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About the Journal

MAIMS Economic Journal, started in June 2020, is a bi-annual refereed Journal of the Department of Economic, Maharaja Agrasen Institute of Management Studies, Delhi India. The Journal aims at providing an opportunity to academicians, scholars, policy makers, and industrialists to publish their valuable research work in the field of economics and its allied areas such as statistical and mathematical methods, and financial economics etc.

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Dr. Sanjay Kumar Mangla

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Research is an enduring field with persistent and focussed efforts leading to new knowledge and Department of Economics, Maharaja. The second issue brings vibrant and pioneering research content in the field of Economics, Finance and Geo Political issues of 'MAIMS Economic Journal' to solve socio-economic problems.

The Current Issue of the Journal comprises of six research papers. The first paper highlights the seasonal behaviour of liquidity premium in stock market of India. The second paper analyses effect of climate and geographical factors on yield of cash crops in India. The third paper examines the role of innovative technologies to boost circular economy. The fourth paper studies total quality management of HEI's. Fifth paper explores the massive economic disruption in 2020. The last paper highlights the Geo- political space of industrial revolution, utilitarianism and class struggle.

On behalf of the entire Editorial team, I would like to extend a very warm welcome to all the readers. I also take this opportunity to thank the Honorary Members of the Maharaja Agrasen Technical Education Society for giving us this opportunity to bring the MAIMS Economic Journal. I also pay my sincere thanks to Authors, Reviewers and Advisory Board Members for their time and efforts to bring the inaugural issue of the Journal.

I am sure that this Journal will make significant contributions in promoting economic research and benefit scholars, academicians and policy makers around the world.

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MAIMS Economic Journal

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Vanita Tripathi**
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SEASONAL BEHAVIOR OF LIQUIDITY PREMIUM IN INDIAN STOCK MARKET

ABSTRACT: This study empirically investigates the seasonal behavior of liquidity premium in Indian stock market with the sample of BSE 500 stocks and Nifty 500 stocks representing Bombay Stock Exchange and National Stock Exchange respectively for a brief period from 1st April 2000 to 31st March 2017. We have employed four different proxies of liquidity - Trading volume, Turnover rate, Relative Spread & Amihud Illiquidity Ratio to strengthen the results. To capture seasonality on liquidity premium, we decompose the alpha and slope coefficients by using the dual beta model (Bhardwaj and Brooks, 1993) constructed by incorporating a dummy variable in the standard CAPM and liquidity augmented CAPM. The evidence suggests strong seasonal component in liquidity premium at both the exchanges such as (i) January Effect – the liquidity premium is reliably positive during non-January months whereas January generates negative or very low premium. (ii) April Effect – the month of April generates significantly higher liquidity premium relative to non-April months. It has strong inference for investors and portfolio managers who all are on the lookout for investment strategies that can lend a hand to beat the market.

Keywords: Liquidity Premium, Seasonality, January Effect, April Effect, Indian Stock Market
JEL Codes: C01, C10, C33, G3, H72

INTRODUCTION

"*Investors prefer to commit capital to liquid investments, which can be*

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traded quickly and at low cost whenever the need arises. Investments with less liquidity must offer higher expected returns to attract investors. In equilibrium, the expected returns on capital assets are increasing functions of both risk and illiquidity." (Amihud & Mendelson, 1991)

Liquidity is the market's ability to handle large orders from traders swiftly with least transaction cost and minimal influence on prices. If markets are fully efficient, then assets would be perfectly liquid where any amount of trade orders can be executed without influencing prices. But in reality, markets are not fully efficient due to the existence of market imperfections that lead to illiquidity. Amihud, Mendelson & Pedersen (2005) identified five market imperfections that drive the variations in stock liquidity–exogenous transaction costs, demand pressure, inventory risk, asymmetric information and search frictions. These market imperfections make trading expensive for traders eventually affecting stock prices. The risk of holding less liquid or illiquid securities that cannot be traded with ease at the prevailing prices in the market is known as liquidity risk. Investors face liquidity risk at the time of transfer of ownership of their assets, thus they should regard it as a significant element while evaluating their investment opportunities. Liquidity varies over time as well as across stocks, therefore risk-averse investors command superior returns for being exposed to liquidity risk.

The influential research of Amihud & Mendelson (1986) proposed that liquidity is a significant factor in the pricing of assets as the expected stock return increases with a drop in the level of liquidity as calculated by the bid-ask spread. Since then many studies like Amihud & Mendelson (1989), Brennan & Subrahmanyam (1996), Datar et al. (1998), Amihud (2002) and Liu (2006) all elaborate upon the role of liquidity as a determinant of equity returns and evidence the existence of liquidity premium in securities market by showing that investors command superior return for investing in illiquid stocks with high transaction cost. Eleswarapu & Reinganum (1993) pointed out on the seasonal behaviour of liquidity premium at NYSE and observed liquidity premium to be significantly positive only in January and does not exist otherwise. Hence, it is important to verify the realism of seasonal behaviour of liquidity premium at two premier stock exchanges of India i.e. BSE and NSE. In the Indian context, we should check the seasonality of liquidity premium through two probable ways: (i) January effect (because of the growing integration of Indian market around the globe) and (ii) April effect (equivalent to US market January effect).

LITERATURE REVIEW

The most influential work on this front owes to Amihud & Mendelson (1986), who theoretically modelled a marketplace where investors were

rational with diverse holding periods and assets having distinctive relative spread. The resulting market features were: (a) market average return goes up with spread, (b) expected stock returns increases with spread, (c) High spread stocks are preferred by investors with longer holding periods (clientele effect) & (d) stock return and spread relationship to be concave. They empirically examined the association between expected stock return and bid-ask spread for NYSE stocks over a period of 1961-1980 and found that stock return was a rising and concave function of the spread. Hence, liquidity is a significant factor in asset pricing and investors require compensation for the cost of illiquidity.

Following that paper, many studies have empirically investigated liquidity & stock return relationship using various proxies of liquidity such as bid-ask spread, turnover rate, trading volume, Amihud illiquidity ratio (daily price response associated with one dollar of trading volume) and others. Amihud & Mendelson (1989), Brennan & Subrahmanyam (1996), Eleswarapu (1997), Datar, Naik & Radcliffe (1998), Chalmers & Kadlec (1998), Chordia, Subrahmanyam & Anshuman (2001), Amihud (2002), Pastor & Stambaugh (2003), Liu (2006), Nguyen, Mishra & Ghosh (2007), Korajczyk & Sadka (2008), Hasbrouck (2009), Asparouhova, Bessembinder & Kalcheva (2010), Baradarannia & Peat (2013) and Kim & Na (2018) all examined the effect of liquidity on the pricing of securities in the U.S. equity market for NYSE, AMEX & NASDAQ stocks. Nevertheless, most of these papers support Amihud and Mendelson's (1986) finding. While most of the studies in the literature have been conducted for the U.S. market, but few studies do exist for other emerging markets like Marshall & Young (2003) examined Australian stock market; Wang & Cheng (2004), Wang & Kong (2010), Narayan & Zheng (2011) studied Shenzhen and Shanghai Stock Exchanges of the Chinese Stock Market; Chang, Faff & Hwang (2010) studied Tokyo Stock Exchange; Li, Sun & Wang (2011) examined Japanese Stock Market; Florackis, Gregoriou & Kostakis (2011) explored London Stock Exchange; Lam & Tam (2011) examined Hong Kong Stock Exchange and Hoang & Phan (2019) pursued Ho Chi Minh Stock Exchange in Vietnam market. Also, Bekaert, Harvey & Lundblad (2007) studied 19 emerging markets including India; Amihud et. al. (2015) scrutinized 45 countries around the world including 19 emerging & 26 developed markets and Chiang & Zheng (2015) explored the G7 countries. All these studies elaborate on the concerned issue in different markets across the globe and evidence that liquidity is a significant factor in the pricing of securities. As evidenced by the foregoing scrutiny, most of the studies have been performed on the U.S. market with only some studies on other emerging markets but none for the Indian market in isolation.

However, the literature has severely neglected the issue with respect to the seasonality of liquidity premium in the equity market. Eleswarapu &

Reinganum (1993) examined the seasonal behaviour of liquidity premium in the pricing of securities at NYSE by employing relative bid-ask spread to measure liquidity. A strong seasonal component was evidenced, where liquidity premium was substantially positive only in January and couldn't detect any affirmative liquidity premium for other than January months. Hence, in the absence of much literature on seasonality of liquidity premium, this research is substantial to fill a hole by studying the seasonal behavior of liquidity premium in the Indian stock market.

RESEARCH METHODOLOGY

Data: The sample consists of S&P BSE 500 stocks and Nifty 500 stocks to represent BSE and NSE respectively. They fairly represent the markets as both the indices have a broad spectrum of stocks belonging to 20 major industries of the economy and accounts for more than 90% market capitalisation of the exchanges. Also, the data is easily available for these companies than for the other companies that are not a part of these groups. The sample period ranges from 1st April 2000 to 31st March 2017, not including data before 2000 essentially because of the major developments in the market structure of Indian stock market during that period and data before this period is sparsely available. The record is mainly gathered from the CMIE Prowess and Thomson Reuters databases and official websites of BSE, NSE and RBI, all of these are renowned sources for providing accurate and complete historical data. The dataset includes:

- Monthly closing adjusted share prices of BSE and NSE sample stocks have been utilised to estimate the stock returns. The monthly stock returns are computed using the equation:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

  where,
  $R_{i,t}$ is the return on stock i in the month t
  $P_{i,t}$ is the closing adjusted share price of stock i in month t
  $P_{i,t-1}$ is the closing adjusted share price of stock i in month $t-1$.

- Monthly closing index values have been used to calculate monthly return on market portfolio (indices S&P BSE 500 & Nifty 500 are taken as proxies of the exchanges).
- The cut-off implicit yield on 91 days Treasury Bills considered as a risk-free return (RBI website).
- To compute different liquidity proxies for the sample stocks of BSE and NSE, two frequencies of data have been used that includes:

1. Daily Data: Bid price, ask price, mid-price, closing price, volume-weighted average price, trading volume (no. of shares traded).
2. Monthly Data: Volume-weighted average price, trading volume (no. of shares traded) and the number of outstanding shares.

It is important to specify that complete data set was not available for all the 500 sample companies of both BSE and NSE all through the sample span of 17 years, therefore the effectual number of stocks employed in the study varies from 265 to 490 over the period.

Construction of Liquidity Proxies: According to Liu (2006), "liquidity can be best described as the ability to trade large quantities quickly at low cost with little impact on price". Liquidity is a multidimensional concept, so we employ several liquidity proxies from the literature to capture different aspects of liquidity based on data availability. Many measures of liquidity have been proposed but none of them has been put superior to others. To study the effect of liquidity at BSE and NSE, the present study comprehensively employs four liquidity measures:

1. *Trading Volume:* Brennan & Subrahmanyam (1995) identified trading volume as a significant measure of liquidity. For a particular stock, it is directly related to liquidity as a large volume of trading signifies higher liquidity. For each stock, the monthly trading volume is computed as the value of shares traded over a month.

$$\text{Rupees Trading Volume}_t^i = V_{i,t} * P_{i,t}$$

where,
$V_{i,t}$ is trading volume (no. of shares traded) for stock i in month t
$P_{i,t}$ is volume weighted average price for stock i in month t

2. *Turnover Rate:* It is another important measure of liquidity capturing trading frequency calculated as a proportion of number of shares traded to shares outstanding during a particular month. For a stock, the turnover rate is positively related to liquidity implying greater the turnover rate, better the liquidity of an asset.

$$Turnover\ Rate_t^i = \frac{V_{i,t}}{Shares_{i,t}}$$

where,
$V_{i,t}$ is the total trading volume (no. of shares traded) for stock i in month t
$Shares_{i,t}$ is the number of shares outstanding for stock i in month t

3. *Relative (Quoted) Spread:* Amihud & Mendelson (1986) put forward a direct measure of transaction cost defined as the ask price minus the bid price, divided by the mid prices. It gauges illiquidity implying that stocks with higher spread have lesser liquidity (illiquid). Daily relative/quoted spread for each stock is computed with the formula:

$$\text{Quoted Spread}_d^i = \frac{P_{i,d}^A - P_{i,d}^B}{(P_{i,d}^A + P_{i,d}^B)/2}$$

where,
$P_{i,d}^A$ is the ask price for stock i on day d
$P_{i,d}^B$ is the buy price for stock i on day d

4. *Amihud Illiquidity (ILLIQ) Ratio:* Amihud (2002) defined this price impact measure of liquidity as – "daily price response associated with one dollar of trading volume". The core idea of ILLIQ ratio was that illiquid stocks have a lower capacity to absorb larges trades – implying that stocks with high ILLIQ ratio are less liquid. Illiq ratio is computed as:

$$ILLIQ_t^i = \frac{1}{D_t^i} \sum_{d=1}^{D_t^i} \frac{|R_{td}^i|}{V_{td}^i}$$

where,
$|R_{td}^i|$ is the absolute return of stock i in day d of month t
V_{td}^i is the trading volume (in million rupees)for the stock I on day d of month t
D_t^i is the total trading days for stock i in month t

Construction of Liquidity-Sorted Portfolios: Decile portfolios are created for all the liquidity proxies separately for each year throughout the sample span for the sample stocks of BSE and NSE. To begin with, decile portfolios were created on the basis of trading volume for each year all through the sample period. Every year June end, we sort the stocks in descending order based on the average trading volume in the previous year (in order of liquidity from most to least liquid). After that, the sorted securities were divided into decile portfolios (P1 to P10) and then for next twelve month (July of Y_t to June of Y_{t+1}) equally-weighted monthly returns are estimated for these portfolios. Then, the excess portfolio return is computed by deducting the risk-free rate from the portfolio returns. P1 (liquid portfolio) includes 10% of the most liquid stocks, while P10 (illiquid portfolio) comprises 10% of the least liquid stocks. A portfolio P10-P1 is also constructed to assess the economic feasibility of liquidity-based trading

strategy (buying P10 & short selling P1). Portfolios were continuously rebalanced all through the sample span in June end every year. This strategy is known as 12/12 strategy i.e. 12 months portfolio formation & 12 months portfolios holding period. For inclusion of a stock in portfolio formation process, it must be traded during the year. Similarly, liquidity-sorted decile portfolios were created for other three liquidity proxies' viz. turnover, relative spread and ILLIQ ratio. However, for the formation of liquidity portfolios for the relative spread and ILLIQ ratio (being direct measures of illiquidity) stocks were sorted in ascending order.

Notes:

- Portfolio formation starts from June, 2000 and continues throughout the sample period for all the proxies of liquidity.
- It is important to mention that financial year in India is from 1st April to 31st March every year, but the formation of portfolios is performed in each year June end with the assumption that financial data is available to investors at the time of investment decision to evade look ahead-bias.

Construction of Risk Factors: The following risk factors are used in regression models employed in this study:

Market Factor: Market Risk Premium ($R_{M_t} - R_{f_t}$) calculated by subtracting risk-free return (cut-off implicit yield on 91 days Treasury Bills) from the monthly return on the market portfolio - S&P BSE 500 & Nifty 500 indices are taken as the proxies of market portfolios of BSE & NSE respectively.

Liquidity Factor: IMV_t is estimated for each of the liquidity measures: trading volume, turnover, quoted spread & ILLIQ ratio separately. In June end each year, we sort the sample stocks into three liquidity portfolios (Very Liquid (V), Moderately Liquid (N) & Illiquid (I)) on a 30:40:30 divide using each liquidity measure independently. Then for the next twelve months (July of Y_t to June of Y_{t+1}), equally-weighted average monthly returns are computed for these three portfolios. Portfolios are rebalanced each year and it continues all through the sample period. Liquidity Factor (IMV_t) is the excess return on the portfolio of illiquid stocks (I) over very liquid stocks (V).

Risk-Adjusted Measures of Performance Evaluation: Following risk-adjusted ratios are calculated for the liquidity portfolios to assess their investment appraisal.

1. *Sharpe Ratio:* It measures the relationship between the average excess portfolio return ($R_P - R_f$) and the total risk of the portfolio. It does not presume well-diversified portfolios, so it employs standard deviation to measure of risk.

$$\text{Sharpe Ratio} = \frac{R_P - R_f}{\sigma_P}$$

where,
R_P is return of portfolio,
R_f is risk − free rate &
σ_P is standard deviation of portfolio.

2. *Treynor Ratio:* This ratio measures the relationship between the portfolio return over the risk-free rate with its systematic risk indicated by portfolio beta (β_P). As it accounts only systematic risk, it is mostly suitable for assessing the performance of diversified portfolios.

$$\text{Treynor Ratio} = \frac{R_P - R_f}{\beta_P}$$

where
R_P is the return of portfolio,
R_f is risk − free rate &
β_P is portfolio's beta (systematic risk).

3. *Information Ratio:* It is estimated as the residual return of the portfolio divided by tracking error. Residual return = portfolio return minus benchmark index return & tracking error is residual return standard deviation.

$$\text{Information Ratio} = \frac{E[R_P - R_B]}{\sqrt{var[R_P - R_B]}}$$

where, R_P is return of portfolio & R_B is index or benchmark return.

Regression Models: The well-documented models considered in this study are the Standard CAPM model of Sharpe (1964) & Lintner (1965) and Liquidity augmented CAPM Model to identify the existence of liquidity premium in India stock market.

Standard CAPM

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \varepsilon_t$$

Liquidity Augmented Standard CAPM

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{IMV}(IMV_t) + \varepsilon_t$$

where,
$R_{P_t} - R_{f_t}$ is portfolio excess return,
$\propto$ is the intercept,

$R_{M_t} - R_{f_t}$ is market excess return,
IMV_t is liquidity risk factors,
β_M & β_{IMV} are the slope coefficient for market and liquidity risk factors respectively &
ε_t is a residual term.

Effect of Seasonality: Eleswarapu & Reinganum (1993) examined the seasonal behaviour of liquidity premium at NYSE, where liquidity premium was observed only in January and does not exist otherwise. Therefore, it is essential to verify the realism of seasonal behaviour of liquidity at BSE and NSE. In the Indian context, we can check the seasonality through two probable ways: (i) January effect (because of the growing integration of Indian market around the globe) and (ii) April effect (equivalent to US market January effect).

First, we evaluate the performance of liquidity-sorted portfolios for January & Non-January months and April & non-April months by using performance evaluation measures. Further, to capture the January effect on liquidity premium at BSE and NSE, we decompose the alpha and slope coefficients for January & Non-January months using dual beta model (Bhardwaj and Brooks, 1993) constructed by incorporating a dummy variable (D_J) in standard CAPM and liquidity augmented CAPM. Similarly, to capture the April effect on liquidity premium at BSE and NSE, we decompose the alpha and slope coefficients for April and Non-April months by employing dual beta model constructed by incorporating a dummy variable (D_A) in standard CAPM and liquidity augmented CAPM.

- **January Effect**

Dummy variable (D_J) is formed by allotting 0 for non-January & 1 for January month. Following modified dual beta version of the factor models are estimated to capture the seasonality with respect to January effect.

Dummy Variable Regression

To isolate the liquidity effect in January & non-January months, the following dummy variable regression models are estimated for the liquidity-sorted decile portfolios:

$$R_P - R_f = \alpha_0 + D_J\alpha_1 + \beta_0\left(R_M - R_f\right) + \beta_1 D_J.\left(R_M - R_f\right) + \varepsilon_t$$
$$R_P - R_f = \alpha_0 + \alpha_1 D_J + \beta_0\left(R_M - R_f\right) + \beta_1 D_J.\left(R_M - R_f\right) + \beta_2 IMV + \beta_3 D_J.IMV + \varepsilon_t$$

where,
$R_P - R_f$ is portfolio excess return,
$\propto$ is the intercept,

$R_M - R_f$ is the market excess return,
IMV is the liquiidty factor,
ε_t is a residual term &
β_M & β_{IMV} are the slope coefficients for market and liquidity risk factors respectively.
D_J (Dummy Variable) = 0 for Non-January & 1 for January Month
α_0 = Intercept for Non-January Month
$\alpha_0 + \alpha_1$ = Intercept for January Month
β_0 = Slope of Market Risk for Non-January Month
$\beta_0 + \beta_1$ = Slope of Market Risk for January Month
β_2 = Slope of Liquidity Effect for Non-January Month
$\beta_2 + \beta_3$ = Slope of Liquidity Effect for January Month

- **April Effect**

Dummy variable (D_A) is formed by allotting 0 for the non-April months and 1 for the April. Following modified dual beta version of the factor models are estimated to capture the seasonality on account of April effect.

Dummy Variable Regression

To isolate liquidity effect in the April & non-April months, the following dummy variable regression models are estimated for the liquidity-sorted decile portfolios:

$$R_P - R_f = \alpha_0 + D_A\alpha_1 + \beta_0(R_M - R_f) + \beta_1 D_A.(R_M - R_f) + \varepsilon_t$$
$$R_P - R_f = \alpha_0 + \alpha_1 D_A + \beta_0(R_M - R_f) + \beta_1 D_A.(R_M - R_f) + \beta_2 IMV + \beta_3 D_A.IMV + \varepsilon_t$$

where,
$R_P - R_f$ is portfolio excess return,
$\propto$ is the intercept,
$R_M - R_f$ is market excess return,
IMV is the liquidity factor,
ε_t is a residual (random error) term &
β_M & β_{IMV} are the slope coefficients for market and liquidity risk factors respectively.
D_A (Dummy Variable) = 0 for Non-April & 1 for April Month
α_0 = Intercept for Non-April Month
$\alpha_0 + \alpha_1$ = Intercept for April Month
β_0 = Slope of Market Risk for Non-April Month
$\beta_0 + \beta_1$ = Slope of Market Risk for April Month
β_2 = Slope of Liquidity Effect for Non-April Month
$\beta_2 + \beta_3$ = Slope of Liquidity Effect for April Month

EMPIRICAL RESULTS

The results of liquid stocks portfolios (P1 & P2), illiquid stocks portfolios (P9 & P10) and liquidity-based investment strategy (P10-P1) are reported in the tables.

Performance evaluation of liquidity portfolios of BSE and NSE stocks is reported in table 1. As a first confirmatory indication of liquidity risk being a significant factor affecting stock returns, it is noticed that the portfolios across all four liquidity proxies show an increasing trend in mean monthly excess return as we go from first portfolio P1 (liquid stocks) to last P10 (illiquid stocks). It is to be noted that the average return of illiquid stocks portfolio (P10) is much higher than liquid stocks portfolio (P1). Illiquid stocks portfolio (P10) provides a superior return that is about two to three times of liquid stocks portfolio (P1). Long short liquidity-based trading strategy may be adopted by investors by going long on P10 and short on P1 to earn liquidity premium. A strong liquidity effect is observed such that when liquidity of portfolio decline, the average excess portfolio returns increases almost monotonically indicating that high risk related to illiquid stocks generates higher returns. This implies the relationship liquidity and stock returns to be negative.

In harmony with the theory of finance, where risk return go together in tandem, high risk in less liquid stocks portfolio generates a high Sharpe ratio. Sharpe ratio of portfolios increases monotonically from P1 to P10 signifying that as risk increases due to a drop in the level of liquidity, returns also increases. Sharpe ratio of P10 (Illiquid stocks portfolio) is about three to four times that of P1 (liquid stocks portfolio). Similarly, Treynor ratio and information ratio also increases almost monotonically from P1 to P10 for all the proxies of liquidity indicating investors are rewarded with superior returns for holding a risky portfolio of less liquid stocks. This validates the presence of a strong liquidity effect as liquidity risk in portfolio increases, returns also expand to recompense investors to put up for holding lesser liquid stocks.

The return performance of portfolios sorted on different liquidity measures is consistent with the risk-return trade off such that illiquid stocks portfolio (P10) provides higher returns than liquid stocks portfolio (P1). Mere confirmation of liquidity premium may not be exciting for the investors who look for abnormal profits. A more essential concern is to confirm the presence of observed liquidity premium through capital asset pricing framework.

Tables 2 presents the regression results of CAPM for liquidity-sorted portfolios derived from different liquidity proxies. Intercept value (α – a measure of abnormal returns) increases monotonically as we move from

liquid to illiquid stocks portfolio (i.e. P1 to P10) which indicates that as liquidity risk widens return also increases to compensate investors for holding illiquid stocks in their portfolios. This implies the existence of a negative or inverse relationship between liquidity and stock returns as abnormal return generated by portfolio increases with a decline in its liquidity level. These results verify the presence of strong liquidity premium in Indian stock market both at BSE and NSE such that illiquid stocks outperform liquid stocks. Mostly, the market beta "β_m" is greater than one and highly significant across portfolios. Market beta decreases as one move from liquid to illiquid stocks portfolio (P1 to P10) indicating that liquid stocks are more sensitive to market risk in comparison to illiquid stocks. A glance at the adjusted R^2 value provides evidence that market risk is a significant factor to capture a substantial amount of variation in stock returns, particularly for the portfolios of liquid stock. It is essential to point out that the adjusted R^2 value is low for illiquid stocks portfolios implying that the illiquid stocks portfolios have greater unexplained variations in their returns. The adjusted R^2 value declines as we move from P1 to P10 indicating that as illiquidity increases unexplained variations in portfolio returns also increases.

We advance our analysis to isolate the effect of liquidity risk in equity pricing at BSE and NSE by augmenting liquidity risk factor (IMV) in CAPM. The regression results of liquidity augmented standard CAPM are presented in table 3. With the insertion of liquidity factor in the asset pricing framework, there is a considerable improvement in adjusted R^2 values indicating that there is a significant enhancement in explaining variability of portfolio returns by liquidity-adjusted model. This implies that liquidity augmented asset pricing models can better explain cross-sectional variations in equity returns. Alpha values reduce and market factor coefficients continue to remain positive and significant across portfolios. However, when we involve liquidity risk factor in the asset pricing model, trend observed in intercept, adjusted R^2 and market beta values disappear. The liquidity-augmented model reveals that the liquidity (IMV) factor coefficients are statistically significant. Notably, the illiquid stocks portfolios have significantly positive IMV betas implying that investor's demand compensation for holding illiquid stocks; in contrast, the liquid stocks portfolios have significantly negative IMV betas suggesting that liquid stocks portfolios may offer lower returns for a given risk. A strong pattern of increasing slope coefficient of IMV factor is observed as we move from the portfolio of liquid to illiquid stocks (i.e. P1 to P10) implying that the illiquid stocks are more responsive to provide liquidity premium.

The liquidity premium is observed at both the exchanges such that investors get recompense through superior returns for holding illiquid stocks in their portfolios. The strength of results is proved using four alternate liquidity measures. Therefore, this research provides significant evidence for the pricing of liquidity risk at two leading stock exchanges in India.

[Insert Table 1 here]

[Insert Table 2 here]

[Insert Table 3 here]

January Effect

Table 4 presents the performance evaluation of liquidity portfolios of BSE and NSE for January & Non-January months. For non-January months, portfolios exhibit significantly positive average excess returns, while negative average portfolio returns are observed for January. An increasing trend in mean monthly excess returns is observed from portfolio P1 to P10 for non-January months, however no such pattern is noticed for January. Therefore, strong liquidity premium is observed only in non-January months at both the exchanges where illiquid stocks portfolio (P10) outperformed liquid stocks portfolio (P1). Similarly, performance evaluation ratios also mount from P1 to P10 across all proxies of liquidity during non-January months, however for January no such trend is observed and all these ratios are mostly negative. This indicates the existence of liquidity premium at BSE and NSE is confined to non-January months only with no premium visible in January.

Table 5 provides the results of standard CAPM for January & non-January months obtained by employing dummy variable regression. Results illustrate that in non-January months, abnormal returns (alpha values) are significantly positive for all portfolios and increases from P1 to P10 signifying that illiquid stock portfolio outperforms liquid stock portfolio. However, for January, abnormal returns are mostly negative implying that stocks prices fall severely and no fixed pattern is observed in its values as we move from P1 to P10. It is observed that abnormal returns of illiquid stocks portfolios (P9 & P10) are significantly higher in non-January months relative to January with differential returns being statistically significant across all liquidity proxies. At BSE, the liquidity premium earned for trading volume, turnover, relative spread & Illiq ratio sorted liquidity portfolios are found to be 3.68%, 1.18%, 3.82%, & 3.28% for non-January months and 0.29%, 0.97%, -0.42% & -1.29% for January respectively with differential being statistically significant. At NSE, the liquidity premium is found to be 3.66%, 1.34%, 3.07% & 2.86% for non-January months and 1.14%, 0.42%, -

0.56%, & -0.14% for January respectively. Liquidity premium in January is either very small or negative. Market betas are positive across portfolios and decreases as one move from P1 to P10 with the differential slopes being statistically insignificant between January & non-January months.

