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# ARTHAVAAN



**Prof. Saloni Gupta** Editor-in-Chief, Arthavaan

Dear Readers,

I am delighted to welcome you to the latest issue of Arthavaan, a dedicated journal in the field of finance, commerce, and economic trends. As the Editor of this renowned publication, I am pleased to present a collection of insightful articles based on the theme "Viksit Bharat@2047".

This issue features an exciting collection of articles that showcase cutting-edge research and innovative ideas dedicated to the government's vision to transform the county into a developed country by its 100th independence in 2047. The vision of Viksit Bharat is that of a prosperous Bharat in harmony with modern infrastructure and nature and giving opportunities for all citizens of all regions to reach their potential. On 11 December 2023, the honorable Prime Minister of India launched 'Viksit Bharat @2047: Voice of Youth' via video conferencing. At the launch, he highlighted the role of educational institutions in an individual's personality development and stated that a nation becomes developed only when there is development of its people. The role of academics in the Viksit Bharat has been multifaceted and crucial. Academics has been bestowed with the responsibility of enhancing research that addresses India's developmental challenges, such as poverty, healthcare, education, and sustainability; design and develop innovative solutions, products, and services that can help solve India's problems and collaborate with industry partners to translate research into practical applications. Further, academics is believed to lead in demonstrating values and ethics that promote a culture of excellence, integrity, and social responsibility.

Following the vision of Viksit Bharat in letter and spirit, the research papers presented in this issue highlight the research problems in domains like finance, organization behavior, and economics and recommend innovative solutions that can address the developmental challenges. The authors have made significant contributions to the field, and I am proud to share their work with our readers. I believe that the research presented in this issue will not only advance our understanding but also inform policy and practice in meaningful ways.

**Prof. Saloni Gupta** Editor-in-Chief, Arthavaan Principal, Bharati College

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# Volume 7, Issue 1, December 2024

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# Empirical Investigation into the Interlinkages Between the Price Movements of Energy Commodities and Stock Market in India

Dr. Nishi Sharma\* and Tarandeep Kaur\*\*

#### Abstract

The present study is an attempt to empirically inquire into the behaviour of and integration between energy commodity prices and the benchmark index of the Indian securities market. For this, two prime energy commodities are considered, i.e., crude oil and natural gas and the Nifty 500, the broader market index of India's National Stock Exchange (NSE). The inquiry is based on data for the daily spot price (FUTCOM) of crude oils and natural gas in the evening session from January 1, 2017, to September 30, 2024, from the Multi Commodity Exchange of India and the daily close price of Nifty 500 index from the National Stock Exchange of India. Firstly, the series are tested for stationarity and transformed in the log return form. Next, a preliminary analysis is performed using graphical and descriptive methods. Then, the times series approach of the Vector Autoregressive (VAR) model, the Granger causality and the Johansen cointegration are applied to investigate the inter-relation among the three variables in the short and long run. The variables are found to be sensitive to external effects of the Covid-19 pandemic. Results establish bidirectional causality between the crude oil prices and the Nifty 500 index. Long-term equilibrium relationships among all three variables are discovered using the cointegration test. The study concludes that the connectedness among the trio variables is time-varying. The results have practical implications for the benefit of investors, traders, arbitrageurs, and managers in hedge

and mutual funds, as they can consider the findings while designing and reframing risk management and hedging strategies. Similarly, the empirical results can benefit policymakers when drafting and designing policies governing the commodities and equity markets.

*Keywords*: energy commodity, crude oil, natural gas, cointegration, stock market, causality

#### 1. Introduction

Crude oil and natural gas are the two prominent sources of energy that serve as a pivotal factor in an economy's development. Globally, India is the third largest oil-consuming country after the USA and China (Terra Nova, T. 2024). Further, it is experiencing a tremendous growth in consumption of energy from 26,822 Petajoules (PJ) in 2013-14 to 35,159 Petajoules (PJ) in 2022-23 (Provisional). Moreover, 6.48% of total energy consumption increased from 2021-22 to 2022-23 (Ministry of Statistics and Program Implementation, 2024). Natural gas consumption in India is also rapidly growing owing to population growth and economic development, reflecting a significant shift towards cleaner energy. India relies heavily on imports to fulfil its constantly growing oil and natural gas demand. India imports approximately 83% of its crude oil and 47% of its natural gas. Further, about 30% of India's total energy consumption is met by crude oil. The price of these two commodities is driven by the demand, supply and geopolitical factors that significantly impact other

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sectors of the economy. Crude oil and natural gas prices are subject to more significant uncertainty that might result in low investment, less production and reduced aggregate output. It affects the performance of various industries and sectors, ultimately affecting the stock market performance, a barometer of the economy. Thus, the volatility in oil and natural gas prices significantly impacts economic and financial structures and influences stock market returns. Hence, it is important to identify the underlying dynamics between the energy commodity and equity markets.

Many studies have shown that volatility in the prices of these commodities affects the financial market. Many traders dealing in the commodity markets shift to stock markets to hedge investment risks and optimize returns. There is growing interest among researchers in understanding the contagion and interconnection between the commodity and stock markets driven by increasing uncertainty in both sectors and the significance of these markets for portfolio diversification and hedging risk (Mensi W. et al., 2022).

Extensive literature is available on assessing the interrelationship between the commodities and stock market as aggregate and at sectoral levels in developed and emerging economies, with a few studies covering Indian markets. We were motivated to identify how the securities market in India responds to price shocks, particularly in the two leading energy commodities, crude oil and natural gas, which play an important role in the development of the economy.

This study aims to assess the overall performance of the equity market and the energy commodity market. It will also examine the cointegration and causal effect between the price movements of two prime energy commodities, crude oil and natural gas, and the stock market, focusing on India.

The significance of this research lies in providing informed knowledge on the performance and interlinkages between the energy and equity markets in India to investors, portfolio managers, and policymakers with empirical evidence using Vector Autoregressive (VAR) model, cointegration, and causal methodologies on daily data spanning from January 2017 to September 2024, covering more than seven years that includes the periods before, during, and after COVID-19.

The contribution of our study can be summarised as follows. Initially, we provide the performance evaluation of the stock market by considering a broader benchmark index, i.e., the Nifty 500 index and the energy commodity market represented by crude oil and natural gas based on risk and return parameters. Then, considering the significance of the trio of crude oil, natural gas and equity investments for short-term (speculators and arbitrageurs) as well as long-term (mutual and hedge funds) investors, we build the cointegrating and causality models helpful in framing mixed assets portfolio and effectively hedging the risk in the financial market.

The structure of the paper is as follows: Section 2 provides a review of the relevant literature. Section 3 outlines the data used in the study. Section 4 details the research methodology. Section 5 presents the results along with a discussion. Lastly, Section 6 concludes the study, offering policy recommendations and suggesting directions for future research, followed by references and appendix section.

#### 2. Literature Review

Many studies that focused on similar variables using various statistical techniques are reviewed to get the knowledge of existing literature of the interconnectedness of commodity and stock markets across nations. Anna Creti et al. (2013) identified that the correlations between the commodity and stock markets are highly volatile, especially from the financial crisis of 2007-08 onwards, which led to the growing financialization of commodity markets. They investigated the correlation between the price returns of 25 commodities and the stock market using GARCH methodology involving the study period from January 2001 to November 2011. Similar results were obtained by Marco J. L. et al. (2016),

who examined the correlation between the returns from commodity and equity and its implications for asset allocation using the time-varying Bayesian Dynamic Conditional Correlation Model. They identified higher volatility between the two variables and concluded that joint modelling of equity and commodity prices yields accurate forecasts. Syzdykova, A. & Azretbergenova, G. (2024) examined the asymmetric effect of oil prices on exchange rates and stock market index returns in Kazakhstan by applying nonlinear ARDL cointegration technique over monthly data from January 2010 to February 2024. It was found that changes in oil prices, whether positive or negative, significantly affected the Kazakhstan stock exchange (KASE) returns and the exchange rates.

Numerous recent studies have examined spillover effects between the various sectors and markets. One such study by Elsayed, A.H. et al. (2020) analyzed the volatility spillover mechanism between the energy markets and stock prices of seven major global securities markets during 2000-2018 using time domain interlinkages techniques of Diebold and Yilmaz. They identified an insignificant contribution of volatility in the energy sector to the global securities market. In the clean energy market, the major transmitters of volatility were the returns from the World Stock Index and the World Energy Index. Further, their study identified a strong impact of the energy market on the global financial markets. Maghyereh, Aktham I., et al. (2016) explored the oil and equities directional connectedness using the implied volatility indexes, taking samples from the eleven global stock exchanges from 2008-2015. Their research established the bi-directional information spillovers between the two markets across the studied countries. However, the transmission from oil to equity markets significantly contributed to the linkages between the two.

To understand the impact of COVID-19, Lucey, Brian and Ren, Boru (2023) examined dynamic connectedness between the sustainability indices, equities and energy assets employing the CAViaR-TVP-VAR technique on daily data about the period October 14, 2014 - August 14, 2022. They observed that total risk connectedness was at a medium level. COVID-19 also had a mild effect in the short run. Another research by Hanif W. et al. (2023) evaluated the time-frequency dependence and risk connectivity between the green stocks and oil shocks by applying wavelet coherence and frequency connectedness analysis. Their study discovered tighter dependency relationships between the two variables at mid and long-term scales. Lead lag patterns were mixed and time-varying. They further noticed a substantially significant risk spillover from the oil market in the green stock market. They also concluded that various global crises, viz., the Great Recession, the oil price collapse and the COVID-19 pandemic, significantly enhanced the magnitude of risk spillovers.

Mensi W. et al. (2022) examined the interlinkages between the sectoral markets and crude oil and gold in the USA to comprehend the impact of oil prices on various sectoral markets. They also studied the implications of their connectedness on portfolio management using Diebold and Yilmaz (2012) and Barunik and Krehlik's approaches. They discovered that gold, oil, financials, utilities, communications services and health care were the net recipients of the spillover effects, and the rest of the sectors were the net contributors irrespective of the frequencies. Furthermore, a reduced spillover effect was observed when gold and oil were included in the sector portfolio.

In India, Shahani, R. et al. (2023) investigated the cointegrating behaviour of crude oil and natural gas in the Indian commodity market using daily returns from April 1, 2017, to March 31, 2022. Based on ARDL (with structural break) and nonlinear ARDL methods, their study evidenced the long-run cointegration for natural gas only and not for crude oil. Further, they found that natural gas, concerning crude in the short run, was inelastic while highly elastic in the long run. There was no asymmetric impact of crude on natural gas in the short run, whereas, in the long run, it was found only at a 10% significant level. Furthermore, the negative and

significant Error Correction term (using VECM) for natural gas reflected the stable movement from shortrun disequilibrium to long-run equilibrium, though the speed of adjustment was 3 percent per period. Another study by Bhullar Pritpal et al. (2024) investigated the volatility spillover between the energy commodities, viz. oil and natural gas and the stock indices, including India, USA and Japan, during 2001-2023 using DCC-GARCH models. They found strong interdependence between the crude oil and all the stock indices under study compared to natural gas.

Thus, body of literature has discussed the association between the various commodities and equity markets by applying numerous techniques, viz. correlation, GARCH model, wavelet analysis, and so on, across developed and emerging economies, including India. However, scant literature is available in the Indian context. Thus, there is scope of research to assess the commodity and equity market nexus. This study is one-step addition to the empirical evidence on it in the Indian context.

#### 3. Data

The data for this study is sourced from the Multi Commodity Exchange (MCX) India and the National Stock Exchange (NSE) India databases. From the NSE, daily closing prices for the Nifty 500 Index are obtained. From the MCX, spot market prices for crude oil (per barrel) and natural gas (per Metric Million British Thermal Unit, mmBtu) are used. All values are reported in Indian Rupees (INR). The analysis period spans from January 2017 to September 2024, using daily price data for all series, though data is only available for business days, excluding weekends and national holidays. It results in three-time series with irregular intervals.

#### 4. Methodology

The Time series data is analyzed using Graphical, Descriptive and econometric methods. Time plots are made to represent data graphically in order to understand the trends over the period. The original data series were checked for stationarity as a pre-condition for time series analysis. Stationarity implies that the mean and variance remain constant over time. Additionally, the covariance between two time periods depends solely on the interval between them, rather than the specific times at which it is calculated (Enders, 2004). The original series were transformed into log return series to make the data stationary and the analysis more meaningful. Log returns possess multiple advantages over simple returns. They can be easily summed over multiple periods, which allows for straightforward calculations of cumulative returns across different time frames. The distribution tends to be more symmetrically distributed, providing advantages for statistical analysis. The descriptive statistics are analyzed for absolute values and log return values.

Stationarity testing is performed using the Augmented Dickey-Fuller (ADF) test. The ADF test is a unit root test whose null hypothesis is the presence of a unit root, which is non-stationarity.

A Vector Autoregression (VAR) model is employed to capture the dynamic interactions among multiple time series variables. Unlike univariate models that analyze a single time series, the VAR model examines the interdependencies by treating all variables in the system as endogenous (dependent on each other) (Enders, 2004). Further, the causal effects are checked using the Granger Causality test. Following that, the long-run relationship is checked using the Johansen Cointegration test.

The analysis is performed using the latest version of the statistical software R. R is an open-source program for statistical analysis and visualization.

#### 5. Results

Figure 1 below shows the line plots of the series. Panel A shows the Nifty

500 closing prices; the series was stable below Rs. 10,000 before 2020.

<sup>&</sup>lt;sup>1</sup> A barrel (BBL) equals 42 US gallons or 159 litres.

<sup>&</sup>lt;sup>2</sup> A Metric Million British Thermal Unit (mmBtu) is commonly used to measure energy value, particularly for natural gas.

After that, it witnessed a sharp decline in 2020, attributed to the COVID-19 pandemic. The series started rising in value and stabilized for 2022. In 2023, the series started rising till 2024 and reached above Rs. 24,000. The series showcases the significant growth of the Indian stock market during the period under consideration, thereby showcasing the robust growth of the economy.

Panel B shows the line plot of crude oil spot price series. The series depicts a fluctuating trend, which is

Panel a) Nifty 500 Closing Price (Rs.)

rising overall. The series also dropped significantly in 2020, around the time lockdowns were announced in the nation as a preventive measure for the pandemic. Till 2022, the series increased rapidly above Rs. 8000, thereafter noting a decline coming down to Rs. 6000.

Panel C shows the natural gas spot price series. The series was stable with minor fluctuations until the middle of 2021, after which it observed peaks. The series stabilized at its original level after 2022.



#### **Figure 1: Line Plots of actual series**

Source: Authors' computation



#### Panel b) Crude Oil Spot Price (Rs.)



#### Panel c) Natural Gas Spot Price (Rs.)





Nifty 500 Index and Crude Oil Spot Price Over Time

Source: Authors' own computation

Figure 2 provides us with a comparative view of the three series. It displays that the Benchmark Index, Nifty 500, holds the highest value, followed by Crude oil price in the spot market, and natural gas price takes the lowest value. Moreover, it can be observed that the Nifty 500 and crude oil prices followed similar trends

until 2022. However, post 2022, the Nifty 500 value has increased, whereas Crude oil prices have decreased slightly, indicating the growth of the stock market.

#### 5.1 Checking for Stationarity

After plotting the series, it was observed that they

showed trends that indicated non-stationarity, as it did not revert back to the mean. It is tested for using the formal testing procedure of the unit root test. It is one of the commonly used methods for assessing stationarity. The presence of a unit root signifies that the data series is non-stationary. The stationarity of the series was evaluated using the formal ADF test, which confirmed that the series was non-stationary.

The series was then transformed into a log return form to perform the analysis further. The log return series were found to be stationary, reverting to the mean (see Figure 2). The ADF test also confirms this (Table A2).



**Figure 3: Line Plots of Log returns** 

#### Panel a) Nifty 500 Index



#### Panel b) Crude Oil Spot Price

7



#### Panel c) Natural Gas Spot Price



#### 5.2 Descriptive Statistics

Descriptive statistics are discussed for both the actual and the series with log differencing transformations. The actual series is important as it depicts the overall trends in the variables during the time period. Log return series are also discussed as analysis is based on them.

Table 1 showcases the descriptive statistics of the actual series. The actual series, Nifty 500, shows a mean of Rs. 12,572 with a standard deviation of Rs. 4,237. The minimum value of the series is Rs. 6,243,

and the maximum value is Rs. 24,497. Series is slightly positively skewed with a skewness of 0.84. The kurtosis of the distribution is -0.18.

The crude oil price series shows a mean of Rs. 4,964, with a standard deviation of Rs. 1,617. The minimum value is Rs. 887, and the maximum value is Rs. 9,510. Series is slightly positively skewed, with a skewness of 0.31. The kurtosis of the distribution is -0.65.

The natural gas spot price averaged Rs. 244, with a standard deviation of Rs. 124. The series' minimum value is Rs 111, and its maximum value is Rs. 773. Series

is highly positively skewed, with a skewness of 2.14. The distribution is peaked, with a high kurtosis of 4.16.

Descriptive Statistics of Absolute values				
	Nifty 500 Crude Oil Price Natural Ga		Natural Gas Price	
Source	NSE India	MCX India	MCX India	
Unit	Rs./ INR	Rs. /INR	Rs./INR	
Mean	12572	4964	244.4	
SD	4236.87	1616.67	124.44	
Min	6243	887	111.2	
Max	24497	9510	773.1	
Range	18253.9	8623	661.9	
1st Quartile	9151	3688	179.7	
Median	10697	4664	200	
<b>3rd Quartile</b>	15280	6324	245.5	
Skewness	0.84	0.31	2.14	
Kurtosis	-0.18	-0.65	4.16	
Observations	1933	1933	1933	

Table 1: Descriptive Statistics of Actual values of series

Source: Authors' computation

Table 2 presents the descriptive statistics for the log return values of the series. The average return of 0.00064 is provided by the Nifty 500 series, which is the highest. Crude oil has shown an average return of 0.00023 over the period in consideration. Natural gas shows a negative return with a minimal magnitude. The risk, measured by the standard deviation, is also lowest

for the Nifty 500, followed by crude oil. The highest risk is associated with Natural gas. Risk to return reward, measured by the Coefficient of Variation (CV), is also the lowest for the Nifty 500. These characteristics make the Indian stock market a better investment avenue than these commodities.

