested using t-statistic. They found that the pattern failed in generating profits and returns were significantly negative.
Dawson and Steeley (2003) analyzed the existence of technical patterns and their influence on return distribution in the U.K. stock market. They replicated and extended the work of Lo et al. (2000) using U.K. stock market data comprising of companies contained within the FTSE 100 & FTSE 250 indices from 26 October 1986 to 30 May 2001. Initially, the data was smoothened using kernel regression and a computerized pattern recognition algorithm was run to identify technical patterns like head and shoulders, inverse head and shoulders, broadening top, broadening bottom, triangle top, triangle bottom, rectangle top, rectangle bottom, double top and double bottom. Further, the conditional returns, unconditional returns and market adjusted excess returns were analyzed using descriptive statistics, the chi-square goodness of fit test and kolmogorov-Smirnov test. They found the existence of technical trading patterns and supported the findings of Lo et al (2000) due to significant difference in distribution of returns conditioned and unconditioned.

Omrane and Oppens (2004) investigated the existence and profitability of twelve chart patterns in the euro-dollar foreign exchange market using five minutes mid-quotes from May 15, 2001 till November 14, 2001. Patterns were identified using kernel regression and pattern recognition algorithm on closing prices and low-high prices, separately. Monte Carlo simulations and t-tests were used to test the statistical significance of the results. It was found that more than half of the predictive patterns seemed to have significant predictive power while only two patterns were significantly profitable but with profits too small to cover the transaction costs.

Savin, Weller and Zvingelis (2007) studied the predictive power of head and shoulders price pattern using modified pattern recognition algorithm contributed by Lo, Mamaysky, and Wang (2000) along with Bulkowski (2000) restrictions. They analyzed the daily data of S&P 500 and the Russell 2000 over the period 1990–1999. They examined the profitability by focusing solely on the mean excess returns conditional on the occurrence of pattern over subsequent one, two and three months. They found that neither bulkowski restrictions had any predictive power, nor a trading strategy based solely on head and shoulders was profitable. However, after using it, in conjunction with three factor fama-french model and four factor carhart model, they found that some of the excess returns could be attributed to the negative momentum.
Zapranis and Samolada (2007) make an attempt to create an automated process, based on a combination of a rule-based system and a neural network, of recognizing the head and shoulders pattern based on a criteria used by Chang and Osler (1995). The study didn’t evaluate the profitability of pattern but concentrated on developing an algorithm to detect it in data series which could be used by academicians in future to determine its performance.

Friesen et al. (2009) developed a theoretical framework that could provide possible explanation for the success of few technical price patterns like head and shoulders and double bottom pattern. They focused on individual stocks comprising S&P 100 index as on January 1, 2006. The data was collected from the NYSE’s Trade and Quote (TAQ) database for six years i.e. from January 1, 1999–December 31, 2005. Their model confirmed empirical properties of US equity markets that return autocorrelations are negative over very short horizon, positive over intermediate horizon and become negative again over long horizon. Further, they empirically confirmed that the sequential price jumps in equity prices were statistically and economically significant and positively autocorrelated.

Zapranis and Tsinaslanidis (2010) created a neural network that identifies the Head and Shoulders pattern in a stock price by using a method similar to hand-written character and digit recognition studies. They overcome the small observation frequency of the pattern with a rule-based pattern identification mechanism and a large number of simulated stochastic price series using Geometric Brownian Motion. The results are very promising with an overall correct classification rate of 97.1%, thereby, outperforming the rule based algorithm.

Bender et al. (2011) tested the presence of illusory correlations among the noise traders by focusing on head and shoulders chart pattern. They analyzed the daily data of 304 stocks listed at NYSE & AMEX and 373 stocks listed at NASDAQ. They found that trading on head and shoulders pattern was not profitable. However, trading volume was found to be higher by 60 % and bid-ask spreads were lower on the formation of pattern.
Choong and Poong (2014) revisited the performance of head and shoulders patterns in US market by adding additional variable of market trend to the algorithm as defined by Lo et al. (2000) and Savin et al. (2007) to filter out invalid patterns. Their sample consisted of the daily data of the stocks comprising S&P 500 and Russell 2000. The performance was analyzed using Carhart four factor model. They found that the use of filters significantly improved the performance of the pattern and advocated use of more filters to further improve its profitability.

2.3 STUDIES ANALYZING THE PERFORMANCE OF CANDLESTICK PATTERNS

Candlestick charting is considered to be the oldest and most popular charting technique. This section provides the review of the studies conducted on data from various financial markets around the globe on the profitability of candlestick patterns over different time periods.