Table 6 presents dummy variable regression results of liquidity augmented Standard CAPM to isolate the January effect on liquidity premium at BSE and NSE. A strong pattern of increasing slope coefficient of IMV factor (β_{IMV}) is observed as we move from portfolio of liquid to illiquid stocks (P1 to P10) for non-January months. The illiquid stocks portfolios have positive and highly significant IMV betas; in contrast, the liquid stocks portfolios have negative IMV betas. Overall, the slope coefficient of the liquidity risk factor is higher in non-January months relative to January with differential slope being significant for illiquid stocks portfolio.

Eleswarapu & Reinganum (1993) stated the relationship between bid-ask spread and expected returns on stock to be seasonal at NYSE restricted to January only otherwise not. Our results evidence the existence of an inverse January effect on liquidity premium at both BSE and NSE in contrast to Eleswarapu & Reinganum (1993). The inverse January effect is noticed where significantly lower returns are observed for illiquid stocks during January relative to non-January months; indeed, the liquid stocks outperform illiquid stocks in January. Feasible reason for this occurrence could be that each year February end the Indian national budget is finalized which has critical repercussions for the securities market. A few months before the budget date there exists high uncertainties because of unexpected government policies. Therefore, the investors appear to hedge the macroeconomic insecurities by modifying their portfolios to liquid stocks and offload illiquid stocks. The existence of liquidity premium is confined to non-January months only where illiquid stocks have an edge over liquid stock as investors are rewarded with superior returns for including lesser liquid stocks in their portfolio. And so, the null hypothesis is rejected and finishes off with that the seasonality with respect to January effect does have a significant impact on liquidity premium as significantly higher premium can be earned in non-January months whereas January may provide negative or very low premium.

[Insert Table 4 here]

[Insert Table 5 here]

[Insert Table 6 here]

April Effect

Table 7 presents the performance evaluation of liquidity portfolios of BSE and NSE for April & Non-April months. Both for non-April & April months, liquidity portfolios exhibit significantly positive average excess returns and an increasing trend is observed in its values from portfolio P1 to P10. Performance evaluation ratios that are Sharpe, Treynor and information ratios, all boost up from portfolio P1 to P10 across all proxies of liquidity for both April & non-April months. The return tendency is much superior (more than double) in April relative to non-April months, this may be owing to tax-loss selling hypothesis or window dressing on financial year end similar to the US market January effect. Overall, illiquid stocks portfolio (P10) outperforms liquid stocks portfolio (P1) in both periods with returns being reasonably higher in April relative to non-April months at both the exchanges.

Table 8 provides the results of dummy variable regression on Standard CAPM to analyse the April effect on liquidity premium at BSE and NSE. In both non-April and April months, abnormal returns (alpha values) are significantly positive for all portfolios and increases from P1 to P10 signifying that illiquid stock portfolio outperforms liquid stock portfolio. However, it is observed that abnormal returns are significantly higher in April relative to non-April months with differential returns being statistically significant across all liquidity proxies. At BSE, the liquidity premium observed for trading volume, turnover, relative spread & Illiq ratio sorted liquidity portfolios are found to be 3.16%, 1.31%, 3.35% & 2.79% for non-April months and 7.31%, 0.25%, 6.32% & 5.78% for April respectively with differential being statistically significant. At NSE, the liquidity premium observed for trading volume, turnover, relative spread & Illiq ratio sorted liquidity portfolios are found to be 3.19%, 1.31%, 2.48%, & 2.33% for non-April months and 7.22%, 1.61%, 7.03% & 6.84% for April respectively with differential being statistically significant. Liquidity premium in April months is significantly higher in comparison to non-April months at both the exchanges. Market betas are positive across portfolios and higher in non-April relative to April with the differential slopes being statistically significant for illiquid stocks portfolios.

Table 9 illustrates dummy variable regression results of liquidity augmented Standard CAPM to isolate the April effect on liquidity premium at BSE and NSE. A strong pattern of increasing slope coefficient of IMV factor (β_{IMV}) is observed as we go from portfolio liquid to illiquid stocks (P1 to P10) for both April and non-April months. Overall, no fixed pattern of variation in slope coefficient of the liquidity risk factor is observed between April & other non-April months.

This put forward considerable evidence for the presence of strong April effect on liquidity premium both at BSE and NSE, to an extent similar to Eleswarapu & Reinganum (1993) January effect who reported seasonality of liquidity premium at NYSE as it was confined to January only otherwise not. But, at BSE and NSE we observed that liquidity premium can be earned in both April and non-April months but significantly higher premium is observed at April months with the differential return being statistically significant. It is observed that returns are significantly higher in April relative to non-April months. A probable explanation for this could be tax-loss selling and window dressing effect, where investors sell off stocks in losses in March end to lower their taxes on net capital gains or to present a better picture of their financial position and thereafter reinvest in next month resulting in large April returns.

Thus, the null hypothesis is not accepted seeing that seasonality with respect to April effect does have a significant impact on liquidity premium as significantly higher premium can be earned in April at both the exchanges may be due to tax-loss selling and window dressing hypotheses which is exactly similar to US market January effect.

[Insert Table 7 here]

[Insert Table 8 here]

[Insert Table 9 here]

CONCLUSION

This study addresses the seasonal behavior relating to January and April effect on liquidity premium at BSE and NSE with a sample of BSE 500 stocks and Nifty 500 stocks representative of two exchanges for time span from 1st April, 2000 to 31st March, 2017 by employing four different liquidity measures to strengthen the robustness of results. In harmony with the seminal work of Amihud & Mendelson (1986) in U.S. equity market, we have seen the presence of strong liquidity premium with a negative liquidity & stock returns relationship both at BSE and NSE signifying that investors call for extra return for being exposed to liquidity risk. It provides evidence for the reality of significant January effect on liquidity premium in contrast to Eleswarapu & Reinganum (1993). Liquidity premium can be earned in non-January months where illiquid stocks outperformed liquid stocks and January generates negative liquidity premium where liquid stocks outperformed illiquid stocks. The possible explanation for this occurrence could be that each year February end the Indian national budget is finalized which has critical repercussions for the securities market. It further

provides considerable evidence for the existence of strong April effect on liquidity premium at both exchanges to an extent similar to Eleswarapu & Reinganum (1993). We observed that significantly higher liquidity premium can be earned in April may be due to tax-loss selling and window dressing hypotheses which are exactly similar to US market January effect. On the whole, we wrap up by ruling that seasonality on account of January and April effect, have a substantial impact on liquidity premium on liquidity premium at BSE and NSE in Indian stock market.

The research has significant strategic inferences and is of pertinent use for companies, regulators and policymakers, stock analysts and the entire investment community. Investors and analysts may adopt a liquidity-based investment strategy that may provide extra risk-adjusted returns instead of relying on fundamental and technical portfolio management analysis. The investment basket can be designed using liquidity risk-return trade-off taking into consideration investor's investment horizon and risk aversion. Companies should enhance the liquidity of assets and increase transparency in their operations with better information availability to reduce their cost of capital. Companies can go for voluntary disclosures, even if they were not mandatory, publish forecasts and other data and provide ratings for their assets for improving liquidity to lessen the yield. The study illustrates the significance of microstructure and policies designed to enhance liquidity of securities and the market as a whole. Market regulators need to introduce strict norms and rules pertaining to facilitate a well-organized competitive market environment for exchange of securities. Proper designing of trading system, efficient execution of transaction, fair competition among market participants, enforcing rule that equalize disclosure to investors, to bring transparency in companies operations and restrict trading on insider's information all that can boost the liquidity and information symmetry and thereby promoting investment and economic growth in the country.

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TABLES

Table 1: Performance Evaluation of Liquidity-Sorted Portfolios

	BSE					NSE				
Portfolios	**P1 (Liquid)**	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**	**P1 (Liquid)**	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**
L1: Trading Volume										
Mean	0.0066	0.0109	0.0303	0.0384	0.0318	0.0036	0.0088	0.0243	0.0367	0.0331
t-stat.	0.949	1.700*	4.539***	5.882***	5.426***	0.556	1.431	4.020***	5.703***	6.453***
Sharpe Ratio	0.0670	0.1199	0.3202	0.4149	0.4657	0.0392	0.1009	0.2836	0.4023	0.5487
Treynor Ratio	0.0052	0.0095	0.0296	0.0394	-0.1075	0.0032	0.0082	0.0266	0.0391	-0.1798
Information Ratio	-0.0291	0.1042	0.4052	0.5361	0.1598	-0.0984	0.0449	0.3271	0.5025	0.1921
L2: Turnover Rate										
Mean	0.0162	0.0203	0.0223	0.0242	0.0080	0.0116	0.0139	0.0227	0.0210	0.0093
t-stat.	1.958*	2.908***	3.923***	4.296***	5.520***	1.431	2.051**	3.976***	3.757***	5.830***
Sharpe Ratio	0.1381	0.2051	0.2767	0.3030	0.1234	0.1009	0.1447	0.2805	0.2650	0.1478
Treynor Ratio	0.0112	0.0165	0.0239	0.0261	-0.0156	0.0084	0.0119	0.0254	0.0247	-0.0177
Information Ratio	0.1503	0.3079	0.3590	0.4104	-0.0419	0.0751	0.1599	0.3317	0.2818	-0.0279
L3: Relative (Quoted) Spread										
Mean	0.0069	0.0111	0.0275	0.0406	0.0337	0.0060	0.0086	0.0237	0.0332	0.0272
t-stat.	1.058	1.765*	4.354***	5.908***	5.827***	1.010	1.415	3.873***	5.091***	5.360***
Sharpe Ratio	0.0746	0.1245	0.3071	0.4167	0.4947	0.0712	0.0998	0.2732	0.3591	0.4773
Treynor Ratio	0.0058	0.0098	0.0270	0.0403	-0.1834	0.0058	0.0082	0.0247	0.0346	-0.3147
Information Ratio	-0.0209	0.1131	0.4189	0.5317	0.1851	-0.0337	0.0379	0.3374	0.4444	0.1460
L4: Amihud Illiquidity Ratio										
Mean	0.0093	0.0106	0.0265	0.0386	0.0292	0.0059	0.0096	0.0241	0.0312	0.0252
t-stat.	1.491	1.699*	4.416***	5.324***	5.061***	0.999	1.577	3.813***	4.805***	4.808***
Sharpe Ratio	0.1051	0.1199	0.2925	0.3755	0.4434	0.0704	0.1112	0.2689	0.3389	0.4370
Treynor Ratio	0.0082	0.0094	0.0265	0.0349	-0.7133	0.0056	0.0092	0.0250	0.0330	-0.2345
Information Ratio	0.0646	0.1042	0.3668	0.4995	0.1575	-0.0400	0.0657	0.3148	0.4040	0.1242

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively

Table 2: Results of Standard CAPM for Liquidity-Sorted Portfolios

Portfolios		BSE					NSE				
		P1 (Liquid)	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**	**P1 (Liquid)**	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**
L1: Trading Volume											
Constant	$\propto$	-0.0030	0.0021	0.0225	0.0310	0.0340	-0.0045	0.0011	0.0178	0.0300	0.0344
	t-stat.	-1.5353	1.0141	5.657***	7.5953***	7.4112***	-1.7774*	0.4553	4.8007***	7.2025***	8.2469***
Market	β_m	1.2690	1.1557	1.0246	0.9736	-0.2954	1.1222	1.0643	0.9154	0.9381	-0.1841
	t-stat.	47.8595***	40.77***	19.2118***	17.8383***	-4.8082***	33.3097***	31.5932***	18.4343***	16.8327***	-3.292***
Adjusted R^2		0.9197	0.8925	0.6479	0.6133	0.0996	0.8472	0.8329	0.6288	0.5854	0.0469
L2: Turnover Rate											
Constant	$\propto$	0.0052	0.0110	0.0152	0.0172	0.0119	0.0018	0.0055	0.0163	0.0149	0.0131
	t-stat.	1.5747	4.1087***	5.2635***	6.0163***	3.1969***	0.4758	1.9329*	4.9774***	4.4006***	3.7335***
Market	β_m	1.4437	1.2322	0.9332	0.9281	-0.5156	1.3755	1.1704	0.8916	0.8476	-0.5279
	t-stat.	32.4837***	34.4249***	24.1626***	24.2829***	-10.304***	27.5741***	30.6505***	20.3364***	18.6932***	-11.2124***
Adjusted R^2		0.8405	0.8555	0.7445	0.7464	0.3446	0.7915	0.8243	0.6735	0.6353	0.3841
L3: Relative (Quoted) Spread											
Constant	$\propto$	-0.0021	0.0025	0.0197	0.0329	0.0351	-0.0015	0.0011	0.0168	0.0263	0.0278
	t-stat.	-1.0660	1.2071	5.8555***	7.4664***	7.399***	-0.6218	0.4272	4.834***	6.3301***	6.9154***
Market	β_m	1.1919	1.1271	1.0176	1.0084	-0.1835	1.0477	1.0397	0.9623	0.9613	-0.0864
	t-stat.	44.9385***	40.569***	22.5662***	17.0694***	-2.8929***	33.298***	29.6668***	20.6236***	17.2442***	-1.6039
Adjusted R^2		0.9098	0.8916	0.7176	0.5921	0.0355	0.8471	0.8147	0.6797	0.5971	0.0078
L4: Amihud Illiquidity Ratio											
Constant	$\propto$	0.0006	0.0020	0.0189	0.0302	0.0295	-0.0016	0.0021	0.0172	0.0244	0.0260
	t-stat.	0.3637	1.0435	5.1601***	6.9024***	6.3106***	-0.7346	0.8002	4.5056***	5.797***	6.4006***
Market	β_m	1.1450	1.1312	1.0002	1.1041	-0.0410	1.0510	1.0483	0.9635	0.9434	-0.1076
	t-stat.	48.7057***	43.5509***	20.4057***	18.8596***	-0.6538	36.0217***	29.2909***	18.8005***	16.7263***	-1.9768**
Adjusted R^2		0.9222	0.9046	0.6750	0.6394	-0.0029	0.8664	0.8108	0.6380	0.5823	0.0143

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively

Table 3: Results of Liquidity Augmented Standard CAPM for Liquidity-Sorted Portfolios

Portfolios		BSE					NSE				
		P1 (Liquid)	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**	**P1 Liquid)**	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**
L1: Trading Volume											
Constant	$\propto$	0.0017	0.0046	0.0007	0.0079	0.0063	-0.0004	0.0040	-0.0011	0.0075	0.0079
	t-stat.	0.8114	1.9996**	0.2814	3.2764***	2.8783***	-0.1341	1.4313	-0.3744	2.509**	3.9271***
Market	β_m	1.2293	1.1348	1.2086	1.1679	-0.0614	1.0940	1.0448	1.0450	1.0922	-0.0019
	t-stat.	47.4075***	38.8625***	37.7546***	38.2552***	-2.237**	32.2605***	30.3652***	29.4373***	29.4985***	-0.0750
Liquidity	β_{IMV}	-0.4386	-0.2309	2.0332	2.1468	2.5854	-0.3956	-0.2735	1.8199	2.1654	2.5611
	t-stat.	-5.35***	-2.5006**	20.0893***	22.243***	29.8016***	-3.3514***	-2.2833**	14.7281***	16.8023***	29.6518***
Adjusted R^2		0.9295	0.8953	0.8835	0.8889	0.8350	0.8546	0.8364	0.8220	0.8282	0.8239
L2: Turnover Rate											
Constant	$\propto$	0.0093	0.0129	0.0113	0.0133	0.0040	0.0087	0.0090	0.0091	0.0082	-0.0005
	t-stat.	3.1971***	4.9805***	4.6072***	5.4926***	2.113**	2.447**	3.1433***	3.0571***	2.583**	-0.2775
Market	β_m	1.2288	1.1300	1.1378	1.1301	-0.0987	1.1507	1.0558	1.1262	1.0660	-0.0848
	t-stat.	26.3948***	27.2696***	29.1279***	29.211***	-3.276***	20.2484***	22.9241***	23.6268***	20.9645***	-3.0432***
Liquidity	β_{IMV}	-1.2931	-0.6151	1.2308	1.2155	2.5086	-1.3269	-0.6764	1.3851	1.2894	2.6162
	t-stat.	-8.2048***	-4.3848***	9.308***	9.2814***	24.5988***	-6.557***	-4.1247***	8.1611***	7.1217***	26.3809***
Adjusted R^2		0.8804	0.8676	0.8214	0.8224	0.8376	0.8279	0.8374	0.7545	0.7082	0.8629
L3: Relative (Quoted) Spread											
Constant	$\propto$	0.0021	0.0028	0.0013	0.0068	0.0046	0.0015	0.0019	0.0003	0.0049	0.0034
	t-stat.	1.0055	1.2175	0.5286	2.4414**	1.9717*	0.5831	0.6565	0.1111	1.6407	1.7506*
Market	β_m	1.1592	1.1245	1.1595	1.2099	0.0507	1.0354	1.0364	1.0311	1.0506	0.0152
	t-stat.	43.8653***	38.7678***	38.2105***	35.0289***	1.7309*	33.0507***	29.2087***	30.7189***	28.8932***	0.6427
Liquidity	β_{IMV}	-0.3959	-0.0312	1.7176	2.4383	2.8342	-0.3148	-0.0840	1.7609	2.2858	2.6006
	t-stat.	-4.4195***	-0.3170	16.6983***	20.8258***	28.545***	-2.675***	-0.6300	13.9652***	16.7345***	29.283***
Adjusted R^2		0.9175	0.8911	0.8821	0.8715	0.8105	0.8517	0.8141	0.8378	0.8323	0.8129
L4: Amihud Illiquidity Ratio											
Constant	$\propto$	0.0033	0.0019	0.0007	0.0070	0.0037	0.0004	0.0028	0.0018	0.0069	0.0066
	t-stat.	1.7783*	0.9050	0.3072	2.9311***	1.6672*	0.1540	0.9878	0.6649	2.4296**	3.3596***
Market	β_m	1.1355	1.1315	1.0653	1.1873	0.0519	1.0429	1.0455	1.0277	1.0160	-0.0268

Portfolios		BSE					NSE				
		P1 (Liquid)	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**	**P1 Liquid)**	**P2**	**P9**	**P10 (Illiquid)**	**P10-P1**
	t-stat.	49.4012***	43.1673***	36.8187***	40.4547***	1.9147*	35.9174***	28.9714***	30.2502***	28.2829***	-1.0887
Liquidity	β_{IMV}	-0.2828	0.0112	1.9273	2.4630	2.7459	-0.2459	-0.0866	1.9429	2.1996	2.4455
	t-stat.	-3.605***	0.1254	19.5128***	24.5845***	29.7044***	-2.3928**	-0.6783	16.1597***	17.301***	28.0341***
Adjusted R^2		0.9266	0.9041	0.8883	0.9106	0.8153	0.8695	0.8103	0.8431	0.8328	0.8006

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

Table 4: Performance Evaluation of Liquidity-Sorted Portfolios for January & Non-January Months

Portfolios		BSE					NSE				
		P1	**P2**	**P9**	**P10**	**P10-P1**	**P1**	**P2**	**P9**	**P10**	**P10-P1**
L1: Trading Volume											
Non-January	Mean	0.0086	0.0137**	0.0345***	0.0425***	0.0340***	0.006	0.0107*	0.0288***	0.0409***	0.0349***
	Sharpe Ratio	0.0874	0.1515	0.3656	0.4608	0.4940	0.0663	0.1245	0.3399	0.4502	0.5763
	Treynor Ratio	0.0068	0.0120	0.0341	0.0442	-0.1136	0.0054	0.0102	0.0322	0.0442	-0.1819
	Information Ratio	-0.0266	0.1341	0.4408	0.5676	0.2101	-0.0822	0.0454	0.3715	0.5347	0.2428
January	Mean	-0.0146	-0.0186	-0.0153	-0.0068	0.0078	-0.0229	-0.012	-0.0238	-0.0088	0.0141
	Sharpe Ratio	-0.1389	-0.1868	-0.1748	-0.0811	-0.1389	-0.2483	-0.1238	-0.2773	-0.1033	-0.2483
	Treynor Ratio	-0.0105	-0.0145	-0.0143	-0.0068	-0.0105	-0.0196	-0.0098	-0.0230	-0.0090	-0.0196
	Information Ratio	-0.0519	-0.1557	-0.0679	0.1436	0.1801	-0.3116	0.0378	-0.2864	0.1051	0.2606
L2: Turnover Rate											
Non-January	Mean	0.0202**	0.0237***	0.0259***	0.0273***	0.0071	0.0157**	0.0174***	0.0265***	0.0245***	0.0089
	Sharpe Ratio	0.1738	0.2411	0.3229	0.3411	0.1084	0.1381	0.1840	0.3292	0.3108	0.1418
	Treynor Ratio	0.0142	0.0194	0.0278	0.0296	-0.0141	0.0116	0.0151	0.0301	0.0292	-0.0174
	Information Ratio	0.1896	0.3479	0.4054	0.4329	-0.0189	0.1120	0.2001	0.3655	0.3109	-0.0015
January	Mean	-0.0272	-0.016	-0.0168	-0.0092	0.018	-0.0321	-0.0243	-0.0183	-0.0176	0.0145
	Sharpe Ratio	-0.2221	-0.1522	-0.2217	-0.1268	-0.2221	-0.2512	-0.2317	-0.2405	-0.2429	-0.2512
	Treynor Ratio	-0.0173	-0.0119	-0.0192	-0.0101	-0.0173	-0.0198	-0.0185	-0.0196	-0.0206	-0.0198

Portfolios		**BSE**					**NSE**				
		P1	**P2**	**P9**	**P10**	**P10-P1**	**P1**	**P2**	**P9**	**P10**	**P10-P1**
	Information Ratio	-0.2456	-0.0762	-0.1014	0.1150	0.2411	-0.3094	-0.2584	-0.1666	-0.1197	0.1995
L3: Relative (Quoted) Spread											
Non-January	Mean	0.0090*	0.0141***	0.0310***	0.0456***	0.0366**	0.0080*	0.0119**	0.0274***	0.0379***	0.0299*
	Sharpe Ratio	0.0978	0.1608	0.3481	0.4685	0.5385	0.0952	0.1428	0.3171	0.4117	0.5311
	Treynor Ratio	0.0076	0.0127	0.0308	0.0455	-0.2120	0.0077	0.0118	0.0286	0.0400	-0.3482
	Information Ratio	-0.0151	0.1559	0.4479	0.5795	0.2470	-0.0324	0.0782	0.3733	0.4858	0.2126
January	Mean	-0.0153	-0.0217	-0.0107	-0.0137	0.0016	-0.0149	-0.0273	-0.0164	-0.0175	-0.0026
	Sharpe Ratio	-0.1459	-0.2203	-0.1222	-0.1657	-0.1459	-0.1561	-0.2570	-0.1984	-0.2085	-0.1561
	Treynor Ratio	-0.0110	-0.0172	-0.0098	-0.0148	-0.0110	-0.0123	-0.0204	-0.0176	-0.0178	-0.0123
	Information Ratio	-0.0712	-0.2338	0.0523	-0.0229	0.1193	-0.0463	-0.3242	-0.0691	-0.1044	0.1006
L4: Amihud Illiquidity Ratio											
Non-January	Mean	0.0113	0.0134**	0.0301***	0.0440***	0.0327***	0.0082	0.0117*	0.0285***	0.0358***	0.0276***
	Sharpe Ratio	0.1288	0.1530	0.3356	0.4278	0.5016	0.0978	0.1375	0.3223	0.3919	0.4770
	Treynor Ratio	0.0100	0.0120	0.0307	0.0397	-1.3240	0.0078	0.0114	0.0303	0.0385	-0.2346
	Information Ratio	0.0706	0.1366	0.3965	0.5586	0.2312	-0.0273	0.0705	0.3584	0.4459	0.1836
January	Mean	-0.012	-0.0199	-0.0125	-0.0199	-0.0079	-0.0187	-0.0128	-0.0236	-0.0186	0.0001
	Sharpe Ratio	-0.1205	-0.2107	-0.1331	-0.2365	-0.1205	-0.2177	-0.1259	-0.2585	-0.2139	-0.2177
	Treynor Ratio	-0.0092	-0.0157	-0.0108	-0.0219	-0.0092	-0.0170	-0.0100	-0.0216	-0.0189	-0.0170
	Information Ratio	0.0162	-0.2727	0.0016	-0.1410	0.0398	-0.2107	0.0137	-0.2511	-0.1144	0.1363

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively

Table 5: Results of Standard CAPM of Liquidity-Sorted Portfolios for January & Non-January Months

Portfolios		BSE					NSE				
		P1	P2	P9	P10	P10-P1	P1	P2	P9	P10	P10-P1
L1: Trading Volume											
Non-January	$\propto$	-0.0033	0.0028	0.0249***	0.0334***	0.0368***	-0.0041	0.0011	0.0207***	0.0324***	0.0366***
	β_m	1.2603***	1.1424***	1.0119***	0.9612***	-0.299***	1.1167***	1.0495***	0.8937***	0.925***	-0.1916***
January	$\propto$	0.0028	-0.0024	-0.0018*	0.0058*	0.0029**	-0.0072	0.0044	-0.0099**	0.0041*	0.0114*
	β_m	1.3904	1.2858	1.0666	1.0082	-0.3821	1.1682	1.2331	1.0346	0.9726	-0.1955
L2: Turnover Rate											
Non-January	$\propto$	0.0067*	0.0121***	0.017***	0.0185***	0.0118***	0.0034	0.0069**	0.0185***	0.0169***	0.0134***
	β_m	1.4275***	1.2186***	0.9307***	0.9241***	-0.5034***	1.3474***	1.1521***	0.879***	0.8391***	-0.5083***
January	$\propto$	-0.0074	0.0009	-0.0057**	0.0022**	0.0097*	-0.0104	-0.0067	-0.0058**	-0.0062*	0.0042
	β_m	1.5716	1.3431	0.8746	0.9107	-0.6609	1.6244	1.3153	0.9358	0.8530	-0.7714
L3: Relative (Quoted) Spread											
Non-January	$\propto$	-0.0021	0.0035	0.0214***	0.0361***	0.0382***	-0.0013	0.0027	0.0187***	0.0293***	0.0307***
	β_m	1.1759***	1.112***	1.0051***	1.0031***	-0.1727***	1.0336***	1.0076***	0.9574***	0.9477***	-0.0859
January	$\propto$	0.0022	-0.0057	0.0030*	-0.002**	-0.0042**	0.0012	-0.0094	-0.0039*	-0.0043**	-0.0056**
	β_m	1.3896**	1.2614	1.0881	0.9220	-0.4675	1.2075	1.3377***	0.9311	0.9832	-0.2242
L4: Amihud Illiquidity Ratio											
Non-January	$\propto$	0.0006	0.0028	0.0208***	0.0334***	0.0328***	-0.0012	0.0024	0.02***	0.0273***	0.0286***
	β_m	1.1317***	1.1172***	0.9799***	1.1071***	-0.0246	1.0459***	1.0268***	0.9417***	0.9284***	-0.1174**
January	$\propto$	0.0044	-0.0039	0.0020*	-0.0084***	-0.0129***	-0.0040	0.0043	-0.009**	-0.0054**	-0.0014**
	β_m	1.3102**	1.2630	1.1584	0.9097	-0.4005	1.0945	1.2855**	1.0892	0.9823	-0.1122

Note: (i) Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively. (ii) Statistical significance of alpha and beta coefficients for January represents the significance of differential slope and beta coefficients in dummy variable regression

Table 6: Results of Liquidity Augmented Standard CAPM of Liquidity-Sorted Portfolios for January & Non-January Months