Table 2: Descriptive Statistics of Log Return values of ser
---

Descriptive Statistics of Log return values				
	Nifty 500	<b>Crude Oil Price</b>	Natural Gas Price	
Mean	0.00064	0.00023	-0.00002	
SD	0.01000	0.03000	0.04000	
<b>Coefficient of Variation</b>	15.55694	129.87013	-1860.46512	
Range	0.21000	0.92000	0.39000	

Source: Authors' computation



#### 5.3 Correlation analysis

Source: Authors' computation

The correlation plot reveals the degree and direction of association between variables. In our case, the series are positively associated. The Nifty 500 index and Crude oil have a 0.76 association. The natural gas price and Crude oil price have a 0.62 association. The Nifty 500 index and natural gas prices have a low association 0.26.

#### **5.4 Econometric Analysis**

R suggested models with different lag lengths based on four criteria. The four criteria choose the lags to minimize the function laid down. The Schwarz Criterion (SC) suggested the model with two lags, also known as the Bayesian Information Criterion (BIC).

The first model with 2 lags was selected to keep it simple and retain degrees of freedom. The model was then checked using a diagnostic check.

#### 5.4.1 Diagnostic Check

A stability check and autocorrelation test were performed as diagnostic checks. The VAR model with two lags, as Schwarz Criterion (SC) suggested, is stable but has autocorrelated residuals. Hence, another model with five lags was considered, as suggested by Hannan Quinn's (HQ) criterion. This model is also found to be stable and does not have the problem of autocorrelated residuals.

#### **Stability Check**

The stability test for VAR models is based on the eigenvalue stability condition. Checks roots of the characteristic polynomial to evaluate whether the system satisfies the stationarity condition. This test ensures that all roots of the characteristic polynomial are strictly within the unit circle in the complex plane (i.e., their moduli are less than 1). A stable VAR model indicates that the dynamic relationships among the variables are well-behaved over time without exhibiting explosive or non-stationary behaviour.

Our model is found to be stable.

#### **Figure 5: Stability Test Result**

```
> stability_check2 <- roots(var_model2)
> print(abs(stability_check2))
[1] 0.7356676 0.7356676 0.6642790 0.6061909 0.5786935 0.5786935 0.5756241
[8] 0.5756241 0.5644191 0.5644191 0.5334809 0.5334809 0.5147053 0.4514878
[15] 0.4514878
> # Check if all roots are within the unit circle
> if (all(abs(stability_check2) < 1)) {
+ cat("The VAR model is stable.\n")
+ } else {
+ cat("The VAR model is unstable.\n")
+ }
The VAR model is stable.
```

Source: Authors' computation

#### **Residual Autocorrelation Test**

To assess the adequacy of the estimated Vector Autoregression (VAR) model, the residuals were tested for autocorrelation by using the Portmanteau test. This test evaluates whether the model's residuals exhibit white noise, a crucial assumption for the validity of VAR models.

The Portmanteau test assesses the null hypothesis that the residuals have no autocorrelation up to a specified lag, with the alternative hypothesis indicating the existence of autocorrelation. The test statistic is calculated as a function of the sum of squared residual autocorrelations and follows a chi-squared ( $\chi^2$ ) distribution under the null hypothesis.

For this analysis, the test was conducted for up to 12 lags using the asymptotic version of the Portmanteau test. The test results include the chi-squared statistic, degrees of freedom, and the associated p-value. A

p-value exceeding 0.05 suggests that the null hypothesis cannot be rejected, indicating that the residuals are uncorrelated and that the model is adequately specified. Conversely, a p-value of 0.05 or lower would indicate significant residual autocorrelation, necessitating a reevaluation of the model specification.

The model with two lags is found to have autocorrelated residuals with a p-value of approximately zero. Models with higher numbers of lags, 5 (suggested by HQ criteria) and 7 (suggested by AIC and FPE criteria) lags, were also checked, but the autocorrelation problem remained. The reason for this might be that the number of variables under consideration is not enough to explain each other, as some macroeconomic and global factors and governance-related factors also affect our variables.

Hence, a model with 5 lags is considered to conduct the study. A drawback is that the results of the Granger causality test based on this model may be biased.

#### Figure 5: Autocorrelation test: VAR model with five lags

```
> print(autocorr_test)
    Portmanteau Test (asymptotic)

data: Residuals of VAR object var_model2
Chi-squared = 136.51, df = 63, p-value = 2.397e-07

Sserial
    Portmanteau Test (asymptotic)

data: Residuals of VAR object var_model2
Chi-squared = 136.51, df = 63, p-value = 2.397e-07

> cat("No significant autocorrelation in residuals (p-value =", autocorr_testSserialSp.value,
").\n")
No significant autocorrelation in residuals (p-value = 2.396967e-07 ).
    Source: Authors' computation
```

#### 5.4.2 VAR Model with five lags

The following is the table for the model with five lags. The model is found to be stable, but its residuals show autocorrelation. This model was suggested by the Hannan-Quinn (HQ) Criterion.

#### Table 3: VAR Model estimation results

```
Estimated coefficients for equation Crude_Return:
Call:
Crude_Return = Nifty_500_Return.11 + Crude_Return.11 + N.Gas_Return.11 + Nifty_500_Return.12 +
Crude_Return.12 + N.Gas_Return.12 + Nifty_500_Return.13 + Crude_Return.13 + N.Gas_Return.13 + N
ifty_500_Return.14 + Crude_Return.14 + N.Gas_Return.14 + Nifty_500_Return.15 + Crude_Return.15
+ N.Gas_Return.15 + const
                   Crude_Return.11
                                      N.Gas_Return.ll Nifty_500_Return.l2
Nifty_500_Return.l1
                                                             0.0978987041
      0.1157528607
                       0.0214911793
                                         0.0005797115
   Crude_Return.12 N.Gas_Return.12 Nifty_500_Return.13
                                                         Crude_Return.13
                       -0.0059791624
                                                           -0.0495371358
     -0.1167176477
                                         -0.0780075786
                                       Crude_Return.14 N.Gas_Return.14
    N.Gas_Return.13 Nifty_500_Return.14
                                          0.1210396784
                                                          0.0046219840
     -0.0037455495
                       -0.1447788153
                     Crude_Return.15 N.Gas_Return.15 const
0.0257427404 -0.0253615148 0.0005241040
Nifty_500_Return.15
      0.3104544454
Estimated coefficients for equation N.Gas_Return:
Ca11:
N.Gas_Return = Nifty_500_Return.l1 + Crude_Return.l1 + N.Gas_Return.l1 + Nifty_500_Return.l2 +
Crude_Return.12 + N.Gas_Return.12 + Nifty_500_Return.13 + Crude_Return.13 + N.Gas_Return.13 + N
ifty_500_Return.14 + Crude_Return.14 + N.Gas_Return.14 + Nifty_500_Return.15 + Crude_Return.15
+ N.Gas_Return.15 + const
                                     N.Gas_Return.ll Nifty_500_Return.l2
Nifty_500_Return.11
                    Crude_Return.l1
      0.0723348098
                       0.0017029589
                                         -0.0582488004
                                                             0.0123801692
                                                          Crude_Return.13
   Crude_Return.12 N.Gas_Return.12 Nifty_500_Return.13
                                         -0.0835535682
      0.0742712367
                      -0.0322804062
                                                           -0.0369274026
   N.Gas_Return.13 Nifty_500_Return.14
                                       Crude_Return.14
                                                        N.Gas_Return.14
      0.0481661082
                       0.0287579864
                                         -0.0305494858
                                                          0.0160044131
Nifty_500_Return.15
                     Crude_Return.15
                                        N.Gas_Return.15
                                                                   const
                                         -0.0208872880
      0.0993599606
                      -0.1032775170
                                                            0.0008079393
```

Source: Authors' computation

The Vector Autoregression (VAR) analysis with five lags reveals complex dynamic relationships between the Nifty 500 index, crude oil, and natural gas returns. For the Nifty 500 returns equation, we observe that its own first lag has a negative coefficient (-1.706), while the second lag shows a positive effect (0.0374), suggesting short-term mean reversion in stock market returns. The impact of crude oil returns on the Nifty 500 is relatively modest, with the first lag showing a negative coefficient (-0.1283) and the second lag displaying a positive coefficient (2.28), indicating a volatile transmission mechanism from oil markets to stock returns. All subsequent variables have a positive effect; only lag 5 of crude and natural gas have a negative impact.

In the crude oil returns equation, we find significant feedback effects from the stock market, with the first leg of Nifty 500 returns showing a positive coefficient (0.1157) and the impact being stronger (0.31) at the 5<sup>th</sup> lag. It suggests that stock market movements have a substantial bi-directional relationship with crude oil returns. The own-lag effects for crude oil are relatively small, with the first lag showing a positive coefficient (0.0214) and the second lag of crude oil lag showing a similar magnitude but a negative coefficient (-0.1167). Subsequent lags show diminishing effects. The impact of natural gas is comparatively smaller as its coefficients are small.

For natural gas returns, the results indicate moderate sensitivity to stock market movements, with the first leg of Nifty 500 returns showing a positive coefficient (0.0723). The own-lag effects for natural gas are notably negative for the first lag (-0.0582), suggesting mean-reverting behaviour in natural gas prices. The relationship between crude oil and natural gas appears relatively weak, with small coefficients across different lags.

These findings suggest that while significant interconnections exist between Indian stock markets and energy commodities, the relationships are complex and time-varying. Compared to natural gas, the stronger bidirectional relationship between stock markets and crude oil highlights the importance of oil prices for Indian financial markets.

#### 5.4.3 Granger Causality Test Results

It is important to note that the Granger causality test is designed to identify linear causal relationships, which implies that the detected causality is based on the predictive ability of one variable in relation to another within the framework of a linear model.

The test results reveal significant causal relationships among the variables under consideration (refer to Table A4). Crude oil prices have a statistically significant causal effect on the Nifty 500 index and natural gas prices (p-value < 0.01). Similarly, the Nifty 500 index demonstrates a statistically significant causal effect on crude oil and natural gas prices (p-value < 0.01). However, natural gas prices do not exhibit a statistically significant causal effect on the Nifty 500 index or crude oil prices (p-value = 0.65).

#### 5.4.4 Johansen cointegration test

An enquiry into the long-term relationship among the variables is made using the Johansen cointegration test. "According to Engel and Granger (1987), if the variables are found to be cointegrated, they would not drift apart over time, and the long-run combination amongst the non-stationary variables can be established." The test results reveal a significant long-term equilibrium relationship among natural gas prices and the Nifty index (Table A5, panel a). The test identifies two cointegrating relationships, as the trace statistic for r = 0 is 1614.13, far exceeding the critical value of 24.60 at the 1% significance level, and for  $r \le 1$ , it is 738.23, also well above the critical value of 12.97. The first cointegrating vector indicates that a unit increase in natural gas prices corresponds to a 1.189-unit decrease in the Nifty index in the long run. The adjustment coefficients show that natural gas prices exhibit a stronger correction mechanism with a loading value of -1.001, compared to the Nifty index's weaker adjustment at 0.0816. These findings confirm a robust cointegrating relationship, highlighting the interdependence of energy prices and stock market movements.

The test confirms a long-term equilibrium relationship between crude oil prices and the Nifty index, suggesting that changes in crude oil prices significantly influence stock market movements (refer to Table A5, panel b). The test indicates the presence of at least one cointegrating relationship, demonstrating that these variables move together over the long term despite short-term fluctuations. The cointegrating vectors reveal that an increase in crude oil prices is associated with a decrease in the Nifty index, highlighting the inverse relationship between energy prices and market performance. The loading matrix suggests that crude oil prices dominate in correcting deviations from the equilibrium while the stock market adjusts more slowly. These findings underline the critical impact of global energy price dynamics on financial markets.

The test indicates a significant long-term relationship among natural gas and crude oil prices (Table A5, panel c). The test results confirm at least one cointegrating vector, suggesting that these energy commodities are closely tied in their long-term price movements. The coefficients in the cointegrating relation highlight that a change in crude oil prices has a measurable impact on natural gas prices, reflecting the interdependence of these energy markets. As revealed by the loading matrix, the adjustment speeds show that crude oil prices play a larger role in correcting deviations from the equilibrium, while natural gas prices adjust more slowly. These findings underscore the integrated nature of energy markets and the influence of crude oil prices on related energy commodities.

Hence, all the series are cointegrated and showcase a long-term relationship.

#### 6. Conclusion and Policy Recommendations

The study's main objective was to check the interaction between the Indian stock market and commodity market, taking values of a benchmark index, Nifty 500, from NSE and two important energy sector commodities, crude oil and natural gas, from MCX. This study provides compelling evidence of the intricate relationships between India's stock market and key energy commodities. The empirical analysis reveals several crucial findings. First, both markets demonstrated significant vulnerability to external shocks, as evidenced by the sharp declines during the COVID-19 pandemic. Second, the analysis through the risk-return framework depicts nifty 500 as the best investment avenue with minimal risk and high return. Crude oil can be seen as a possible avenue. Natural gas cannot be seen as a potential commodity for investment due to the negative average returns offered during the last 7-8 years.

Third, the Granger causality tests establish bidirectional causality between crude oil prices and the Nifty 500 index, while natural gas prices do not show a causal influence on the Nifty 500 and Crude Oil prices. Fourth, the Johansen cointegration analysis confirms the existence of long-term equilibrium relationships among all three variables, highlighting their fundamental interconnectedness in the Indian financial system. The inverse relationship between energy prices and market performance is found to exist.

These findings put forward important implications for policymakers, regulators, and market participants. From a risk management perspective, there is a clear need to establish an integrated market monitoring system that tracks real-time correlations between energy commodities and stock market movements. This should be complemented by early warning systems for potential market disturbances based on commodity price volatility. The government should also strengthen its strategic petroleum reserves management to buffer against external shocks.

On the regulatory front, we recommend implementing mandatory disclosure requirements for listed companies regarding their commodity price exposure. It should include standardized reporting formats for commodity risk assessment and specialized regulatory guidelines for companies with significant exposure to energy commodities. The strong interconnection between markets suggests that regulatory bodies should adopt a more coordinated approach to oversight.

Market infrastructure development is another crucial area for improvement. Creating specialized derivative instruments would enable better hedging of commodityrelated risks, while improved price discovery mechanisms for energy commodities would enhance market efficiency. The market infrastructure should be enhanced to facilitate seamless integration between commodity and stock markets, reducing cross-market transactions and information flow friction.

Information dissemination and education also require significant attention. Regulatory bodies should create dedicated channels for disseminating commodity market information to stock market participants. It should be supported by comprehensive educational programs focusing on the interconnections between commodity and equity markets. Enhanced transparency and understanding enable market participants to make well-informed investment choices and more effectively manage their exposure to risk.

The present study limits the analysis to include only two energy commodities and a benchmark index from NSE. This limitation can be addressed by including certain control variables to capture the effects of macroeconomic and global factors. Future research can explore the impact of other commodities on the behaviour of stock market using a different benchmark index, like Sensex from the Bombay Stock Exchange and investigate the transmission mechanisms through several commodity price shocks affecting the Indian economy. Such research would further enhance understanding of these complex market dynamics and help in developing more effective policy responses.