Caginalp and Laurent (1998) tested the predictive power of three day candlestick reversal patterns from 1992 till 1996 using daily open, high, low and close prices of all S&P 500 stocks and all world equity closed ended funds (as listed in Barron’s). The candlestick patterns analyzed include three white soldiers, three black crows, three inside up, three inside down, three outside up, three outside down, morning star and evening star. The profitability was tested by holding the trading position for three days. Using non-parametric tests, they found that candlestick patterns had significant predictive value.

Fock et. al. (2005) examined the predictive power of candlesticks in German financial markets using intraday data from 1st January 2002 till 31st December 2003. They detected and tested the profitability of 19 candlestick patterns on five minute candles of DAX futures (future contract of german stock index DAX) and Bund futures (future contract of german government bond) using t-test. On trading the candlestick patterns, without using any technical indicator, only dark cloud cover pattern was found to generate significant return in DAX futures. However, there was no significant improvement in the results, when candle patterns were combined with technical indicators like moving average, momentum, RSI and MACD. Thus, they concluded that
it was not possible to earn significant superior returns using candlesticks apart from dark cloud cover.

**Marshall et al. (2006)** examined the profitability of trading strategy based on candlestick pattern in U.S. markets. The strategy involved buying a stock after the completion of pattern and holding it for ten trading days. Using the daily data of open, high, low and close prices, the study was carried out on individual stocks comprising Dow Jones Industrial Index from 1st January 1992 till 31st December 2002. The results obtained from the trading strategy were compared with those of bootstrap methodology. It was found that candlestick analysis failed in generating any superior return.

**Goo et al. (2007)** explored the profitability of candlestick trading strategies in Taiwan stock market from 1997 to 2006 by using the daily data of 25 component stocks of Taiwan 50 Tracker Fund and Taiwan Mid-Cap 100 tracker Fund. The trading strategy recommended initiating the trades at the opening price on the day following the pattern completion. The profitability was tested by holding the trading position from one till ten days. Later, five per cent stop loss rule was introduced to increase the profitability of the trading strategy. Various statistical techniques like t-test, annova, general liner model, duncan’s multiple range test etc. were employed to analyze the profitability. They found that many candlestick patterns generated significant positive returns for the traders. However, the use of five per cent rule enhanced the profitability of the trading strategy based on candlesticks.

**Marshall et al. (2008)** made another attempt to study the profitability of candlestick charting analysis. They analyzed 100 stocks with largest capitalization in the Japanese stock market from 1975 till 2004 using daily open, high, low and close prices. A new trading position was initiated on the formation of the candlestick pattern and held for 10 days. The actual returns were compared with those obtained using bootstrap methodology. It was found that trading strategy based on candlestick charting didn’t add any value to the traders as it failed in generating any superior return.

**Horton (2009)** analyzed eight candlestick reversal patterns in American markets using daily data of 349 stocks chosen randomly from Commodity Systems Inc. (CSI). The candlestick patterns tested were Three White Soldiers, three inside up, three outside
up, morning star, evening star, three black soldiers, three inside down and three outside down. The profitability was tested by holding a trading position for average three days. The patterns were analyzed using three nonparametric tests i.e. the Kolmogorov–Smirnov test, the Cramer–von Mises test and the Birnbaum–Hall test (BH). Further, the returns obtained from patterns were compared with those of S&P 500 and were tested using T-test. It was found that candlestick patterns are not useful in trading US stocks.

Shiu and Lu (2011) inspected the predictive power of the two-day candlestick patterns in Taiwan stock market using daily open, high, low and close prices along with volumes of 69 securities traded electronically from 1998 till 2007. Six candlestick patterns tested in the study were bullish harami, bearish harami, piercing pattern, dark cloud cover, bullish engulfing and bearish engulfing. Using a trading strategy based on three confirmatory factors i.e. opening price of next day after the completion of pattern, gap between real bodies of the pattern and the change in volume, harami patterns were found to be most profitable.

Lu et al. (2012) studied the profitability of six two days candlestick reversal patterns in Taiwan stock market using daily data of component stocks in the Taiwan Top 50 Tracker Fund from 29 October 2002 through 31 December 2008. Three bullish patterns (piercing, bullish engulfing, bullish harami) and three bearish patterns (dark cloud cover, bearish engulfing, bearish harami) were examined using skewness adjusted T-test, binomial test and bootstrap methodology. It was found that bullish patterns generated significant positive returns. Among all the patterns, piercing pattern was found to be most profitable.