Portfolios		BSE					NSE				
		P1	P2	P9	P10	P10-P1	P1	P2	P9	P10	P10-P1
L1: Trading Volume											
Non-January	$\propto$	0.0013	0.0053**	0.0010	0.0079***	0.0066***	0.0001	0.0039	0.0001	0.0079**	0.0078***
	β_m	1.2243***	1.1229***	1.1961***	1.1573***	-0.0669**	1.0899***	1.0319***	1.0248***	1.0811***	-0.0087
	β_{IMV}	-0.4013***	-0.2176**	2.0536***	2.1847***	2.586***	-0.3742***	-0.2457*	1.8266***	2.1752***	2.5494***
January	$\propto$	0.0029	-0.0023	-0.0019	0.0057	0.0027	-0.0071	0.0045	-0.0102	0.0038	0.0109
	β_m	1.2476	1.1932	1.3029	1.2200	-0.0275	1.0641	1.1614	1.1822	1.1722	0.1081
	β_{IMV}	-0.9977	-0.6466	1.6505*	1.4792*	2.4770	-0.9843	-0.6783	1.3971*	1.8887*	2.8731
L2: Turnover Rate											
Non-January	$\propto$	0.0111***	0.0141***	0.013***	0.0143***	0.0031	0.0109***	0.0105***	0.0106***	0.0095***	-0.0013
	β_m	1.212***	1.1256***	1.1249***	1.1284***	-0.0835***	1.127***	1.0465***	1.1106***	1.056***	-0.0709**
	β_{IMV}	-1.3182***	-0.5687***	1.1876***	1.2494***	2.5677***	-1.3296***	-0.6369***	1.397***	1.3089***	2.6386***
January	$\propto$	-0.0075*	0.0008	-0.0056**	0.0023	0.0098	-0.0109*	-0.0071*	-0.0055	-0.0059	0.0049
	β_m	1.3441	1.0693	1.2142	1.0501	-0.294*	1.2778	0.9997	1.1846	1.0494	-0.2283
	β_{IMV}	-1.0867	-1.3080	1.6222	0.6662*	1.7529**	-1.5078	-1.3727	1.0824	0.8544*	2.3623
L3: Relative (Quoted) Spread											
Non-January	$\propto$	0.0022	0.0040	0.0009	0.0073**	0.005**	0.0011	0.0030	0.0008	0.0056*	0.0045**
	β_m	1.1465***	1.1091***	1.1427***	1.196***	0.0494	1.0251***	1.0065***	1.0181***	1.0278***	0.0027
	β_{IMV}	-0.3769***	-0.0376	1.7656***	2.4738***	2.8507***	-0.251**	-0.0302	1.7804***	2.3491***	2.6002***
January	$\propto$	0.0017	-0.0058	0.0042	-0.0004	-0.0022	0.0016	-0.0092	-0.0046	-0.0050	-0.0066*
	β_m	1.2983	1.2471	1.3454	1.2615	-0.0368	1.0919	1.254*	1.1286	1.1815	0.0895
	β_{IMV}	-0.4978	-0.0783	1.4033	1.8512*	2.3490*	-0.9074	-0.6571	1.5503	1.5562*	2.4637
L4: Amihud Illiquidity Ratio											
Non-January	$\propto$	0.0033*	0.0028	0.0003	0.0078***	0.0045**	0.0007	0.0028	0.0025	0.0077**	0.0069***
	β_m	1.1232***	1.1171***	1.0446***	1.1881***	0.0649**	1.0385***	1.0253***	1.0043***	0.9988***	-0.0397
	β_{IMV}	-0.2574***	-0.0027	1.9494***	2.4405***	2.698***	-0.2303**	-0.0445	1.9575***	2.201***	2.4314***
January	$\propto$	0.0026	-0.0037	0.0078	-0.0012	-0.0038	-0.0063	0.0022	-0.0036	0.0012	0.0076
	β_m	1.2524	1.2685	1.3393***	1.1368	-0.1156*	1.0318	1.2301	1.2353*	1.1648	0.133*
	β_{IMV}	-0.6287	0.0599	1.9698	2.4718	3.1006	-0.7052	-0.6220	1.6403	2.0499	2.7552

Note: (i) Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.
(ii) Statistical significance of alpha and beta coefficients for January represents the significance of differential slope and beta coefficients in dummy variable regression

Table 7: Performance Evaluation of Liquidity-Sorted Portfolios for April & Non-April Months

Portfolios		BSE					NSE				
		P1	P2	P9	P10	P10-P1	P1	P2	P9	P10	P10-P1
L1: Trading Volume											
Non-April	Mean	0.0040**	0.0079**	0.0261**	0.0340**	0.0300***	0.0018**	0.0066**	0.0206**	0.0327**	0.0309***
	Sharpe Ratio	0.0398	0.0856	0.2724	0.3639	0.4504	0.0194	0.0741	0.2378	0.3536	0.5170
	Treynor Ratio	0.0031	0.0068	0.0254	0.0343	-0.1084	0.0016	0.0061	0.0221	0.0345	-0.1836
	Information Ratio	-0.0628	0.0563	0.3574	0.4999	0.2062	-0.1181	0.0138	0.2889	0.4586	0.2335
April	Mean	0.0369**	0.0455**	0.0787**	0.0893**	0.0524**	0.0240**	0.0340**	0.0681**	0.0825**	0.0585**
	Sharpe Ratio	0.4799	0.7492	1.2543	1.3782	0.6180	0.3235	0.6024	1.0331	1.4113	0.9314
	Treynor Ratio	0.0286	0.0492	0.1070	0.2049	-0.0613	0.0198	0.0456	0.1699	0.1633	-0.0827
	Information Ratio	0.4522	0.6958	1.1092	0.9574	0.2227	0.1226	0.3464	0.6942	1.0841	0.3741
L2: Turnover Rate											
Non-April	Mean	0.0113**	0.0170**	0.0191**	0.0214**	0.0101***	0.0076**	0.0110**	0.0203**	0.0176**	0.0100**
	Sharpe Ratio	0.0954	0.1670	0.2350	0.2634	0.1540	0.0654	0.1138	0.2468	0.2210	0.1553
	Treynor Ratio	0.0079	0.0136	0.0203	0.0229	-0.0202	0.0056	0.0095	0.0225	0.0206	-0.0191
	Information Ratio	0.0897	0.2595	0.3300	0.3807	0.0315	0.0259	0.1191	0.3078	0.2418	0.0306
April	Mean	0.0728**	0.0595**	0.0591**	0.0568**	-0.0160**	0.0576**	0.0470**	0.0500**	0.0599**	0.0023**
	Sharpe Ratio	0.8434	1.1162	0.9462	1.0432	-0.2914	0.6915	0.5844	0.8790	0.9518	0.0427
	Treynor Ratio	0.0509	0.0760	0.0921	0.0856	0.0209	0.0442	0.0375	0.0859	0.1011	-0.0032
	Information Ratio	1.2874	1.1103	0.6380	0.7450	-0.3799	0.7958	0.5973	0.5820	0.6914	-0.1736
L3: Relative (Quoted) Spread											
Non-April	Mean	0.0046**	0.0080**	0.0231**	0.0370**	0.0325**	0.0047**	0.0061**	0.0208**	0.0291**	0.0244**
	Sharpe Ratio	0.0483	0.0883	0.2569	0.3734	0.4793	0.0542	0.0698	0.2370	0.3106	0.4380
	Treynor Ratio	0.0038	0.0071	0.0225	0.0363	-0.1952	0.0045	0.0059	0.0215	0.0299	-0.3319
	Information Ratio	-0.0504	0.0598	0.3768	0.4962	0.2379	-0.0423	-0.0006	0.3073	0.3998	0.1856
April	Mean	0.0345**	0.0467**	0.0779**	0.0819**	0.0473**	0.0218**	0.0373**	0.0580**	0.0812**	0.0593**
	Sharpe Ratio	0.4608	0.7694	1.1593	1.3009	0.6568	0.3355	0.5775	0.8102	1.2889	0.9401
	Treynor Ratio	0.0271	0.0484	0.1296	0.1320	-0.0723	0.0201	0.0364	0.0769	0.1563	-0.1047
	Information Ratio	0.4229	0.8650	0.8633	1.0217	0.2049	0.0822	0.5273	0.6378	0.9945	0.3964

Portfolios		**BSE**					**NSE**				
		P1	**P2**	**P9**	**P10**	**P10-P1**	**P1**	**P2**	**P9**	**P10**	**P10-P1**
L4: Amihud Illiquidity Ratio											
Non-April	Mean	0.0070**	0.0077**	0.0229**	0.0348**	0.0278**	0.0045**	0.0080**	0.0195**	0.0273**	0.0228***
	Sharpe Ratio	0.0780	0.0852	0.2494	0.3331	0.4228	0.0532	0.0904	0.2188	0.2921	0.4016
	Treynor Ratio	0.0062	0.0068	0.0227	0.0313	-1.1013	0.0043	0.0076	0.0202	0.0285	-0.2616
	Information Ratio	0.0310	0.0519	0.3283	0.4596	0.2126	-0.0513	0.0507	0.2647	0.3606	0.1668
April	Mean	0.0364**	0.0448**	0.0677**	0.0825**	0.0461**	0.0221**	0.0282**	0.0775**	0.0758**	0.0537**
	Sharpe Ratio	0.4850	0.6989	1.1073	1.2016	0.6723	0.3038	0.5221	0.9623	1.3370	0.8398
	Treynor Ratio	0.0286	0.0428	0.1016	0.1046	-0.0945	0.0181	0.0348	0.1093	0.1643	-0.0707
	Information Ratio	0.4926	0.8666	0.8426	1.0922	0.2069	0.0794	0.2626	0.7992	0.9614	0.3215

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively

Table 8: Results of Standard CAPM of Liquidity-Sorted Portfolios for April & Non-April Months

Portfolios		BSE					NSE				
		P1	P2	P9	P10	P10-P1	P1	P2	P9	P10	P10-P1
L1: Trading Volume											
Non-April	$\propto$	-0.0038*	0.0007	0.0198***	0.0278***	0.0316***	-0.005*	0.0001	0.0148***	0.0269***	0.0319***
	β_m	1.2654***	1.1621***	1.0293***	0.9888***	-0.2766***	1.1171***	1.0747***	0.9298***	0.9487***	-0.1684***
April	$\propto$	0.0055	0.023***	0.0608***	0.0787***	0.0731**	0.0004	0.0194**	0.0603***	0.0727***	0.0722**
	β_m	1.2903	0.9245*	0.7354	0.4357**	-0.8546*	1.2125	0.7457*	0.4009**	0.5054**	-0.7071*
L2: Turnover Rate											
Non-April	$\propto$	0.0024	0.0092***	0.0132***	0.0156***	0.0131***	-0.0007	0.0039	0.0148***	0.0123***	0.0131***
	β_m	1.4354***	1.2478***	0.9408***	0.9356***	-0.4997***	1.3725***	1.1632***	0.9008***	0.8521***	-0.5203***
April	$\propto$	0.0381***	0.0404***	0.0435***	0.0406**	0.0025	0.0322**	0.0226*	0.0387*	0.0483***	0.0161
	β_m	1.429	0.7825***	0.6415	0.6628*	-0.7662	1.3054	1.2532	0.5824	0.5927**	-0.7126
L3: Relative (Quoted) Spread											
Non-April	$\propto$	-0.0027	0.001	0.0167***	0.0307***	0.0335***	-0.0017	-0.0002	0.0148***	0.0231***	0.0248***
	β_m	1.1859***	1.1299***	1.0275***	1.0195***	-0.1663**	1.0455***	1.037***	0.9662***	0.972***	-0.0735
April	$\propto$	0.0036	0.0233***	0.0633***	0.0668**	0.0632**	0.0007	0.0174*	0.0433**	0.071***	0.0703***
	β_m	1.2753	0.9646	0.6008**	0.6203*	-0.655	1.0862	1.0245	0.7546	0.5193**	-0.5668*
L4: Amihud Illiquidity Ratio											
Non-April	$\propto$	0	0.0006	0.0167***	0.0279***	0.0279***	-0.0018	0.0015	0.0136***	0.0214***	0.0233***
	β_m	1.1368***	1.1308***	1.0088***	1.1116***	-0.0252	1.0434***	1.0567***	0.9655***	0.9563***	-0.087
April	$\propto$	0.0054	0.0194**	0.0515**	0.0633**	0.0578**	-0.0016	0.0124	0.0637***	0.0668***	0.0684***
	β_m	1.2755	1.0471	0.6663**	0.7882*	-0.4873	1.2208	0.8122	0.7092	0.4612*	-0.7595**

Note: (i) Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively. (ii) Statistical significance of alpha and beta coefficients for April represents the significance of differential slope and beta coefficients in dummy variable regression.

Table 9: Results of Liquidity Augmented Standard CAPM of Liquidity-Sorted Portfolios for April & Non-April Months

Portfolios		BSE					NSE				
		P1	P2	P9	P10	P10-P1	P1	P2	P9	P10	P10-P1
L1: Trading Volume											
Non-April	$\propto$	0.0007	0.0035	-0.0003	0.0069***	0.0061***	-0.0007	0.0033	-0.0013	0.0065**	0.0072***
	β_m	1.2257***	1.138***	1.2051***	1.1712***	-0.0544*	1.0868***	1.0511***	1.0461***	1.0945***	0.0077
	β_{IMV}	-0.4568***	-0.2771***	2.0202***	2.0961***	2.553***	-0.4512***	-0.351***	1.7294***	2.1669***	2.6181***
April	$\propto$	0.0164	0.0278**	0.0187	0.0294*	0.013	0.0024	0.0238	0.0076	0.03	0.0276**
	β_m	1.1847	0.878*	1.1453	0.9152	-0.2695	1.195	0.7056*	0.883	0.8958	-0.2992**
	β_{IMV}	-0.4884	-0.2151	1.8963	2.2185	2.7069	-0.0798	-0.1829	2.1945	1.7769	1.8567**
L2: Turnover Rate											
Non-April	$\propto$	0.007**	0.0115***	0.0093***	0.0116***	0.0046**	0.0063*	0.0075**	0.0083***	0.0064**	0.00
	β_m	1.2109***	1.1384***	1.1321***	1.1305***	-0.0804***	1.1347***	1.0412***	1.1179***	1.0523***	-0.0824***
	β_{IMV}	-1.3644***	-0.665***	1.1631***	1.1852***	2.5496***	-1.4379***	-0.7378***	1.3132***	1.2106***	2.6485***
April	$\propto$	0.0381***	0.0403***	0.0402***	0.0382***	0.0001	0.0344*	0.0214	0.0162	0.0268	-0.0075
	β_m	1.4296	0.8085*	1.0879	0.9986	-0.431**	1.2445	1.2887	1.2119	1.1959	-0.0486
	β_{IMV}	0.003**	0.1375	2.3608**	1.7756	1.7726*	-0.2152	0.1253	2.2257	2.1325	2.3477
L3: Relative (Quoted) Spread											
Non-April	$\propto$	0.0014	0.0014	0.00	0.0055*	0.0041*	0.0011	0.0008	0.0001	0.0034	0.0023
	β_m	1.154***	1.1267***	1.1558***	1.2132***	0.0591**	1.0338***	1.0326***	1.0265***	1.0527***	0.0189
	β_{IMV}	-0.4061***	-0.0401	1.6324***	2.4633***	2.8695***	-0.3319**	-0.1246	1.7074***	2.2878***	2.6198***
April	$\propto$	0.0108	0.0283***	0.0229**	0.0288*	0.018	0.0067	0.0192	0.0002	0.0315**	0.0247**
	β_m	1.198	0.9114	1.0304	1.0236	-0.1743	1.0358	1.0094	1.1168	0.8522	-0.1836
	β_{IMV}	-0.3813	-0.2626	2.1211	1.9913	2.3727	-0.2874	-0.0862	2.0667	1.8991	2.1865
L4: Amihud Illiquidity Ratio											
Non-April	$\propto$	0.0023	0.0008	-0.0001	0.0059**	0.0036	0.00	0.0027	0.0013	0.0065**	0.0065***
	β_m	1.1293***	1.1304***	1.0625***	1.1814***	0.052*	1.0356***	1.0518***	1.0185***	1.0206***	-0.0149
	β_{IMV}	-0.265***	-0.0126	1.9098***	2.4811***	2.7462***	-0.2656**	-0.1685	1.8074***	2.1923***	2.458***
April	$\propto$	0.0166	0.02*	0.0137	0.0207	0.004	0.0005	0.0027	-0.0103	0.0194	0.0189
	β_m	1.165	1.0406	1.0399	1.2095	0.0445	1.2037	0.8885	1.2906	0.8329	-0.3708**
	β_{IMV}	-0.568	-0.0333	1.9201	2.166	2.734	-0.0906	0.4047	3.0874***	1.9737	2.0643

Note: (i) Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively. (ii) Statistical significance of alpha and beta coefficients for April represents the significance of differential slope and beta coefficients in dummy variable regression

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EFFECT OF CLIMATIC AND GEOGRAPHICAL FACTORS ON YIELDS OF CASH CROPS IN INDIA: A STATE-WISE PANEL DATA EXPLORATION

ABSTRACT: This study assesses the impact of climatic and geographical factors on yield of potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds crops using state-wise panel data in India during 1971-2013. Regression coefficients of climatic and geographical factors with a yield of crops are estimated through Cobb-Douglas production function model. The yield of a specific crop is considered as a dependent variable, and average maximum and minimum temperature, actual precipitation and rainfall during crop season, and latitude and longitude of a certain state are used as an independent variable. Hence, it estimates the expected yield of individual crop due to a marginal increase in climatic factors. The empirical result shows that maximum temperature has a negative impact on the yield of potato, groundnut, sesame, linseed, sugarcane, rapeseed & mustard, sunflower seeds. Yields of all crops (except cotton) improve as an increase in minimum temperature. Precipitation has a negative effect on cotton, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds. The yield of potato, rapeseed & mustard and sunflower seeds tend to be declined due to an increase in actual rainfall. Latitude and longitude have a significant impact on crops yields. Probable results infer that yield of sesame, linseed, rapeseed & mustard, potato and cotton may be declined by 0.16%, 0.83%, 5.65%, 14.68% and 23.31% on hectare land respectively due to marginal increase in average maximum and minimum temperature, actual precipitation and rainfall. Therefore, there needs to adopt

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a crop-specific climate action policy to mitigate the negative impact of climate change in Indian agriculture.

Keywords: Agricultural productivity; Climate change; Cobb-Douglas production function; Marginal impact analysis technique
JEL Codes: C01, C10, C33, O21

INTRODUCTION

Climate change has a negative impact on agricultural productivity and food security at word-wide (Kumar et al., 2017; Singh and Sharma, 2018a). All economic activities are being adversely affected due to climate change (Singh et al., 2019). It has become a serious concern for developing countries as these do have less economic and physical resources to mitigate the negative consequences of climate change in the agricultural production system (Kumar and Sharma, 2013; Kumar et al., 2015a; Kumar et al., 2016). Developing countries are located at lower latitudes, therefore these economies are highly prone to climate variations including rapid population growth, higher urbanization and large dependency of population on agriculture (Lee, 2009; Ahmad et al., 2011). Furthermore, crops yields are expected to be decreased in developing countries, and crop yield would be increased in developed countries. It may therefore will increase extensive disparities in food-grain and cereal yields across developed and developing countries (Parry et al., 2004; Fischer et al., 2005).

India is the second agricultural intensive country in the world. Despite that, it has the largest number of hungry and deprived people in the world and counts around 360 million undernourished (Ahmad et al., 2011). There are still more people who are suffering from chronic diseases due to lack of food consumption and low quality of food. As more than 52% of the Indian population depends on climate-sensitive sectors such as cultivation, forestry and fishery; and natural resources (water, biodiversity, mangroves, coastal zones, grasslands) for their livelihoods. Thus, agriculture is an important sector to sustain the livelihood security of the population in India (Sathaye et al., 2006). Moreover, there are many other reasons such as low productivity of crops, high illiteracy and low economic capacity of farmers, insignificant support from financial organizations to farmers, the low contribution of government in agricultural research & development, and low technological skills of farmers that are making Indian agriculture more vulnerable (Singh and Sharma, 2018b). Also, arable land is declining due to high urbanization, population growth and industrialization in India (Kumar et al., 2020). These activities are also

increasing the extensive burden on ecological services (i.e. water, air, land, forest, rivers) and agricultural production system (Kumar et al., 2020; Singh and Singh, 2020). Also, climate change and its impact on agricultural production system have created a wide-ranging burden to sustain the livelihood security of Indian farmers. Further, it is also found the climate change have a negative impact on human health (Singh and Singh, 2020). India thus may be at high risk due to climate change in the near future (Kumar et al., 2015a).

In India, several studies have assessed the influence of climatic and non-climatic factors on the gross domestic product (GDP), agriculture GDP, agricultural productivity, and production, cropped area and yield of a specific crop using district, regional, state and national level data in the form of time series and panel data. A summary of associated previous studies is given here: Zhai and Zhuang (2009) have reported the GDP may be decreased up to 6.2% by 2080 in India. Ramulu (1996) have identified that sugarcane yield affecting factors in Andhra Pradesh (India). Saseendran et al. (2000) have perceived that crop yield may be decreased due to an increase in temperature up to 5^0C in Kerala (India). Kumar et al. (2004) have inspected the association of production and yield of rice, wheat, sorghum, groundnut, sugarcane, and cereal and oilseed crops in Uttar Pradesh, Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu states of India. Kavikumar (2009) have found that agriculture revenue is likely to be diminished by 9% on per hectare land due to climate change in thirteen Indian states.

Asha Latha et al. (2012) have observed the impact of drought, rainfall and temperature on production and yield of groundnut, onion, cotton and other crops in Karnataka. Kumar and Sharma (2013) have observed the impact of climatic and non-climatic factors on productivity of potato, sugarcane, cotton, soybean, groundnut, and sesame and linseed crops in India. Birthal et al. (2014) have assessed the impact of temperature and rainfall on the yield of groundnut, rapeseed & mustard and other food-grain crops in India. Kumar and Sharma (2014) have measured the climatic and non-climatic factors on sugarcane yield in India. Kumar et al. (2015a) have examined the influence of climatic and non-climatic factors on mean yield of cotton, potato, groundnut, linseed and sesame crops in India. Kumar et al. (2015b) have measured the influence of climatic and non-climatic factors on the yield of sugarcane crop in India. Yadav at al. (2016) has assessed the influence of CO_2 concentration and temperature on the productivity of various cash crops in Varanasi (India).

Singh et al. (2017) have examined the impact of climatic and non-climatic factors on production, yield and cropped area of potato, groundnut, sesame and cotton crops in India. Ramachandran et al. (2017) have assessed the impact of climate change on yield of rice, groundnut and sugarcane crops in Tamil Nadu. Singh et al. (2019) have estimated the climatic and non-climatic factors on sugarcane farming in India. Singh and Jyoti (2019) have assessed the impact of climatic and non-climatic factors on production, yield and cropped area of potato, cotton, groundnut and sesame crops in Indian states. Guntukula (2019) have evaluated the climate change impact on the yield of rice, wheat, pulses, rapeseeds & mustard, cotton, sugarcane and groundnut crops in India. Praveen and Sharma (2019) have examined the impact of climate change on yield of rice, wheat, Jowar, bajra, maize, ragi, barley, tea, cotton, groundnut, tea, cotton, groundnut, rapeseed & mustard, linseed, and sesame crops in India. Kelkar et al. (2020) have estimated the expected impact of climatic factors on sugarcane, cotton and rice crops in Maharashtra (India).

The above-mentioned review indicates that climate change has a negative impact on the agricultural production system in India. For this, most studies have considered yield of a specific crop as dependent variables, and climatic factors, socio-economic and other demographic parameters as independent variables (Kumar and Sharma, 2013; Kumar and Sharma, 2014; Kumar et al., 2015a; Kumar et al., 2015b; Singh et al., 2017; Singh and Sharma, 2018b; Guntukula, 2019; Panda et al., 2019; Singh et al., 2019). However limited studies could estimate the impact of climatic factors and geographical location on the productivity of cash crops in India. Due to the aforesaid research gap, the present study is addressed in the following research questions:

- Which cash crop is most vulnerable due to climate change in India?
- What is the relationship of latitude and longitude of a specific state with a yield of cash crops in India?
- What is the marginal impact of climatic factors on the yield of cash crops in India?

With concerns to aforesaid research questions, the present is achieved the following objectives:

- To assess the impact of climatic and geographical location on the yield of potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds crops using state-wise panel data in India through Cobb-Douglas production function approach.
- To examine the predicted yields of cash crops due to marginal change in climatic factors using marginal impact analysis technique in India.

- To provide conclusive and viable policy suggestions to mitigate the negative consequences of climate change in Indian agriculture based on previous studies.

RESEARCH METHOD AND MATERIAL

Description of Study Area

The present study includes yield of potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard, and sunflower seeds crop as a dependent variable for 43 years (i.e. 1971-2013). However, for rapeseed & mustard and sunflower seed crops, the period is limited for 38 years (i.e. 1977-2014). Aforesaid cash crops provide the raw material to textile, oilseed, sugar and other industries in India (Singh et al., 2017; Singh and Jyoti, 2019). Average maximum and minimum temperature, actual precipitation and rainfall during the crop season, and latitude and longitude location of a specific state are considered as an explanatory variable. Dependent and explanatory variables are compiled in state-wise panel data for an individual crop to assess the impact of climatic factors and geographical location on yield. For each crop following states are compiled as a state-wise panel data:

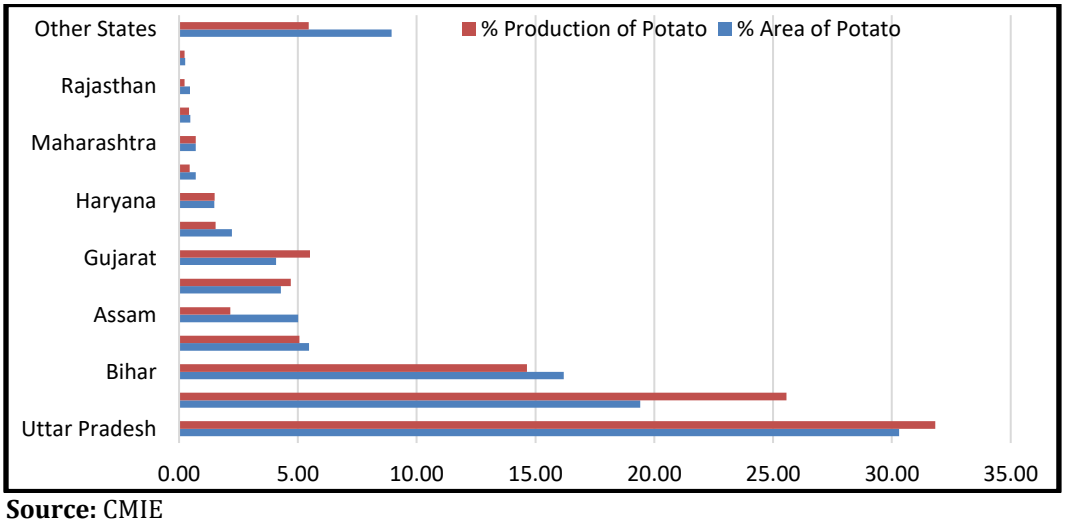
Table 1: List of states that are considered under a specific crop

Crops	States	No. of States
Potato	Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh	17
Cotton	Andhra Pradesh, Assam, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal	14
Groundnut	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh	17
Sesame	Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh	18
Linseed	Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh	14

Sugarcane	Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh	18
Rapeseed & Mustards	Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal	14
Sunflower Seeds	Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal	10

Every group of states cover more than 90% cropped area and production of each cash crop in India. State-wise area and production of potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard, sunflower seed crops are presented in Figure 1, 2, 3, 4, 5, 6, 7, and 8 respectively. Uttar Pradesh, West Bengal and Bihar states have a larger share in potato production in India (See Figure 1).