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#### Appendix

^	Date <sup>‡</sup>	Nifty_500_Cl_price	Crude_price	N.Gas_price
1	2017-01-02	7002.5	3651	253.1
2	2017-01-03	7028.7	3651	253.1
3	2017-01-04	7030.7	3563	226.5
4	2017-01-05	7106.9	3631	222.7
5	2017-01-06	7083.1	3644	221.9
6	2017-01-09	7085.1	3669	223.2
7	2017-01-10	7132.2	3543	211.6
8	2017-01-11	7214.1	3459	223.1
9	2017-01-12	7231.8	3565	220.0
10	2017-01-13	7228.3	3609	230.5
11	2017-01-16	7247.9	3573	233.3
12	2017-01-17	7243.6	3573	233.3
13	2017-01-18	7269.0	3571	232.2
14	2017-01-19	7287.7	3470	224.3
15	2017-01-20	7202.7	3502	229.6

#### Table A1: Data Series in Absolute Numbers

^	dataactual.Date 🚊	Nifty_log_ret	Crude_log_ret	N.Gas_log_ret
1	2017-01-03	3.734539e-03	0.000000000	0.000000000
2	2017-01-04	2.845072e-04	-0.0243982160	-0.1110397226
3	2017-01-05	1.077987e-02	0.0189052058	-0.0169193707
4	2017-01-06	-3.354478e-03	0.0035738870	-0.0035987443
5	2017-01-09	2.823224e-04	0.0068371660	0.0058414006
6	2017-01-10	6.625755e-03	-0.0349453195	-0.0533705305
7	2017-01-11	1.141770e-02	-0.0239942959	0.0529224015
8	2017-01-12	2.450524e-03	0.0301845239	-0.0139925551
9	2017-01-13	-4.840907e-04	0.0122666718	0.0466233161
10	2017-01-16	2.707895e-03	-0.0100251466	0.0120743166
11	2017-01-17	-5.934514e-04	0.000000000	0.000000000
12	2017-01-18	3.500410e-03	-0.0005599104	-0.0047261098
13	2017-01-19	2.569265e-03	-0.0286910747	-0.0346146277
14	2017-01-20	-1.173204e-02	0.0091796399	0.0233542229
15	2017-01-23	5.510495e-03	0.0342441543	-0.0509265910

Table A2: Data series in Log Return Values

#### Table A3: Augmented Dickey-Fuller (ADF) Test Results

Augmented Dickey-Fuller Test

```
data: datalogret$Nifty_log_ret
Dickey-Fuller = -11.373, Lag order = 12, p-value = 0.01
alternative hypothesis: stationary
```

Augmented Dickey-Fuller Test

data: datalogret\$Crude\_log\_ret Dickey-Fuller = -12.176, Lag order = 12, p-value = 0.01 alternative hypothesis: stationary

Augmented Dickey-Fuller Test

```
data: datalogret$N.Gas_log_ret
Dickey-Fuller = -11.668, Lag order = 12, p-value = 0.01
alternative hypothesis: stationary
```

#### Table A4: Granger's Causality test results

```
> print(grangertest_crude_to_nifty_gas$Granger)
        Granger causality H0: Crude_Return do not Granger-cause Nifty_500_Return
        N.Gas_Return

data: VAR object var_model2
F-Test = 5.7046, df1 = 10, df2 = 5733, p-value = 1.451e-08
> print(grangertest_nifty_to_crude_gas$Granger)
        Granger causality H0: Nifty_500_Return do not Granger-cause Crude_Return
        N.Gas_Return

data: VAR object var_model2
F-Test = 3.4834, df1 = 10, df2 = 5733, p-value = 0.0001376
> print(grangertest_gas_to_crude_nifty$Granger)
        Granger causality H0: N.Gas_Return do not Granger-cause Nifty_500_Return
        Crude_Return
```

data: VAR object var\_model2 F-Test = 0.77126, df1 = 10, df2 = 5733, p-value = 0.6569

#### **Table A5: Johansen Cointegration test results**

#### Panel a) Natural Gas and Nifty 500 Index

Test type: trace statistic , without linear trend and constant in cointegration Eigenvalues (lambda): [1] 0.3648115 0.3178480 0.0000000 Values of teststatistic and critical values of test: test 10pct 5pct 1pct r <= 1 | 738.23 7.52 9.24 12.97 r = 0 | 1614.13 17.85 19.96 24.60 Eigenvectors, normalised to first column: (These are the cointegration relations) timeseries\_n.gas\_re.12 timeseries\_Nifty\_re.12 1.000000e+00 timeseries\_n.gas\_re.12 1.00000000 timeseries\_Nifty\_re.12 -1.189063e+00 13.29157659 5.503856e-05 -0.01005018 constant constant timeseries\_n.gas\_re.l2 1.0000000 timeseries\_Nifty\_re.12 -0.9685869 constant 8.0383949 Weights W: (This is the loading matrix) timeseries\_n.gas\_re.12 timeseries\_Nifty\_re.12 timeseries\_n.gas\_re.d -1.00165328 -0.08639188 timeseries\_Nifty\_re.d 0.08167139 -0.06653928 constant timeseries\_n.gas\_re.d -2.435938e-20 timeseries\_Nifty\_re.d 5.785462e-21

K 4.4.1

#### Panel b) Crude oil and Nifty 500 Index

lest type: trace statistic , without linear trend and constant in cointegration Eigenvalues (lambda): [1] 4.050380e-01 3.126414e-01 5.551115e-17 Values of teststatistic and critical values of test: test 10pct 5pct 1pct r <= 1 | 723.56 7.52 9.24 12.97 r = 0 | 1725.72 17.85 19.96 24.60 Eigenvectors, normalised to first column: (These are the cointegration relations) timeseries\_crude\_re.12 timeseries\_Nifty\_re.12 timeseries\_crude\_re.12 1.000000e+00 1.000000000 timeseries\_Nifty\_re.12 -1.037431e+00 10.449226592 constant -6.454950e-06 -0.008000836 constant timeseries\_crude\_re.12 1.000000 timeseries\_Nifty\_re.12 -7.358074 constant 54.168231 Weights W: (This is the loading matrix) timeseries\_crude\_re.12 timeseries\_Nifty\_re.12 timeseries\_crude\_re.d -1.04801233 -0.07725963 timeseries\_Nifty\_re.d 0.08608218 -0.08434812 constant timeseries\_crude\_re.d 2.67560e-21 timeseries\_Nifty\_re.d 1.51703e-21

#### Panel c) Natural gas and Crude Oil

Test type: trace statistic , without linear trend and constant in cointegration Eigenvalues (lambda): [1] 4.029607e-01 3.563966e-01 1.110223e-16 Values of teststatistic and critical values of test: test 10pct 5pct 1pct r <= 1 | 850.50 7.52 9.24 12.97 r = 0 | 1845.94 17.85 19.96 24.60 Eigenvectors, normalised to first column: (These are the cointegration relations) timeseries\_n.gas\_re.12 timeseries\_crude\_re.12 timeseries\_n.gas\_re.12 1.00000000 1.00000000 0.376549965 timeseries\_crude\_re.12 -3.072654751 0.001469408 constant -0.001049497 constant timeseries\_n.gas\_re.l2 1.00000000 timeseries\_crude\_re.12 0.04575895 constant 8.22144132 Weights W: (This is the loading matrix) timeseries\_n.gas\_re.12 timeseries\_crude\_re.12 timeseries\_n.gas\_re.d -0.1400168-0.9523032 timeseries\_crude\_re.d 0.3245633 -0.3247392 constant timeseries\_n.gas\_re.d 6.428159e-21 timeseries\_crude\_re.d 1.035276e-20

# Gender-based Strategies & Electoral Politics in India Through the Lens of Public Choice Theory and Capability Approach

Dr. Rekha Sharma\*

#### Abstract

The paper is written in the context of the rising electoral gender ratio and consequent competition among the political parties to mobilise the vote and support of the women voters. Its objective is to examine genderbased strategies and electoral politics in India through the lens of two salient theoretical frameworks, namely public choice theory (PCT) and capability approach (CA). In other words, the objective of the paper is to ascertain if gender-based strategies and electoral politics in India could lead to a situation of bliss where women empowerment and sustainable development agendas converge. It uses the lens of public choice theory (PCT) to understand the collective behaviour of women as voters and how their demands are responded to by the political parties. The paper argues that driven by the interest of attracting voters and converting them into supporters and members might make it incumbent upon the political parties to draw up their manifestos for their welfare. This welfare emphasis in turn might lead to sustainable political success for the parties; and more inclusive & equitable development. The capability approach (CA) is used to understand how their participation in the electoral process enhances women's greater entitlement to health, education and other measures and thus expands capabilities/ opportunities for them. Making the development process more inclusive and equitable. The common outcome of sustainable polity, economy and society evident from these two approaches is shown by way of an intersection between the PCT and CA frameworks. The paper then draws a gender based electoral strategic direction framework for discerning the pathways implying the various combinations of the ego states & life positions of the contestants and the voters. Finally, the paper evaluates the relevance of gender-based politics in terms of the opportunities for and challenges to the realization of the vision 'Viksit Bharat @2047' in alignment with sustainable development goals.

**Keywords**: Electoral Gains, Gender-based Strategies, Public Choice Theory, Capabilities Approach, Viksit Bharat, SDGs

#### 1. Introduction

Right from day one, that is 26 January 1950, Republic of India has bestowed universal adult franchise in deference to the fundamental right of all its citizensmale or female to equality (Basu, 1966). Our constitution makers believed that the political right to women would be a means to her social and economic emancipation as well. Although not related to it alone, yet the electoral gender ratio is at least an important indicator of women's political participation and their representation as contributors to and the beneficiaries of the development of a nation (Ghosh, 2022; United Nations, 2005).

The political participation of women in India has undergone a remarkable transformation, with trends highlighting their increasing influence on electoral

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outcomes and the narrowing gender gap in voter turnout. Over the decades, the electoral gender ratio has consistently improved and has risen from 715 female voters per 1,000 male voters in the 1960s to 883 in the 2000s. It reached an all-time high of 948 female voters per 1,000 males in 2024 marking a 9-percentage-point reduction in the gender gap since 2010 representing the smallest gap in India's electoral history. For the first time, women constituted nearly half of the total voter turnout in the 2024 General Elections symbolizing their growing role as an influential and decisive voting bloc (PIB., 2024b). The least-ever gender gap in the 2024 elections as shown in Figure 1 reflects not only statistical progress but also a broader societal transformation in the attitude of the women as they become more empowered (Dhingra & Dev, 2024; Singh, 2019).



#### Figure 1: Temporal Behaviour of Electoral Gender Ratio

The narrowing gender gap has spurred political parties to recognize the importance of women voters and adapt their electoral strategies accordingly. With women demonstrating higher turnout rates in many states including UP, Kerala, and West Bengal political parties are increasingly prioritizing gender-centric policies to address their needs. Thus, women are transitioning from being passive participants to active agents of change who are influencing electoral outcomes and governance priorities.

#### **Objectives of the Paper**

This paper delves into the possible intersectionality between Buchanan's public choice theory (PCT) and Sen's capability approach (CA) of development in explaining gender- based strategies in the context of electoral politics in India (Buchanan, 1968; Sen, 1985; Sen, 2001) It argues that although independent yet the public choice and capabilities approach intersect in ways- positive and normative- that may provide useful insights into the gender-based strategies (GBS) in India and elsewhere. Further, it aims to develop a genderbased electoral strategic direction framework to explore pathways through various combinations of the ego states and life positions of contestants and voters. And suggests the approach to reach the ultimate bliss. The study evaluates the relevance of gender-based strategies in terms of the opportunities and challenges in realizing the vision of 'Viksit Bharat @2047,' aligned with the Sustainable Development Goals.

The method chosen is to explore the intersection between public choice theory and develop a directional matrix for gender-based electoral strategies that enable the realization of the idea and ideals of diversity, inclusion and equity on the one hand and the other aspects of sustainable development.

The paper is divided into four sections. In the present

Source: PIB. (2024b)

section, an attempt is made to elaborate the context of the paper and state its purpose. Section II is devoted to a discussion of GBS in the context of public choice theory and capability approach. In Section III the intersectionality between the PCT and the CA is explored. Section IV contains conclusions and a discussion of the implications in the context of the idea of India as a developed nation, that is the Vision Viksit Bharat @ 2047, aligned with achievement of sustainable development goals (SDGs).

#### 2. Theoretical Frameworks

#### **Public Choice Theory**

Within the Neoclassical Counter-Revolution framework, the public choice theory challenges the assumption that governments always act in the public interest. Instead, Buchanan (1968) introduces the idea that political actors are driven by self-interest similar to individuals in a market. It treats voters, politicians and bureaucrats as rational agents. Women as a rising electoral force exercise their voting power based on perceived benefits that align with their priorities such as safety, education, healthcare, economic security. Just as firms keep on innovating to meet the desired demands of consumers, political parties craft gender-specific strategies to appeal to women voters. These strategies not only address immediate electoral objectives but also foster long-term trust and loyalty further solidifying the party's position in future electoral cycles.

In the process of attracting the voters by satisfying their "demand", competition among compelling parties makes them more efficient and encourages parties to be more responsive to women's concerns. It should then make sense for them to turn their customers into clients; clients into advocates & ambassadors; and ambassadors into evangelists. In other words, cultivation of a woman voters as a constituency must lead to their enrollment as members of the party; as party candidates in state legislatures and parliament; and in the cabinet. These women then can act as influencers in drawing more women to vote for and affiliate with the party. What results in effect is greater inclusion and equity in matters related to health and education for girls, legal protections against gender-based violence and institutions that reinforce not only gender equality but also the adoption of feminine ethics and values that would make any polity, economy and society more sustainable and inclusive.

#### The Capability Approach

The capability approach developed by economist and philosopher Amartya Sen provides a holistic framework for evaluating well-being, development and social justice (Sen, 1985; Sen, 2001). It focuses on expanding capabilities of individuals implying freedom, that is, to lead a life one values rather than solely measuring resources or income. Central to this approach are two concepts(i) 'capabilities' which represent opportunities or freedoms such as access to education, healthcare; and (ii) 'functionings' which are the realized achievements of these opportunities like being educated or healthy. By emphasizing the role of agency, the women in the present context, the approach highlights the importance of autonomy and the ability to make meaningful choices and thus, contributing to the holistic and sustainable development of the polity, economy and society.

#### 3. Intersection Between PCT and CA

The intersection between public choice theory and capability approach provides a nuanced understanding of the rationale and impact of gender-based strategies. While public choice theory explains the motivation behind these policies driven by political actors seeking electoral gains, the capability approach focuses on the broader societal benefits that accrue and enhance the capabilities of women. Both these approaches show congruence in terms of sustainable politics, economy and society as shown in Figure 2.

Figure 2: Intersection Between Public Choice Theory and Capability Approach



**Gender-Based Strategies Directional Matrix** 

The four-quadrants of the gender-based strategies (GBS) directional matrix, representing south-west, south-east, north-west and north-east directions have been respectively labeled as opportunism, stepping stone, graded incrementalism and ultimate bliss.

The paper uses these four quadrants of the matrix as depicted in Figure 3 to show how gender-based strategies can evolve from opportunistic freebies addressing basic needs to purpose-driven empowerment strategies targeting women's aspirations However, it would be pertinent here to elaborate the ideas of ego state and life positions that have been borrowed from psychology (Berne, 1985). Whereas ego states are essentially transactional and experienced in the moment, life positions/values imply more fundamental beliefs that drive people's behaviour. For example, if a political party is driven by the belief that votes can be bought in via freebies then rather than ideological adoption of the gender issues in its vision it may repetitively resort to freebie driven electoral strategies. This belief may in turn be reinforced by the opportunistic expectations of the voters.





Source: Self

**Opportunism:** The coordinate labeled 'opportunism' is at the south-west end of the matrix. It shows a situation where the political opportunism of the voters and the contestants /contesting political parties coincide. The power-seeking parties offer freebies that are lapped by opportunity deprived and necessity driven voters. In a situation of vast inequality any subsidisation and benefit transfer can really swing in the votes for the contestant / party that is able to touch the pulse of the voters. The freebie schemes target necessity-driven voters prioritizing survival needs through direct benefits. For instance, 'Ujjwala Yojana' (2016) provided free 103.3 million LPG connections to rural households by 2024 (PIB., 2024e). It improved health and safety for rural women by reducing exposure to smoke from traditional cooking methods. Other examples include 'Swachh Bharat Mission' (2014) prioritized sanitation infrastructure and built more than 100 million toilets across the country directly addressing women's safety and dignity in rural areas (PIB., 2024a). These initiatives were instrumental in building trust among necessitydriven voters but can be perceived as opportunistic as they addressed immediate needs without addressing systemic barriers.

Stepping-Stone: Freebie-driven contestants-aspirationdriven voters coordinate in the south-east quadrant. Stepping Stone implies that the voters buy-in the freebie politics of the contestants in the hope of getting more freedom or leveraging their emancipation. Thus, the women utilise the savings arising from the consumption subsidization as investment in sustainably empowering in education, health, housing, capacity building and other ventures. 'Beti Bachao Beti Padhao' (2015) aimed to improve the sex ratio by raising awareness about the importance of girls' education. State-specific initiatives such as 'Rajshree Yojana' (Rajasthan, 2016), 'Kanyashree Prakalpa' (West Bengal, 2013), 'Pudhumai Penn Scheme' (Tamil Nadu, 2022)) were launched to support girl child education and provide financial incentives for girl child education so that it encourages higher aspirations and also delays early marriage. 'Pradhan Mantri Matru Vandana Yojana' (2017) provided maternity benefits combining financial support with health outcomes. 'Lakshmi Bhandar' (West Bengal, 2021) and 'Mukhyamantri Ladli Bahna Yojana' (Madhya Pradesh, 2023) introduced direct monthly cash transfers to support women in achieving financial stability and enabling them to focus on longterm aspirations.

Graded Incrementalism: The north-west quadrant at the purpose-driven contestants- necessity-driven voters. It addresses systemic barriers to gender emancipation in sync with its long-run purpose while harnessing the necessity-driven voters in the short-run. Such a strategy is exemplified through structured programs that systematically enhance women's capabilities over time. Initiatives such as 'Stand-Up India' (2016) provided access to credit for women entrepreneurs to foster financial independence. 'Mahila Nidhi' (Rajasthan, 2022) focused on supporting rural women through microfinance and self-help groups. Additional examples include 'Deendayal Antyodaya Yojana- National Rural Livelihood Mission'(DAY-NRLM, 2016) empowered women through income-generating activities. 'National Nutrition Mission' (2018) addresses malnutrition among women and children while promoting healthier life style.