Duvinage et al. (2013) tested the performance of 83 Japanese candlestick trading rules using 5-minute interval data of 30 stocks comprising Dow Jones Industrial Average Index from 1st April 2010 till 13th April 2011. Using bootstrap methodology and stepwise Superior Predictive Ability as introduced by Hsu et al. (2010), they found that some Japanese candlesticks intraday trading strategies have significant explanatory power but after considering trading costs, they fail in beating the buy-and-hold strategy.

Lu and Chen (2013) investigated the profitability of two day candlestick patterns in European markets using 1x4 vector approach systematically. The study was
carried out using the daily data of component stocks of FTSE 100, DAX 30 and CAC 40 from 2 January 2003 to 31 October 2012. On applying skewness adjusted T-test, binomial test and bootstrap methodology, it was found that three different patterns yielded positive raw returns after considering transaction costs in the major European stock markets. However, the direct comparisons among the three European markets shows that distinct candlestick charting strategies should be used differently in each market. Also, it was found that the profitability of candlestick patterns reduced during global financial.

**Detollenaere and Mazza (2014)** investigated the role of Japanese candlesticks in solving traders’ dilemma to find the best trade-off between market timing and market impact costs. They used tick-by-tick data of 81 European stocks comprising three national indexes i.e. BEL20, AEX or CAC40 for 61 trading days from 1 February 2006 to 30 April 2006 and focused on two categories of candlestick structures i.e. doji and hammer. They showed that use of specific Japanese candlestick patterns could better characterize implicit transaction costs. While market impact costs were found to be significantly lower when a Doji pattern was formed, market timing costs were not improved.

**Lu (2014)** examined the profitability of one day candlestick patterns in Taiwan stock market using the daily data from 4\textsuperscript{th} January 1992 till 31\textsuperscript{st} December 2009 on a sample of 151 stocks. He developed a four price level approach to identify, categorize and analyze patterns in a systematic way. Using skewness adjusted T-test and binomial test, he found that only four candlestick patterns to be profitable i.e. one bullish reversal, one bullish continuation and two bearish reversal patterns. The bootstrap analysis and out of sample test provided consistent results, confirming the profitability of these patterns. Also, he found that the patterns generated superior returns for smallcap and low priced stocks.

**Roy et al. (2014)** proposed a model using fuzzy logic to identify two candlestick patterns i.e. hammer and inverse hammer on CNX NIFTY using daily and weekly data values. Further, they proposed fuzzy rule-base system aimed at taking a decision to make a new fresh buy or sell position in the market by effectively identifying the
present trend and predict the immediate future trend. However, they didn’t explore the profitability of these patterns.

Lu et al. (2015) used various combinations of trend definition and holding period to determine the profitability of trading strategy based on three-day candlestick reversal patterns. Using the daily data of 26 stocks comprising Dow Jones Industrial Index from January 2, 1992 to December 31, 2012, they analyzed eight patterns i.e. Three White Soldiers, three inside up, three outside up, morning star, evening star, three black soldiers, three inside down and three outside down. The three different definitions of trend were those as introduced by levy (1971), Caginalp and Laurent (1998) and Marshall et al. (2006). Also, four types of holding period were tested. They included average measure of the exit price for the three day and ten day holding period as advocated by Caginalp and Laurent (1998) and exiting after holding the trading position for three days and ten days as used by Marshall et al. (2006). The results are obtained using Stepwise Superior Predictive Ability test of Hsu et al. (2010). They found that holding strategy plays a crucial role in the profitability of their trading strategy based on candlestick patterns. Of all the four holding strategies, exiting out of each trade at the average closing price of three days was considered best as all the patterns were found to earn statistically significant positive returns across three trend definitions.

Lu and Shiu (2016) investigated the profitability of one day candlestick patterns in American stock market from 1974 till 2009 using the daily data of stocks comprising Dow Jones Industrial Average. They developed a four price level approach to identify patterns in a systematic way. The returns obtained upon the completion of the patterns were analyzed using skewness adjusted T-Test and bootstrap methodology. They found that one day patterns were successful in creating value for the investors. Also, buy signals were found to generate better returns than sell signals.