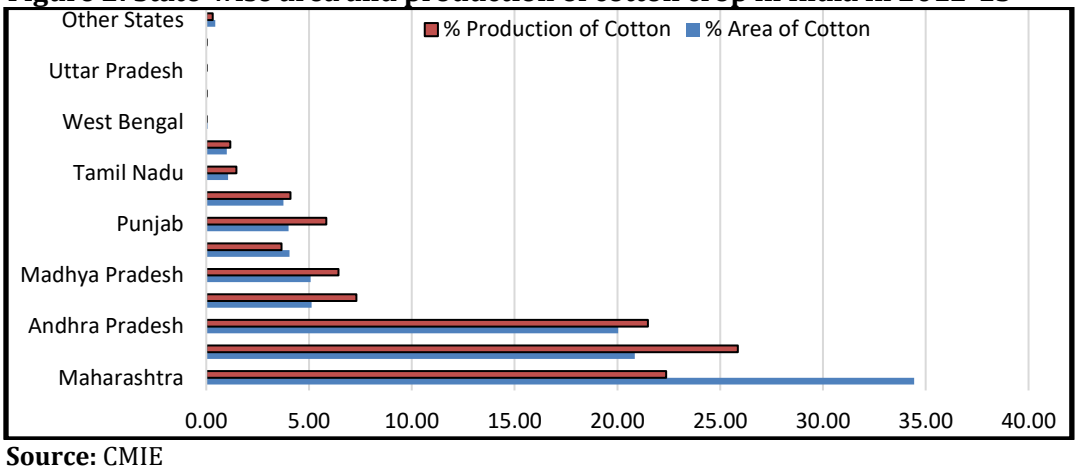
Figure 1: State-wise area and production of the potato crop in India in 2012-13



Source: CMIE

Maharashtra, Gujarat and Andhra Pradesh states are the largest producer of the cotton crop (See Figure 2). Maharashtra has the largest area under cotton crop, while Gujarat has the largest share in cotton production in India.

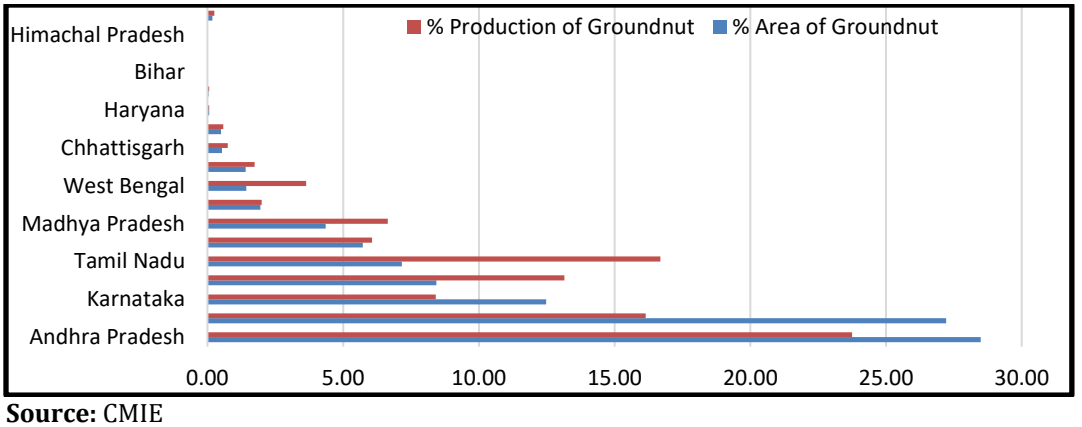
Figure 2: State-wise area and production of cotton crop in India in 2012-13



Source: CMIE

Andhra Pradesh, Gujarat and Rajasthan are the main groundnuts producing states of India (See Figure 3). Andhra Pradesh has the largest area of groundnut crop and the state contribute around 23.75% groundnut production of India.

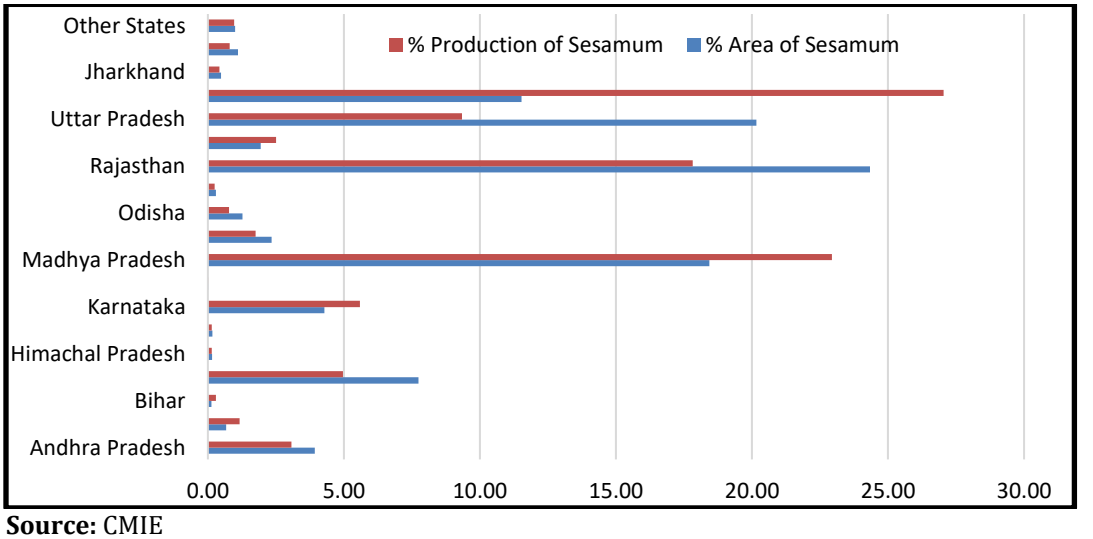
Figure 3: State-wise area and production of groundnut crop in India in 2012-13



Source: CMIE

West Bengal, Madhya Pradesh and Rajasthan have the dominant position in sesame production (See Figure 4). Rajasthan has the largest cropped area under sesame crop and West Bengal contributes around 27.04% sesame production in India.

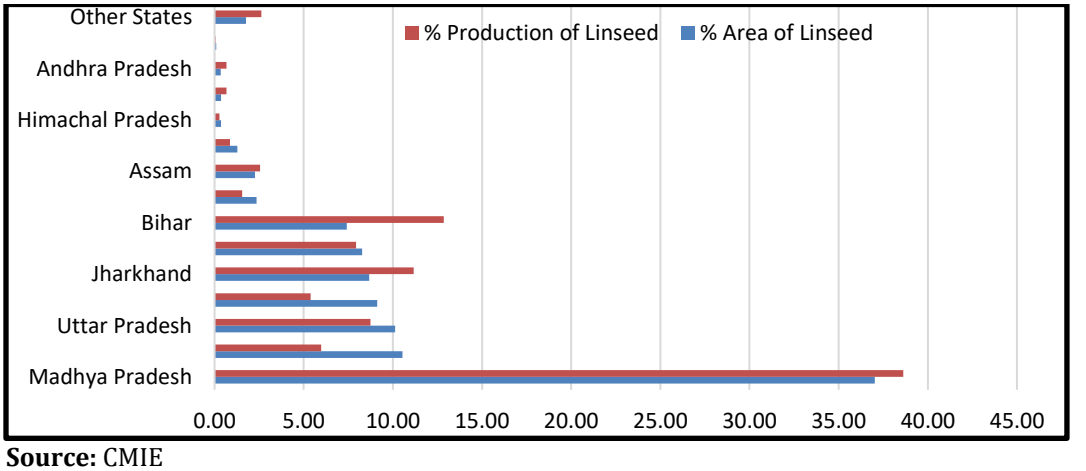
Figure 4: State-wise area and production of sesame crop in India in 2012-13



Source: CMIE

Linseed crop grows in most Indian states (See Figure 5). However, Madhya Pradesh, Chhattisgarh, Uttar Pradesh and Jharkhand have a greater contribution in area and production of this crop in India.

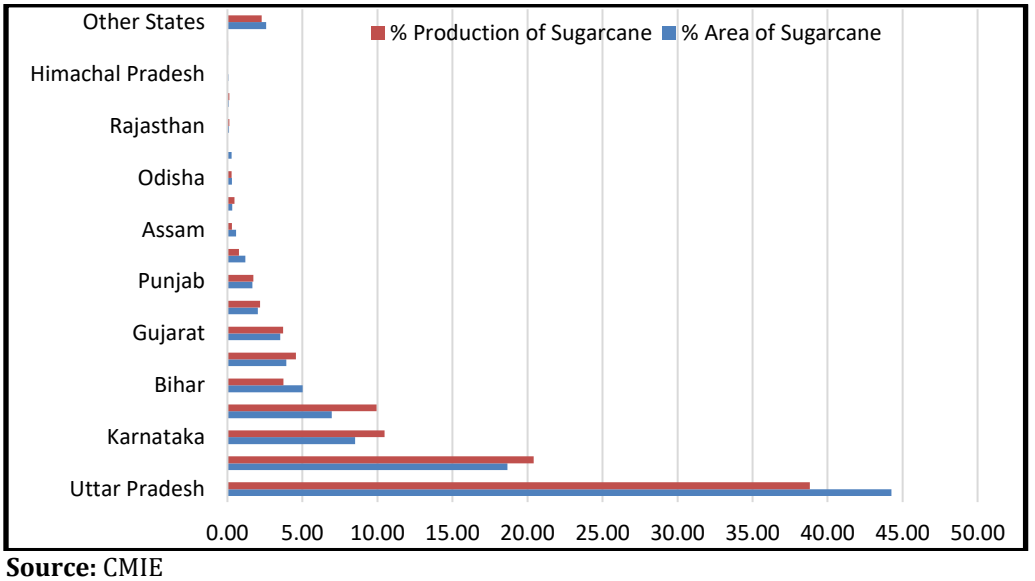
Figure 5: State-wise area and production of linseed crop in India in 2012-13



Source: CMIE

Sugarcane is a very important cash crop and it grows in most states of India (See Figure 6). Uttar Pradesh, Maharashtra and Karnataka have the largest contribution in area and production of sugarcane crop in India.

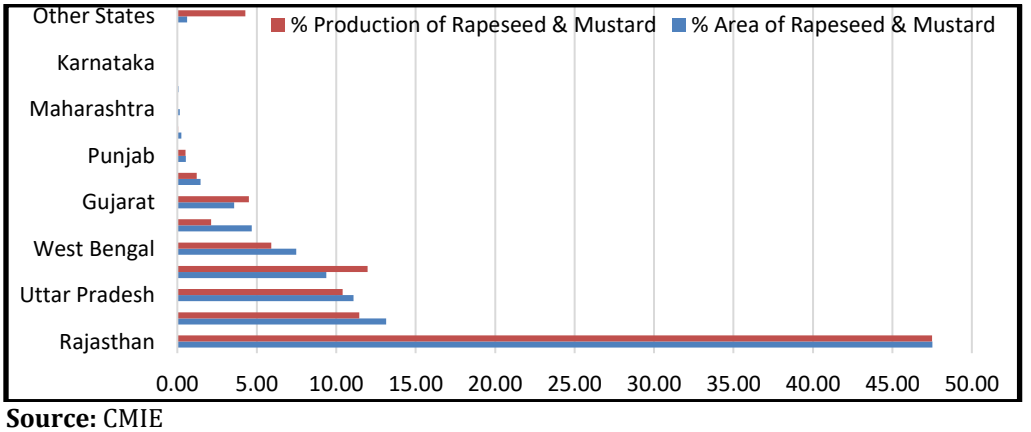
Figure 6: State-wise area and production of sugarcane crop in India in 2012-13



Source: CMIE

Rapeseed & mustard is a crucial oilseed crop that grows in Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, West Bengal, Assam, Gujarat, Bihar, Punjab, Odisha, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. These states contribute more 90% area and production of Rapeseed & mustard crop in India (See Figure 7).

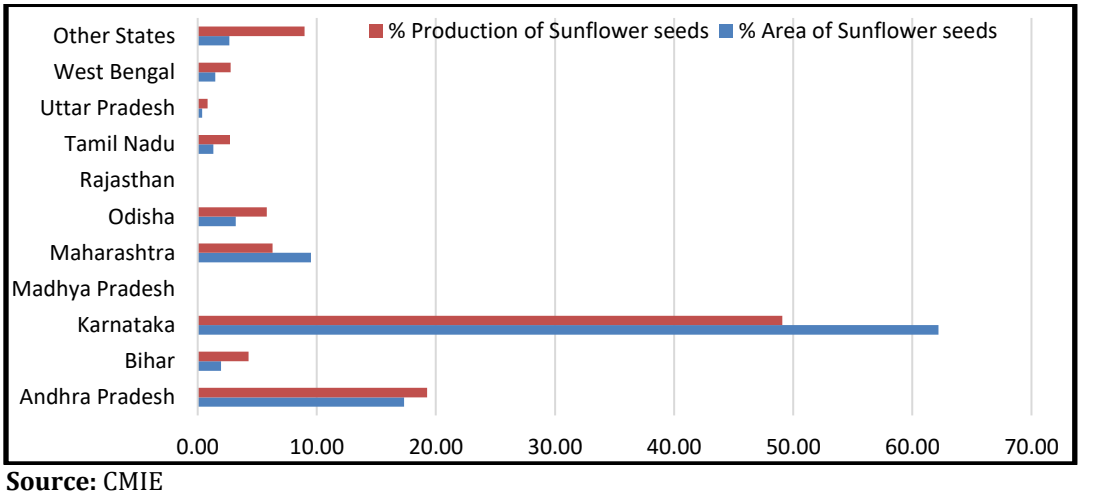
Figure 7: State-wise area and production of rapeseed & mustard crop in India in 2012-13



Source: CMIE

Sunflower seed crop is also an oilseed crop which cultivates in Andhra Pradesh, Bihar, Karnataka, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal (See Figure 8). Karnataka and Andhra Pradesh have the largest share in area and production of this crop in India.

Figure 8: State-wise area and production of sunflower seed crop in India in 2012-13



Source: CMIE

Explanation of Data Sources

The data for agricultural and climatic variables are taken from the following sources:

Agricultural Data: Yield, production and area sown of selected crops is taken from the Centre for Monitoring Indian Economy (CMIE). Sowing, growing and harvesting time of each crop is taken from Indian Council of Agricultural Research (Crop Science Division).

Latitude and Longitude Information: The geographical location of all states is derived from https://www.distancelatlong.com/country/india and https://www.mapsofindia.com/lat_long/.

Climatic Data: Minimum and maximum temperature are collected from the Indian Meteorological Department (GoI). These data are available on daily intervals with latitude and longitude information of specified monitoring stations. The stations pertaining to the specific latitude and longitude information of cities are identified due to absence of city-wise data of climatic data. Thereafter, the groups of different geographical regions are linked to arrive at the state-level data. Monthly district-wise rainfall information is taken from Hydromet Division, Indian Meteorological Department (GoI). District-wise precipitation is derived from Geographical Information System statistical database. Aforementioned all data are converted into monthly averages city-wise after that data is transformed at state-wise monthly maximum and minimum temperature. The SPSS statistical software is used to extract and bring data to excel format. Average minimum and maximum temperature;

and actual rainfall and precipitation in crop duration (i.e. sowing time to harvesting time) is considered for empirical investigation. Interpolation and extrapolation techniques are considered to estimate the values for those variables which do have the few missing values (Kumar et al., 2015a; Kumar et al., 2017; Singh and Issac, 2018; Singh and Jyoti, 2019).

Econometric Modeling

Cobb-Douglas production function model is used to assess the impact of climatic factors (i.e. average maximum and minimum temperature, and actual precipitation and actual rainfall) and geographical factors (i.e. latitude and longitude) on the yield of cash crops. This approach is used by Kumar and Sharma (2013), Kumar and Sharma (2014), Kumar et al. (2015a), Kumar et al. (2016), Singh et al. (2017), Singh and Sharma, 2018b; Singh et al. (2019), Singh and Jyoti (2019), Kumar et al. (2020) to examine the climatic and non-climatic factors on yield of the individual crop and agricultural productivity at district, state and national level in India. In this study, the yield of an individual crop is used as a dependent variable, and average maximum and minimum temperature, actual precipitation and rainfall during crop season, latitude and longitude location of a specific state is considered as an independent variable. For this, the proposed empirical model is used as:

$$\log(lampro)_{st} = B_0 + B_1(year)_{st} + B_2 \log(amaxtemtcs)_{st} + B_3 \log(amintemcs)_{st} + B_4 \log(aprecs)_{st} + B_5 \log(arfcs)_{st} + B_6 \log(lat * as)_{st} + B_7 \log(lon * as)_{st} + U_{st} \quad (1)$$

Here, the *log* is the natural logarithm of associated variables, *lanpro* is land productivity, *amaxtemtcs* is average maximum temperature, *amintemcs* is average maximum temperature, *aprecs* is actual precipitation, *arfcs* is actual rainfall, lat and lon are latitude and longitude of respective state respectively, *as* is cropped area of respective crop, and *year* is time trend factor that is considered to capture the influence of technological change on yield of crops (Kumar et al., 2015a; Kumar et al., 2015b; Singh and Sharma, 2018b). s is cross-sectional states; t is time period; and β_0 is constant coefficient, β_1, β_2,.., β_7 are the regression coefficient of corresponding variables, U_{st} is error term in equation (1). The summary of dependent and explanatory variables is presented in Table 2.

Table 2: Summary of the dependent and independent variables

Symbol	Variables	Unit
as	Area sown	000 Ha.
Tp	Total production	000 tonne
lanpro	Land productivity	Tonne/Ha.
Year	Time trend factor	Number
amaxtemtcs	Average maximum temperature during crop season	^{0}C
amintemcs	Average maximum temperature during crop season	^{0}C
aprecs	Actual precipitation during crop season	mm
arfcs	Actual rainfall during crop season	mm
*lat*as*	Latitude *Area sown	^{0}C*Ha.
*Lon*as*	Longitude *Area sown	^{0}C*Ha.

Selection of Proper Model

The proposed regression model is run through STATA statistical software. The following process is applied to select a proper model. Pesaran's test is used to identify the presence of cross-sectional independence in panel data (Kumar and Sharma, 2014; Kumar et al., 2017). Wald test is used to identify the existence of group-wise heteroskedasticity in panel data of each crop (Kumar and Sharma, 2014; Kumar et al., 2016). Wooldridge test is used to address the presence of the autocorrelation (Singh et al., 2017). Panels corrected standard errors estimation model is used to reduce the presence of serial correlation, heteroskedasticity and cross-sectional autocorrelation for all crops (Kumar and Sharma, 2013; Kumar et al., 2015a; Singh et al., 2017).

Marginal Impact Analysis Technique

The marginal impact analysis technique is useful to examine the contribution of each input in crop yield (Coster and Adeoti, 2015; Singh et al., 2017; Singh, 2017; Singh and Sharma, 2018b). It also examines the percentage change in output due to the marginal change in various inputs in production activities. In this study, therefore marginal impact analysis technique is used to predict the yield of cash crops due to marginal change in climatic factors, and cropped area for corresponding crops under a geographical location (Kumar et al., 2016; Singh and Sharma, 2018b). The projected yield of the crop is estimated as:

$$[\Delta(lanpro)] = \{\beta 1[\delta(lanpro)/\delta(year)] + \beta 2\,[\delta(lanpro)/\delta(amaxtemtcs)] + \beta 3\,[\delta(lanpro)/\delta(amintemcs)] + \beta 4\,[\delta(lanpro)/\delta(aprecs)] + \beta 5\,[\delta(lanpro)/\delta(arfcs)] + \beta 6\,[\delta(lanpro)/\delta(lat * as)] + \beta 7\,[\delta(lanpro)/\delta(lon * as)]\} * 100 \quad (2)$$

Here, Δ(*lanpro*) is change in yield of respective crops due to marginal change in all variables; β_1, β_2,.., β_7 are the regression coefficient of associated variables which is estimated through equation (1); *year*, *amaxtemtcs*, *amintemcs*, *aprecs*, *arfcs*, *lat*as* and *lon*as* are the mean values of respective variables under each crop across state-wise panel.

DESCRIPTIVE RESULTS

Potato Yield and Climatic Factors: The fluctuation on potato yield and climatic factors during 1971–2013 is presented in Figure 9. The correlation coefficients of potato with climatic and geographical variables presented in Table 3. It infers that potato productivity is positively correlated with maximum temperature (r= 0.037), minimum temperature (r= 0.026), latitude (r= 0.386**) and longitude (r= 0.391**). Precipitation and rainfall are negatively associated with yield of potato crop. Thus, it shows that climatic and geographical factors are significantly associated with productivity of potato.

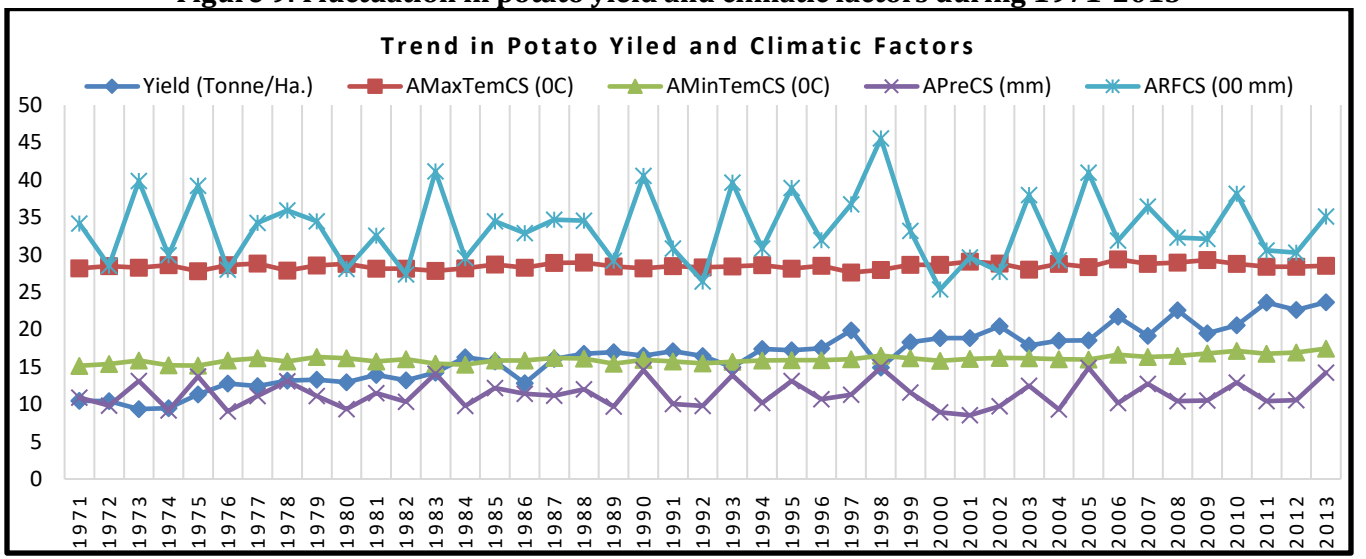
Cotton Yield and Climatic Factors: The trend in productivity of cotton yield and climatic factors are presented in Figure 10. The correlation coefficients cotton yield with climatic and non-climatic factors is presented in Table 3. It is found that cotton yield is negatively correlated with minimum temperature (r= - 0.032), precipitation (r= - 0.197**) and actual rainfall (r= - 0.291**). As correlation coefficient of latitude and maximum temperature with cotton yield is found positive, thus both factors will be useful to increase the cotton yield.

Table 3: Correlation coefficients of potato yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	0.037	0.026	-0.159**	-0.201**	0.386**	0.391**
amaxtemcs	0.037	1	0.880**	-0.130**	0.022	-0.098**	-0.065*
amintemcs	0.026	0.880**	1	0.249**	0.381**	-0.068*	-0.015
aprecs	-0.159**	-0.130**	0.249**	1	0.894**	0.006	0.056
arfcs	-0.201**	0.022	0.381**	0.894**	1	0.026	0.084*
*lat*as*	0.386**	-0.098**	-0.068*	0.006	0.026	1	0.988**
*lon*as*	0.391**	-0.065*	-0.015	0.056	0.084*	0.988**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 9: Fluctuation in potato yield and climatic factors during 1971-2013



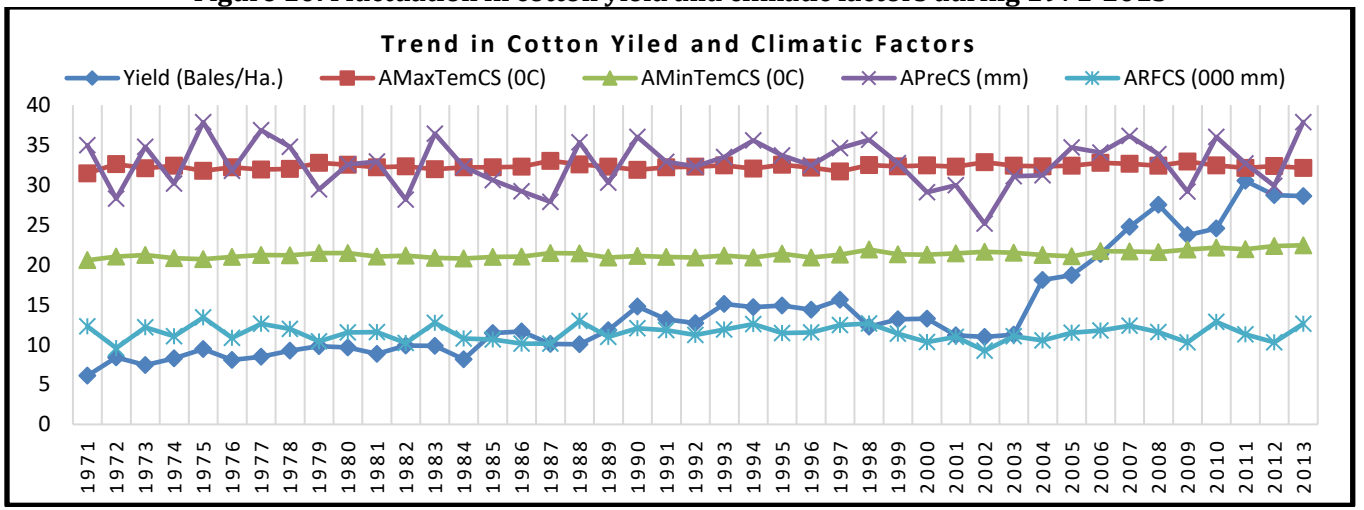
Source: Author's estimation

Table 4: Correlation coefficients of cotton yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	0.142**	-0.032	-0.197**	-0.291**	0.105**	0.026
amaxtemcs	0.142**	1	-0.051	-0.728**	-0.808**	0.335**	0.250**
amintemcs	-0.032	-0.051	1	0.293**	0.256**	-0.257**	-0.184**
aprecs	-0.197**	-0.728**	0.293**	1	0.869**	-0.220**	-0.171**
arfcs	-0.291**	-0.808**	0.256**	0.869**	1	-0.424**	-0.349**
*lat*as*	0.105**	0.335**	-0.257**	-0.220**	-0.424**	1	0.978**
*lon*as*	0.026	0.250**	-0.184**	-0.171**	-0.349**	0.978**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 10: Fluctuation in cotton yield and climatic factors during 1971-2013



Source: Author's estimation

Groundnut Yield and Climatic Factors: The trend in groundnut yield and climatic factors are presented in Figure 11. It demonstrates that productivity of groundnut is varied due to change in climatic factors during 1971–2013. The correlation coefficient of groundnut yield is positively correlated with maximum temperature (*r*= 0.049), minimum temperature (*r*= 0.148**) and precipitation (*r*= 0.009) (See Table 5). Actual rainfall (*r*= - 0.034), latitude (*r*= - 0.034) and longitude (*r*= - 0.014) are negatively associated with groundnut yield.