Ultimate Bliss: The north-east quadrant at the intersection of aspiration-driven women voters and purpose-driven political outfits is the ideal to strive for. Rightly, therefore it has been referred to as the 'ultimate bliss'. This quadrant manifests in the initiatives that empower women comprehensively so that it enables meaningful participation across economic, social and political domains. For example, 'Mission Shakti' (2021) demonstrating a multidimensional approach to empowerment integrated safety, financial independence and leadership development into a single framework. Similarly, 'Safe City' initiative (2018) used technologydriven solutions to ensure women's safety across many cities. 'Kudumbashree' 1997 (Kerala) expanded the scope of women's self-help groups into areas like agro-processing and digital services. Programs

such as 'Mahila Samman Savings Certificate' (2023) encouraged financial independence by offering savings opportunities tailored to women's needs. Other examples include 'Free Public Transport Schemes' in many states such as Delhi, Maharashtra enhanced women's mobility and access to opportunities. Pink Protection Project (Kerala, 2021) ensured women's safety in public and workspaces. According to Women Reservation Bill 2023, thirty-three per cent of seats in the assemblies and the Lok Sabha would be reserved for only female candidates is a milestone achievement. A rightful place in legislative chambers is likely to foster policies that uplift marginalized groups, drive grassroots development and foster harmony and thereby, achieving a vision of ultimate bliss for purpose-driven voters (FitzGerald & Valdini, 2020)

#### 4. Conclusion and Implications

The study explores the potential of gender-based strategies (GBS) founded on principles of public choice theory (PCT) and capability approach (CA) to contribute towards the realization of core objectives of Vision Viksit Bharat 2047, that is, sustainable polity, economy and society (Virmani, 2024; Sharma, 2024). The four quadrants approach used discusses the behavioural patterns implying gender-based strategies and the outcomes these might lead to depending on voters' and contestants' ego state and life position. The GBS directional matrix developed here as a result shows at least two pathways via 'graded incrementalism' and 'stepping stone' implying the contestants / contesting parties and voters respectively can reach the most desired outcome, 'ultimate bliss'. The situation of opportunism that the results of the directional analysis acknowledge is an inevitable aspect of the political and economic reality of a society characterised by a legacy of gender-based inequities and inequalities. The good news is that a breakthrough is possible.

#### Achieving Viksit Bharat@2047

The rise of women as a voting bloc has led to substantial changes in governance with a stronger focus on welfare

programs and public services, laying the foundation for achieving Viksit Bharat@2047. From driving electoral strategies to reshaping governance and challenging societal norms, women are at the forefront of India's transformation. Empowering women to participate fully in political and economic life is not just an electoral necessity but a developmental imperative (U.N. Women, 2015).

States with higher female representation in governance have demonstrated notable improvements in socioeconomic indicators (Deshmukh, 2005;). States like Rajasthan, Bihar, Madhya Pradesh and Uttar Pradesh which actively implemented sanitation programs reported a significant reduction in open defecation and also had an improvement in women's health outcomes (PIB. 2022; 2024a; 2024d). Female literacy in states with proactive gender policies such as Kerala and Tamil Nadu exceeded 90% compared to the national average of 78%. India's MMR has dropped significantly from 130 (2014–16) to 97 (2018–20). While few states such as Kerala Maharashtra Telangana, Andhra Pradesh have met the SDG target of <70, many others still report MMRs above 100 requiring targeted efforts to bridge regional gaps (PIB., 2022). Investments in maternal health can reduce mortality rates with long-term benefits for human development.

Women's labor force participation has risen from 18% in 2015 to 41.7 % in 2024 driven by government initiatives promoting financial independence (PIB, 2024c). McKinsey Global Institute Report (2015) laid the emphasis on gender equality and its impact on economic growth - "Achieving gender equality in India would have a larger economic impact there than in any other region in the world—\$700 billion of added GDP in 2025—but comprehensive change is needed". The World Bank Report (2018) highlights the importance of female education and states "Limited educational opportunities for girls and barriers to completing 12 years of education cost countries between \$15 trillion and \$30 trillion in lost lifetime productivity and earnings".

Programs like 'Stand-Up India' facilitated loans 1,44,787 women entrepreneurs encouraging for economic participation (PIB. 2023). Increased female representation in governance is another sign of progress. As of 2024, 13.7% of Lok Sabha members of parliament are women still short of the global average of 26% (IPU Parline, 2024). States like Bihar, Odisha have excelled in grassroots representation with women holding 50% of leadership positions in local governance(PIB., 2024f) Women leaders have demonstrated transformative governance by prioritizing welfare and social equity Women-led self-help groups contributed to the state's rural development by increasing household incomes (Kumar et al., 2021; Bhorse, 2024). Research studies shows that states with women in leadership roles allocate more funds to education and healthcare, directly benefiting marginalized /disadvantaged group (Chattopadhyay & Duflo, 2004; Ballington, 2008; Saikia, 2019). Initiatives such as the 'One Stop Centres' and the 'Women Helpline Scheme' provide immediate support to survivors of violence, ensuring justice and rehabilitation. Legal reforms such as the Criminal Law (Amendment) Act, 2013 have strengthened the framework against sexual offenses, promoting accountability and reducing impunity. Programs to sensitize law enforcement and judicial institutions on gender issues are helping to create inclusive and responsive systems. Moreover, promoting women's participation in governance and decision-making enhances the inclusivity of institutions and fosters a culture of peace and justice (Ballington, 2008; Political participation of women. (n.d.).

Women's empowerment is critical to achieving Viksit Bharat@2047 with their contributions directly linked to key developmental goals. By integrating women into decision-making processes, India can create a governance model that is inclusive, effective and reflective of the needs of all citizens. The upward trend in women's political participation underscores the urgency of institutionalizing gender-focused strategies that transcend electoral gains. By embedding these
initiatives into the core of governance, India can not only achieve its developmental aspirations but also serve as a global exemplar of inclusive growth and sustainable development.

These gender- based strategies expanding access to health, education, credit, skill development, and entrepreneurship opportunities for women can drive economic independence and reduce poverty aligning with sustainable development goals such as 'SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth), Gender Equality (SDG 5), Quality Education (SDG 4), and Peace, Justice, and Strong Institutions (SDG 16)' (United Nations, n.d.).

# **Challenges That Remain**

It is important to take cognizance of the challenges before the gender-based political agenda in India. Gender disparities manifest at home, in public spaces, educational institutions, workplaces and communities, reinforced by media, textbooks and entrenched patriarchal structures. Girls often face limitations in mobility, decision-making, and access to education and healthcare. Many are subjected to early marriage, domestic work, violence and exploitation because of poor financial condition or social norms. Addressing these issues requires societal transformation and greater investment in empowering women and girls.

Embedding of gender concerns in governance, budgetary allocations and institutional accountability and assurance beyond head-count compliance are the measures that can transform gender-based strategies into tools for sustainable empowerment and inclusive development in India and anywhere else.

As India approaches 2047, the integration of women and feminine ethics in policy discourse and the programs of national development is an imperative that cannot be ignored. Let us not only make her vote count but also her voice and values guide and shape India's destiny and that of the world. Indeed if the electoral competition can break free from short-sighted opportunism, genderbased politics in India and anywhere else can be a potent mechanism for the realization of sustainable healthy polity, economy and society.

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# India-EFTA TEPA: Analyzing Prospects for Growth Using ARDL Modelling

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#### Abstract

India has recently signed a historic Trade and Economic Partnership Agreement (TEPA) agreement with the countries of the European Free Trade Association (EFTA). The EFTA countries include non-EU countries namely, Iceland, Liechtenstein, Norway and Switzerland. This Agreement precedes the muchdiscussed and much-awaited India-EUFTA (Free Trade Agreement) or even the India-UK FTA. This Agreement is the first instance, whereby India has finalized a trade deal with a European bloc. It also marks the first instance where EFTA countries have explicitly committed to an investment of USD 100 billion in India over the next 15 years thereby opening the gates to a million jobs for Indian youth.

This paper examines the relationship between trade with EFTA nations and India's GDP by analysing historical data for the period 1995-2022. It employs the Autoregressive Distributed Lag Model (ARDL) and the Granger Causality Test to assess this relationship.

The paper concludes that there exists a causal relationship between exports to EFTA as well as imports from EFTA and India's GDP in the short-run, though in the long run, only exports exhibit a causal relationship with imports as well as GDP.

Keywords: India-EFTA, Trade, TEPA, ARDL, GDP

# 1. Introduction

India and European Free Trade Association (EFTA) which include Iceland, Liechtenstein, Norway and Switzerland, achieved a momentous breakthrough in March 2024. The two entered into a significant Trade and Economic Partnership Agreement (TEPA). Important economic benefits for both partners are expected to be achieved with the signing of this agreement. The agreement is expected to enhance supply chain integration and resilience, create new trade and investment opportunities for the signatories to the agreement. Economic growth along with job creation is one of the prime outcomes expected from this agreement<sup>1</sup>.

The agreement has also been termed as a win-win for both partners as it aligns with the "China Plus One" strategy of India and EFTA. India advocates for its trading allies to broaden their horizons beyond China, in order to leverage India's attractive investment environment amid global challenges<sup>2</sup>. The shifting geopolitical landscape is also encouraging EFTA nations to strengthen trading partnerships beyond China. The COVID-19 pandemic has further accelerated this trend.

The TEPA agreement has for the first time a detailed chapter on investment. Its inclusion is conspicuous as it is absent from recent Agreements signed by India with Australia, United Arab Emirates (UAE)

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<sup>&</sup>lt;sup>1+2</sup> https://www.edelmanglobaladvisory.com/insights/primer-india-efta-trade-and-economic-partnership-agreement-tepa#:~:text=India%20and%20EFTA%20

and Mauritius. Investment facilitation rather than investment protection forms the core of this chapter. From an Indian perspective, the agreement is important as EFTA nations commit to investment inflows of USD 100 billion into India, excluding foreign portfolio investment. Inclusion of environment and labour issues, which India considered as sensitive, signal a softening of its traditionally rigid stance (Ranjan, 2024).

The tariff coverage of EFTA's offer further covers 99.6 per cent of India's exports, including all non-agricultural products, along with concessions on processed agricultural goods. Switzerland, specifically, has granted duty free access to 98 per cent industrial exports.

On its part, Indian products like coal, pharmaceuticals, textiles, machinery, electronics and agricultural goods will be available to EFTA nations at reduced tariff rates. This reduction is set to be implemented gradually over a ten-year period<sup>3</sup>.

In view of the historic agreement, the current study analyzes trade variables to understand their impact on GDP of India. Autoregressive Distributed Lag Model (ARDL) has been applied to conduct the empirical analysis. The objective of the study is to examine the causal relationship between the variables.

# 2. EFTA and TEPA

EFTA is one of the three major economic blocs in Europe, alongside the European Union (EU) and the United Kingdom (UK). It is an inter-governmental organization established in 1960 by signing a convention in Stockholm. Seven European countries namely Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the UK formed EFTA. The formation of EFTA was a response to the EU's predecessor, the European Economic Community (EEC) which was established in 1957 with the aim of European integration. EFTA did not establish a customs union thereby allowing its members a greater degree of sovereignty<sup>4</sup>. At different points in time, five of the seven founding members left EFTA and joined the EU, leaving just two members in EFTA namely, Norway and Switzerland. While Iceland joined EFTA in 1970, Liechtenstein became a member in 1991.

As of today, EFTA comprises of Iceland, Liechtenstein, Norway, and Switzerland. Its principal goal is to promote free trade and economic integration within Europe and globally for the benefit of its members. Currently, India has trading relations with all EFTA members. The largest trading partner of India in EFTA is Switzerland followed by Norway. For India, EFTA continues to be a significant regional group with increasing opportunities to expand international trade in goods and services.

The Agreement has seen the light of the day after long years of negotiations between India and EFTA. Both the partners have been discussing this Agreement since 2008. A legal commitment to target-oriented investment and job creation is a first in the history of trade agreements. TEPA will support the "Make in India" and "Atmanirbhar Bharat" initiatives. Through the TEPA agreement, vital sectors of Indian manufacturing like infrastructure, machinery, pharmaceuticals and others are expected to get a boost.

TEPA will increase job opportunities for the Indian workforce including vocational and technical training. The Agreement has an obligation of conduct, which means that the EFTA countries will make an honest effort to "facilitate the generation of one million jobs" in India. This differs from the obligation of result which legally binds the parties to a result-oriented outcome. However, the obligation of conduct itself is a first-time inclusion in such agreements.

<sup>&</sup>lt;sup>3</sup> https://www.edelmanglobaladvisory.com/insights/primer-india-efta-trade-and-economic-partnership-agreementtepa#:~:text=India%20and%20EFTA%20

<sup>&</sup>lt;sup>4</sup> https://www.efta.int/about-efta/frequently-asked-questions#:~:text=EFTA%20and%20the%20EU%20are,barriers%20 and%20enhance%20economic%20relations.

The TEPA is expected to facilitate technological collaboration by granting access to cutting-edge technologies in fields such as precision engineering, health sciences, renewable energy, innovation and research and development.

The Agreement between India and EFTA commits the two partners to enhance economic ties with each other. This agreement holds special importance for India and the EFTA countries, as it is concluded after a series of discussions between the two partners. Further, it signifies a major milestone for India in connecting it to international markets especially the developed countries. It will also open up avenues for diversifying trade between the two partners. Currently, Gold as a commodity is being imported by India from Switzerland and it forms the bulk of India-EFTA trade.

In the backdrop of this historic agreement, the study looks at the current impact of trade on India's GDP and the growth-trade relationship between India and EFTA.

### 3. Literature Review

EFTA countries form a significant grouping in the European context. The advantages of a trade and economic partnership with EFTA allow for greater market access to developed countries. This is the first instance whereby India has signed a trade agreement with a developed country block.

In terms of empirical analysis, the Autoregressive Distributed Lag (ARDL) model is an econometric tool commonly used to analyse both the short-run and longrun relationships between variables. The application of ARDL model to corroborate the classical theory of trade being a driver of economic growth has been put to test by numerous experts. Available literature and vast expanse of empirical analysis can be identified by their unique characteristics in order to understand the Trade Growth Hypothesis.

Academicians have used the empirical research, examining the relationship between exports and economic growth and have produced varied outcomes across different contexts. Jung and Marshall (1985) found no causal link between exports and growth in 33 out of 37 developing countries they studied, with notable exceptions being Indonesia, Egypt, Ecuador and Costa Rica.

In contrast, studies on China have shown that exports have a significant positive effect on economic growth (Kwan et al., 1996; Kwan & Cotsomitis, 1991).

Ghartey (1993) examined the cases of the United States (US), Taiwan and Japan uncovering distinct patterns; economic growth appeared to drive exports in the US, a mutual relationship was observed in Japan, and in Taiwan, exports were a catalyst for economic growth.

Other studies using time-series technique also support these findings. Shan and Sun (1998) discovered a bidirectional causality between exports and economic growth in both China and Australia, utilising the Augmented Dicky Fuller (ADF) single test and Granger Causality tests.

Love and Chandra (2005) used cointegration and error correction models to explore India's export led growth, identifying one way causality where exports positively affected economic growth. Conversely, Tang (2006) applied ARDL modelling and the JJ approach to China but did not find evidence of cointegration among exports, economic growth, and imports.

In Eastern Europe, Awokuse (2007) discovered a bidirectional relationship between exports and growth in Bulgaria. However, in Czech Republic and Poland a one-way causality was observed, with the findings for Poland emphasising the crucial role of imports in contributing to economic growth.

In the context of South Asia, Lee (2010) found that exports, imports and economic growth in Pakistan was interlinked through bi-directional causality in the short run.

While analysing India's quarterly data form 1996-2009 using Granger Causality test and Vector Autoregressive (VAR) framework, Nain and Ahmad (2010) refuted the export led growth hypothesis for India but confirmed that economic growth spurred exports.

Additional research has explained the examination of these dynamics. A long-term association between financial instability and environmental degradation in Pakistan was identified, indicating broader economic implications (Shahbaz, 2013). Hye et al. (2013) utilised the time series data to assess the trade growth nexus in South Asian nations.

Employing cointegration and Vector Error Correction Model (VECM), Devkota (2019) explored India's GDP, exports, and imports, finding evidence of causality between GDP and imports.

Santoso and Moenardy (2023) have done a qualitative analysis on the Indonesia-EFTA Comprehensive Economic Partnership Agreement (IE-CEPA) and concluded that the agreement brings economic advantages to Indonesia through reduced tariffs, improved indigenous quality of Indonesian products, diversified export basket of Indonesian products to EFTA and indirectly boosts infrastructure development. Agarwal (2023) has analyzed the relationship between India's trade with the UK and its GDP using the ARDL model finding a bi-directional relationship between India's exports (including goods and services) to UK and India's economic growth.

#### 4. Objectives of the Research Study

There exists a gap in the existing literature on the subject of India-EFTA trade and economic issues. This is partly because the volume of trade between India and EFTA in the year 2022 has been a meagre USD 19 billion. And within this, gold dominates the product portfolio with India importing gold worth USD 13 billion in the year 2022. Given this background, it is important to understand the significance of an India-EFTA TEPA and analyze the benefits that could accrue to the partners through this landmark agreement.

Figure 1 shows the composition of Gold in total imports from EFTA to India. The volume of trade for products, excluding gold, is USD 6 billion, which is an insignificant amount.



Figure 1. Share of Gold in Total Imports from EFTA to India (1995-2022) (in million USD)

<sup>&</sup>quot;Source: Authors own calculations"

The objective of this research is to examine the underlying relationship between India's trade with EFTA member nations and its economic growth. Specifically, the current research analyses the impact of Indian exports to EFTA and Indian imports from EFTA on India's GDP (Gross Domestic Product). At the same time, the relation between Indian exports (to EFTA) and Indian imports (from EFTA) is also analyzed. The results of this research based on the empirical evidence will ensure that suitable policies are drafted to utilize the potential of trade between India and EFTA in order to have a positive impact of trade on India's economic growth

# 5. Research Methodology

The empirical analysis has been undertaken for the period 1995-2022. Secondary data from United Nations Statistical Division (Comtrade dataset) taken from https://www.oec.world has been used to conduct the analysis. The Comtrade dataset is chosen as it provides uniformity to the data, which is maintained on a calendar year basis. The time series data from Comtrade is a reliable source used for statistical analysis by researchers across the world. The data has been analyzed using Eviews 12 software.