2.4 STUDIES ANALYZING THE PERFORMANCE OF INDICES

Most of the literature on indices primarily focuses on determining inter linkages between the international markets. Using data of various indices world over, researchers have found existence of inter market linkage at global level (Wheatley (1988), Dwyer and Hafer (1988), Eun and Shim (1989), Hamao et al. (1990), Fischer and Palasvirta


In Indian context, there are mixed results. While Narayan et al. (2004) and Rajhans & Singh (2013) have found significant integration of Indian stock markets with world markets, Rao & Naik (1990), Kumar (2002), Mishra (2002), Nath and Verma (2003), Ahmad, Ashraf and Ahmed (2005) and Janak, Raj, Sarat Dhal (2008) have found absence of such integration. However, the authors come across only one study of Suresh and Tiwari (2012), who have found presence of short term and long term linkages among the sectoral indexes at Bombay Stock Exchange in India.

Contrary to the vast majority of research on market integration, very few studies have been conducted on performance of various indices. They are as follows:

Narasimhan and Balasubramanian (1999) compared risk-return characteristics of three indices i.e. Sensex, Natex and BSE 200 in Indian stock market. They analyzed their monthly returns for a period of five years from January 1991 till December 1995 using mean difference test and variance difference test. They found statistically insignificant difference in the risk-return characteristics of these indices which further were not suitable for hedging and suggested introduction of new indices that represent different segments of the market.

Statman (2000) analyzed the performance of the Domini Social index (DSI) against S&P500 in US from May 1990 to September 1998 using Jensen’s alpha and excess standard-deviation-adjusted return. He found that Domini social index outperformed S&P 500 as its average annual return was higher, but it was risky too, because of higher standard deviation. The risk-adjusted returns of Domini social index
were also higher than S&P 500 but were statistically insignificant. This lead to the conclusion that there was no significant difference in the risk adjusted performance of the two indices.

**Ahmad and Ibrahim (2002)** made a comparison in the performance of Kuala Lumpur Syariah Index (KLSI) and the Kuala Lumpur Composite Index (KLCI) in Malaysian stock market. Using the daily closing values of the both indices from April 1999 till January 2002, they assessed the performance using Adjusted Sharpe ratio, Treynor ratio, and Jensen’s Alpha. The daily closing values of both the indices were collected from investors’ Digest and the KLSE Daily Diary Report. They found that although, means of the two indices were statistically insignificant, KLSI slightly outperformed KLCI on risk adjusted basis.

**Hakim and Rashidian (2004)** investigated risk-return characteristics of Dow Jones Islamic Stock Market Indices (DJIM) from 1999 to 2002. They found that both Islamic Index and Wilshire 5000 stock market index failed to generate superior returns over three month T-bill. There was significant difference in the risk-return characteristics of the two indices. However, return and risk of Islamic index was found to be less than Wilshire 5000. Also, cointegration analysis showed that there was lack of any relationship between the two in the long run.

**Hussein (2004)** tested whether returns of FTSE Global Islamic Index are significantly different from their index counterpart (FTSE All- World Index). The sample period was divided into two sub-periods, bull period (July 1996 –March 2000) and bear period (April 2000 - August 2003). It was found that while Islamic index yielded statistically significant positive abnormal returns in bull market period, it underperformed in bear market period.

**Arnott et. al. (2005)** investigated the portfolios constructed on the basis of different parameters like book value, revenues, dividends, cash flows and total employment with the traditional market capitalization weighted portfolios. The performance of fundamental indexes was analyzed from 1962 till 2004 by comparing with the returns generated by S&P 500 and reference cap weighed portfolio of 1000 stocks. On applying performance ratios and tracking error, it was confirmed that
fundamental indexes outperformed by 1.97% over S&P 500 and 2.15% over reference portfolio. The concentration was found similar in all indexes ranging between 51% - 57% but fundamental indexes were found substantially more efficient on mean variance rule than standard cap weighted indexes. It was further evident by robust performance of fundamental indexes across time (four decades), different phases of business cycles (recession and expansion), bear and bull stock market conditions and rising and falling interest rate periods.

**Hussein (2005)** made an effort to test whether monthly returns of Financial Time Stock Exchange (FTSE) Global Islamic index and Dow Jones Islamic Market Index are significantly different from their common index for the period January 1996 to December 2004. They divided the entire sample period into three sub periods. Using CAPM, it was found that Islamic indices outperformed in first bull period but underperformed in bear period and second bull period. However, over the entire period of nine years, they performed better than their counterparts.