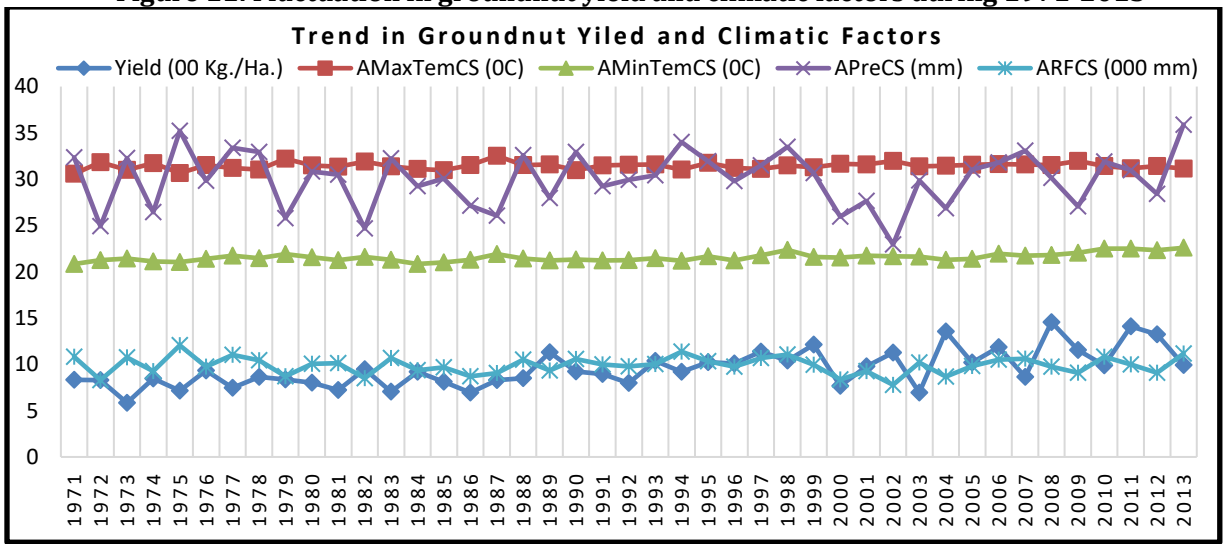
Sesame Yield and Climatic Factors: The trend in sesame yield and climatic factors is presented in Figure 12. It shows that sesame yield is fluctuated due to variability in climatic factors. Correlation coefficient of sesame yield is positively associated with minimum temperature (*r*= 0.182**), precipitation (*r*= 0.138**) and rainfall (*r*= 0.190**) (See Table 6). While, other factors such as maximum temperature, latitude and longitude have a negative correlation with sesame yield.

Table 5: Correlation coefficients of groundnut yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	0.049	0.148**	0.009	-0.034	-0.034	-0.014
amaxtemcs	0.049	1	0.729**	-0.330**	-0.460**	0.287**	0.206**
amintemcs	0.148**	0.729**	1	0.187**	0.047	0.310**	0.297**
aprecs	0.009	-0.330**	0.187**	1	0.895**	-0.193**	-0.188**
arfcs	-0.034	-0.460**	0.047	0.895**	1	-0.199**	-0.155**
*lat*as*	-0.034	0.287**	0.310**	-0.193**	-0.199**	1	0.957**
*lon*as*	-0.014	0.206**	0.297**	-0.188**	-0.155**	0.957**	1

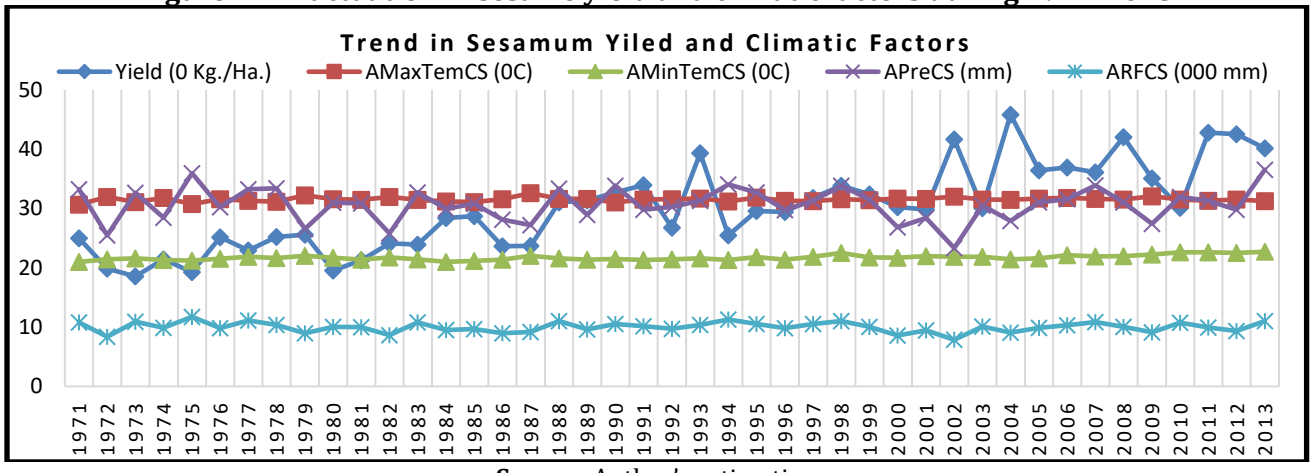
Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 11: Fluctuation in groundnut yield and climatic factors during 1971-2013



Source: Author's estimation

Figure 12: Fluctuation in sesame yield and climatic factors during 1971-2013



Source: Author's estimation

Table 6: Correlation coefficients of sesame yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	-0.058	0.182**	0.138**	0.190**	-0.204**	-0.168**
amaxtemcs	-0.058	1	0.746**	-0.206**	-0.391**	0.304**	0.272**
amintemcs	0.182**	0.746**	1	0.272**	0.093**	0.093**	0.131**
aprecs	0.138**	-0.206**	0.272**	1	0.913**	-0.291**	-0.273**
arfcs	0.190**	-0.391**	0.093**	0.913**	1	-0.319**	-0.298**
*lat*as*	-0.204**	0.304**	0.093**	-0.291**	-0.319**	1	0.974**
*lon*as*	-0.168**	0.272**	0.131**	-0.273**	-0.298**	0.974**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

The trend in linseed yield and climatic factors is presented in Figure 13. It indicates that productivity of linseed crop is significantly fluctuated due to change in climatic factors during 1971-2013. Furthermore, correlation coefficients of maximum temperature (*r*= -9.159**), minimum temperature (*r*= - 0.182**), precipitation (*r*= - 0.084*), rainfall (*r*= -0.066), latitude (*r*= - 0.274**) and longitude (*r*= - 0.303**) with linseed are seemed negative (See Table 7). Thus, the productivity of this crop is expected to be declined as increase in aforementioned climatic factors and more cropped area under latitude and longitude.

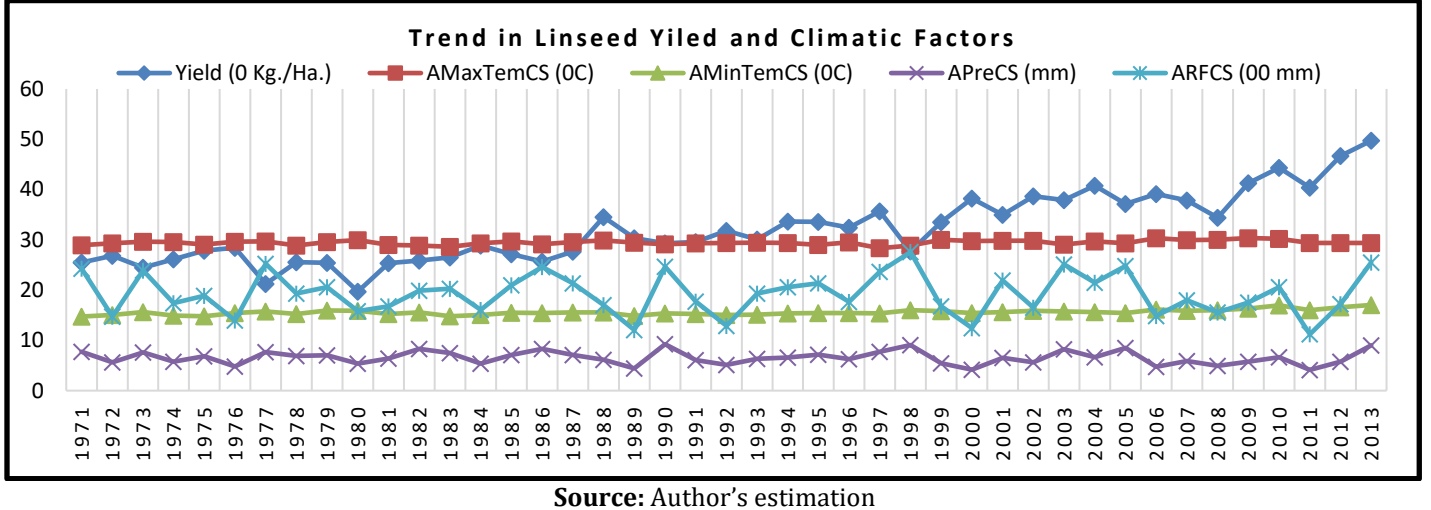
The trend in sugarcane yield and climatic factors is presented in Figure 14. It infers that sugarcane yield is varied as change in climatic variables. The correlation coefficients of maximum temperature (*r*= 0.051), minimum temperature (*r*= 0.123**), precipitation (*r*= 0.359**) and actual rainfall (*r*= 0.526**) with yield of sugarcane crop is found positive (See Table 8). These variables, thus play a crucial role to increase the yield of sugarcane crop.

Table 7: Correlation coefficients of linseed yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	-0.159**	-0.182**	-0.084*	-0.066	-0.274**	-0.303**
amaxtemcs	-9.159**	1	0.900**	-0.439**	-0.01	0.245**	0.278**
amintemcs	-0.182**	0.900**	1	-0.099**	0.318**	0.018	0.064
aprecs	-0.084*	-0.439**	-0.099**	1	0.806**	-0.367**	-0.358**
arfcs	-0.066	-0.01	0.318**	0.806**	1	-0.308**	-0.291**
*lat*as*	-0.274**	0.245**	0.018	-0.367**	-0.308**	1	0.994**
*lon*as*	-0.303**	0.278**	0.064	-0.358**	-0.291**	0.994**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 13: Fluctuation in linseed yield and climatic factors during 1971-2013



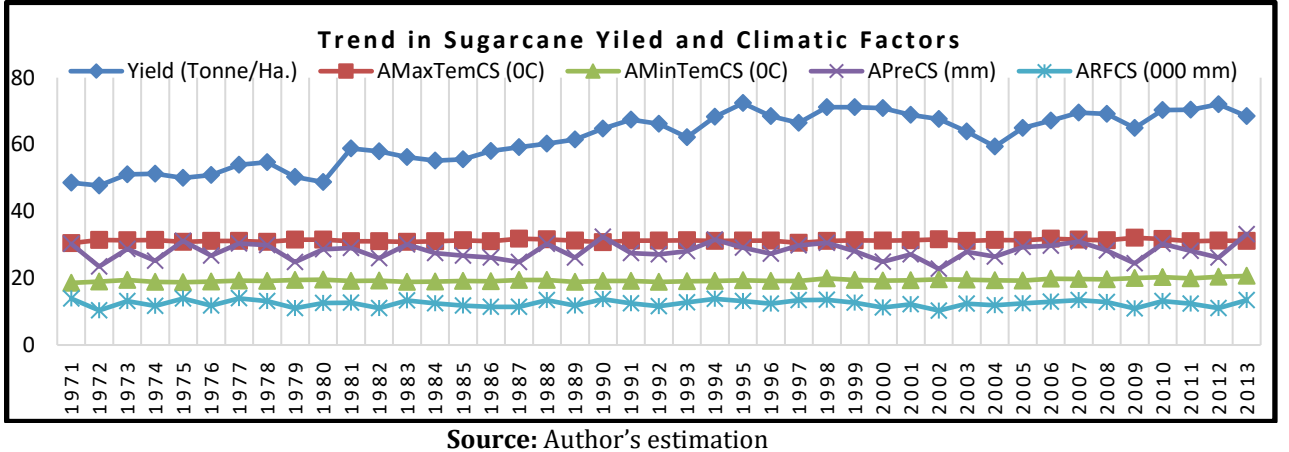
Source: Author's estimation

Table 8: Correlation coefficients of sugarcane yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	0.051	0.123**	0.359**	0.526**	-0.147**	0.022
amaxtemcs	0.051	1	0.992**	0.087*	-0.037	-0.280**	-0.200**
amintemcs	0.123**	0.992**	1	0.112**	0.009	-0.282**	-0.200**
aprecs	0.359**	0.087*	0.112**	1	0.825**	-0.184**	-0.218**
arfcs	0.526**	-0.037	0.009	0.825**	1	0.099**	0.214**
*lat*as*	-0.147**	-0.280**	-0.282**	-0.184**	0.099**	1	0.652**
*lon*as*	0.022	-0.200**	-0.200**	-0.218**	0.214**	0.652**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 14: Fluctuation in sugarcane yield and climatic factors during 1971-2013

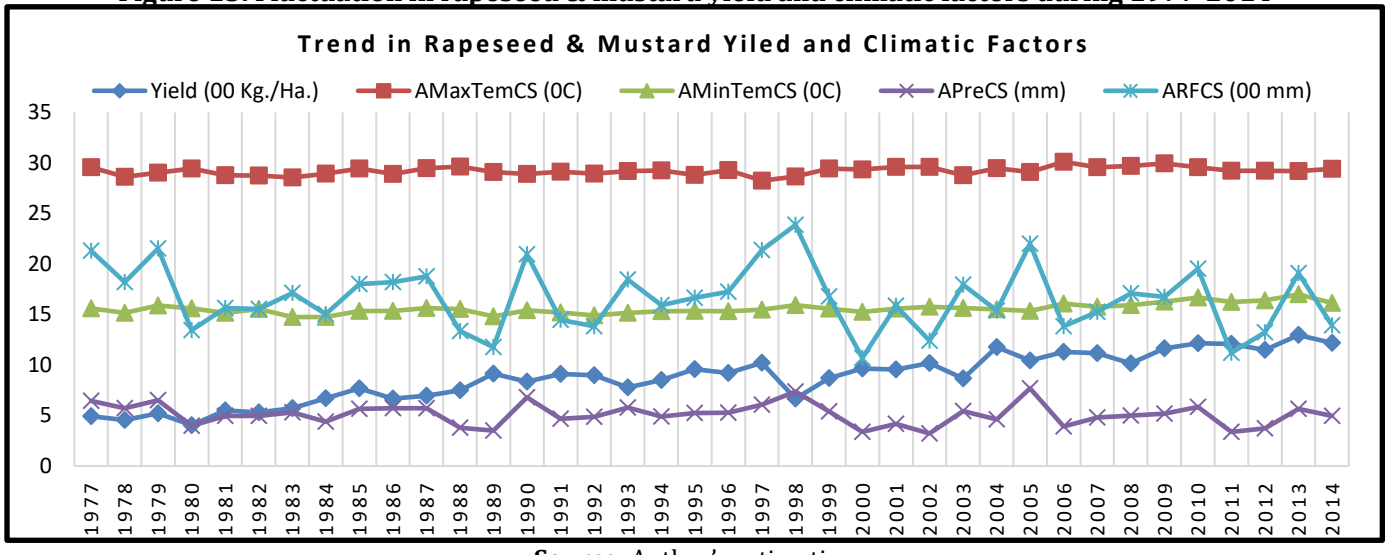


Source: Author's estimation

The trend in rapeseed & mustard yield and climatic factors is presented in Figure 15. It concludes that rapeseed & mustard yield is fluctuated as change in climatic variables during 1977-2014. The correlation coefficients of maximum temperature (r= 0.371**), minimum temperature (r= 0.375**) with productivity of rapeseed & mustard yield is appeared positive (See Table 9). While, of rapeseed & mustard yield negatively associated with precipitation (r= -0.451**), actual rainfall (r= - 0.586**), latitude (r= - 0.440**) and longitude (r= -0.466**) with productivity of rapeseed & mustard crop is found positive.

The trend in yield of sunflower seeds and climatic factors during 1977-2014 is presented in Figure 16. It displays that productivity of sunflower seeds is varied due to high variability in climatic factors during the aforesaid period. The correlation coefficient of maximum temperature (r= - 0.137**), minimum temperature (r= - 0.144**) and precipitation (r= - 0.006) with productivity of sunflower seed are seemed negative (See Table 10). Correlation coefficient of actual rainfall (r= 0.371**), latitude (r= 0.094) and longitude (r= 0.034) with yield of sunflower seed crop is observed positive.

Figure 15: Fluctuation in rapeseed & mustard yield and climatic factors during 1977-2014



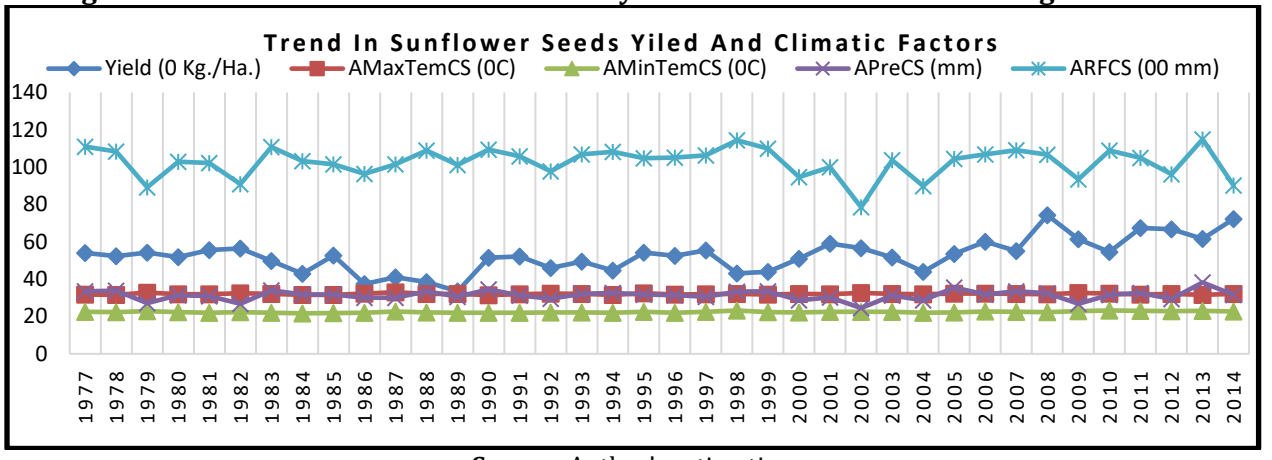
Source: Author's estimation

Table 9: Correlation coefficients of rapeseed & mustard yield with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	0.371**	0.375**	-0.451**	-0.586**	-0.440**	-0.466**
amaxtemcs	0.371**	1	0.998**	-0.147**	-0.314**	-0.218**	-0.213**
amintemcs	0.375**	0.998**	1	-0.143**	-0.307**	-0.213**	-0.208**
aprecs	-0.451**	-0.147**	-0.143**	1	0.812**	0.072	0.113**
arfcs	-0.586**	-0.314**	-0.307**	0.812**	1	0.500**	0.531**
*lat*as*	-0.440**	-0.218**	-0.213**	0.072	0.500**	1	0.964**
*lon*as*	-0.466**	-0.213**	-0.208**	0.113**	0.531**	0.964**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

Figure 16: Fluctuation in sunflower seeds yield and climatic factors during 1977-2014



Source: Author's estimation

Table 10: Correlation coefficients of sunflower seeds yield with with explanatory variables

Variables	*lanpro*	*amaxtemcs*	*amintemcs*	*aprecs*	*arfcs*	*lat*as*	*lon*as*
lanpro	1	-0.137**	-0.144**	-0.006	0.371**	0.094	0.034
amaxtemcs	-0.137**	1	0.981**	-0.561**	-0.521**	-0.058	0.186**
amintemcs	-0.144**	0.981**	1	-0.594**	-0.539**	-0.073	0.248**
aprecs	-0.006	-0.561**	-0.594**	1	0.468**	-0.368**	-0.623**
arfcs	0.371**	-0.521**	-0.539**	0.468**	1	0.251**	-0.032
*lat*as*	0.094	-0.058	-0.073	-0.368**	0.251**	1	0.789**
*lon*as*	0.034	0.186**	0.248**	-0.623**	-0.032	0.789**	1

Note: ** and * imply that correlation coefficients are statistically significant at 1% and 5% level respectively

DISCUSSION ON EMPIRICAL FINDINGS

Influence of Climatic and Geographical Factors on Yield of Crops

Regression coefficients of explanatory variables with productivity of potato, cotton, sugarcane, groundnut, sesame, linseed, rapeseed & mustard and sunflower seed crops is presented in Table 11. R-square values of rapeseed & mustards and cotton crops are found 54% and 72% respectively. Thus, 54% and 72% variation in yield of these crops can be explained by climatic and geographical factors. Estimates also indicate that yield of rapeseed & mustard crop is highly climate sensitive as compared to other crops.

***Time Trend Factor*:** Regression coefficient of time trend factor with yield of all crops is found positive. It shows that use of technologies in cultivation will be effective to increase the yield of cash crops. This result is consistent with previous studies such as Singh and Sharma (2018b) which have also noticed positive impact of technological change on yield of crops in India.

Average Maximum Temperature: Maximum temperature show a negative impact on productivity of potato, groundnut, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds. It infers that productivity of these crops have a tendency to be declined as increases in maximum temperature. Previous studies such as Kumar and Sharma (2013) have also observed negative impact of maximum temperature on yield of different cash crops in India. Kumar et al. (2015a) have found negative impact of maximum temperature on yield of potato, cotton, groundnut and sesame crops.

Table 11: Regression coefficients of explanatory variables with yields of cash crops

Crops	Potato		Cotton		Sugarcane		Groundnut	
No. of Obs.	731		602		774		688	
No. of groups	17		14		18		16	
R-squared	0.3891		0.3554		0.4654		0.1852	
Wald Chi²	531.54		303.08		21414.25		259.29	
Prob > Chi²	0.000		0.000		0.000		0.000	
Variables	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*
Year	0.0136* (0.001)	0.000	0.0225* (0.002)	0.000	0.0015 (0.001)	0.110	0.0128* (0.001)	0.000
amaxtemcs	-1.5495* (0.531)	0.004	-5.4274* (1.238)	0.000	-4.1997* (0.496)	0.000	-0.4935 (0.859)	0.566
amintemcs	0.5805** (0.246)	0.018	-1.2091 (0.747)	0.105	2.7427* (0.273)	0.000	0.4542 (0.433)	0.294
aprecs	0.0662 (0.056)	0.235	0.1588* (0.035)	0.000	-0.0844* (0.012)	0.000	0.2276* (0.063)	0.000
arfcs	-0.3248* (0.031)	0.000	-0.9763* (0.094)	0.000	-0.2668* (0.037)	0.000	-0.3849* (0.081)	0.000
latas	-0.3538* (0.090)	0.000	-0.1343 (0.113)	0.232	-0.5884* (0.039)	0.000	-0.2596* (0.070)	0.000
lonas	0.5280* (0.097)	0.000	0.1097 (0.102)	0.282	0.7213* (0.039)	0.000	0.2814* (0.066)	0.000
Con. Coef.	-20.4500* (2.767)	0.000	-13.4797* (5.085)	0.008	7.9876* (2.535)	0.002	-23.0562* (3.733)	0.000

Note: *, ** and *** indicate that regression coefficients are statistically significant at 1%, 5% and 10% significance level respectively. Values in bracket is standard error of the corresponding variables

Average Minimum Temperature: The impact of minimum temperature on productivity of all crops (except cotton) are seemed positive. Estimates, therefore indicate that increase in minimum temperature will be useful to increase the productivity of these crops. Estimates are consistent with earlier studies such as Kumar and Sharma (2013) which have also observed positive influence of minimum temperature on yield of sugarcane, cotton and sesame crops.

Actual Precipitation: The regression coefficients of precipitation with yield of cotton, sesame, linseed, sugarcane and rapeseed & mustard crops are found negative. Thus, estimates show that yield of aforesaid crops may be declined as increase in precipitation during crop season.

Actual Rainfall: It is an important natural resource to increase ground water and to maintain the water level in the earth. However, extreme variability in rainfall has a negative impact on crop growth. Subsequently, crop yield decreases due to change or shift in rainfall pattern. Actual rainfall during crop season has a negative influence on yield of potato, groundnut, sugarcane, rapeseed & mustard and sunflower seeds crops. Thus, it indicates the productivity of these crops will be declined due to

change in actual rainfall. The estimates are consistent with previous studies such Kumar and Sharma (2013) which have observed negative influence of actual rainfall on yield of sugarcane and linseed crops in India. Kumar et al. (2015a) have found a negative impact of rainfall on cotton and groundnut crop in India.

Table 11: Continued…..

Crops	Sesame		Linseed		Rapeseed & Mustard		Sunflower Seed	
No. of Obs.	774		602		528		436	
No. of groups	18		14		14		10	
R-squared	0.2429		0.3715		0.7249		0.3443	
Wald Chi²	252.11		486.79		1217.91		439.42	
Prob > Chi²	0.000		0.000		0.000		0.000	
Variables	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*	*Reg. Coef.*	*P>z*
Year	0.0071* (0.001)	0.000	0.0079* (0.001)	0.000	0.0125* (0.002)	0.000	0.0235* (0.002)	0.000
amaxtemcs	-5.6266* (0.773)	0.000	-1.107*** (0.629)	0.078	-3.0697* (0.443)	0.000	-4.7115* (1.488)	0.002
amintemcs	4.2103* (0.466)	0.000	0.8982* (0.282)	0.001	0.3584*** (0.199)	0.072	5.7486* (0.794)	0.000
aprecs	-0.6160* (0.084)	0.000	-0.2753* (0.076)	0.000	-0.0095 (0.065)	0.884	-0.1972*** (0.112)	0.079
arfcs	0.4127* (0.083)	0.000	0.2149* (0.072)	0.003	-0.2000* (0.064)	0.002	-0.0805 (0.101)	0.424
latas	0.26792* (0.060)	0.000	1.0996* (0.107)	0.000	0.1674 (0.107)	0.118	0.2528* (0.100)	0.011
lonas	-0.3588* (0.059)	0.000	-1.1923* (0.104)	0.000	-0.0474 (0.113)	0.676	-0.2579** (0.103)	0.012
Con. Coef.	-9.5963* (3.629)	0.008	-14.5964* (2.760)	0.000	-15.6109* (3.557)	0.000	-47.1474* (5.526)	0.000

Note: *, ** and *** indicate that regression coefficients are statistically significant at 1%, 5% and 10% significance level respectively. Values in bracket is standard error of the corresponding variables

Latitude and Longitude: Regression coefficient of latitude with productivity of potato, cotton, groundnut and sugarcane crops are found negative. Estimates show that productivity of these crops will not be beneficial for those states which are located at high latitude. Longitude is showing a negative impact on productivity of sesame, linseed, rapeseed & mustard and sunflower seeds crops. Estimates, therefore clearly indicate that geographical location also has significant contribution to in crop production.

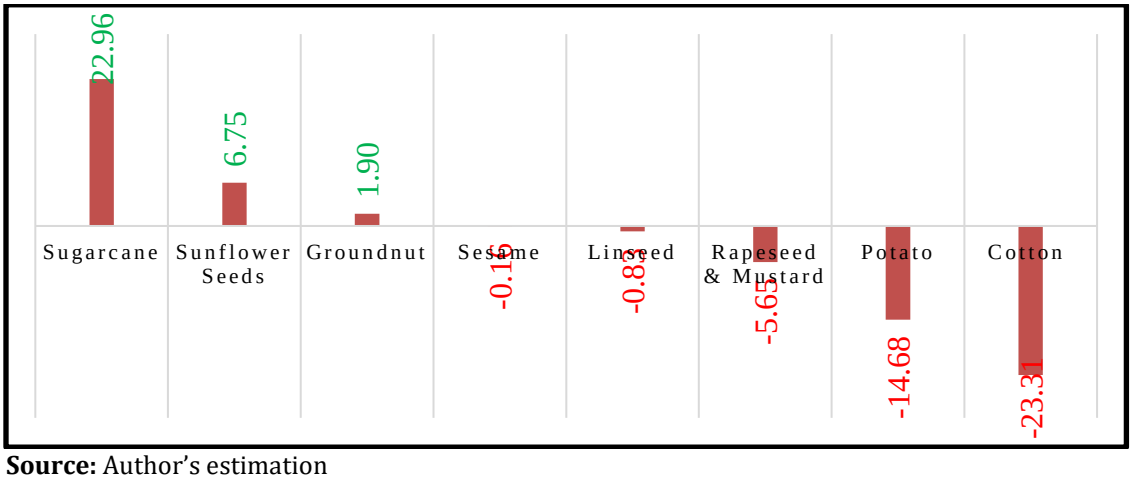
Expected Yield of Cash Crops

Expected yield of cash crop due to marginal increase in climatic factors is presented in Figure 17. Yield of crops are estimated using marginal impact analysis technique. Estimates demonstrate that sugarcane yield is likely to be increased by 23% on per hectare land due to 1% change in maximum

and minimum temperature, actual precipitation and actual rainfall in India. However, this estimate is not similar with previous studies such as Ramachandran et al. (2017) which have noticed that sugarcane yield is predictable to be declined by the end of century due to climate change in Tamil Nadu. Kelkar et al. (2020) have also observed that sugarcane production will be declined due to climate change in Maharashtra. Productivity of sunflower seed crop is expected to be increased by 6.75% on per hectare land due to marginal change in climatic factors (i.e. average maximum temperature and minimum temperature, actual precipitation and actual rainfall) during crop season. Groundnut yield is also projected to be increased by 1.90% on per hectare land due to marginal change in undertaken climatic factors in India. This result is highly contradictory with previous study like Asha latha et al. (2012) which have observed that groundnut yield is declined by 34.09 Kg/Ha in rainfed area in Karnataka.