The current study focusses on merchandise trade between India and EFTA only, and excludes trade in services. The trade in services is excluded due to the low volume of trade in services between India with EFTA countries. The amount of trade in services between India and the EFTA countries being negligible and thus insignificant. While considering merchandise trade between India and EFTA, it is noticeable that the dominant product in the import basket is gold comprising of approximately 80 per cent of the total value of imports from EFTA to India. Therefore, for an unbiased result, the current research presents the analysis with gold and without gold.

The current study employs the Autoregressive Distributed Lag (ARDL) technique on the time-series data to find a causal relationship between the variables. The variables for the study are Gross Domestic Product (GDP) of India and the trade data of India with EFTA countries. The composition of trade data includes the Exports of India (EXP) to EFTA and Imports from EFTA (IMP) to India. LGDP, LEXP and LIMP are the natural logarithm of the dataset. FDI inflows from EFTA are not considered in this work<sup>5</sup>.

The Augmented Dicky Fuller (ADF) test has been applied to determine the stationarity of the series. The descriptive statistics indicates the series to be normally distributed.

ARDL model is applied to show the short run and long run relationship amongst the variables, LGDP, LEXP and LIMP. Each of these variables is treated as a dependent variable. The other two variables are treated as independent variables. The generalised ARDL (p, q)model is specified as:

where

 $Y_{t}$  dependent variable at time t

Xt: Explanatory variable at time t

v: Constant

β: Coefficient of independent variable

 $\delta$ : Coefficient of dependent variable

p: number of lags for dependent variable

q: number of lags for independent variable

εt: Error term at time t

n: 1.....k

the

In the case of LIMP, the variables namely LGDP multi-collinearity has and LEXP. In order to been found between mitigate the effect of multi-collinearity, LIMP two independent

<sup>5</sup> The quantum of FDI inflows from EFTA into India during the period 1995-2022 amounted to USD 8.5 billion and hence, are insignificant

has been regressed at a bi-variate level. Therefore, the results for LIMP are shown with respect to LGDP and LEXP separately.

The Error Correction Model (ECM) has been applied after establishing the long run relationship. The fitness of the model has been checked using the residual diagnostics and stability diagnostics. Granger Causality test is used to verify the pair-wise short run causality. It explains the temporal relationship between variables.

# 6. Empirical Analysis

The results of the ADF test are given in Table 1. DLGDP denotes the differenced logarithm values of GDP; DLEXP denotes the differenced logarithm values of exports; DLIMP (with gold) denotes the differenced logarithm values of total imports and DLIMP (without gold) denotes the differenced logarithm values of imports without gold.

At First Difference		DLGDP	DLEXP	DLIMP with gold	DLIMP without gold		
With Constant	t-Statistic	-4.6792	-5.5118	-6.6835	-5.0517		
	Prob.	0.001	0.0001	0.0000	0.0004		
		***	***	***	***		
"With Constant & Trend"	t-Statistic	-4.6016	-5.3652	-6.9993	-3.3379		
	Prob.	0.0058	0.0011	0.0000	0.0832		
		***	***	***	*		
"Without Constant & Trend"	t-Statistic	-0.631	-1.6417	-6.083	-4.8596		
	Prob.	0.4329	0.0939	0.0000	0.0000		
		no	*	***	***		

 Table 1. Augmented Dicky Fuller (ADF) Test Results

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1% and (no) Not Significant" "Source: Authors own"

As per Table 1, all series are stationary at first difference with constant at 1 per cent significance level. DLGDP, DLEXP and DLIMP (with gold) are also stationary with constant and trend at 1 per cent significance level, however DLIMP (without gold) is stationary at 10 per cent significance level. Table 2 shows the descriptive statistics of the differenced logarithm series. The average annual growth rate of Indian GDP is 8.33 per cent. The highest growth rate of Indian GDP is 25.77 per cent, while the lowest is negative 5.95 per cent. India's exports to EFTA countries are growing at 7.39 per cent and imports at a rate of 9.86 per cent.

#### Table 2. Descriptive Statistics of differenced log series

	DLGDP	DLEXP	DLIMP (with gold)	DLIMP (without gold)
Mean	0.083316	0.073882	0.098576	0.059079
Max	0.257771	0.390505	0.995009	0.630838
Min	-0.05958	-0.323227	-0.689338	-0.324507

Standard Deviation	0.073706	0.157034	0.383729	0.256573
Skewness	0.411973	-0.251133	0.308422	0.389126
Kurtosis	2.835408	3.096507	3.008122	2.315496
Jarque-Bera	0.794224	0.294282	0.428133	1.2085
Probability	0.672259	0.863172	0.807295	0.546484
Observations (N)	27	27	27	27

"Source: Author own"

The standard deviation in import series is highest at 0.38, indicating greater variability of the series. GDP and imports exhibit positive skewness, suggesting that most values are concentrated towards the left side of the distribution, while the right tail extends further.

Moreover, all series are normally distributed as p-value(s) > 0.05 satisfies Jarque Bera test of normality.

# 6.1 ARDL Model: India's imports with Gold

Table 3 shows the results of the ARDL model in the short run. There exists a bi-directional relationship between imports from EFTA and GDP of India in the short-run. Similarly, a bi-directional relationship exists between imports from EFTA and exports to EFTA in the shortrun. However, there exists a uni-directional relationship between GDP and exports to EFTA, whereby, GDP is causing exports to EFTA in the short run.

			Explanatory Varia	ıbles	
			Short-run causality		
		LGDP	LEXP	LIMP	
Explained Variable	LGDP		-0.6148 (0.6811)	0.1111/-0.1047 <sup>◊</sup> (0.0149)**	LIMP→LGDP
	LEXP	1.2754 (0.0017)***		0.1401 (0.0123)**	LGDP→LEXP LIMP→LEXP
	LIMP	2.4311 (0.0459)**			LGDP →LIMP
	LIMP		1.3048 (0.0031)***		LEXP →LIMP

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%";

 $\Diamond$ : (t-1);  $\beta$  represents the coefficient(s);

"Source: Authors own calculations"

		<b>Explanatory Variables</b>			<b>T</b>	Error Correction
			β (p-value)			Coefficient (λ)
		LGDP	LEXP	LIMP	causanty	(p-value)
LODD		1.3379	-0.1403	Indonondont	No opintografian	
ble	a LGDP		(0.4256)	(0.8945)	Independent	No connegration
	I EVD	0.6920		0.1477	LGDP→LEXP	-0.9487
	LEAI	(0.0000)***		(0.0112)**	<b>LIMP→LEXP</b>	(0.000)***
nec	I IMD	2.3699			Indonondont	No cointegration
	(0.001)			independent	No connegration	
EX	I IMD		1.0642		Indonondont	No sointogration
	LIMP		(0.0163)		Independent	no connegration

TII 4 T E I			
Iable 4 I and Farm and	Rounds lost and Frrai	r Correction Repression Mode	A lindig's imports with goldi
$\mathbf{I} \mathbf{A} \mathbf{V} \mathbf{I} \mathbf{C} \mathbf{T} \mathbf{I} \mathbf{I} \mathbf{U} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} I$			A THUIA S IMPOLIS WITH ZOIU/

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%"

"Source: Authors own calculations"

Table 4 indicates that there is no cointegration between GDP and both exports and imports in the long run. Similarly, when imports are considered as a dependent variable, no cointegration is observed with GDP and exports, respectively. However, exports do show cointegration with both GDP and imports over long term.

The feedback effect in exports is -0.9487, which is statistically significant at 1 per cent significance level. This value reflects the rate at which the shocks from previous periods in the short run, will adjust to reach equilibrium in the subsequent periods. Moreover, the adjustment towards equilibrium will happen in a monotonic manner as the value of  $\lambda$  is between zero and minus one.

# 6.2 ARDL Model: India's imports without Gold

The composition of gold imported from EFTA into India is a substantial amount with a total value of USD 13 billion in the year 2022, out of a total import value of USD 16.99 billion. In order to evaluate the merchandise imports (other than gold) and their impact on India's GDP and exports, the current study also shows the analysis of trade without gold.

Table 5 shows the short run relationship between the variables using ARDL model. There exists a bidirectional relationship amongst all the variables. Whereas, GDP is causing exports, exports are also causing GDP, similarly, GDP is causing imports and imports are also causing GDP. There also exists a bidirectional relationship between exports and imports between India and EFTA countries.

		Ex			
			Short-run		
			(p-value)		causality
		LGDP	LEXP	LIMP	
	LGDP		0.3726 (0.0068)***	0.1453/-0.1497 (0.0298/0.0459)**	LEXP→LGDP LIMP→LGDP
Explained Variable	LEXP	1.0964 (0.0029)***		0.1884 (0.0023)***	LGDP→LEXP LIMP→LEXP
	LIMP	1.6882/-1.4479 (0.0110/0.0245)**			LGDP →LIMP
	IMP		1.0801/-0.8984 (0.0006/0.0027)***		EXP →IMP

# Table 5. Short-Run Relationship using ARDL model (India's imports without Gold)

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%"

"Source: Authors own calculations"

# Table 6. Long Form and Bound Test and Error Correction Regression Model (India's imports withoutGold)

		Explanatory Variables			I and mun	Error Correction
		β (p-value)			Long-run causality	Coefficient $\lambda$
		LGDP	LEXP	LIMP	causanty	(p-value)
			1.6249	-0.6278	Indonondont	
ble	LGDF		(0.7297)	(0.9026)	Independent	No cointegration
Iria	IFVD	0.7046		0.1807	LGDP→LEXP	-1.0
	LEAF	(0.0000)***		(0.0342)**	LIMP→LEXP	(0.000)***
nec		0.8682			Index and and	
plai		(0.0006)			Independent	No cointegration
ExJ			0.8238		Indonendent	
	LIMP		(0.0162)		independent	No cointegration

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%"

"Source: Authors own calculations"

Table 6 reveals that there is no cointegration when GDP is treated as a dependent variable. Likewise, when imports are the dependent variable, no cointegration is found between imports and GDP and imports and exports. However, exports are cointegrated with GDP and imports in the long run. There exists a long run relationship as GDP and imports cause exports. The speed of adjustment in exports is -1.0 and the adjustment is proportional, implying any deviation will be corrected completely in one period.

## 6.3 Pairwise Granger Causality Test

The robustness of the model is checked through pair-wise Granger causality test. Table 7 depicts the results of Granger causality test. It indicates short-run causality and measures the extent to which one timeseries explains the change in other series. The table shows that GDP Granger causes exports at one per cent significance level. Likewise, GDP causes total imports at five per cent significance level.

"Null Hypothesis:"	Obsns.	<b>F-Statistic</b>	Prob.
"DLEXP does not Granger Cause DLGDP"	26	3.8676	0.0614*
"DLGDP does not Granger Cause DLEXP"		24.6767	0.0001***
-DLIMP does not Granger Cause DLGDP"	26	3.3861	0.0787*
-DLGDP does not Granger Cause DLIMP-		4.4519	0.0459**
"DLIMP does not Granger Cause DLEXP"	26	3.7400	0.0655*
-DLEXP does not Granger Cause DLIMP-		0.4491	0.5094
-DLIMP(excl. gold) does not Granger Cause DLEXP.	26	4.34566	0.0484**
"DLEXP does not Granger Cause DLIMP (excl. gold)"		3.66434	0.0681*

#### **Table 7. Pairwise Granger Causality Tests**

"(\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%"

"Source: Authors own calculations"

At ten per cent significance level, exports Granger causes GDP and import Granger causes GDP. Total Imports excluding gold is Granger causing exports from India at five per cent significance level. Exports

#### 7. Conclusion

The results of ARDL analysis show that there is cointegration between GDP and exports. GDP is positively influencing exports signifying that with the growth in the Indian economy, its exports to EFTA tend to increase. This could be attributed to increased production capabilities and enhanced international competitiveness that accompany a growing economy.

Simultaneously, imports are positively influencing exports indicating a complementarity between imports and exports. This suggests a value-added process or are Granger causing Imports (excluding gold) at ten per cent significance level. These results of Granger Causality conform with the ARDL results.

increased efficiency in production capacity of exported goods, which implies, that the import of intermediate goods or raw materials from EFTA is contributing to enhanced export capabilities.

In the long run, a higher GDP of India boosts export performance and an increase in imports potentially supports or complements export activities, by contributing to the production processes or enhanced competitive dynamics.

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# Mediating Effect of Job Factors, Employee Commitment and Organisational Initiatives for Maintaining Work-Life Balance

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# Abstract

This study aims to investigate the factors influencing work-life balance (WLB) among employees at Satluj Jal Vidyut Nigam Ltd. (SJVN). Using a quantitative approach, the study examines the impact of personal attributes, organisational elements, job characteristics, and workplace practices on WLB. The findings highlight key dimensions such as departmental factors, external influences, family care responsibilities, and organisational policies as significant contributors to work-life conflicts. The study underscores the importance of individual and organisational measures in reducing work-life conflicts and enhancing employee well-being. Recommendations include adopting familyfriendly policies, flexible work arrangements, and effective grievance-handling mechanisms to improve *WLB*, *job satisfaction and organisational performance*. This research provides valuable insights for publicsector organisations striving to enhance employee satisfaction and productivity.

Keywords: Workplace Stress, Organisational Climate, Flexible Work Arrangements, Factor Analysis, Public Sector Enterprises.

JEL Code: J28, M12, J81, M54, I31

# 1. Introduction

An effective work-life balance facilitates the attainment of personal objectives. The six fundamental quadrants of an individual's life encompass profession, family and friends, community, hobbies, sleep, and physical activity/exercise. Work-life balance promotes stability across multiple dimensions. A fundamental aspect of an employee's life is their profession. Integrating work-life balance inside an organisation effectively retains personnel and enhances their quality of life. Making time for work and personal life is an organisational principle in which employees allocate their emotional, intellectual, imaginative, spiritual, and physical energies across essential domains. Work-life balance does not entail equal time distribution across all life aspects; this is impractical and unfulfilling. Instead, it embodies the "art of living" through the equilibrium of accomplishments and pleasure. At its inception, labour was a matter of survival. The composition of the workforce and the very definition of "work" have evolved. Shifting economic conditions and social pressures have transformed the nature of labour globally. Work-life balance typically involves two primary factors: insufficient time and schedule conflicts and feeling overburdened, overloaded, or stressed due to the demands of various tasks, which can diminish performance levels. Currently, employment

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is broadly regarded as a source of personal fulfilment. An effective equilibrium between work and life can significantly influence achieving personal and professional objectives. A balanced work-life dynamic is crucial for mitigating stress and securing individual and organisational success.

The rapidly evolving global landscape and diverse economies have created numerous difficulties in the corporate environment. Intense competition, innovation, and research are pivotal variables influencing performance in contemporary organisations; nonetheless, these changes concurrently induce significant stress among personnel. They struggle to reconcile their professional responsibilities with personal commitments due to work-related stress on one side and familial duties on the other. The organisations are downplaying the necessity of organisational initiatives and work-family policies and programs.

# **1.1 Significance of Research**

Ahealthy work-life balance promotes mental well-being, enhances self-esteem, and fosters overall satisfaction and harmony. It shows successful professional-personal balance. Achieving an optimal work-life balance offers numerous benefits, including increased motivation, higher job satisfaction, improved employee morale and productivity, adequate time for individual and family obligations, and better physical and mental health. Furthermore, it yields positive outcomes for both employees and organisations. Therefore, the main factors affecting work-life balance must be identified and examined.

# **1.2 Research Problem**

Even though work-life balance is vital for improving employee well-being and organisational performance, a considerable gap persists in the execution and efficacy of work-family policies. Numerous firms neglect to prioritise or sufficiently support efforts that enable employees to reconcile professional and personal obligations. This oversight can increase stress, reduce job satisfaction, and higher employee turnover rates (Panda and Sahoo, 2021). Research indicates that organisations with robust work-life balance policies experience higher employee retention and engagement. However, the lack of tailored strategies to address the workforce's diverse needs often results in ineffective outcomes. Furthermore, the rapid pace of technological advancements and the evolving nature of work have intensified employees' challenges in managing worklife boundaries. These concerns must be addressed by studying the factors that support a healthy work-life balance and their effects on worker well-being and organisational success. Understanding these interactions can help create workplace health treatments.

# **1.3 Research Questions**

- What are the key personal and organisational factors influencing work-life balance in SJVN Ltd.?
- How do job-related factors and organisationallevel initiatives aid in promoting work-life balance among employees in SJVN Ltd.?

# **1.4 Research Objectives**

- To identify key personal and organisational factors contributing to work-life balance in Satluj Jal Vidyut Nigam Ltd.
- To examine the impact of job-related factors and organisational-level initiatives on employees' work-life balance within SJVN Ltd.

# 1.5 Scope of the Study

The present paper aims to address the research questions and illuminate work-life balance strategies and their effects on employee well-being, satisfaction, and organisational performance. The scope of the present study has been limited to examining the mediating effect of job factors, employee commitment and organisational initiatives for maintaining a work-life balance of employees working in SJVN Ltd.

# 2. An Examination of Existing Literature

Dubey Supriti et al. (2010) asserted that an inspiring workplace enhances staff efficiency and performance. Achieving a successful work-life balance relies on organisations and comparable efforts from families. They proposed that organisations must establish favourable conditions enabling individuals to reconcile work with their needs and aspirations. The main factors impacting Indian women entrepreneurs' work-life balance, according to Matthew & Panchanatham (2011), include caregiving obligations, health quality, role overload, time management issues, and a lack of social support. His study also demonstrated considerable disparities in the work-life balance challenges encountered by different types of women entrepreneurs. Similarly, Chandel, K., & Kaur (2015) identified organisational initiatives as key contributors to WLB, advocating stress-preventive strategies to reduce occupational stress and foster a balanced work culture. Kumar Rakesh (2014) indicated that an organisation's inability to foster a conducive environment for its employees may result in diminished loyalty and satisfaction among its most valuable assets, namely the employees. Rai Rashmi (2014) proposed that the corporation can sustain a positive working environment characterised by high satisfaction, dedication, organisational commitment, and engagement by emphasising these elements more. Chandel, S., Chanda, K., & Chandel, K. (2023) highlighted that organisational commitment and job involvement significantly influence work-life balance (WLB), emphasising the need for sector-specific strategies to reduce conflicts and improve work-life integration in the banking sector. Vijavalakshami Ch. and Dr Das Tulsi (2016) noted that providing employees with internal, personal, physical, and spiritual working

environments enhances organisational efficiency. The working conditions and organisational culture significantly influence Quality of Work Life. Agha K, Azmi F T, and Irfan A. (2017) stated that life outside of work must be seamlessly interwoven to prevent adverse impacts on one another. This equilibrium or disparity influences both the individual's performance and the organisation's overall efficacy.