**Hussein and Omran (2005)** studied the performance of the Islamic index against the Dow Jones index from 1995 to 2003 using monthly data and suggested that the Islamic index outperformed the non-Islamic index both over the entire period and the bull period, while the vice-versa was true for the bear period.

**Statman (2006)** inspected the performance of four socially responsible indexes with conventional S&P 500 Index from May 1990 till April 2004. The four socially responsible indexes included were the Domini 400 Social Index, the Calvert Social Index, the Citizens Index, and the U.S. portion of the Dow Jones Sustainability Index. They found that all the four indexes showed superior performance in bull periods but underperformed in bear period. Also, there was presence of strong correlation between the socially responsible indexes and S&P 500 but tracking errors were significantly higher.

**Schroeder (2007)** tested the performance characteristics of 29 international SRI equity indices using sharpe ratio, single factor model using spanning test, three factor model and multi equation models. It was found that SRI equity indices performed in
similar manner like their benchmark indices by generating equivalent returns. On comparing their riskiness, most of them were more risky as compared to their benchmarks. Also, multi equation tests and robustness checks suggested that SRI indices exhibited similar performance like their benchmarks.

**Albaity and Ahmad (2008)** analyzed risk and return performance of Kuala Lumpur Syariah Index (KLSI) and the Kuala Lumpur Composite Index (KLCI) in Malaysian stock market from 1999-2005. Using t-test, they found that there was no statistically significant difference in mean returns of the two indices. Further, they examined the short term and long term relationship between them using causality and Johansen cointegration tests. They found presence of significant bidirectional causality in short term. In long term, both were found to move in tandem with each other. Thus, KLCI could be used to predict the movement of KLSI in both time periods.

**Tabner (2009)** made a comparison between the performance of market capitalization weighted index and an equal weighted index of UK equity market. The data comprised the time period from January 1984 to December 2004 to measure concentration level, volatility levels and returns of actual FTSE 100 index and an equal weighted FTSE 100 index. He confirmed that the investors were compensated in an efficient form for increase in market risk with FTSE 100 index than for equal weighted FTSE 100 index. Further, the incremental standard deviation explained that capitalized index was less prone to downside risk than equal weighted portfolio and the value weighted standard deviation was found to be correlated with incremental returns proving increased returns during extreme situations of shocks than equally weighted portfolio.

**Chan et al. (2009)** assessed merits of popular performance evaluation procedures adopted by academicians to a sample of active money managers and passive indexes. They found negative and statistically significant alpha for Russell 2000 growth index. As a result, they found severe limitations in traditional performance evaluation models like CAPM, three factor Fama-French model and four factor carhart model. Thus, they suggested alternative models with more variables which should be adopted for evaluating portfolios.
Amnec et al. (2010) examined the performance of market capitalization weighted indexes and efficient portfolios taking risk return trade off from investors’ perspective over S&P 500 using weekly return data from January 1959 to December 2008. The efficient portfolios were constructed on the design of tangency portfolios with minimum transaction cost control approach. Using Principal Component Analysis for extracting factors to estimate co-movement of stock returns, Optimal control theory as given by Leland (1999) for controlling transaction cost and performance ratios, they documented that the efficient indices provided higher sharpe ratio, which was consistent across different business cycles, volatility regimes and time periods.

Amnec et al. (2011) examined the beta using efficient indexes, fundamental indexes, equal weighted indexes and traditional market capitalization weighted indexes. They used data of stocks listed at NYSE, AMEX and NASDAQ from January 1999 to August 2011 to develop indexes for US markets and world family of FTSE indexes from December 2002 to August 2011 to develop world portfolios. On the application of risk adjusted return ratios like Sharpe, Sortino, Information and Treynor ratio, it was evident that all the alternative indices performed better than market cap weighted indices.

Bolognesi and Zuccheri (2011) compared two major equity index construction methodologies i.e. equal weighted approach and market capitalization weighted approach using DJ Euro Stoxx index constituents. They focused on the DJ Euro Stoxx index constituents from January 2002 till December 2010. Using three factor Fama-French model, they tested the index construction methodologies over four weighting frequencies i.e. monthly, quarterly, semiannually and annually. They concluded that equally weighted indexes generate superior risk adjusted returns as compared to market capitalization weighted indexes.