Productivity of sesame crop may be declined by 0.16% on per hectare land due to increase in 1^0C maximum and minimum temperature, and 1 mm actual precipitation and rainfall during crop period. Estimate is consistent with previous study such as Singh et al. (2017) which have also observed that sesame yield is likely to be declined due to marginal change in climatic factors. Productivity of linseed crop is expected to be declined by 0.83% on per hectare land due to 1% change in maximum and minimum temperature, and actual precipitation and rainfall during the crop season. Furthermore, yield of rapeseed & mustard crop may be declined by 5.65% on per hectare land due to marginal change in climatic factors. Potato yield is expected to be decreased by 14.68% on per hectare land due to marginal increase in climatic factors. Singh et al. (2017) have also reported that productivity and production of potato decline due to climate change. As cotton yield is predicted to be decreased by 23.33% on per hectare land due to marginal increase in climatic factors, thus the greater impact of climate change is appeared on cotton crop as compared to other cash crops in India. Asha latha et al. (2012) have also detected that cotton yield is likely to be decreased by 59.96 Kg/Ha in rainfed area in Karnataka. Singh et al. (2017) have also found that cotton yield decreases due to climate change in India.

Figure 17: Predicted yield of crops due to marginal change in climatic factors



Source: Author's estimation

CONCLUSION AND POLICY IMPLICATIONS

The main objective of this study is to assess the impact of climatic and geographical factors on yield of potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds crop in India. For this, it includes yield of an individual crop as a dependent variable, and average maximum and minimum temperature, actual precipitation and rainfall during crop season, and latitude and longitude of corresponding state as an explanatory variable. Cobb-Douglas production function model is used to estimate regression coefficient of explanatory variables. Accordingly, it examines the expected yields of aforementioned crops using marginal impact analysis technique. Empirical finding demonstrates that the impact of technological change on yield of all crops is seemed positive. Yield of these crops, therefore would be increased as adoption of advance technologies in cultivation. Maximum temperature has a negative impact on yield of potato, groundnut, sesame, linseed, sugarcane, rapeseed & mustards and sunflower seeds crops. In contrary, yield of all crop (excluding cotton) may be improved as increase in average minimum temperature. Impact of actual precipitation on yield of cotton, sesame, linseed, sugarcane and rapeseed & mustard crops are found negative. Effect of actual rainfall on yield of potato, groundnut, sugarcane, rapeseed & mustard and sunflower seeds crops are seemed negative. Furthermore, yield of potato, cotton, groundnut and sugarcane crops may be declined at highly latitude located states in India. Yield of sesame, linseed, rapeseed & mustard and sunflower seeds crops are possible to be declined at highly longitude located states in India. Projected results based on marginal impact analysis technique show that yield of sesame, linseed, rapeseed & mustard, potato and cotton crops may be decreased by 0.16%, 0.83%,

5.65%, 14.68% and 23.31% on per hectare land respectively due to marginal increase in average maximum and minimum temperature, actual precipitation and rainfall during sowing time to harvesting time of corresponding crops.

Based on abovementioned finding, here it can be determined that yield of most cash crops is adversely affected due to change in climatic factors and geographical location in India. However, impact of climatic factors and geographical location on yield are varied across crops. As potato, cotton, groundnut, sesame, linseed, sugarcane, rapeseed & mustard and sunflower seeds are main cash crops which meet the requirement of raw material for agro-based industries in India. Climate change, therefore have a negative impact on production activities of agro-based industries, consumers and crop producers in India (Kumar et al., 2015a; Singh et al., 2017; Singh and Jyoti, 2019). Subsequently, it would also adversely affect the livelihood security of cash crop producers in India (Singh et al., 2017). Policy makers, therefore needs to formulate the crop specific policies to mitigate the negative consequences of climate change in cash crops farming and to maintain the production activities of industries in India.

Adoption of modern technologies such as change in planting methods, mixed cropping pattern and irrigation methods may be an effective way to reduce the negative impact of climate change in cash crop farming (Kumar et al., 2016; Singh et al., 2019). Technologies can be used in term of change in irrigation methods, use of fertilizer and pesticide, and change in planting method of seeds (Singh and Sharma, 2018b). Irrigated area is seemed as a vital factor to increase productivity of cash crops (Kumar and Sharma, 2014; Kumar et al., 2015a; Kumar et al., 2016). Thus, proper water management policies would be beneficial to enhance crop yield in India (Kumar et al., 2017). For this, water conservation schemes must be considered (Kumar et al., 2016; Singh and Sharma, 2018a). Minimum use of fertilizer will be useful to increase crop productivity and to maintain the quality of soil, water and air (Singh et al., 2019). Therefore, it may be useful to reduce the more possibility of climate change in near future. There also needs to provide credit facilities to farmers in India (Kumar et al., 2016; Singh et al., 2019). India needs to increase extensive expenditure on agricultural R&D (Kumar et al., 2016) and it would incentivize to researchers and scientists to discover more varieties of seeds which can tolerate the heat impact (Singh et al., 2017) and high yielding varieties of seeds (Kumar et al., 2016). Arrangement of regular training for farmers would be useful for them to increase their understanding on climate change and its impact on crop production (Kumar et al., 2016; Singh and Sharma, 2018a). Subsequently, farmers will be in a strong position to use

different strategies to reduce the negative implications of climate change in cultivation.

Agricultural Extension Offices and Rural Development Agencies must be taken an effective policy action at farm level to mitigate the impact of climate change on agriculture and to increase livelihood security of farmers in rural India (Kumar et al., 2016; Singh and Sharma, 2018a). Also, agricultural industries must be associated with researchers and agricultural scientists to reach a conclusive policy decision to maintain agricultural production system in India. As the present study provides several policy perceptions to mitigate the negative consequences of climate change in cash crops farming at macro level. However, micro level study, therefore will be greatly useful to get better understanding of farmer's awareness towards climate policy action and their various adaption strategies to mitigate the negative effect of climate change in crop farming. Thus, existing researchers and scientists may consider micro level study to check the validity of the empirical finding of present research.

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ROLE OF INNOVATIVE TECHNOLOGIES TO BOOST CIRCULAR ECONOMY: A CASE OF CONTROLLING DELHI POLLUTION CAUSED BY STUBBLE BURN

ABSTRACT: In recent years, the economy has started shifting from a linear business model to a circular business model among scholars and practitioners. There is a lot of wastage in the linear economy and a lot of resources are left unused. Pollution in Delhi is the major issue prevailing among the researchers. Circular economy, as a combination of reducing, reuse, recycle and recover can reduce the pollution by providing alternative strategies to control it. This paper provides a case study on pollution of Delhi, focussing on the stubble burning. During the winter season, farmers burn the crop residue (stubble and straws) which is the main contributor to pollution. The major effect of stubble burning is on Delhi due to its geographical location. The paper aims to highlight alternatives made available in the circular economy, which not only help to reduce pollution but also prevents the wastage in agriculture. It provides an incentive to re-utilise agricultural waste in different forms.

Keywords: Innovative technologies; Stubble burn; Delhi; Pollution; Circular Economy; Farmers; Geographical location
JEL Codes: L31, O1, O33, Q1, N5

BACKGROUND AND CONTEXT

"The Circular Economy is a blueprint for a new sustainable economy, one that has innovation and efficiency at its heart and addresses the business challenges presented by continued economics unpredictability, exponential

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population growth and our escalating demand for the world's natural resources" ------- Chris Dedicoat, President, EMEA

The concept of Circular Economy has gained importance in recent times among the scholars in connection with sustainable development. There is not a single definition of Circular economy and everyone defines and understand it differently. It is an industrial system which highlights the importance of regeneration in an innovative way. But the traditional economy is primarily in function in most of the fields.

With the growing population, our resources are continuously depleting as they are limited in nature. The main reason behind this is wastage of resources since people do not use them judiciously. This is a common tradition that once the product becomes useless, customers usually discard it. Recycling or reusing the product is not the economic priority as new products and alternatives are easily available.

The current system where wastage is common is generally known as 'take-make-dispose' model or linear model. The functioning of this model is quite simple. Companies buy raw materials, use energy for manufacturing and sell the final product to the consumers, who use it for a specific purpose and then discards it. Thus this process incurs an unnecessary loss of resources in the economy.

There is wastage at different stages of the product. Take the example of a food market. There is wastage in the production chain as food is lost due to pests or sometimes due to poor efficiency of farmers. Then there is wastage in the food supply chain in the form of leakages during transport or storage in bad condition. There is also end-of-life wastage by consumers as they just use the main food and throw the seeds like while eating mangoes, its kernel or seed is thrown. This kernel has various health benefits if used properly.

The circular economy is a step to change this end-of-life concept into restoration, stimulate the use of renewable energy, replace the use of toxic materials which does not allow the product to be reused and aims for innovative methods of production to reduce wastage. It comprises of 4Rs – Reduce, Reuse, Recycle and Recover. It focuses on achieving the objective of economic prosperity, environmental quality and social equity.

Some researchers used only 3R framework, leaving out the process of recovery. While Potting et al. (2017) used the 9R framework (as shown in Figure 1) instead of 4R framework to extend the definition of circular economy (as explained in the figure below). They explained how an economy moves from linear to circularity. It focussed on using the material

of all products in some way or the other and reduce the wastage to its minimum. (J. Kirchherr et al. 2017)

Few methods that have been introduced for a circular economy are – use of biodegradable packaging instead of plastics; remanufacturing of mobile phones by giving incentives to consumers to return their old phones (it has reduced the cost of mobile phones by 50%); increased use of organic materials as these materials can be breakdown by insects which then become compost (a form of recycling). (Ellan MacArthur Foundation)

Figure 1

Source: Potting et al. (2017, p.5)

If the waste is eliminated from the production process, then it will save the costs of production. Elimination of waste also results in less resource dependence. It encourages innovation and thus growth in the economy. Prevention of wastage of resources is beneficial for the industries, consumers and also the economy.

There is a transformation from linear to circular business models in products like mobile phones, light commercial vehicle (LCV) and washing machines. The transition is observed in the product design, business models and reverse cycle skills. Earlier the importance was on primary extraction but it has now shifted to repeated use of products, components and materials. Yield improvement of around 95% (from 70%) was observed and on an average 60% time savings in pre-processing was found. Also, around 25% of savings were detected in the overall costs of production.

Agriculture is one of the main sources of income for many households in India. More than 50% of India's workforce is engaged in agriculture. Thus it plays an important role in the overall socio-economic development of the country. It generates a lot of agricultural waste in the form of crop residue. Once the crop has been harvested, some material is left on the cultivated land which is called crop residue. This includes stalks and stubble, leaves and seed pods. Instead of utilising these residues, farmers generally burn the stubble to get rid of the waste in a convenient manner.

In late September and October each year, farmers mainly in Punjab and Haryana burn an estimated 35 million tons of crop waste from their paddy fields. This practice is regarded as a low-cost straw-disposal practice and it helps to reduce the turnaround time between harvesting and sowing for the second (winter) crop. A cloud of particulates called "toxic cloud" in New Delhi Smoke is being produced from this smoke which is also visible from space and results in declarations of an air-pollution emergency in the state.

When a farmer intentionally sets a fire on the remaining of the food grains like paddy, wheat, etc., after being harvested is known as Stubble or Straw Burning or Parali in short. The practice was common among farmers until the governments restricted its use during the 1990s. This method is widely accepted as a cost-effective method, it kills slugs and other pests and it also helps to reduce nitrogen tie-up. Besides these few benefits of stubble burning, there are many harmful effects which are as follows:

1. Loss of nutrients: Organic quality of soil gets affected due to stubble burning as it damages the micro-organisms present in the upper layer of the soil. Due to the loss of 'friendly' pests, the solubility capacity of the upper layers of soil reduces. The crops become more prone to diseases as the wrath of 'enemy' pests has increased.
2. Pollution from smoke: Another adverse effect of stubble burning includes the emission of greenhouse gases (GHGs) which contributes to global warming, increased levels of particulate matter (PM) and smog. The smog results in serious health problems, loss of biodiversity of agricultural lands, and the degradation of the fertility of the soil.
3. Damage to electrical and electronic equipment from floating threads of conducting a waste
4. Risk of spread of uncontrol fire

In this respect, the current study focuses on the advantages of the circular economy taking into consideration the case of stubble burning. Our focus is primarily on the capital city of India, New Delhi. It is surrounded by states of Uttar Pradesh, Punjab and Haryana where most of the agricultural

activities and thus crop residue burning takes place. Due to its geographical location, Delhi suffers maximum pollution because of stubble burning. We will explore alternative strategies available in the circular economy which will benefit Delhi by reducing pollution and economy by providing reusable resources.

POLLUTION PROBLEM IN INDIA

Air is the core element for the sustenance of life. However, going by the data and statistics, various sources have merged, posing a significant threat to air quality. Air Pollution is the greatest risk to human life, more so in India than in any other country. And with the rapid urbanisation, the country has been detrimental in many ways to its environment.

An increase in the country's population and inadequate infrastructure have left many Indian cities with unhealthy living conditions. With existing challenges posed by the COVID-19 Pandemic, worsening air quality is the leading environmental concern amongst the people of India, where many citizens bear the brunt of the toxic, unhealthy living conditions.

In the U.S., Air Quality Index or AQI is used as the measure of outdoor air pollution, which rates air conditions across the country. It is based on concentrations of five major pollutants: ground-level ozone, particle pollution (or particulate matter), carbon monoxide, sulphur dioxide, and nitrogen dioxide. WHO data shows that low- and middle-income countries suffer most from the highest exposures.

Some of the short-term problems caused by air pollution include sneezing and coughing, eye irritation, headaches, and dizziness. While the long term problems associated with air pollution has been linked to higher rates of cancer, heart diseases, stroke, and respiratory diseases like asthma. Particulate matter smaller than 10 micrometres (classified as PM_{10} and the even smaller $PM_{2.5}$) pose higher health risks because they can be breathed deeply into the lungs and may cross into the bloodstream. Major concerns for human health from exposure to PM_{10} include long term health problems. Few categories of people including elderly persons, children and people with chronic lung disease, influenza or asthma are highly vulnerable to the effects of particulate matter. India saw one-fourth of global deaths linked to $PM_{2.5}$ exposure in 2019.

Air pollution in India is a serious health issue. Of the most polluted cities in the world, 22 out of 30 are in India in 2019 and almost 99 per cent of Indians breathe air that is 10 times or more over the WHO safe limit. Also, 13 of the world's 20 cities with the highest annual levels of air pollution

are in India. Air pollution contributes to the premature deaths of 2 million Indians every year. One in eight deaths in India was attributable to air pollution in 2017 which is way more than those caused by diarrhoea, tuberculosis, HIV, or malaria.

India has no doubt witnessed a surge over air pollution in recent years. Moreover, the country's geographical distribution also contributes to the problem**.** Agricultural practices like burning crop stubble are still commonly used. Its smoke wafts over big cities like Delhi. Given that these regions are landlocked, it is difficult for the smoke to dissipate. Additionally, it often combines with traffic exhaust and factory emissions. According to the Central Pollution Control Board, of the four major Indian cities, air pollution was consistently worse in Delhi, every year over 5 years (2004–2018). Kolkata was a close second, followed by Mumbai.

Delhi- the heart of India, with the levels of PM 2.5- polluting particles, has been ranked as the
most polluted capital city in the world, and the fifth most polluted city worldwide. Delhi air quality is frequently "unhealthy." In 2019, 60.5 per cent of all annual hours were rated "unhealthy" or worse. While poor air quality is common throughout the year, the winter has a much higher frequency of hours rated "unhealthy," "very unhealthy," or "hazardous." With the Air Quality Index (AQI) at 313 in November, Delhi's air quality slips to 'very poor' from 'poor'.

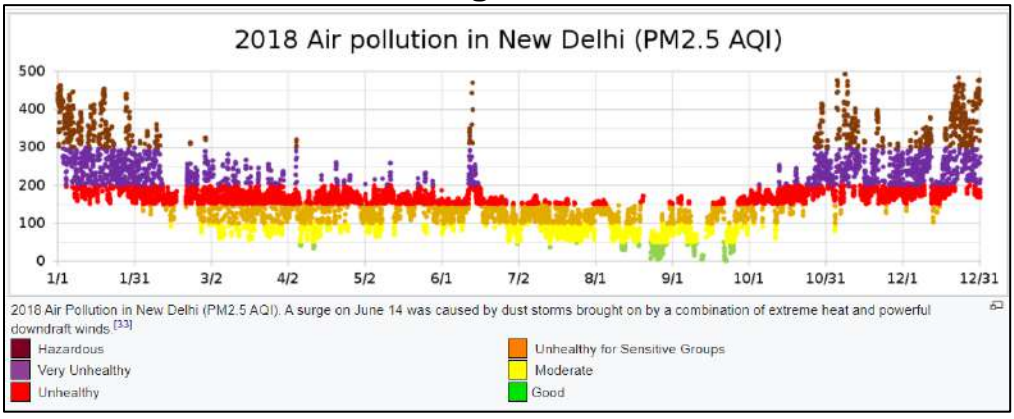
Moreover, Delhi's geographic location in a "bowl" near the foothills of the Himalayas creates a pollution-trapping effect in which air has only narrow outlets to escape. As emissions are generated and coastal winds blow inland, air stagnates in the city as it becomes blocked by the surrounding mountains. Notoriously polluted cities like Beijing, China and Los Angeles, USA experience similar effects.

If we consider the entire winter season (Nov-Feb), as was done in the ARAI-TERI 2018 study on source apportionment, crop burning indeed accounts for roughly 4% of Delhi's air pollution. But this average figure, which the environment minister possibly relied on, hides significant daily differences, and also misses out on the impact of crop burning in October, when stubble burning is quite high. During the peak stubble burning phase, crop burning accounts for more than 50% of Delhi's air pollution, according to data from System of Air Quality and Weather Forecasting And Research (SAFAR).

About 30% $of\ PM_{2.5}$ concentration is contributed by sources outside the city due to Stubble Burning. It India has been cited as a major cause of air pollution in Delhi in winter season in Punjab and Haryana in northwest

India. In Delhi, winter months are often more than 3 times as polluted as summer months. This difference between seasons is typically attributable to weather conditions rather than emissions. In the winter, wind conditions slow down by a third as compared to summertime conditions. Without powerful winds to disperse pollution, pollutants are more likely to accumulate. Winters in Delhi are also relatively dry, with little rain between October and May. Without rain and humidity, particles and gases are less likely to coagulate (merge to form larger particles) and thus fall to the ground due to gravity.

Figure 2



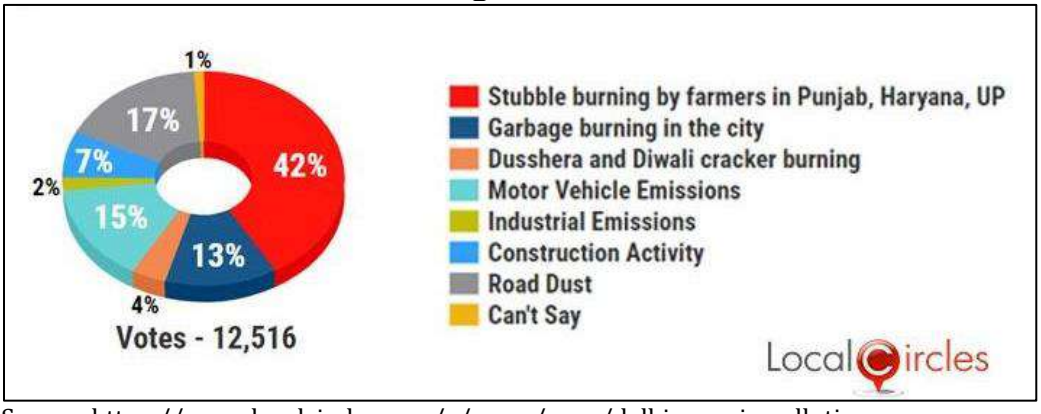
Source: "New Delhi's Air Pollution Went Off the Scale This Week". *15 June 2018.*

Studies have explored that meteorological conditions have compounding effects on air pollution. It was also found that the air quality of both indoor air and outdoor air got deteriorated during winters. The average contribution of stubble burning to the concentration of PM2.5 in Delhi-NCR during peak phase has increased from 10% in 2019 to over 15% this year with Punjab reporting an increase of 48% in fire incidents while these declined by 28% in Haryana. This can be seen in Figure 2 above.

The major sources of pollution include industrial pollution, vehicular pollution, stubble burning and fireworks. Emissions come from vehicles, manufacturing and construction industries, electricity generation whereas in rural areas, much of the pollution stems from biomass burning for cooking and keeping warm. Another driver of pollution in Delhi is the unfavourable meteorological conditions. In autumn and winter months, large scale crop residue burning in agriculture fields – a cheaper alternative to mechanical tilling – is a major source of smoke, smog and particulate pollution. Besides agricultural burning, there are other sources of burning as well such as trash burning, roadside burning, landfill burning, brick klins. Urbanisation is also one of the important contributors to the pollution which ultimately have an adverse effect on humans. In figure 3 below, it can be seen that for the current year (2020) different sources of

pollution have respective shares in their contribution to air pollution. As is visible, stubble burning by farmers in Punjab, Haryana and UP contributes maximum (around 42%) to the pollution followed by road dust whose contribution is only 17%.

Figure 3



Source: https://www.localcircles.com/a/press/page/delhi-ncr-air-pollution-survey#.X8CrEWgzZPY

STRATEGIES TO CONTROL DELHI POLLUTION

As Delhi and National Capital Region got engulfed by the toxic smog with pollution levels breaching permissible standards limits by multiple time in winters. The Air Quality Index in many parts of the city has slipped into the 'severe' category with a score of 448 on a scale of 500 against the permissible limit of 100 micrograms per cubic metre. As per the doctors, it is a state of emergency and has declared the condition as a public health crisis. The government also tend to take various measures to curb the problem of air pollution caused by stubble burning during the season. Moreover, in Delhi, winter months are often more than 3 times as polluted as summer months.

Most Indian cities greatly exceed acceptable levels of suspended particulate matter. This may be because of refuse and biomass burning, vehicles, power plant emissions, industrial sources. The Indian air quality monitoring stations reported lower levels of PM10 and suspended particulate matter during monsoon months possibly due to wet deposition and air scrubbing by rainfall. Higher levels of particulates were observed during winter months possibly due to lower mixing heights and more calm conditions. In other words, India's air quality worsens in winter months and improves with the onset of the monsoon season. All this resulted in declaring an air pollution emergency.

Consequently, in 2015, the Government of India, together with IIT Kanpur launched the National Air Quality Index. In 2019, India launched 'The National Clean Air Programme' with the tentative national target of 20%-30% reduction in PM2.5 and PM10 concentrations by 2024, considering 2017 as the base year for comparison. Also, the NGT (National Green Tribunal) instituted a fine of Rs. 2,00,000 on the Delhi Government for failing to file an action plan providing incentives and infrastructural assistance to farmers to stop them from burning crop residue to prevent air pollution.

There are various measures taken by the authorities to tackle air pollution in Delhi:

Odd-Even Policy on Vehicles: The policy was first introduced in January 2016 when the quality of air had nosedived and was re-introduced in April in the same year. As per the rule, between 8 am and 8 pm private, non-commercial vehicles are allowed out on the roads on alternate days – odd days if the vehicle's license plate ends in an odd number, and even days if it ends in an even number.

Delhi Authorities Enhancing Parking Fees by Four Times: In a bid to discourage people from taking out their cards and reduce vehicular emissions, the Delhi authorities including Municipal Corporations of Delhi, Delhi Development Authority, Delhi Metro Rail Corporation hiked the parking fees by four times.

Ban on Civil Construction: The construction dust has off late been recognised as one of the major sources of pollution in Delhi. It can cause health complications like asthma, chronic obstructive pulmonary diseases, silicosis, etc. Amidst the current crisis, the Delhi government has imposed a ban on construction and demolition activities.

National Green Tribunal Restricts Industrial Activities and Bans Waste Burning in Delhi: All the industrial activities, entry of trucks and all the construction-related activities have been put to hold by the government.

Red Light on, Engine off Campaign: The Delhi government has also kick-started its 'Red Light On, Gaadi Off' anti-pollution campaign for which it has deployed 2,500 environment marshals at 100 traffic signals across the city to generate awareness and curb vehicular pollution.

Green Delhi App: The AAP chief also announced a 'Yudh Pradushan Ke Virudh' campaign, which intends to reduce pollution levels in Delhi to make it a cleaner and greener place for residents. As part of the campaign, the government will be using a technology developed by Pusa Agriculture Institute, to curb the menace of stubble burning.

There is a need to implement the solutions and alternatives to the stubble burning problem. And for the same, new and innovative technologies and machines can prove to be a major boon for the removal of the crop residue of agriculture, that is for straw and stubble. Some of these machines are:

Turbo Happy Seeder (THS), Rotavator, Straw Baler, Paddy Straw Chopper cum spreader and Reaper Binder. But these machines are costly and are thus mainly used by only rich farmers. State governments should come forward and provide better subsidy to farmers so that they can use these machines.

Farmers have expressed willingness to use Turbo Happy Seeder as it has reduced labour and time of farmers. This machine helps to uproot the stubble and also sow seeds in the area cleared, which is then used as mulch in the fields. But it is very costly as farmers are required to spend around Rs. 1,000 on rent and some extra money on diesel. A single machine can cover 10 acres in a day. Thus suitability and availability are the major problems. Also, farmers faced difficulty in sowing and germination of wheat seeds was also lowered when happy seeder was used. Most of the machines were dumped only after 2 years of use.

Straw Baler: It helps to compress crop residue into compact bales which can be then easily moved out of the field. It was successful in initial days as baler owners used to provide their services free of cost and would earn by selling the bales to biomass factories, paper mills and cardboard factories nearby. But this machine also failed as balers started charging price because the machine took an hour for every acre.

Paddy Straw Chopper cum Spreader: It is used to chop leftover paddy straw into pieces and spreads it around the field. Both these actions are performed in a single operation, making it easy and time-consuming for farmers.

Besides new technologies stubble can also be converted into biochar, which can further be burned in a kiln to be used as fertilizer in the fields. It is a renewable source which is much effective and environment friendly alternative. The biogas generated from this process can also be used as fuel or can be converted to electricity. This process is called biomass gasification. The problem is air blown gasifier needs to be set up which has some fixed cost. Also, there needs to be demand for this biogas, otherwise, there is no profit for the farmers.

Also, long-duration paddy varieties can be replaced with short-duration paddy varieties (like Pusa Basmati – 1509 and PR-126) to reduce stubble

burning. This will give enough time for the stubble to decompose and avoid its burning. This is because these varieties will then be harvested in the third week of September, which will extend the time between the end of rice season and the start of wheat season.

Further, the demand of paddy straw and stubble can be increased by the state government. People should be made aware of the traditional way of using paddy straw and stubble as fodder and as a part of feed mixture preparations. It is also used as cattle feed, compost, roofing in rural areas, biomass energy, mushroom cultivation, packing materials, fuel, paper, bio-ethanol and industrial production. This will incentivise farmers to not burn stubble but to remove them using some methods and sell them in the markets. The government can even set up fodder and feed markets for its effective implementation.

As we talk about stubble burning, we need to remind ourselves about agriculture being a regenerative process, one which recycles. Agriculture residues can have huge economic value if utilized properly such, as making particle board, use in mushroom cultivation, use in cover crops, cattle feed, use as biofertilizer.