WLB positively and significantly correlated with job performance among Sri Lankan private bank employees, according to Thevanes (2018). Similarly, Johari et al. (2018) reported that WLB significantly impacted job performance among teachers, highlighting the importance of balance in educational settings. Balance is crucial in the maritime business, as Preena and Preena (2021) showed a strong positive association between WLB and staff performance in a leading Sri Lankan shipping company. Inegbedion (2024) found that WLB affects employee commitment, with job satisfaction as a mediating variable, suggesting that balanced employees are more dedicated to their companies. The WLBperformance nexus is mediated by employee wellbeing, as Medina-Garrido et al. (2023) found that workfamily policies indirectly boost job performance. These studies underscore the imperative for organisations to implement and maintain effective WLB practices, as they are instrumental in fostering a satisfied, productive, and committed workforce, ultimately driving organisational success. Moreover, a broader overview can be drawn from the Table 1.

Author(s) and	Focus Area	Methodology	Key Findings	Contribution to Study
Year				
Dubey Supriti et al.	Workplace	Conceptual	Inspiring workplaces	Highlights how
(2010)	Environment	Analysis	enhance efficiency	workplaces promote
	and Employee		and performance.	work-life balance and
	Efficiency		Organisations	efficiency.
			should facilitate	
			work-life balance	
			through supportive	
			environments.	

<b>Table 1: Analysis</b>	of Literature on	Work-Life Balance:	<b>Key Dimensions</b>	and Findings
•			•	

Matthew & Panchanatham (2011)	Women Entrepreneurs and WLB	Survey-based Empirical Study	Caregiving duties, role overload, and lack of social support impact women entrepreneurs' equilibrium between work and personal life.	Identifies personal and social barriers affecting work-life balance, especially for women entrepreneurs.
Kumar Rakesh (2014)	Organisational Support and Employee Loyalty	Empirical Analysis	A poor organisational environment reduces employee satisfaction and loyalty.	Emphasises the importance of organisational support for worker happiness and retention.
Rai Rashmi (2014)	Positive Work Environments and Employee Engagement	Empirical Analysis	Positive work environments foster satisfaction, commitment, and engagement.	Stresses the role of positive work environments in boosting employee engagement and commitment.
Chandel, K., & Kaur, R. (2015)	Exploring contributors to WLB and managing occupational stress.	Factor analysis and descriptive analysis.	Organisational initiatives reduce stress and enhance WLB; stress-preventive strategies are critical.	Highlights organisational initiatives and stress-reduction practices as facilitators for promoting work-life balance.
Vijayalakshami Ch. and Dr Das Tulsi (2016)	Work Conditions and Quality of Work-Life	Conceptual Analysis	Personal and spiritual work environments improve organisational efficiency and Job Satisfaction.	Links internal and external work conditions to Quality of Work Life and efficiency.
Agha K, Azmi F T, and Irfan A. (2017)	Work-Life Integration and Organisational Efficacy	Theoretical Framework	Interweaving work and life prevents negative impacts, improving performance and organisational efficacy.	Reinforces the need for seamless work-life integration to improve overall performance.
Thevanes (2018)	Banking Sector and Job Performance	Quantitative Analysis	WLB is positively correlated with job performance in Sri Lankan private banks.	Provides evidence of a direct link between WLB and performance in banking sectors.
Johari et al. (2018)	Education Sector and Job Performance	Quantitative Analysis	WLB significantly affects job performance among teachers.	Demonstrates how WLB impacts performance in teaching professions, generalising findings.

Preena and Preena	Maritime	Survey-based	WLB positively	Proves WLB's
(2021)	Industry and	Empirical Study	impacts performance in	significance in
	Employee		the maritime business.	specialised industries,
	Performance			highlighting
				performance
				improvements.
Inegbedion (2024)	Job Satisfaction	Quantitative	WLB enhances	Shows how job
	and Employee	Analysis	commitment, with job	happiness improves
	Commitment		satisfaction mediating	WLB outcomes.
			the relationship.	
Medina-Garrido et	Work-Family	Quantitative	Work-family policies	Confirms that work-
al. (2023)	Policies and	and Mediation	indirectly improve	life policies affect
	Employee Well-	Analysis	performance through	performance indirectly
	Being		employee well-being.	through employee well-
				being.
Chandel, S.,	Organisational	Exploratory	Organisational	Provides insights
Chanda, K., &	commitment,	and descriptive;	commitment and	into organisational
Chandel, K. (2023)	job involvement,	primary and	job involvement	culture, rules, and job
	and work-life	secondary data.	significantly influence	involvement as factors
	balance in		WLB; the banking	influencing WLB.
	banks.		sector needs strategies.	

Source: Authors' Compilation

The literature review in Table 1 highlights that worklife balance (WLB) is a multidimensional construct influenced by workplace environments, organisational policies, and personal attributes (Dubey et al., 2010; Vijavalakshami & Das, 2016). Research emphasises the importance of supportive workplace environments and organisational initiatives in fostering employee satisfaction, loyalty, and performance (Kumar, 2014; Rai, 2014). Studies focusing on women entrepreneurs identify caregiving responsibilities, role overload, and lack of social support as significant barriers to WLB (Matthew & Panchanatham, (2011)). Empirical findings further confirm the positive correlation between WLB and job performance across banking, education, and maritime sectors (Thevanes, 2018; Johari et al., 2018; Preena & Preena, 2021). Recent studies also show that work satisfaction and employee well-being mediate and organisational outcomes (Inegbedion, WLB 2024; Medina-Garrido et al., 2023). These results highlight the necessity for tailored WLB strategies and organisational-level interventions to improve employee productivity and commitment, making it a critical area for ongoing research and policy development.

#### 2.2 Research Gap

Work-life balance (WLB) affects employee well-being, work satisfaction, and organisational effectiveness; thus, a recent study has focused on it (Dubey et al., 2010; Vijayalakshami & Das, 2016). Previous research has examined how organisational contexts, worklife policies, and individuals affect WLB. Dubey et al. (2010) stressed the relevance of supportive workplaces in employee efficiency, while Kumar (2014) highlighted that a lack of organisational support reduces job satisfaction and loyalty. Similarly, studies have identified specific challenges, such as role overload and caregiving responsibilities, particularly among women entrepreneurs, as significant barriers to achieving balance (Matthew & Panchanatham, (2011). Although these studies establish the positive association between WLB and employee performance across sectors like banking, education, and maritime industries (Thevanes, 2018; Johari et al., 2018; Preena & Preena, 2021), research remains fragmented regarding the combined influence of personal, organisational, and job-related factors in public-sector enterprises. Studies have primarily examined private-sector organisations, creating a gap in understanding how WLB tactics affect public-sector companies like SJVN.

Moreover, recent research has shown that worker happiness and contentment with the work strengthen the WLB-performance link (Inegbedion, 2024; Medina-Garrido et al., 2023). However, insufficient empirical evidence examines how organisational-level initiatives, such as grievance-handling mechanisms, flexible work arrangements, and participative decision-making, influence WLB, specifically within public-sector enterprises. This study tackles this gap by examining how personal, organisational, and professional factors affect work-life balance in SJVN Ltd. It contributes to the discourse on sustainable human resource practices in public-sector firms by examining the effectiveness of organisational-level initiatives and how they influence the happiness and productivity of workers.

# 3. Research Methodology

This descriptive study examined aspects of SJVN work-life balance. Descriptive research is adequate for understanding phenomena and analysing relationships between variables (Creswell and Creswell, 2018). Quantitative data analysis was chosen to capture insights into organisational and personal factors affecting employees' work-life balance. Stratified random sampling was employed to pick 399 respondents, ensuring adequate representation across various demographic groups such as age, education, background, work experience and job status. For extensive populations, a minimum sample size of 384 provides 95% confidence with a 5% margin of error (Memon et al., 2020). Primary data were also collected from SJVN Ltd. employees via a standardised questionnaire. The questionnaire addressed essential aspects of work-life balance, encompassing human traits, organisational elements, and job-related qualities. Items were created using a 5-point Likert scale, commonly employed to assess attitudes and perceptions due to their dependability and straightforwardness (Robinson, 2014). After that, data were evaluated utilising SPSS version 26, which facilitates robust statistical methodologies, encompassing factor analysis and reliability assessments (Pallant, 2020). Factor analysis identified work-life balance variables, and Cronbach's alpha assessed internal consistency, demonstrating reliability over 0.837 (Nunnally, 1978).

### 4. RESULTS AND DISCUSSIONS

### 4.1 Respondent Demographics

Sr. No.	Demographic Variables	Associated Factors	Frequency	Percentage (%)
1	Age	Less than 30 years	94	24
		Between 30 to 50 years	205	51
		More than 50 years	100	25
2	Education Qualification	Graduation	140	35
		Post-Graduation	219	55
		Any other	40	10

**Table 2: Summary of Respondents' Demographics** 

3	Background	Rural	197	49
		Urban	202	51
4	Experience	Less than 5 years	74	19
		Between 5 to 10 years	150	38
		More than 10 years	175	43
5	Job Status	Executives	212	53
		Supervisors	122	31
		Workmen	65	16

Source: Authors' Compilation

The demographic profile in Table 2 indicates a diverse workforce with a majority (51%) aged 30–50 years, suggesting a mature and experienced employee base. Educational qualifications show 55% of postgraduates, reflecting a highly skilled workforce suitable for strategic and managerial roles (Dubey et al., 2010). The urban-rural distribution is almost balanced (49% rural, 51% urban), ensuring representation of different social contexts (Kumar, 2014). Work experience reveals 43% with over 10 years, highlighting a stable and experienced workforce, while 19% with less than 5 years suggest ongoing employee additions. Regarding job roles, 53% of executives dominate, indicating a management-oriented sample, with supervisors and workmen accounting for 31% and 16%, respectively.

#### 4.2 Work-Life Balance: Reliability Analysis

#### Table 3: Testing for KMO and Bartlett's

KMO Sampling Adequacy Measure	.756
Bartlett's Sphericity Test Approx. Chi-Square	1726.081
Df	120
Sig.	.000

Source: Authors' Compilation

Work-life balance factors were identified using factor analysis. This technique is renowned for data reduction and condenses many variables into a limited set of principal components. Baseline factor analysis must pass Bartlett's Sphericity Test KMO sample adequacy tests. Kaiser-Meyer-Olkin measures sample adequacy with values between zero and one. Values around 1 are ideal, while 0.6 is the bare minimum that should be met. Bartlett's measure verifies the identity matrix nature of the initial correlation matrix. Factor Analysis works well with this data set since the KMO value 0.756 indicates sufficient sample size in Table 3. The Factor Analysis is validated using Bartlett's Sphericity Test, indicating a Sig. of < 0.05.

#### 4.3 Testing for Communalities

Key Variables	Initial	Extraction
Managing household responsibilities	1.000	.634
Child care responsibility	1.000	.612
Elder care responsibility	1.000	.648

# **Table 4: Communalities**

Time for personal activities	1.000	.786
Time for social, religious or spiritual activities	1.000	.759
Relations with colleagues	1.000	.613
Relations with supervisors	1.000	.622
Unproductive committee work	1.000	.507
Unrealistic departmental objectives	1.000	.602
promotional opportunities	1.000	.596
Discrimination over workload	1.000	.573
Relationship with other departments	1.000	.625
Problem with outsiders/ clients	1.000	.577
Institutional policies and procedures	1.000	.712
Change in the organisational climate (policy changes, mergers, acqui-	1.000	510
sitions, etc.)	1.000	.318
Changes in technology and system	1.000	.570

Source: Authors Compilation

All variables in communalities table 4 have sufficient variance extraction, ranging from 0.507 to 0.786, justifying factor analysis. Personal (0.786) and social, religious, or spiritual (0.759) activities had the most significant extraction values, indicating their importance to work-life balance. Family demands are emphasised by household obligations (0.634) and childcare (0.612), whereas institutional policies (0.712) and supervisor interactions (0.622) emphasise the organisational environment. Committee work (0.507) meets the threshold, confirming that all elements can be included in the model.

### 4.4 Explanation of the Variables

Component	Initial Eigenvalues		Extraction Sums of Squared			Rotation Sums of Squared			
					Loadin	igs		Loadings	
	Total	% of	Cumulative	Total	% of	Cumulative	Total	% of	Cumulative
		variance	%		variance	%		variance	%
1	4.221	26.379	26.379	4.221	26.379	26.379	2.522	15.763	15.763
2	1.716	10.726	37.104	1.716	10.726	37.104	2.043	12.769	28.532
3	1.596	9.973	47.077	1.596	9.973	47.077	1.977	12.354	40.886
4	1.409	8.804	55.881	1.409	8.804	55.881	1.957	12.232	53.118
5	1.012	6.323	62.204	1.012	6.323	62.204	1.454	9.086	62.204
6	.807	5.044	67.249						
7	.788	4.923	72.171						
8	.742	4.640	76.812						
9	.660	4.122	80.934						
10	.598	3.734	84.668						
11	.553	3.457	88.126						

**Table 5: Total Variance Explained** 

12	.476	2.972	91.098			
13	.443	2.766	93.864			
14	.397	2.483	96.346			
15	.306	1.911	98.257			
16	.279	1.743	100.000			

Source: Authors Compilation

The primary elements are the numerical values of the variables employed in the Factor Analysis. Nevertheless, not all 16 variables can be preserved. Initial eigenvalues are produced in the process. Table 5 indicates that only five components have been derived by amalgamating the pertinent data. An eigenvalue signifies the degree of variance linked to the factors. Only factors with eigenvalues exceeding one are preserved. The eigenvalues represent the variances of the factors. The initial factor consistently explains the most variance and possesses the highest Eigenvalues. The subsequent component accounts for as much of the remaining variance as possible, continuing until the last factor.

#### 4.5 The Scree Plot





Cattell's scree plot in Figure 1 determines the final solution's component count. The eigenvalues of each extracted variable are shown against each variable. Only five elements can be kept, as they possess an eigenvalue of one or above. Consequently, varimax rotation was employed to analyse the generated data in a factor way. A factor loading shows the associations between variables and factors. This shows factorvariable correlation.

#### 4.6 The Component Matrix

	Component						
Key Variables	1	2	3	4	5		
Relations with supervisors	.747	.089	.012	.083	.221		
Promotion opportunity	.732	- 109	.025	- 026	216		

Fable 6: Rotated	Component Matrix	: Personal and	l organisational	factors and	work-life balance
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Discrimination over workload	.623	.205	.338	.021	168
Relations with colleagues	.570	.152	006	.515	.000
Relationships with other departments	140	.767	003	.027	s.125
Problems with outsiders/clients	.150	.694	.232	.106	.084
Unrealistic departmental objectives	.513	.573	.020	.098	005
Unproductive committee work	.413	.514	032	.168	.209
Child care responsibilities	.057	051	.762	.069	.144
Managing household responsibilities	.224	.076	.756	073	.041
Elder care responsibilities	136	.241	.712	.233	.100
Time for some personal activities apart from organisational work	.064	.091	.065	.873	.088
Time for social, religious or spiritual activities	.052	.041	.101	.861	.056
Institutional policies and procedures	.102	.122	.041	.147	.814
Change in technology and system	.069	.442	.234	168	.536
Change in the organisational climate (policy changes, mergers, acquisitions, etc.)	.381	.090	.278	.133	.519

#### Source: Authors' Compilation

The rotated component matrix Table 6 suggests that just five elements have been retrieved. Consequently, following rotation, the first factor represents 15.7 per cent of the variance. It includes relations with supervisors, promotion opportunities, discrimination over workload, and problems with colleagues. So, these variables could be summed up as **departmental factors.** It conveys that the lack of mutual trust and confidence between superiors, subordinates, and coworkers causes strain among employees, leading to poor performance and work-life balance at SJVN Ltd.

A supportive workplace environment should be encouraged, and adequate promotion opportunities should be provided. Variables like relationships with other departments, problems with outsiders/clients, unrealistic departmental objectives and unproductive committee work represent the next load. These could be termed as **external factors**. It indicates that efficient employees feel demoralised due to ineffective work committees and impractical organisational goals. Therefore, organisational objectives should be carefully laid down in SJVN Ltd. **Child care** responsibilities characterising the third load and managing household and elder care responsibilities. These variables could be termed as family care responsibilities. The fourth factor identifies a lack of time for some personal activities apart from organisational work and social, religious or spiritual activities. So, these variables could be considered time for individual and social activities. The fifth factor is loaded with institutional policies and procedures, changes in technology and systems, and organisational climate changes (policy changes, mergers, acquisitions, etc.). Thus, it could be called organisational policies and climate change. The factor analysis identified departmental factors as the major contributor, followed by external factors in SJVN Ltd. Family care responsibilities are also considered significant contributors in maintaining work-life balance. More time devoted to work means compromising the time for domestic responsibilities, creating work conflict in SJVN Ltd. It correlates with heightened job stress, diminished health, organisational commitment, and job performance. Workplace familyfriendly policies reduce work-family conflict. Time for personal and social activities has also been considered essential for a better work-life balance.