Chow et al. (2011) studied the performance of alternative weighted indexes with market capitalization weighed indices for US and global portfolios using total monthly returns for each strategy. The data was analyzed for US markets from 1964 till 2009 and global portfolios from 1987 till 2009. All the stocks listed on NYSE, AMEX and NASDAQ were taken for US markets and those forming part of MSCI index were
used for building global portfolio. The performance was tested on the basis of annual and quarterly rebalancing frequency after considering transaction cost. The performance ratios confirmed that each of the alternative strategy presented a different performance advantage, but a single strategy did not outperform in all categories. The underperformance of mean variance optimization strategy was found consistent with the findings of previous literature.

Dharani and Natarajan (2011) compared risk and return of the Nifty Shariah index and Nifty index for each day of the week, month and quarter using daily closing values from 2nd January 2007 to 31st December 2010. They tested the difference in the mean returns of both the indices using t-test and found that there was no statistical difference between average daily returns of both the indexes. However, there existed significant difference between average return of both the indexes in the month of July and September.

Desai and Trivedi (2011) examined seasonality in Indian stock market by focusing on day of the month effect. They analyzed the daily data of S&P CNX Nifty from January 3, 1994 till November 27, 2012 using descriptive statistics, Augmented Dickey Fuller Test, Kruskal-Wallis test and Z score. They found presence of the day of month effect in Indian stock market as few days delivered significantly positive returns while some days exhibited significantly negative returns. They concluded that Indian stock market was not efficient and market timing could help investors in generating superior returns.

Pani (2012) compared the performance of equal weighted Nifty Index with traditional Nifty Index weighted by market capitalization using the data from January 2007 till January 2012. He compared their performance using various performance ratios and volatility measures. He found that equal weighted Nifty index outperformed over traditional Nifty market capitalization weighted index by giving better allocations to component stocks and generating excess return.

Cremers et al. (2013) found that standard fama-french and carhart models produce economically and statistically significant non-zero alpha for passive benchmark indexes like S&P 500 and Russell 2000. This is because of the biasness in the factor
variables. The size factor was found to allocate uneven weight to value stocks, which resulted in positive correlation in the betas of size and value factors of capital weighted portfolios. Similarly, value factor was found to assign disproportionately higher weightage to small cap stocks, thereby leading to superior performance of value stocks which was in fact because of small cap stocks. Thus, they recommended the use of alternative models for performance evaluation. The alternative models included seven factor index model for daily data and four factor index model for monthly data.

Clare et al. (2013) outlined the performance of alternative strategies of equity index construction. The alternative approaches were based on two broad techniques i.e. Heuristic and Optimization. The data used for testing the performance constituted the total returns of all stocks listed on the NYSE, AMEX and NASDAQ stock exchanges at the end of each month over the period of January 1968 to December 2011. On the application of performance ratios, they confirmed the outperformance of alternative strategies, with evidence that the difference in performance was because of more biasness towards small cap stocks and less towards value stocks. Further, the study proved that the timing was a significant factor to enhance risk return trade off with an alarm of high trading cost involved in some alternative indices that might eliminate the advantage of higher returns eventually.

Le Sourd et al. (2013) evaluated the quality of Asian indices based on efficiency concentration and stability factors from January 1996 to December 2010 with varying origin dates of ten indices namely Hang Seng, Nikkei 225, Topix 100, FTSE STI, KOSPI 200, FTSE TWSE 50, CSI 300, FTSE China 25, Nifty 50 and FTSE ASEAN Index. Using mean variance plane, risk adjusted performance ratios and herfindahl index, the results revealed that Asian Indices are not efficient benchmark for reference. The Indices were found highly concentrated and lack in the stability of risk factor. The equal weighting indexes as an alternative weighting scheme were found to outperform over market capitalization weighted indices.

Thus, the perusal of “Review of Literature” brings out that, though, considerable numbers of studies have been carried from time to time as regards different aspects of technical analysis, but, to the knowledge of the researcher, no work could be seen on the
detailed performance of technical trading rules based on chart patterns and candlestick patterns on Indian markets. Hence, it becomes imperative to determine the profitability of these patterns w.r.t Indian markets, so that it can help traders in choosing the right patterns to trade in correct manner to generate superior returns from the market. The existing literature has examined one technical trading rule at one time. Their strategic combination with two or more rules and varied investment strategies has not been tested as it could result in better returns. As a result, this study concentrates on one of the popular investment strategies i.e. passive investment strategy by comparing the performance of all the passive portfolios (all stock market indices) in India and their strategic combination with technical chart patterns to suggest the best passive investment strategy to the investors. So, an attempt is been made to conduct a comprehensive study to examine the profitability of various chart and candlestick patterns and passive investment strategies (stock market indices) and their strategic combination in Indian stock market.