What we need is to utilise every product in the process and return it to the soil in one form or another. From 35 million tonnes of stubble (parali), we can obtain 21 million tonnes of high-grade organic fertiliser. The total amount of nitrogen, phosphorous, potassium and sulphur in the 23 million tonnes of parali annually burnt in Northwest India is about seven lakh tonnes, valued at Rs 1,000 crore. This apart, organic carbon is also destroyed during stubble burning. Thus, parali offers an important source for meeting the nutrient requirements of crops and improving soil health. These nutrients also reduce the risk of cancers in Punjab by reducing the levels of carcinogens in soil.

And for the same, the government is set to use a technology developed by Pusa Agriculture Institute, to curb the menace of stubble burning.

PUSA Bio-Decomposer (The Hindu)*

Pusa bio-decomposer is a solution developed by the scientists at the Indian Agricultural Research Institute, Pusa, which can turn crop residue into manure in 15 to 20 days and therefore, can prevent stubble burning

- The decomposers are in the form of capsules made by extracting fungi strains that help the paddy straw to decompose at a much faster rate than usual.
- The fungi help to produce the essential enzymes for the degradation process.

Decomposer Mixture

- It involves making a liquid formulation using decomposer capsules and fermenting it over 8-10 days and then spraying the mixture on fields with crop stubble to ensure speedy bio-decomposition of the stubble.
- The farmers can prepare 25 litres of the liquid mixture with 4 capsules, jaggery and chickpea flour. The mixture is sufficient to cover 1 hectare of land.

Time to Decompose

- It takes around 20 days for the degradation process to be completed.
- Under usual circumstances, shredded and watered paddy straw, which is mixed with soil, takes at least 45 days to decompose.
- It does not give enough time for farmers to prepare fields for the wheat crop on time.

Benefits

- The decomposer improves the fertility and productivity of the soil as the stubble works as manure and compost for the crops and lesser fertiliser consumption is required in the future.
- The soil loses its richness due to stubble burning and it also destroys the useful bacteria and fungi in the soil, apart from causing harm to the environment.
- It is an efficient and effective, cheaper, doable and practical technique to stop stubble burning.
- It is an eco-friendly and environmentally useful technology and will contribute to achieving Swachh Bharat Mission.

CONCLUSION

As is seen, pollution is a big problem in India, especially in Delhi. This pollution problem surges in the winter season from the month of November to February. During this period, the concentration of $PM_{2.5}$ increases which is harmful to economic health.

Many reasons are observed as the cause of this deadly pollution. Some of them are vehicular pollution, industrial pollution, fireworks, stubble burning and many more. During the winter season, farmers burn the crop residue before the harvesting season which contributes to pollution and becomes the major source of it, leaving all other factors behind.

Instead of burning, if farmers shift to alternative strategies which leads to reusing the stubble and straws, then it will be beneficial for both the farmers and the economy. Thus, the shift from a linear economy (where the focus is only on the main agricultural product) to the circular economy is necessary, so that the waste can be used for economic gains. Using this model to prevent stubble burning, the economy can gain from less pollution and more resources.

Many policies were made by the government in the past like the National Policy for Management of Crop Residues to protect the parali. Since then, crop residue management has helped make the soil more fertile, thereby resulting in savings of Rs 2,000/hectare from the farmer's manure cost. Burning crop residue is a crime under Section 188 of the IPC and the Air (Prevention and Control of Pollution) Act, 1981. However, the government's implementation lacks strength.

To tackle this issue, the Delhi government had launched a widespread campaign to curb air pollution, with an action plan that would include preparing bio-chemicals and spraying them across 800 hectares of farmland in the rural belt of the capital where farmers burn crop stubble. The Delhi government will set up a centralised system to produce bio-chemicals at Najafgarh's Kharkhari Nahar village under the supervision of scientists from the Indian Agricultural Research Institute (IARI), which recently developed a low-cost solution to stop farmers from setting fire to paddy stubble.

In order to keep in check pollution from stubble burning which is not under the control of the Delhi government, it was decided that it would work with neighbouring states and agencies so that the poor air quality could be curbed in winters in advance.

The state needs to step in and engage already-existing mechanisms like the MGNREGA for this purpose. To do this, the Centre needs to allow states to include activities like harvesting and composting in MGNREGA. This has been a longstanding demand of many states. Stubble (parali) can be mixed with cow dung and few natural enzymes under MGNREGA to generate high-grade compost, and also reduce air pollution in North India.

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STUDY ON TOTAL QUALITY MANAGEMENT OF HEI'S: RESEARCH REVIEW

ABSTRACT: The educational institutions of today are concerned with quality. Due to increasing competition, the identification of the academic institutions that have a high level of quality has become a crucial issue. The concept of Total Quality Management (TQM) was developed by an American, W. Edwards Deming, after the World War II, for improving the production quality of goods and services. The concept was not taken seriously by Americans but the Japanese adopted it seriously in 1950. The success of TQM in Japan made this concept famous in many countries across the world. Based on the literature review carried out, it was acknowledged that, in fact, there are still many doubts about the relationship between quality management and performance in education sector; hence, it is relevant to study the adoption of Total Quality Management in Education sector and its outcome in India.

Keywords: TQM, Educational Institutions, Management

INTRODUCTION

The concept of Total Quality Management (TQM) was developed by an American, W. Edwards Deming, after the World War II, for improving the production quality of goods and services. The concept was not taken seriously by Americans but the Japanese adopted it seriously in 1950. The success of TQM in Japan made this concept famous in many countries across the world. Originally, the concept was developed for manufacturing organizations. Later on, it gained popularity in other service institutions including banking, insurance, non-profit organizations, health care and so on. TQM consists of organization wide efforts to install and make permanente climate where employees continuously improve their ability to provide on demand products and services that customers will find of particular value. TQM is philosophy and system for continuously improving

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the services and/or products offered by an organization to its customers. TQM refers to the management method which increases the quality and productivity in the organizations. It is a continuous quality process which moves in the direction of the vision of the organization and helps in realizing its goals.

The definition of Total Quality Management terms by concept is described below:

Total Quality Management (TQM)

Total = involves/ relates to everyone and all the activities of the company.

Quality = Conformance to Requirements (Meeting Customer Requirements). Management = Planning, organizing, directing, controlling and co-coordinating all the activities of the organization for continuous improvement and maintaining a high level of quality.

According to British Standard Institution, TQM consists of a "Management philosophy and company practices which aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization".

In Simple Terms, Total Quality Management as an integrative management philosophy and a set of guiding principles, representing the foundation of a continuously improving organization/institution.

FEATURES OF TQM

- It enhances the way of doing business
- Art of managing the whole to achieve excellence
- Both a philosophy and a set of guiding principles that represents the foundation of a continuously improving the institution.
- Application of quantitative methods and human resources to improve all processes within an organization and exceeds customers' needs now and in future.

OBJECTIVE OF STUDY

To Study the literature on TQM
To study the level of TQM in HEI's

REVIEW OF LITERATURE

Brigham (1993) stated that no other management philosophy in recent memory has captured the fancy of American business like Total Quality Management (TQM). The shining lights of U.S. industry - Motorola, Proctor

and Gamble and Xerox - witness the success that can come with effective TQM practices. The momentum of TQM has been so contagious that it swept through manufacturing, then service and health care, and now comes to government and education. Yet TQM's standing in business circles has been sullied recently by critical press reports in "The Wall Street Journal", "Newsweek", and "The Economist". Much of the criticism originates from surveys conducted by Arthur D. Little, A. T. Kearney, Ernst & Young, McKinsey & Company, and Rath & Strong that have reached similar conclusions: in more cases than not, TQM has failed to produce its promised results. Before higher education proceeds further with its infatuation with TQM, it will do well to ponder the mistakes and accomplishments of previous practitioners, thereby increasing the odds of benefitting from the intelligence and holism of TQM.

Bass, et.al. (1996) A national sample of Professors of Business Schools was used to investigate four research questions concerning faculty members' practices and perceptions about using total quality management (TQM) principles to improve classroom teaching. The findings suggest that few universities have formal plans for applying TQM principles in the classroom, although most respondents apply them in teaching. Also reported are respondent choices of TQM actions to apply to classroom teaching and measures that could be used to evaluate the effectiveness of TQM applications in university classrooms.

Smith & Lewis (1997) strongly berated total quality management, claiming it is a tool of management used to adversely manipulate workers in pursuit of corporate gain. This paper questions this supposition, arguing it is the abuse of TQM by management that is at fault. Effective TQM is based on four principles, Customer Satisfaction, Continuous Improvement, Speaking with Facts, and Respect for People. It is the lack of the genuine respect for people that is the demise of most TQM initiatives.

Koch & Fisher (1998) stated that those who advocate the use of total quality management (TQM) in higher education, issue strong promises that it will unite campuses, increase employee satisfaction and improve nearly any process that it touches. Unfortunately, the empirical evidence in favor of TQM in universities is mostly anecdotal and surprisingly sparse. The evidence that does exist relates primarily to administrative tasks such as bill collection, check writing, financial aid and registration. But, the truly significant problems facing higher education today relate to the nature of the curriculum, uses of faculty time, how to restrain cost increases, distance learning and the use of technology, cooperative relationships with business and governance & leadership arrangements. TQM has precious little to say about these things and even erects subtle roadblocks to change in these areas because of its strong emphasis upon meetings, consensus and process over product. Further, it turns out to be a costly approach to

decision-making because it is very time-intensive. Thus, while TQM appears to have been quite helpful to some business firms, it is only marginally useful in the rapidly changing, indeed revolutionary, environment that universities inhabit today.

Joiner (2006) undertook the study to find out the relationship between the extent of Total Quality Management (TQM) implementation and organization performance and to find out the moderating effect of co-worker support and organization support on the TQM and performance relationship. 80 motor vehicle parts and accessories manufacturing firms in Australia were taken as sample. Mean, Standard deviations, Correlations and Factor Analysis were used for data analysis. The results indicated that there is a strong positive relationship between the extent of implementation of TQM practices and organization performance. This study also found that co-worker support and organization support moderated the relationship between TQM implementation and organization performance.

Soltani & Lai (2007) examined management perception and understanding of the concept of control in the context of TQM and its implications for its success or failure. Three quality driven manufacturing organizations operating in United Kingdom were taken as sample. Multiple Case Study, Indepth Interviews and Content Analysis were used as research methodology. It was concluded that the majority of the managers of TQM-driven organizations at various organizational levels see no difference or relatively little difference between the TQM desirable types of control i.e. process control and control over the workforce.

Vijande & Gonzalez (2007) conducted the study to provide empirical evidence on the relationship between management practices and measures of business performance in the EFQM Excellence Model. Ninety three firms from manufacturing and service sectors in Spain were taken as sample for the study. The statistical techniques used for the purpose of the study were Confirmatory Factor Analysis and Structural Equation Modeling. The results revealed that the adoption of the TQM practices, suggested in the EFQM Excellence Model, allows the firms to outperform their competitors.

Pour & Yeshodhara (2009) investigated the Level of Perception of Secondary School Teachers regarding TQM in Education, difference between the level of perception of male and female secondary school teachers and difference between level of perception of Arts and Science secondary school teachers regarding TQM in education. A sample of 126 High School teachers belonging to 21 schools in Mysore (India) was taken. Mean, Standard Deviation, t- test and Analysis of Variance (ANOVA) were used for data analysis. According to the finding of the study, majority of secondary school teachers have exhibited average level of TQM in

education. It was also observed that female teachers have better perception than male teachers regarding TQM in education and there is no significant difference in the perception of Arts and Science secondary school teachers regarding TQM in education.

Talib et.al. (2010) conducted a study to identify some Critical Success Factors (CSFs) that contribute to the success of TQM in the service industry in India. Thirty nine TQM studies on CSFs were undertaken for the purpose of study. Pareto Analysis was used as research methodology. It was concluded that in the service industry the commitment of the top-management is the top most CSF, whereas Customer Focus and Satisfaction is the second most vital factor for effective TQM implementation.

Gorji and Farooquie (2011) examined Health Care Quality and Performance in two countries - India and Iran. A sample of 50 hospitals from India and 60 hospitals from Iran (government, semi – government and private) was taken. ANOVA was used for the purpose of data analysis. The results did not show any significant difference between practicing the philosophy of total quality management for performance excellence in health care in India and Iran. Results showed that there is significant difference between groups of hospitals and the hospitals from India and Iran are not found to be scoring close to the benchmarks.

Idris (2011) investigated the relationship between Total Quality management (TQM) elements and sustainable company performances. For the study, a sample of 400 employees of companies listed in the SIRIM Directory (containing ISO 9000 certified companies) was taken. The research showed significant relationship between the elements of Leadership, Best Practices, Productivity, Customer, Employee, Community Focus and Company Performances.

Bhalla (2012) analyzed the need of continuous quality improvement, components of TQM, challenges of TQM in higher education and to study the means and strategies adopted by different educational institutions for ensuring TQM. The findings of the study revealed that high rate or increasing rate of students' enrolment in the higher educational institutions indicates that the quality of education in the higher educational institutions has been improved. To make TQM a success, today the educational institutions are starting their TQM initiatives from the grass root level. But still there is a huge stress to improve the quality of education in future because India has not yet attained excellent results in the TQM implementation in the higher education sector.

Pourrajab et.al. (2012) conducted the study to identify the level of Total Quality Management (TQM), the level of Culture of Teaching and Learning

(COTL) and to investigate the relationship between TQM and COTL in Iranian secondary schools. The sample comprised of 280 teachers and 40 principals of 20 schools. Mean, Standard deviation and Karl Pearson Correlation Method were used for data analysis. The findings of this study revealed that the level of TQM and COTL is high in Iranian secondary schools. It was concluded that an increase in the level of TQM in schools will also increase the level of COTL in the schools.

Talib et.al. (2012) identified and analyzed TQM practices in Indian Hospitality Industry based on e-mail survey of 34 Hospitality Companies. Statistical measures like mean, standard deviation, reliability test and Pearson Correlation analysis were used. The results presented are focused on 17 TQM practices identified from literature review. It was found that top-management commitment, customer focus, product and service design, continuous improvement and innovation, quality culture and training and education are the most successful driven practices for TQM program in Indian hospitality industry. Moreover, supplier management and human resource management are the least important practices.

Cornelison (2013) analyzed the core principles of TQM and tested their prevalence and effectiveness within the Printing Industry in USA. A sample of 223 employees of printing companies in California (U.S.A) was taken for the purpose of the study. Content analysis, Case study and In-depth survey were used as research methodology. According to the authors, the core principles of TQM were widely implemented in the printing industry. It was also found that many employees did not have a clear idea of TQM concept and successful companies have full knowledge and usage of TQM concept and principles.

Altahayneh (2014) conducted the study to investigate the perceptions of physical education faculty members regarding the application of TQM Principles to Colleges of Physical Education in Jordan, to examine the extent to which these faculty members differ in their perceptions and the extent to which differences in perceptions are influenced by rank, educational level and years of experience. The sample consisted of 72 faculty members from four Colleges of Physical Education in Jordan. Frequencies, Mean, Standard deviation, t-test and One-Way Analysis of Variance (ANOVA) were used for data analysis. A large percentage (58.33%) of the faculty members indicated that there was no effort or slight effort to implement TQM at their colleges. In addition, the findings revealed that academic rank, years of experience and education level did not significantly affect the faculty members' perceptions of TQM implementation.

Barros et.al. (2014) exposed the conceptual model which tends to reflect the relationship between the use and implementation of quality

management principles and practices and their impact on the companies' quality performance. Results showed a significant and positive relationship between the implementation of quality management principles and practices and their impact on the companies' quality performance.

Wani & Mehraj (2014) stated that all the educational institutions should be provided sophisticated infrastructure, well qualified teaching staff, well qualified management to make TQM implementation a success. Not only government aided institutions but privately managed educational institutions should be insisted to adopt the philosophy of TQM. There should be Autonomous Bodies for all the levels, Primary, Secondary and University, which can inspect the educational institutions after every one or two years, so that implementation of TQM can be ensured and monitored. The concept should be applied wholly and solely to change education system which would be according to changing times and needs.

Boyal, Kumar and Ram (2015) conducted the study to establish the effect of drivers on Total Quality Management in Small and Medium enterprises of Rajasthan. Correlation, Regression Analysis, ANOVA test and t- test were used for data analysis. The drivers affecting Total Quality Management have played a crucial role in increasing the performance and sustainability of Total Quality Management in small and medium enterprises in Rajasthan, India.

Ganguly (2015) mentioned that universally, the role of Higher Education is changing and becoming more and more integrated with the process of economic development and prosperity of an economy by contributing to the intellectual capital of the economy. This prudent approach and quality focus will make higher education not only more integrated with the global standards but also contribute to the talent quotient of any country perfectly ready to take on global challenges and contribute towards economic growth and prosperity. Total Quality Management (TQM) is inevitably common factor that will shape the strategies of Higher Education Institutions in their attempt to satisfy major stakeholders like students, industry, society etc. Author also stated that, TQM is a general management technique can be applied to Higher Education Institutions to define and attain quality with a focus to meet and exceed the expectations of stakeholders by instituting the process of continuous improvement. Over the last few years, TQM was applied in the education industry. Majority of the applications were in the administrative side of the institutions, but some institutions applied TQM to curriculum development and delivery area.

Kaur (2016) stated that TQM is a holistic approach towards the overall improvement of an organization. The theory of TQM has tended to be successful in Higher Education provided that the management or the head of the HEI have enough potential to implement it. TQM looks to improve every department of HEIs or Universities. Author laid the stress on the fact that TQM improves every process, every job and every person within the organization. Its application is important in higher education in order to get maximum benefit out of higher education provided by HEIs or Universities. TQM has already proved its utility as a quality management tool in higher education in different parts of world.

Vasantharayalu & Pal (2016) examined the relation of TQM practices on operational performance in both Service and Manufacturing Industries. A sample of 300 participants from 50 Service and Manufacturing Industries in India was selected for the purpose of the study. Mean, Standard deviation, Correlation and Multiple Regression Technique were used for data analysis. It was concluded that the operational performance views that Leadership, Strategic and Planning, Customer Focus, Information and Analysis, People Management and Quality Performance are statistically significant in both kinds of industries.

Al-Damen (2017) examined the impact of TQM implementation on organizational performance. The study was conducted in Jordan Petroleum Refinery Company (JPRC), the study sample size was (103) managers from different levels. The researcher depended on primary and secondary data. The results show that TQM has positive impact on organizational performance.

Honarpour et.al. (2017) examined the reciprocal relation between Total Quality Management (TQM) and Knowledge Management (KM) and their impact on process and product innovation. The data were collected from a survey of 190 Research and Development (R&D) Unit managers in Malaysia. Confirmatory Factor Analysis was used to assess the reliability and validity of the measurement model and Structural Analysis was performed to evaluate the Research Model. The results revealed that there is a reciprocal relationship between TQM and KM. Additionally, TQM and KM showed a positive association with process and product innovation. Regarding the controversy of the relationship between TQM and innovation, this study supports the positive association between TQM and innovation. This study is among the first studies which provide empirical evidence of the existence of reciprocal relationship between TQM and KM. The analysis shows that R&D firms by implementing TQM alongside KM not only are able to manage their activities efficiently, but also are able to effectively perform in an innovative manner.

Madanat & Khasawneh (2017) investigated the impact of implementation of Total Quality Management (TQM) on the effectiveness of Human Resource Management (HRM) practices in the Jordanian Banking Sector. Variations in the implementation of TQM and the effectiveness of HRM according to demographic characteristics are detected. A high level of implementation of TQM (customer focus, top management commitment, and continuous improvement) was manifested, whereas employee engagement yielded a medium level. Similarly, a high level of effectiveness of all HRM (planning, staffing, training & development, and performance appraisal) was displayed, while a medium level of compensation was yielded. Implementation of TQM varies with respect to job title, whereas no significant variations with respect to gender, age, education, and experience are provided. No significant variations in the effectiveness of HRM due to gender, age, education, experience, job title were reported. A significant difference between Islamic and commercial banks in the implementation of three TQM dimensions and two HRM dimensions is uncovered, in favor of Islamic banks. A strong positive impact of TQM dimensions (customer focus, continuous improvement, employee engagement) on the effectiveness of HRM practices was manifested. Top management commitment was not an important factor in explaining variations of HRM practices.

Abdul Salam & Al-Salim (2018) defined the Total Quality Management and its impact on the performance of education institutions in the University of Samarra. This study was based on the analytical descriptive approach, which was composed of the top management and middle administration of the university. The study sample was of 52 individuals. It found some there is a statistically significant effect of total quality management on the performance of education institutions in the University of Samarra. Based on the findings of the study some prominent recommendations were implemented like: To appoint permanent task force on the dissemination of comprehensive quality culture at the University, Engaging employees in the process of strategic planning for quality and benefit from their experience in the field of the application of total quality management.

Lakmal et.al. (2018) explored relationships between identified TQM factors and their performance with regard to those factors. A questionnaire was given to a group of employees in ABC Company in the Seafood Industry in Sri Lanka. The importance of TQM factors is widely recognized. Analysis of the data obtained showed a positive relationship between the implementation of TQM practices (factors) and firm performance. The results of this study showed the implementation of TQM practices is positively associated with enhanced firm performance. This study has

important implications for managers. first, it motivates managers to invest in the time and resources to implement TQM programs, second, evidence from this study signals the importance of developing an environment or "culture" of support to further enhance the performance outcomes of TQM implementation.

Surendran (2018) described that Quality Education is a huge worry in several societies throughout the world. In an extremely aggressive education segment, the accomplishment of academic institutions relies on the quality of education that is imparted. Hence total quality management (TQM) has gained importance and researchers, educationalists, scholars; policymakers, all are showing their genuine interest towards TQM. Total Quality Management is accepted as an efficient management philosophy for customer contentment, continuous improvement, and organizational distinction. The fundamental idea of TQM is a democratic approach to tackle the question(s) of quality in business and in the area of education. Ubiquitously, the function of Higher Education is shifting and becoming increasingly incorporated into the procedure of economic growth and success. This structured worldwide occurrence is throwing multitudes of significant challenges with regard to developing a qualitative approach for handling higher education in a worldwide platform with an obvious goal to bring consistency in many significant areas and decrease the gap of bias in terms of quality education towards understanding and talent building.

Ali & Rumman (2019) presented the findings of a study investigating how the application of Total Quality Management (TQM) can help organizations to tackle the different business challenges brought about as a consequence of the recent global financial crisis including those associated with planning, cost reduction and increasing competition. The study focused on the experiences of employees based within the leading concrete and cement producer 'Lafarge-Jordan'. The results showed that customer focus and senior management support are the two most important variables that enhance the ability to face different types of challenges. Integrated relationships with suppliers and continuous improvement were found to have a significant impact on reducing quality costs to help overcome competition. Based on the previous literature and results, this research recommends the orientation towards greater employee involvement because they are the cornerstone to successful TQM; further, it is more advantageous to analyze both the soft and hard effects of TQM to overcome challenges. Practically, the outcomes of this research may serve decision makers in the Lafarge Company in their attempts to consider quality issues that have become a must for most stakeholders in this industry including consumers, government as well as investors.

Hawi & Alzyadat (2019) expanded previous studies and the knowledge in this area as well as examining aspects from Total Quality Management definitions as well as present a theoretical framework. The scope of the research from private universities in Jordan comprised of 150 matched members (lecturers) and 200 about to graduate students from business faculty. Total Quality Management was measured with the help of Participation, Development, and Evaluation. Linear Regression Method was used in the study. The findings of this study were instrumental in understanding the influence of Total Quality Management and institutions' excellence in Jordan. Results showed that the Participation variable was the stronger influencer towards students' satisfaction. It was found that, firstly, students in the Jordanian' Universities were most likely satisfied with their universities, secondly, quality and excellence can be found in organizations with high level of practicing management indicators.

CONCLUSION

Quantity and quality of human capital is one of the major determinants of the growth of an economy. Role of Higher Education institutes is changing and becoming more and more integrated with the process of economic development and prosperity by contributing to the intellectual capital of many a country and act as a source of physical and social capital. Reciprocal relation between Total Quality Management and Knowledge Management (KM) enhances the chances of process and product innovations.

In India there is no dearth of human capital quantity-wise but there is still a huge gap in the demand and supply of quality human capital. GOI is making sincere efforts to improve the standards of education imparted by the HEI. GOI is advocating that the techniques of Total quality management should be applied in HEI. Educational institutions should be provided sophisticated infrastructure, well qualified teaching staff, well qualified management to make TQM implementation success. It is believed that the use of TQM practices in higher education will unite campuses, increase employees' satisfaction and improve every process that it touches.

UGC, AICTE and other Regulatory commissions have been established to implement uniform education standards in HEI. In order to know and measure the extent of impact of TQM practices on the performance of education institutions GOI has established the institutions of NAAC, SERB etc.

TQM has failed to produce its promised results mainly in educational institutes. There will be positive results of the adoption of TQM practices provided that the managements or the heads of the HEIs have enough potential to implement it. Before the government agencies and higher

education institutes proceeds further with their infatuation with TQM, it will be beneficial to ponder over the mistakes and accomplishments of previous practitioners

It is observed through the review of literature that studies on TQM was conducted mostly in corporate sector but education sector seems to be unexplored/ neglected by the researchers. Moreover the earlier studies included TQM in education sector covered only in schools and colleges. There are very few studies conducted on TQM in universities and this area is still unexplored.

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AFTER MASSIVE DISRUPTION IN 2020 TIME TO THINK FOR FUTURE

ABSTRACT: When the former president of India Late. Dr. APJ Abdul Kalam dreamt of India becoming a well-developed nation by 2020, not in his wildest dreams could he have imagined the State of India during 2020 (a significant portion of 2020 was spent on tracking data of Covid-19 pandemic cases of infection, recovery rate, the number of patients admitted in the hospital, public to follow the strict lockdown rules, building up a vast infrastructure in the health sector, research in the field of medical science and other related sectors and last but not the least the number of deaths along with an analysis of comparable data from ROW). Aggregate demand in the economy contracted, unemployment was widespread and visible, migrant workers were extremely distressed and millions of people were pushed below the poverty line. In the subject of Economics, we try to address the fundamental problem of optimizing scarce resources. Resources are limited and every sector of the economy has its logic to make out a case for higher allocation. If more is allocated X means less is available to y, thus an implicit trade-off arrives while allocating resources, particularly at the disposal of the Government. Indian economy is going to witness its first contraction of a high order during 2020-21 and this is the first in 41 years. According to the World Bank's latest projections, Indian will overtake China to become the most populous country in 2023 with its population of 1.42 billion. (1) The big question is are we prepared to meet the demands of the future and present generation (eg. Food, clothing, housing, health, education, jobs, pollution-free environment, law and order, justice, social and economic security, social welfare, internal and external security, etc. along with conservation of natural resources for the future generation).

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Growth is just a number, no doubt is necessary but not a sufficient one. This paper is an attempt to highlight several challenges and we have to face them boldly.

Keywords: Demographic dividend, climate crisis, Basic needs without any environmental degradation

JEL Codes: C10, C33

INTRODUCTION

Growth and development are often used synonymously in economic discussion and this remained acceptable. However, there is always a marked difference between quantity and quality Development is a multi-dimensional concept and is reflected by people's better standard of living (better food that is a balanced diet, better clothing, better housing, improved education along with social empowerment and awareness, better sanitization, better medical facility, better means of transport and information technology, reduction in level of hunger, malnutrition, unemployment, inequalities etc.) increase in productivity of inputs with advancement of science and technology, carrying out innovations, promotion of human capital and skills, improvement in production function and process with advancement of technology, participation of disadvantageous or less advantageous section of the society in decision making process; social welfare and social security, sustainable and inclusive growth, conservation of natural resources, well-built system of disaster management, internal peace and law and order, preparedness against any external aggression (to deal with terrorist, separatist, extremists and anti-social elements), corruption etc. India became the fastest growing economy in the world by achieving a growth rate of 08% in 2015-16 and 08.17% in 2016-17 at constant prices (2011-12) and this figure gave us the confidence to make Indian economy of 05 trillion US dollar by 2024-25. The difference between quantity and quality can be understood with the 2020 HDI report published by UNDP on Dec 16, 2020 India (Asia's third-largest economy) has dropped two spots on the HDI ladder as it ranked 131 among 189. HDI value in India was just .429 in 1990 and it went up to .645 in 2019 (50% up) and India, Bhutan and Nambia were ranked equally on 129 notches. India has slipped down two places on the ladder. HDI does not measure only national progress but the development indicators on educational development, health outcome and standard of living are also taken into consideration.