The	fifth-ranked factors	policies	and	climate
are	organisational	change.	SJVN	Ltd.'s

management can change policies, processes, and rules to affect the workplace. These modifications will be welcomed if they improve SJVN Ltd. employees' working circumstances. This may take time, but it may last if workers like the new technology, policies, procedures, and rules. Thus, factor analysis suggests SJVN Ltd. can promote work-life balance by focusing on these areas.

#### 4.7 Factors Contributing to WLB: Reliability Analysis

#### Table 7: KMO and Bartlett's Test

KMO of Sampling Adequacy	.764
Bartlett's Sphericity Test Approx. Chi-Square	1815.781
Df	120
Sig.	.000

Source: Authors' Compilation

Table 7 shows the results of the KMO metric and Bartlett's Sphericity Test of sampling adequacy, which were used to evaluate the factor analysis. A KMO statistic 0.764 is noteworthy because it is more significant than 0.50. Therefore, factor analysis works well when analysing data. Following a substantial result from Bartlett's sphericity test, the sample is deemed acceptable for factor analysis.

#### 4.8 Job Factors and Organisational Initiatives Communalities

Table 8:	Communalities	

	Initial	Extraction
Opportunities to develop new skills	1.000	.667
Opportunities for scholarly pursuits	1.000	.589
Realistic organisational objectives	1.000	.698
Adequate salary	1.000	.643
Nature of work	1.000	.668
Working hours	1.000	.573
Job insecurity	1.000	.732
Job location	1.000	.598
Work complexities	1.000	.567
Workload	1.000	.609
Reward and punishment	1.000	.630
Work autonomy	1.000	.500
Effective redressal of grievances	1.000	.539
Sound organisational climate	1.000	.763
Job satisfaction level	1.000	.626
Work-life policies (employee welfare activities/ employee assistance programmes)	1.000	.622

Source: Authors' Compilation

The communalities table 8 shows that all variables have adequate variance extraction values, ranging from 0.500 to 0.763, confirming their suitability for factor analysis.

Sound organisational climate (0.763) and job insecurity (0.732) are the most influential factors, emphasising the importance of organisational stability and employee

confidence in maintaining work-life balance. Variables like opportunities to develop skills (0.667), realistic objectives (0.698), and adequate salary (0.643) highlight the role of career growth and financial security. Lower

extraction values, such as work autonomy (0.500), also meet the criteria, validating their contribution to the model.

#### 4.9 Total Variances Analysis

Component	nt Initial Eigenvalues		Extraction Sums of Squared			Rotation Sums of Squared			
				Loadings		Loadings			
	Total	% of	Total	Total	Total	Cumulative	Total	% of	Cumulative
		variance				%		variance	%
1	4.412	27.572	27.572	4.412	27.572	27.572	2.764	17.276	17.276
2	1.881	11.755	39.327	1.881	11.755	39.327	2.335	14.594	31.871
3	1.469	9.184	48.511	1.469	9.184	48.511	1.838	11.488	43.359
4	1.193	7.454	55.965	1.193	7.454	55.965	1.705	10.656	54.015
5	1.070	6.686	62.651	1.070	6.686	62.651	1.382	8.636	62.651
6	.890	5.560	68.211						
7	.762	4.762	72.973						
8	.661	4.133	77.106						
9	.628	3.927	81.032						
10	.572	3.573	84.606						
11	.556	3.474	88.080						
12	.507	3.170	91.250						
13	.423	2.642	93.892						
14	.408	2.550	96.442						
15	.320	1.999	98.441						
16	.249	1.559	100.000						

#### Table 9: The Explanation of Total Variance

Source: Authors' Compilation

Variation percentage indicates the proportion of total variance attributed to each element, whereas the cumulative percentage reflects the overall variance accounted for by all factors, as illustrated in Table 9. The initial five factors account for 62.651 of the variation.

### 4.10 WLB Component Matrix and Scree Plot

### Table 10: Job Factors and Organisational Initiatives for WLB: Component Matrix

	Component					
	1	2	3	4	5	
Nature of work	.734	016	.238	098	.251	
Working hours	.724	.174	020	.025	135	
Job insecurity	.688	.387	.030	214	.249	
Inadequate salary	.668	.357	174	.169	101	
Job location	.653	171	.292	.223	.086	

Realistic organisational objectives	031	.813	.172	.038	.070
Workload	.215	.714	.017	.219	.072
Effective redressal	.176	.518	.445	.056	.197
Work autonomy	.282	.498	.326	.239	097
Opportunities for scholarly pursuits	.100	.096	.749	.085	049
Opportunities to develop new skills	011	.195	.734	.014	.299
Sound organisational climate	.047	.328	152	.788	.095
Work-life policies (employee welfare activities/employee assistance programmes)	.014	.039	.238	.750	.043
Reward and punishment	.302	.215	.177	.025	.679
Job satisfaction level	052	.051	.137	.448	.634
Work complexities	.303	.326	.319	.263	445

**Figure 2: Screen Plot** 





The scree plot distinctly illustrates the number of elements that can be preserved (Fig. 2). Five factors have one or more significant eigenvalues, warranting retention. However, identifying the elements to be integrated within these five crucial components is challenging. Table 10 clarifies the rotated component matrix—the squared loading rotation sums show the variance distribution after varimax rotation. Varimax rotation optimises element variance. Factor analysis has grouped 16 variables into five principal components that have emerged as significant contributors. The first five variables load heavily with the nature of work, working hours, job insecurity, inadequate salary, and job location, which mainly relate to job factors. The variables on the second factor seem to be managementrelated. These were realistic organisational objectives, workload, effective redressal and work autonomy. The third important factor contains variables relating to institutional factors like opportunities for scholarly pursuits and opportunities to develop new skills. The two variables that load on the following factor are sound organisational climate and work-life policies (employee welfare activities/employee assistance programmes), all of which seem related to organisational initiatives. The fifth factor can be labelled as overall job satisfaction, which includes three variables: reward and punishment, job satisfaction level, and work complexity.

# 4.11 Discussion And Findings

This research indicates that work-life balance is multifaceted and significantly influenced by personal, organisational, job, and organisational initiatives. Analysis of WLB factors revealed five core contributors, supported by KMO (0.756) and Bartlett's Sphericity Test (p < 0.001), indicating data appropriateness. Departmental and external factors emerged as key determinants, demonstrating that strained relationships with supervisors, unrealistic objectives, and ineffective committees impact organisational harmony, aligning with studies emphasising supportive workplace cultures (Dubey et al., 2010; Vijayalakshami & Das, 2016). Family care responsibilities and time constraints were also significant, reinforcing previous findings that personal obligations exacerbate work-life conflicts (Matthew & Panchanatham, 2011). Factor analysis further established the role of organisational policies and climate changes, emphasising adaptability to improve work environments, as Kumar (2014) suggested. The research objectives-identifying key factors influencing WLB and analysing organisational initiatives-were effectively achieved through the integration of factor analysis. The results address the research questions by confirming that personal attributes, organisational culture, and job-specific variables collectively shape WLB, supporting Thevanes (2018) and Johari et al. (2018) studies on the role of workplace dynamics and individual characteristics in sustaining performance and well-being. These insights provide empirical evidence to guide policy frameworks and recommend workplace family-friendly strategies to reduce stress and improve productivity (Inegbedion, 2024; Medina-Garrido et al., 2023).

# 5. Conclusion

This study examines how human traits, organisational dynamics, job-related variables, and institutional efforts affect work-life balance (WLB) in SJVN Ltd. The findings confirm that WLB is a multifaceted construct

influenced by individual attributes and organisational structures, collectively shaping employees' ability to balance professional and personal responsibilities. Factor analysis identified key contributors, such as departmental challenges, family obligations, time constraints, and organisational policies, reinforcing the need for strategic interventions to boost employee morale and productivity. Results emphasise the relevance of employee-centric practices, such as grievance handling systems, flexible work arrangements, and training programs, to help promote workplace balance and productivity. The study successfully addressed its objectives by identifying critical determinants of WLB and evaluating organisational initiatives, offering actionable insights for enhancing organisational performance and employee satisfaction.

# 5.1 Suggestions

Organisations should implement flexible work policies, grievance redressal mechanisms, and employee assistance programs to enhance work-life balance (WLB). Emphasis should be placed on stress management strategies, training programs, and career development opportunities to reduce work-related conflicts and improve job satisfaction. A supportive organisational culture and clear communication channels can strengthen employee commitment and productivity.

# **5.2 Implications**

Results of this study emphasise the importance of adopting holistic strategies to enhance work-life balance (WLB) at SJVN Ltd. Identifying departmental factors, external influences, family responsibilities, and organisational initiatives highlights the need for targeted interventions, such as flexible work arrangements, employee counselling programs, and participative decision-making processes to address work-life conflicts (Dubey et al., 2010; Kumar, 2014). Organisations should prioritise employee-centric policies, including family-friendly practices, structured grievance redressal mechanisms, and training programs to equip employees with the skills to handle workplace complexities effectively (Matthew & Panchanatham, 2011; Agha et al., 2017). Furthermore, enhancing supervisorsubordinate relationships and streamlining departmental objectives can foster trust, reduce stress, and improve job satisfaction, ultimately contributing to higher employee retention, productivity, and organisational performance (Thevanes, 2018; Johari et al., 2018).

#### 5.3 Limitation and Future Scope

Future research can adopt longitudinal designs to examine the dynamic nature of work-life balance (WLB) and explore causal relationships between organisational initiatives and WLB outcomes (Medina-Garrido et al., 2023). Comparative studies between public and private sectors can highlight sector-specific challenges while investigating the psychological impacts of WLB policies and gender-specific issues can refine strategies for modern workplaces (Inegbedion, 2024; Vijayalakshami & Das, 2016).

This study is limited by its cross-sectional design, single-organisation focus, and quantitative approach, which may overlook qualitative experiences and external factors like socioeconomic conditions (Agha et al., 2017; Kumar, 2014). Future research should incorporate mixed methods, broader samples, and comparative frameworks to enhance generalisability and practical applicability.

#### **Authors Contributions**

Dr. Siddharth Chandel conceptualised the research framework, designed the methodology, and supervised the overall execution of the study. Dr. Vijayta contributed to the literature review, assisted in data interpretation, and provided substantial edits to improve the manuscript. Mr. Vikas Kumar performed the data collection statistical analysis and drafted the initial manuscript.

### **Conflict of Interest**

The authors declare no conflicts of interest related to this research article.

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# Empirical Investigation into Long Run and Causal Relationship Between Sustainability and Benchmark Indices in Indian Stock Market

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### Abstract

Amidst the growing concern about climate change, many investors worldwide believe that adopting sustainable business practices has a positive impact on stock prices in the long run. In light of this, the present study explores the dynamic connectedness between the sustainability index and the benchmark equity market index in India. For this purpose, the two indices from the popular stock market in India, namely, the Bombay Stock Exchange, are selected. The BSE 100 ESG symbolizes the sustainability index, and the BSE 100 index represents a broader benchmark of the Indian equity market. The two indices are initially analysed along the risk and returns parameters using daily closing prices from 1 January 2018 to 30 September 2024, obtained from the Bombay Stock Exchange of India portal. The data set consists of 1672 observations covering six years and nine months. The study further examines the cointegrating and causal behaviour of the two indices. For modelling the intertwined dynamics of the two variables in the long run, the popular cointegration techniques, namely, the Engle-Granger and Johansen Cointegration methods, are applied. Further, the causeeffect relationship between the indices in the short run is investigated using the Granger Causality approach. The data is stationary at the first difference, I(1), as per the Augmented Dickey-Fuller (ADF) unit root test. The study results support cointegration between the ESG and BSE indices in the long run. However, no Granger

causality exists between the two. The serial correlation, heteroskedasticity, and model stability diagnostic tests are performed satisfactorily. The research has theoretical as well as practical implications. It enriches the existing literature by providing empirical insights into the dynamic relationships between sustainability and stock market indices, focusing on the Indian market. The fund managers and investors engaged in pair trading in the stock market can make informed decisions using the cointegrating knowledge evidenced by this research. Further, lawmakers can use the findings to design or reframe the market policies to motivate businesses and investors for ESG-oriented investment

*Keywords:* Cointegration, Sustainability, ESG 100 index, BSE 100 index, Causality

### 1. Introduction

At present, sustainability is one of the most discussed and practiced concepts internationally among all the sections of society, viz. investors, businesses, researchers, environmentalists, and policymakers. The United Nations Brundtland Commission (1987) defined 'sustainability' as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." It aims to ensure that the needs of the three Ps i.e., people, planet, and profit, are balanced. To ensure sustainable development in future for the betterment of all, it is inevitable to pursue an integrated approach that deliberates on environmental

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and social issues while aiming at economic development. ESG is one of the significant steps to accomplish sustainable development goals to improve people's lives worldwide and protect them from the hazardous effects of climate change. ESG stands for environmental, social and governance. It is commonly called sustainability. The environmental issues refer to biodiversity, green energy, renewable energy, waste management, air pollution, water management and so on; social factors cover namely, inclusiveness, gender equality, human rights, working conditions and community relations; and governance factors relate to transparency in business reporting, the formation of the board of directors, ethical business practices and legal compliances. In a business context, ESG refers to a framework or a set of specific criteria that are applied to evaluate an organization's performance in terms of its impact on climate protection, social harmony and good governance practices. It can be said that ESG is a quantifiable measurement of a business practices sustainability in three areas, namely, environment, social and governance, based on well-defined metrics. Thus, sustainability is a broader concept that deliberates on the interdependence of environment, society, and economic factors holistically while ESG is one of the steps to accomplish it.

Further, besides the environmentalists and business communities, investors are also increasingly becoming more aware of climate protection. And many investors are sensitive to social and ethical issues too, particularly the young and educated ones belonging to middle and high-income groups. They are ready to sacrifice some returns in favour of ESG goals (Shrlber, Todd, 2023). They believe that corporates doing well on ESG criteria are less risky and better for the long term. Moreover, the financial investment preferences of younger generations: Gen-X and Millennials are changing as compared to Baby Boomers. Younger investors' choices are more inclined to invest in index funds, ETFs, hedge funds, ESG funds, and cryptocurrency (Hohwald, Sarlota, 2023). Thus, ESG, or commonly known as sustainability, is another dimension many

investors consider while selecting investment securities, along with the traditional criteria of risk and returns. The investors opting for ESG investment, that is also commonly called socially responsible investment (SRI) or value investment, expect not only value from their investments in terms of risk and return parameters but also seek values for the benefit of the environment and society for the long term in the future.

In India, however, ESG investing is an emerging concept gaining prominence gradually. Various market participants in the country have generated interest and started considering ESG factors while investing. The ESG investing culture is on the rising path in India as indicated by the fast-growing pace of nine active ESG funds in India, with aggregate AUM standing at about Rs. 9,986 Crores at present (Soni et al.; Hemanshi, 2024). Further, more ESG-inclined investment is estimated to be popular in India in the next few years, as per the study conducted by Avendus Capital. They projected that by the year 2051, ESG investments in India will reach approximately 34 percent of total domestic AUM moving along with India's Net Zero target for 2070. The driving force for such expected growth being spur in sectors, namely. green energy, green hydrogen, renewable energy, solar energy, climate technology and electric vehicles. (Source: www.avendus.com/India/ newsroom)

The proliferating significance of ESG investing worldwide motivated us to investigate the sustainability scenario in Indian financial market. On other words, how does the sustainability index perform in comparison to the benchmark index on risks and returns criterioa; and how do they associate with each other in short- and long-term. To examine this hypothesis, we conducted a study in the past by considering the NSE 100 ESG index as representative of the sustainability index and the NSE 500 index as a market proxy of the Indian Economy. The prior study failed to identify any cointegration relationship in long-run between the ESG and market indexes pertaining to the National Stock Exchange (NSE). However, a short run bi-directional casualty was identified between the indices in the (Sharma, N. & Shahani; R., 2022). After gathering the research outcome on this issue from our past study that was based on samples drawn from the NSE, we became curious to examine the same hypothesis by taking the samples from the oldest stock exchange of India i.e., the Bombay Stock Exchange (BSE). Hence, our encouragement to conduct this research is to explore if our past study results on the relationship between the ESG and market indices are similar when the indices pertain to different Indian stock markets.

The study has practical implications as the performance of the ESG index helps the impact investors and fund managers navigate and assess the companies' ESG risks against the ESG parameters. Further, a benchmark index reflects the market's overall performance as investors perceive it. To compare the performance of the two indices, in this study, we consider the sustainability index viz., the BSE 100 ESG Index that tracks the performance of the companies included in the BSE 100 index of the Bombay Stock Exchange (BSE) and also comply ESG criteria. As of October 31, 2024, there are 54 such companies in this index (source: www.asian index.co.in). This index was launched on October 26, 2017, hence, our study period in this research starts from January 1, 2018, until September 30, 2024. The BSE 100 index, a broad market index of BSE, is used as the benchmark index in this study. It is a barometer of Indian economy that reflects the financial health of the economy by tracking and measuring the 100 largest and most liquid companies within the domain of S&P BSE large and mid-cap (it was launched on January 1, 1986, with a base value of 100 points). Thus, BSE 100 is a benchmark index reflecting the performance of the Indian economy. While the index, BSE 100 ESG is skewed towards the firms with high score on positive impact on environment, society and governance. In other words, the ESG Index is structured to assess the performance of securities that satisfy the ESG criteria and also having a risk/reward profile analogous to that of its benchmark index, the BSE100.