Labour Force Participation Rate: India's population grew at the rate of 1.2% a year between 2010 and 2019 (marginally higher than the global average of 1.1% a year during the same period) accordingly to the UN population Fund State of World's population, released on 10-04-2019. India's rate of population growth (1-2) = growth rate of China (.5) + growth rate of USA (.7) people There were 1.21 billion people in India as per the census of 2011. (2)

Estimated working-age population $= \frac{55.8 \times 1420}{100} = 80$ crore

India's overall joblessness rate has climbed significantly to close to 10% in the week ended (13th Dec 2020) at least a 23 weak high). Accordingly, data released by CMIE labour force participation rate was 40.03% in Non 2020 and it was 42.9% in Jan 2020.

Let a conservative figure be 45%

$$= \frac{45}{100} \times 80 \text{ crore} = 36 \text{ Cr.}$$

Gap $\longrightarrow$ between supply and demand.

Key numbers

(a) GDP Growth Economic Survey 2020-21 has projected a GDP growth rate of 11% and 6.8% in 2021-22 and 2022-23. The survey has also projected nominal GDP growth of 15.4% in 2021-22. Hence India will go back to being the world's fastest-growing economy in 2021-22 and 2022-23 (according to IMF's latest growth projections)(3)

Year	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
GDP	8.3	7.0	6.1	4.2	-7.71	11.0	6.8

(b) Index eight-core Industries It is a common practice to extrapolate high frequency indicators to project-growth rates. Index of eight-core sector industries contracted for the third consecutive month in Dec 2020. (4)

Jan 20	+2.36	July 20	-7.62
Feb 20	+6.43	Aug 20	-6.85
March 20	-8.43	Sept 20	0.58
Apr 20	-37.87	Oct 20	-0.94
May 20	-21.39	Nov 20	-1.39
June 20	-12.42	Dec 20	-1.25

(c) Growing policy discontent Monetary policy was the pro-active policy instrument in India's initial response to the pandemic's disruption. Retail inflation rising sharply after the lockdown- it

remained above the upper limit of RBI's tolerance of four plus minus two percent from April to Nov 2020. (5)

(d) Measuring Access to Bare necessities The economic survey 2020-21 has constructed the Basic Necessities Index, a composite measure of access to bare necessities for households in rural and urban India for the years 2012 and 2018. The index is based on 26 comparable indicators on five dimensions. Water, Sanitation, housing, microenvironment and other facilities). Corollary of the theorem is that overall contraction driving the year 2020-21 means less tax collection and that is why fiscal deficit during the year will be in the (7.5% - 9.25%) GDP range way above the 3.5% government target. (6)

LITERATURE REVIEW

According to Mathus – A strict enquiry into the principle of population obliges us to conclude that we shall never be able to throw down the ladder by which we have risen to this eminence but it by no means proves that we may not rise higher by the same means. Mathus believed that progress of wealth is a function of capital accumulation and a steady rate of progress can be maintained (other things being equal) Capital accumulation continues unabated.

Mathematical Output = R+W (Profits + wages)

= Now it is known as operating surplus + compensation of employees + mixed income of the self-employed.

Workers are too poor to save and spend major portion of their income on consumption (Cw). Capitalists do save these savings and create income for further investment

$$I = \frac{dk}{dt} = \text{Rate of change of capital accumulation}$$

$$= k_t - k_{t-1}$$

$$R = O - W$$

O_t = Production at a particular to met

$$\propto = \frac{\text{Output}}{\text{Capital}} \text{ or } \frac{1}{\propto} = \frac{\text{Capital}}{\text{Output}}$$

$\frac{1}{\propto}$ = For a unit of output, how many units of capital are needed (Capital Coefficient)

O_t = Industrial Production = $\propto k_t$

(Differentiating this equation w.r.t time)

$$\frac{dot}{dt} = \propto \frac{dkt}{dt} + k_t \frac{d\propto}{dt}$$

If technical progress is constant $\frac{d\propto}{dt} = o$

$$\frac{dot}{dt} = \propto \frac{dkt}{dt}$$

O_A = Agriculture output = f (L_A , k_A)

$$\frac{doa}{dt} = \frac{\delta f}{2L_A} \frac{dL_A}{dt} + \frac{\delta f}{\delta kA} \cdot \frac{dk}{dt}$$

If technical progress is constant $^{dt}/_{dt} = 0$

$$\frac{dO_A}{dt} = \frac{\delta f}{\delta LA} \cdot \frac{dLA}{dt}$$

= MP of labour X Rate of Increase of Labour overtime

Therefore, agriculture production depends on MP_L which is dependent capital investment on land. But now technology is changing for the better.

RESEARCH GAP

Rapid Growth of population leads to **(4.1)** tends to lower agricultural productivity and promote subdivision and fragmentation of landholdings – leads to overutilization of land and retreads the economic welfare of present and future generation. About 15% cake is shared by half of the population engaged in the agriculture sector.

(4.2) Creates overpressure on the country's natural resources.

(4.3) Urbanization: Migration of population farmer rural areas to urban areas (problems of housing, transport, power, health services, development of basic infrastructure, education, etc.)

(4.4) Causes: Environment damages through the setting up of new colonies (air population, water population, climate changes and damages to forest, mineral and water resources) India has 18% of the world

population but just 4% of its freshwater resources. The elasticity of substitution of water is zero. All dependence can be reduced by tapping other sources of energy.

OBJECTIVES

Keeping in view the revenue shortage and the demand for higher expenditure in order to boost aggregate demand in the economy in the year, the government is expected to register a fiscal slippage in 2020-21. Fiscal indicators are expected to re-bound with the recovery in the economy. Our dream of making India a super economic and knowledge power may not be shattered due to a number of disruptions and shocks. All challenges are to be taken as opportunities the objectives of this paper are:

5.1 To resolve the basic issues like poverty, unemployment and inequalities.
5.2 To increase employability so as to get the demographic dividend.
5.3 To examine the problems related to environmental degradation, climate change and corrupt practices.

RESEARCH METHODOLOGY

This paper is based on secondary data obtained from standard and authentic sources like blueprints produced by the govt. and some authorities, non-govt. agencies, data produced by think tank, journals, magazines, bulletins and some websites, Analysis of facts has been made by using simple statistical tools and conclusions have been drawn accordingly.

SIGNIFICANCE OF THE STUDY

Covid-19 pandemic has forced us to adopt new normal eg. Social distancing (but it should be physical distancing), mask-wearing (hiding our smiling face), washing our hand, with sanitizer frequently work from home, online teaching and learning, virtual mode of holding a meeting, conferences, functions, seminars, condolence-meetings etc. These all normal could prove to be a substitute in extraordinary situations. India is a country of observing traditions. Physical presence is always meaningful, that is why this paper is relevant.

ANALYSIS OF OBJECTIVES

(a) Poverty may be defined as the inability to secure the minimum consumption requirements (in the form of a balanced diet) for life, health and efficiency) Definitions of poverty have been given on the basis of

minimum calorie intake, minimum expenditure and minimum income- but there is no accepted definition. Different schools of thought have given different ideas. But we may accept the latest norm of poverty given by the World Bank that is anyone living below US dollar 1.90 per day may be called poor.

It means = Rs. $140 \times 5 =$ Rs. 700 per day per household.

$= 700 \times 30 =$ Rs. 21000 pm per household

Economists have predicted that the number of persons living below the poverty line has gone up from 22% to 46% approximately due to pandemic Covid-19. Poverty has its multi-dimensional effects social, economic, political as well as psychological.

(b) Unemployment is a situation where a person qualified to work, willing to work and able to work does not get the work at the current wage rate and if a person does not get the job for which he/she is qualified and gets a lower job, the situation is known as underemployment. India is young and has the demographic dividend in the form of a significant proportion of the young population (share of the working population has gone up – age group 20-59 from 50.5% in 2011 to 55.8% in 2021 – these are estimated figures) and on the other side labour force participation rate has gone down (from 43.02% in August to 40.03% in Nov 2020). (7) India's overall joblessness rate has climbed significantly to close to 10% in the week ended13th Dec 2020 a 23 week high as per a report released by CMIE. In a fresh study, the UN's International Labour organization found that a full 8.8% of global working hours were lost in the year (2020). (8) In this way, their talents, their skills, their energy have been lost. This is a big loss to their families, loss to society and loss to the nation. Moreover, unemployment and poverty are the two sides of the same coin.

(C) Inequalities The international aid agency Oxfam has published a report with the telling title "The Inequality Virus". The report says that in India the wealth of millionaires was increasing by 35% during the lockdown India's richest 10% control 74% of national wealth and only 01% common four times the wealth held by the poorest. (9) 122 million citizens were losing their jobs and the report blames neo-liberal economics for inequality. The jobs lost in the informal sector amounted to 75% Hence basic issues are still to be resolved from Nehruvian Socialism to Modian's economic reforms.

Employability is a function of a number of variables and attributes e.g. knowledge, understanding, application-oriented and problem solving skills, attitude, soft skill, health conditions, socio-economic environment,

business environment and above all attitude of the person. It means mainly educational outcomes and health conditions are the two determinates of employability.

With the approval of NEP2020 India is all set to witness a much-desired re-structuring in it, it focuses on the essentials of learning in the present while preparing students for learning to learn – fostering a new generation of thinkers. With its multidisciplinary, students will now have the opportunities to innovate and adapt, along with them to move seamlessly between different interests and fields, enabling constant up-gradation of skills. The year 2020 has been a year of transformation from classroom teaching-learning process to virtual learning through digital mode. Necessity is the mother of invention. We may say that NEP 2020 is aimed at us to be innovative, self-reliant and eternally hopeful. The policy is an attempt to achieve the target of India becoming super knowledge power. Some more could have been done in the union budget 2021-22 for education and skilling while allocating funds because this area has been recognized as a critical one due to the implementation of NEP-2020. The union budget pegged an outlay of Rs. 93224.31 crore for education at least Rs. 6087 crore less than the last budget estimate. (10) So far as health and well-being (physical and mental health) are concerned, India's overall allocation has soared by 137% in the financial year 2021-22 to Rs. 2.23 lakh crore compared to the budgeted spending in 2020-21, as the country seeks to boost the capacity of its health care system to detect and cure new and emerging diseases in the aftermath of covid-19. A sum of Rs. 35000 crore has been earmarked for vaccines in the budget. Thus there is a sincere effort to rebuild the crumbling healthcare system. There is the Poshan Abhiyan – India's flagship program to improve nutrition. Outcomes in a mission-driven, time-bound manner (by 2022). When there is a decline in GDP, it could lead to additional children wasted or suffering from acute malnutrition.

Table 1
Expenditure on health and well-being (Rs. Increase)

Ministry/Department	**BE2020-21**	**BE2021-22**	**Actual(2019-20)**
Department of health and family welfare	71269	62397	65012
Department of health research	2100	2663	1934
Ministry of Ayush	2970	1784	2122
Covid-19 Vaccine	35000	-	-
Department of Water and sanitation	21518	60030	18264
Nutrition	2700	1880	3700
Finance Commission grant for water sanitation	-	36022	-
Finance Commission grants for health	-	13192	-
Total	**223846**	**86259**	**94452**

Source: Daily HT, Feb 02, 2021, p.03

The concept of sustainable development is of recent origin, this term was used by world conservation of Nature and Natural resources (Land, Forest, Water, Mountain, hills, minerals, crude oils, soil, environment, climate, rivers, water falls etc.) in 1980, it was commonly used and defined for the first time by the Brut land report – our common Future of world commission on environment and development in 1987. Meeting the needs of the present generation without compromising the needs of future generation, sea-level rise of several metres, major disruption of monsoon rains and river flow in India, risk for climate change, are quality index etc. are among the biggest global economic risks. Water available per Indian declines every year, monsoons becoming erratic due to global warming and change in the climate. The government's ambitious renewable energy programme has meant that India will easily surpass its carbon emission commission under the Paris agreement. Equally telling a consortium of green think tanks recently declared India the only 2c compatible major economy in the world the Jal Jiwan Mission (urban) will be launched aiming at a universal water supply in all 4378 urban local bodies with 28.6 million household tap connections as well as liquid waste management. It will be implemented over 5 years with an outlay of Rs. 287000 crore. The budget allocated the drinking water and sanitation department under Jal Shakti Rs. 60030 Crore while Rs. 9022.57 Crore has been earmarked for the department of water resources, river development and Ganga rejuvenation. Rural India sees a 10% allocation hike. These are attempts towards sustainable and inclusive growth.

Some highlights

1. India stands at the 54th position out of 200 economies evaluated in the Bloomberg Innovation Index.
2. United Nations Happiness Report, India came at 140th position in 2019, dropping 7 places from 133 in 2018.
3. Global Democracy Index – 51 out of 167 droppings by 10 places.
4. Corruption Perception Index – 80th position dropping by 2 places.
5. RBI projected a GDP growth rate 10.5% in the fiscal year 2021-22, in sync with the union budget's assessment of the economy. The decision to keep interest rates unchanged while retaining an accommodative policy stance suggests that while having passed the baton of economic revival of fiscal policy from interest rates, RBI will continue to support the process of maintaining liquidity (Daily HT Feb 06, 2021, p1) while estimates Index will grow by 11.5% in 2021-22. (11)
6. India's absolute fiscal deficit – almost doubled growth Rs. 9.3 each crore in 2019-20 to Rs. 19.5 lakh crore 2020-21 (RE) when

compared to the BE figures of Rs. 30.4 lakh crore for 2020-21 with the denominator going down, the fiscal deficit as a percentage of GDP can increase for the same amount of absolute deficit. (12)

CONCLUSION

Negative numbers of GDP growth rate tells the story of a crashing Indian economy which caused a devasting impact on the lives of millions of poor cases are being made out in favour of a social security net for the poor, the senior citizens, the women, the physically and mentally challenged persons, the most disadvantageous and the marginalized section of the society contraction also means lesser revenue collections. Challenges are many and we are also many. India has built up a fine human capital along with physical capital (a fine combination of both the Goddess Laxmi and Saraswati) and this is the time for the youth of the country to take up their responsibilities and leadership to transform the vicious cycles into Virtuous Cycles with their new scientific approach and thought process.

Prisha Gupta*

THE GEOPOLITICAL SPACE OF COKETOWN AS THE CONFLUENCE OF THE INDUSTRIAL REVOLUTION, UTILITARIANISM AND CLASS STRUGGLE

ABSTRACT: Dickens wrote at a time when the root cause for social inequality could be regarded as the private ownership of economic resources. The present paper establishes the prevalent class struggle that was an outcome of increasing feudalism, capitalism and institutionalized education system through Charles Dickens' novel *Hard Times* published in 1854. The paper is divided into two sections. The first section explores the contextual realities of the time in which *Hard Times* was written. The second section digs deeper into the make-belief world of Coketown and shows how it manifests itself within the larger framework of the theoretical instigations underlying the societal substructure. The text proves to be a simplistic rendering of the industrial town that serves as a setting for the story with the help of the symbolism of the circus in the novel. The social issues are brought to life with the help of the highly sentimental scenes and characters that stand for various virtues in life.

Keywords: Charles Dickens, Industrial Revolution, Utilitarianism, Class Struggle, Nineteenth-Century Literature, Realism
JEL Codes: B30, G38, O14, P1, P3

INTRODUCTION

The present paper reflects on the geopolitical space of Coketown with respect to the socio-economic conditions of its era that surveys Victorian society. It probes over the utilitarian philosophy that has been imbibed by numerous personas within the text. At the same time, it tries to rationalize these realities within the larger framework of the prevalent conditions that were an outcome of the Industrial revolution. These conditions give rise to the underpinning lived realities that can be witnessed through a vivid characterization that directs the readers towards the contemporaneous

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class struggle that proved to be a dreadful reality for a marginalized fraction of the society. It also looks at the various social institutions that have been seen as part and parcel of ideal societies but shown to be crumbling down in the present text due to the shallow and the hypocritical groundings it stands on. All these institutions work within the social structures and are reflective of the confluence of the industrial revolution, utilitarianism and class struggle.

HARD TIMES

Hard Times presents the social and economic conditions of capitalism that were part of nineteenth-century England. It captures the rise of the bourgeoisie class, growth of factory labourers, class violence that was an outcome of the growing industrialism. What makes Dickens' works socially and culturally relevant to date is his remarkable characterization that offers insights into the social evils. His characters have been perceived as caricatures yet the depth lies in their reflection of the failures of humanity. His characters are the product of the society that they inhabit. Literary texts reflect society and capture their morals and values.

COKETOWN

Victorian political economy can be understood by reading the text within the context of certain prevalent ideologies. Coketown is representative of an industrial town that inhabits the characters who are representatives of the social class of those times. The persona of Mr. James Harthouse is representative of the upper class and makes a social commentary on this class by reflecting on its follies. His character imbibes all the vices that are necessary for the exploitation of the underprivileged sections of the society. Thomas Gradgrind along with Louisa Gradgrind, Mr. Josiah Bounderby and Mrs. Sparsit are representative of the class, that tries to justify everything through their hard work, the middle class. The representative of the working class is Mr. Stephen Blackpool who works in Bounderby's factory and is shown suffering from the hard conditions of life. On one hand, is the character of Mr. Harthouse can afford to seduce the married character of Louisa for new things to get rid of his monotonous life. On the other hand, is the character of Stephen Blackpool who cannot afford to divorce his wife and marry his lover for the lack of money. This is representative of how there is an evident class division in the society that these characters are a part of. The novel doesn't stop at the social commentary but also leaves the readers with hope for a socio-economic revolution that may reform the society towards social justice and equality.

CLASS STRUGGLE

It is an established fact that each political party reflects, in many ways, the interest of certain classes in society. Socialist states primarily focus on the needs of the working class and peasantry while on the other hand, capitalist states represent the interest of the class that thrives on exploiting the working class.

Broadly speaking, it is the social being that determines the consciousness of a person contrary to the other determining factors. Those who own the production are the ones who decide the general consciousness of society. Social class can be defined as a group of people who share the same cultural, socio-economic and political status in society. It is therefore easy to identify the different social classes by identifying the inequalities like authority, power, religion, work, education. This class binary can be described in Marxist terms as Bourgeoisie and Proletariat. The bourgeoisie is the Capitalist class or the one which owns the land, financial institutions, factories, etc. They derive their power through materialistic means. The Proletariat class or the labour class is at the periphery with nothing to own except for their ability to provide physical labour.

Coketown embodies the characteristics of the Victorian age that saw a rapid change in the scientific and technological domain. It is also a representative space showcasing the aftermath of the Industrial revolution. Several factors led to the Industrial revolution including the development of machines powered by water, the development of fertilisers and crop rotation systems, the increased production of iron and coal extraction. With the advent of steam trains and new industries, not just travelling became easy but also many commercial products could now be made at a faster pace. Clearly, the upper class gained the most out of this socio-economical shift and kept the political power of the country for themselves. The middle class also created wealth and did benefit from the revolution but was completely devoid of any political power. It can be said that the Industrial Revolution is responsible for the emergence of the middle class which comprised professionals like traders, engineers, lawyers, teachers, etc. The class that was adversely affected by this revolution is the working class that became the victim of oppression. The working class got its young children to work in factories and mills. Working conditions of the times were getting worse and with the increase in child labour, many children fell prey to exploitation at the hands of the factory owners. The narrative technique adapted by Dickens came to be known as realism, which can be defined as a style of writing that aims at representing

reality as it is. This school of thought encouraged the accurate documentation of the sociological observations.

On the surface, Coketown may appear to be a geopolitical space narrating the story of its characters but an in-depth study reveals how it comes out to present a critique of various social institutions of the times. It functions as a setting that thrives to expose the class struggle where the exploitation of one social class by another shows the ill-effects of industrial capitalism. At this juncture, the industrial revolution and communist ideology come face-to-face.

The narrative voice presents a sublime experience on two levels, on the base level it is the unifying component that is visible within the circus members. This can be seen in a n episode where Sissy Jupe's pet dog Merrylegs is brutally beaten by her drunkard father but yet Sissy's father is apologetic for his actions and is devoted towards his dog. This establishes that it is the joblessness and resultant poverty which brings out the bestiality of a man, furthermore, the sobbing figure of Sissy's father portrays a heart-rendering reality of early nineteenth-century England choking the lived experience of Coketown. This episode can be starkly contrasted with the way the figure of a horse has been dealt with. On the higher level, the sublimity is clearly visible, in the latter part of the novel, in the Gradgrind household. As portrayed in the initial half of the text, it is Louisa with her training in cold logic who is presented as a prominent figure but it has always been Sissy Jupe, who maintains the human compassion. But after Tom's untimely and tragic death and Louisa's failed marriage with Bounderby, it is Sissy who finally gains prominence. It is her innate quality of truth and love that prevails over hard logic, this is visible through Mrs. Gradgrind's change in attitude towards Sissy. Also, Louisa's younger sister, Jane Gradgrind, being raised by Sissy, grows up to be a much sort after girl in comparison to Louisa. The text offers a harsh critique of the education system that takes pride in encouraging rote learning as compared to understanding the conceptual values that helps building an emotional component in the students. It also offers a critic of the institution of family and marriage where the structure is based on cold logic and is devoid of any warmth or emotional connection.

UTILITARIANISM

Hard Times offers a bleak criticism of the utilitarian philosophy that prevailed in Victorian England. Utilitarianism is the belief that human beings, in general, begin to think of their self-interest over other sections of society. Charles Dicken's *Hard Times* can be considered as a cornerstone text propounding upon the ideals of utilitarianism as exhibited through the

imaginary place named Coketown. In the novel, Dickens creates certain personas to portray the contemporary social evils devouring the individuals as manifested through the geopolitical space in the backdrop of Industrial Revolution.

In Coketown, Mr. Thomas Gradgrind, a significant character in the text, runs a school. His character is representative of someone who firmly believes in utilitarianism and has completely imbibed this philosophy into his students from a very young age. He has ensured that his children too follow his footsteps, especially his five daughters. Mr. Gradgrind is a staunch follower of utilitarian theory and expects everyone around him to uphold this belief system. He gives a lot of importance to the books and never strays from his theory that focuses on the importance of facts and numbers. He tries to integrate his value system into Coketown's education system. The young and fresh minds are looked at by the school teachers, but unmolded as basic ambitions, eagerly waiting to be loaded with knowledge. They are determined to build potential jobs for Mr. Bounderby's own factories and mould themselves to fit into the monotonous lifestyle. They do not consider, however, that apart from the mechanistic half, there is art and philosophy which makes people humane, filling them with human sympathy and compassion, and elevates the condition of human existence. The children are staunchly warned against fiction, poetry, and other fine arts and are specifically warned not to 'wonder'. They try to create a state of mind where children shall be good workers in the future in a highly mechanized world, but at the cost of losing individual freedom, choice and opinions.

On the other hand, is the character of Mr. Josiah Bounderby who can be seen as a hardcore capitalist. He owns production units within the geopolitical space of Coketown. He is also a practitioner of utilitarianism, as he has his profit motives as the driving force. Josiah Bounderby is the decisive capitalist and an exemplar of utilitarianism. A compulsive fibber and a fabricator, he draws the future worker for his establishments from the school being run by Gradgrind, which validates the continual impression that students should be taught facts, and not fiction. One of the wealthiest persons in the geospatial locale of Coketown, he owns a bank and a factory, he lies about his struggles and declares himself to be destitute, though later, his lies are caught red-handed by his mother. Being the capitalist, he believes and preaches that profit is the sole motive of life. Both in his factory and his bank, there are many employees, and he refers to the workers as "hands," the sole body part which is of significant importance to him. He often tries to shake the moral paradigm of ethics while all they want is a decent working condition and a fair wage for their work. Being driven by profits, he is not concerned about the welfare of his

employees. Moreover, he is well aware of his position within the economical hierarchy. When one of his employees, Stephen Blackpool asks for his advice regarding his failing marriage, he retorts back by saying that divorce is not a viable solution for him, due to his social positioning, as divorcing involves substantial economic support, which individuals like Bounderby ensure that workers like Stephen are never laced with.

Apart from these powerful individuals who indirectly rule over the town of Coketown, the proletarian segment is also captured by Dickens. This class is represented through the factory workers and the group of circus members. Both these factions are forced to deal with the brunt of the industrial revolution and the ensuing economic depravity and the resultant poverty. These two segments feature individuals and families, who lie at the oppositional reality of utilitarianism.

The community of people working for the circus are simple and open-minded human beings whose goal in life is to make people laugh. Interestingly, they are also situated among the lowest rungs of human existence. The circus life reeks of rampant poverty, and yet, they lie outside the purview of the factory workers like Stephen Blackpool. They are hated by the utilitarian heads of the geopolitical space of Coketown, especially Gradgrind and Bounderby, as they seem to encompass the values that utilitarianism condemns and essentially renders useless

Emotions such as passion, imagination, and laughter are portrayed, and the circus is like a carnival, where the conglomeration of participants takes place purely based on the potential of comedy. In addition, by a sense of unification, their world is affirmed, giving them a feeling of community. It is a space where individualism, as promoted by utilitarianism, ultimately fails to hold its ground. Rather, it's a space identified by the members' mutual and co-dependence, something that is vehemently rejected by utilitarian heads. The only representation of the circus in the latter part of the book is Sissy Jupe, who, after her father's death, is adopted by the Gradgrind tribe. It is the Gradgrind family where these two facts of opposition are pitted against each other pithily. Sissy Jupe, free from the pitfalls of utilitarianism, is the supreme and, in a way, the only survivor of the free world. She exercises free will and may not be as smart as Bitzer, but is humane in essence, and helps Tom save his life (though he dies a painful, pathetic, and untimely death).

CONCLUSION

While Dickens doesn't explain any of the progress of the other school children, at least three children are displaying the doctrines of utilitarianism. All the students are from the school run by Mr. Thomas

Gradgrind and these are Bitzer, Tom, and Louisa. The students are robbed of empathy, as has already been stated, and they fail to respond according to the circumstances. Bitzer is Gradgrind's scholarly student, who can describe anything on paper. He is full of statistical and factual knowledge, he succeeds in mathematically describing a horse, even though he is young. This episode is in stark contrast to Sissy Jupe, whose father is a circus worker. She is one of the circus members herself and has certainly seen horses many times, but she struggles miserably to describe a horse. This is precisely how utilitarianism tampers with young children's brains, and the characters of Tom and Louisa, are indicators of how miserably this utilitarian approach collapsed. Tom is a young man who, so fed up with the strictness and repetition of his father, revolts against him and leaves home to work at the Bank of Mr. Bounderby. He begins to gamble, and he robs a bank to get out of debt and is forced to leave the scene. When Bitzer learns that Tom is the suspect, and catches him, Mr. Gradgrind asks him to let Tom go, reminding him of all the hard work he's been doing while at school. Bitzer, however, uses dry statistics and insists that he pays for his schooling, and he owes little more to Gradgrind. While it may be argued that Tom could reasonably be turned over for his crime to the authorities, this episode poses the disturbing likelihood of lack of human compassion, where all the programs are evaluated within the rubrics of the neoliberal mode of production through their capital values. In the greater sense of life, apart from Tom, Louisa still struggles, which again brings us back to the utilitarian world. In the human essence of human life, she, like Tom, is naive and lacks the lived knowledge of emotions. While, contrary to her father's wish, she agrees to marry Bounderby, it is obvious that she does not love him. Since she does not grasp the apparently elusive idea of marriage, and she remains married to Bounderby to live a life within the dictates of the Victorian tradition until she faces an enticing Mr. Harthouse, who attracts her affection and emotions deceivingly towards himself. Louisa, relatively inexperienced of carnal instincts, panics and becomes frantic. At this point, Mr. Gradgrind understands that his ideology and belief system, largely governed by utilitarianism, is bound to fail because he is unable to find any solution for Louisa, who is inconsolable. In this scenario, at least, Gradgrind becomes the parent, not the headmaster of the school, and shows sympathy for his daughter.

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