Further, empirical evidence on the association or co-movement of the ESG and market indices is of interest to the individual investors, as well as to the organizations, and institutions engaged in financial securities investment and connected to the stock market. For exploring this relationship, we applied cointegration analysis which is an essential statistical tool to understand the dependence and the degree of association or linkages in the long run between different assets, stocks, commodities, financial markets and sub-markets. The notion of cointegration explains the situation when two or more variables follow random walks, which means each of them individually is nonstationary. However, there may exist a combination of such variables, which is stationary (Handbook of Statistics, 2020) (Source: www.sciencedirect.com). We substantiate this theoretical proposition by conducting an empirical investigation into the trend, patterns and relationship between the sustainability index and benchmark index in India by taking the sample from the BSE. Moreover, the knowledge of interlinkages of the two variables is significant for investors and fund managers to comprehend the spread dynamics in pair trading. And they can work on their portfolio strategy accordingly. Though many studies have examined the association between sustainability investment and stock markets, most of them focused on developed and other emerging markets, and there is not enough research work has been seen with focus on Indian markets. Furthermore, the available literature in the Indian market has generally considered the study variables from the National Stock Exchange, including the one by Shahani R. and Sharma N., (2023). This study aims to capture if the sustainability index and market index show cointegrating behaviour or not in the long run by using the sample from the different markets, i.e., the Mumbai Stock Exchange in India.

The rest of the paper is presented as follows: Section 2 reviews the concerned literature. Section 3 specifies research data, and methodology. Section 4 contains the data's distribution characteristics. Section 5 deals with methodology and testing hypotheses. Section 6

explains the study results. Finally, section 7 provides the conclusion and implications.

# 2. Literature Review

Plenty of research is conducted on sustainable investing evaluating along different dimensions, assets, indexes, and markets over varied periods using various techniques. Notably, there is no consensus on research findings when comparing the performance from sustainability investment to traditional investment.

Some studies focused on assessing whether investors achieve superior returns from ESG stocks compared to traditional investing. According to Alexander and Buchholz (1978), there was not any significant connection between the returns of the stock market and socially responsible stocks using CAPM approach. Similar results were noticed by Atz et al. (2023), who studied 1,141 peer-reviewed research and 27 metareviews that were published during the years 2015-2020 and concluded that returns obtained from ESG investing were not better than that from traditional investing. Likewise, Hornuf, L. and Yuksel, G. (2023), when evaluating the social responsible investing using meta-analysis, found that SRI neither underperformed nor outperformed the benchmark portfolio, on average. On the contrary, they noticed that global SRI portfolio performance was superior to regional sub-portfolios. Further, Torre, M.L. et al.'s (2020) study also did not support the view that companies with ESG scores report more alpha returns and lower volatility. They concluded this by examining the effect of ESG criteria on equity returns of the corporates from the Eurostoxx50 index during 2010 - 2018.

In contrast, Ashwin, N.C. et al. (2016) identified that stocks of the 157 corporates that were included in the Dow Jones Sustainability Index (DJSI) and practiced ESG criteria, generated higher returns, and they were less volatile comparable to their peers belonging to the same industry but not listed in DJSI; and ESG factor affected each industry differently. Ouchen's A. (2022) study also supported the similar evidence. He empirically evaluated the volatility in the ESG portfolio and compared it with benchmark portfolio volatility. He examined returns (based on daily data) of the ESG portfolio "MSCI USA ESG Select" against the market portfolio "S&P 500" returns during the period 2005-2020 using the Markov-switching GARCH approach, including and excluding the COVID-19 period in the time series. They identified that the ESG portfolio reflected less volatile behaviour than the benchmark portfolio.

Interestingly, Kabderian Dreyer, J. (2023) observed inconsistent results as their study neither supported underperformance nor superior performance on account of pursuing ESG practices. They investigated the influence of ESG oriented strategies on stock prices of the corporates in the US market over the period 2000 - 2020. Based on risk-adjusted returns, they concluded that the ESG brand did not result in significant influence on the financial performance.

At country-level comparison, Moosawi, S., & Segerhammar, L. (2022) examined the cause-effect relationship between the ESG assets and traditional benchmarks by using the GARCH model and the Spillover approach for both returns and volatility. They identified that the country-level ESG indices were more interlinked than other assets. And country-level ESG indexes were spillover transmitter to a greater extent to the MSCI world ESG and equity indices, gold, currency, and crude-oil.

Further, the literature examined the cost of SRI and the influence of negatively screened investment strategy on financial performance. Adler and Kritzman (2008) found that investors of sustainable funds had to sacrifice returns somewhere between 0.17-2.4 % due to restrictions imposed on investment in certain sectors' stock, often called sin stocks. The constrained environment also led to greater volatility caused by enhanced sensitivity to systematic risk. Another Mousa, M. et al. (2022) examined the impact of COVID-19 on equity market performance during March 2019 and March 2021 in the Arab region and also compared the reactions of ESG and equity stocks during the COVID-19 pandemic period using GARCH and nonlinear ARDL models. They concluded that in the ESG market the pandemic shock was short lived without affecting much of its performance. Moreover, while comparing socially responsible mutual funds with conventional funds, Hamilton S. et al. (1993) identified that former funds did not outperform the latter. Rather the performance of SRI funds was similar to that of the traditional funds.

One of the latest studies on ESG index performance by Kossentini, Hager, et al. (2024) showed that the Emerging Market (EM) Europe ESG leaders index was less volatile in comparison to the benchmark index based on static analysis. Meanwhile, based on the dynamic analysis they found that Capital Asset Pricing Model (CAPM) alpha and beta were time sensitive. Based on the rolling window (annual) analysis, they concluded that the FM Europe ESG Leaders index outperformed the benchmark by being less risky and yielding better performance.

Thus, numerous studies have deeply explored financial performance and sustainability, SRI investing, and meta-analyses on corporate social responsibility and ESG funds performance. However, the extant literature provides largely diverse and somewhat inconsistent results. The inconclusiveness may be due to different methodologies, geographical locations, sample choices, and timeframes. Interestingly, the industry research by investment firms, bankers or sell-side analysts often presents a positive influence of ESG practices on financial performance of the corporates. For instance, a study on "ESG from A to Z: a global primer" by Bank of America and Merrill Lynch (2019) and "ESG Investing" by J.P. Morgan (2016) identified a positive correlation between ESG and performance. Whereas academic research generally found a negative correlation.

Furthermore, most of the research comes from developed stock markets and some focus on developing economies and interlinkages between these markets. In India, the sustainability movement is in the air and evolving rapidly, providing a vast ground for research on ESG-related issues, including investment aspect. Hence, more empirical studies in the Indian context are required to expedite ESG culture in India among businesses and investors for the betterment of the future for all. This study is an attempt in this direction and intends to contribute to the existing literature by serving further empirical evidence on interlinkages between ESG and market indices in India. While further continuing our research on the issue we considered the data sample from another stock market to test if the findings confirm in the Indian market.

#### 3. Research Data and Methodology

The study initiates with the research question: How does the returns on sustainability index correlate with benchmark index in the long run in Indian market? And does any causal relationship exist between the two indices? In light of such research questions, the aim of this study is to identify and investigate the cointegrating behaviour and the causal relationship between the ESG index and equity index in India financial market. For this research, data set comprise of the two samples taken from the Bombay Stock Exchange (BSE), viz., BSE 100 ESG index and BSE 100 index. The former representing the sustainability index and the latter is the proxy of market index. Data of the study consist of daily closing price of the two indices downloaded from the BSE website spanning over the period 1 Jan. 2018 to 30 Sep. 2024 (Source: www.bseindia.com).

To accomplish the research objectives, we considered the following hypotheses:

(1) H0: No cointegration between the ESG and BSE index in long run.

H1: Yes, there is cointegration between the two in the long run.

(2) H0: No causality relation between the ESG index and BSE index in short run.

H1: Yes, there is causality relation between the two in the short run.

# Methodology:

Research methodology consists of developing a model and testing it for cointegration and causal relationships between the returns on ESG and Market index.

Initially a simple regression model was formulated as below:

$$Ret_{Bse_t} = \beta_1 + \beta_2 Ret_{Esg_t} + \mu_t \dots (1)$$

It was improved to satisfy the model diagnostics and the final model developed is as below:

$$Ret_{Bse_{t}} = \beta_{1} + \beta_{2} Ret_{Esg_{t}} + \beta_{3} Ret_{Esg_{t-1}}$$
$$+ \beta_{3} Ret_{Bse_{t-1}} + \beta_{4} Ret_{Bse_{t-2}} + \mu_{t} \dots (2)$$

The long run association between the returns from the two indices: ESG index and market index is examined by applying two popular tests on the model viz., Engle Granger and Johansen cointegration methods. While the Granger causality test in VAR (Vector Autoregressive) is applied to examine the linkages between the two variables in short run. Before proceeding on statistical analysis, a summary statistic of the distributions is computed to comprehend the characteristics of the collected dataset and presented in Table1 below. And stationarity test of both the time series is checked by employing a famous unit root test, viz., Augmented Dickey-Fuller (1984) Test. Finally, model diagnostics tests: no serial correlation, no heteroscedasticity of residuals and stability are also performed.

### 4. Distribution Characteristics

### 4.1 Descriptive statistics

This section summarises the statistical characteristics of the data sets with the help of central tendency, dispersion and the patterns of distribution. And present the comparative assessment of the two-time series, i.e. Returns on the BSE 100 Index and BSE 100 ESG index. For this, daily closing prices of the indices have been transformed into the log returns by using the formula:  $\ln\left(\frac{P_t}{p_{t-1}}\right)$ , where refers to the daily closing price of index on day 't', whereas, is daily closing price of same index on day 't-1'. The price data have been transformed to returns series to facilitate comparison between the variables along various parameters as displayed in Table 1.

Statistics	BSE Index	ESG Index
Mean	0.000547	0.000565
Std. Dev.	0.011201	0.011345
C.V.=σ / μ	20.47715	20.07965
Skewness	-1.646872	-1.468008
Kurtosis	25.15027	23.27718
Jarque-bera	34915.76	29227.48
JB (Prob.)	0.00000	0.00000
Observations	1671	1671

Table 1: Statistical Description of Daily Returns ofthe BSE and ESG indices

*Source: Author's computation using 'EVIEWS' software.* 

Table 1 shows that the daily average return on ESG index  $(\mu = 0.000565)$  is slightly higher than BSE index  $(\mu =$ 0.000547). But it is accompanied with little higher risk ( $\sigma = 0.01135$ ) than in case of BSE index ( $\sigma = 0.01120$ ). It points out that investors in India consider ESG little riskier investment. Interestingly, another metrics of dispersion, coefficient of variation (ou that adjusts returns for associated risk measures risk-return trade off slightly in favour of ESG index as the difference is not major. The coefficient of variation ( $\sigma/\mu$ ) for ESG index (C.V. = 20.08) is a bit lower in comparison to BSE index (C.V. = 20.48). Thus, the results of measures of central tendency and dispersion, indicates that ESG investing is slowly gaining acceptance among investors in Indian securities market. The distribution characteristics of both the series show that they are negatively skewed and have fatter tails as indicated by higher Kurtosis value (>3) than in case of normal distribution. Finally, the JB Normality test:  $JB = \{ +$ }, where 'n' is the number of observations, 'S' is the

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skewness and 'K' is the Kurtosis; also confirms that the series are not normally distributed. It reveals a larger impact of outliers, especially during COVID-19 period.

#### 4.2 Graphic representation

Initially to comprehend the pattern and structure of data, we visualised the data time series through plotting a line graph of both the variables: ESG and BSE indices in daily closing price as well as log returns as below.

#### Figure 1:



Source: Author's computation using 'EVIEWS' software

#### 5. Results and Discussions

#### 5.1 Unit Root Test:

Before to build the model and analyse the time series, we checked if each series is stationary. For this a unit root test was done using Augmented Dickey-Fuller (ADF) method. The Null hypothesis is that the data

### Figure 1:



The first graph in Fig. 1 and 2 show that daily closing price series of both the indices are reflecting overall increasing trends over time except with major downfall during COVID-19 period. And it appears that mean of the closing price distribution of both the variables is non-constant over the period reflecting non-stationary series. However, the second graphs in both figures presenting the daily log return series for both the variables show the mean reverting tendency of the data indicating stationarity of the return series. The impact of covid-19 is quite visible from the sharp fall of the price series and high spikes of return series in case of both the indices.

has a unit root (non-stationary) against the alternative hypothesis that the data is stationary. The ADF test results are shown in Table 2 as below:

Stationarity Test (Constant, Linear Trend)	BSE index Close Price (₹)		ESG Index Close Price (₹)	
	Level	First Difference	Level	First Difference

Table 2: Augmented Dickey-Fuller Test Statistics (Unit Root Test)
H0: Data is Non-	1. Coefficient 'P'	0.8786	0.0000*	0.7303	0.0000*
Stationary / Presence	Values				
of Unit Root	2. Table Results	-1.3354	-16.7669	-1.7461	-16.8977
H1: Data is Stationary/	3. Null H	Accepted	Rejected	Accepted	Rejected
No Unit Root	(Accepted/	_	-	_	
	Rejected)				
	4. Critical Value at	-3.4125	-3.4125	-3.4125	-3.4125
	5%				

Source: Author's computation using 'EVIEWS' software. (Criterion: AIC)

Table 2 shows that in case of the BSE index time series the coefficient p-value (0.88) is close to one indicating likely presence of a unit root. Similarly, the coefficient p-value (0.73) for ESG index distribution is close to one, again indicating the likely presence of a unit root. The results fail to reject the null hypothesis suggesting the series is non-stationary at level, in case of both the variables. However, at first difference in case of satisfies the test of stationary as the coefficient p-value closer to zero results in the rejection of the null. Thus, ADF test concludes that both the time series are stationary at first difference, I (1) paving the way for further analysis.

## 5.2 Engle Granger Co-integration Test

Initially we applied Engle Granger co-integration method (1987) to explore the long run association between the two indices. It is commonly called the test of residuals involving two steps: in the first step, we generate residuals from linear regression equation of the two variables and then apply ADF unit root test on the residual's equation. The null hypothesis (Ho) of this test considers no cointegration among the residuals.

## Table 3: Co-integration Test Results: Engle Granger Method

Dependent Variable	Tau-statistics	Prob.	z-statistics	Prob.	Result
Variable	1412401	0.0000*	2(12,50)	0.0000*	NT 11
ESG Index	-14.13481	0.0000*	-2612.596	0.0000*	Null
Returns					Hypothesis
BSE Index	-9.596252	0.0000*	-1893.600	0.0000*	rejected
Returns					

Note: (1) Null Hypothesis: Series are not cointegrated. (2) Lag Criterion: AIC. (3) Number of observations: 1671. (4) Source: Author's computation using 'EVIEWS' software.

Table 3 presents both Tau- and Z-statistics for ESG and BSE indices along with the probability values signifying the rejection of the null hypothesis. Hence, this method concludes that both the indices are cointegrated in the long run.

## 5.3 Johansen Co-integration Test

We further employ another cointegration method using Johansen approach to assess the long-run association between the ESG and BSE indices with assumed hypotheses as below:

H0: No long-run linkages between the ESG and BSE indices.

H1: long-run linkages exist between the ESG and BSE indices.

This is a VAR based technique and consider all variables endogenous and does not require assumptions. The results are presented in Tabe 4.

## Table 4: Co-integration Test Results using Johanson Methodology

#### (A) Unrestricted Co-integration Rank Test (Trace)

Hypothesized	Trace	0.05	Prob.	Result
No. of CE(s)	Statistics	Critical value		
No co-integration	249.3803	15.49471	0.0000*	Null
exists				Hypothesis
One co-integration	105.1697	3.841465	0.0000*	Rejected

Note: (1) Model: Linear Deterministic Trend but no Intercept. (2) Lag interval: 1 to 13. (3) N= 1657 after adjustments. (4) Source: Author's computation using 'EVIEWS' software

#### (B) Unrestricted Co-integration Rank Test (Max Eigen Value)

Hypothesized No. of CE(s)	Max Eigen Statistic	0.05 Critical value	Prob.	Result
No co-integration exists	144.2105	14.26460	0.0000*	Null Hypothesis
One co-integration	105.1697	3.841465	0.0000*	Kejected

Note: (1) Model: Linear Deterministic Trend but no Intercept. (2) Lag interval: 1 to 13. (3) N= 1657 after adjustments. (4) Source: Author's computation using 'EVIEWS' software

(c) Normalised Cointegrating Coefficients (Long run results)				
BSE Index	ESG index			
1.0000	Coefficients: -0.940419			
	S.E.: (0.01000)			
	Z-Statistics: {94.0419}			

Source: Author's computation using 'EVIEWS' software

Table 4 presents the two cointegrating equations; None: No cointegration, at the most one: no cointegration at the most one (at 5% significance level). The 'p' values for both the equations in case of the Trace as well as the Max Eigen Value tests are less than 0.05 revealing the results are significant and rejects the null hypothesis. Hence this test results also supports the presence of long-run equilibrium between the two indices. Further, the normalised cointegrating coefficient results show that in long run ESG index has a positive impact on the BSE index, on average, ceteris paribus. And, the coefficients are found statistically significant at 1% level of significance (Z-statistic: 94.04, p-value< 0.0001).

## 5.4 VAR Causality Test

After identifying the co-movement of the ESG and BSE indices over the long period. We try to capture if the cause-effect relationship exists between these indices in the short run. For this, we apply the test of Granger causality that is based on Vector Autoregression (VAR). Though VAR based model incorporates the lagged (past) values of an endogenous variable as well as the past (lagged) values of the other variables and an error term. And. it does not require prior assumptions of the model. However, this test is sensitive to the variable's lag order. Hence, first we determine the optimal lag order as presented in Table 5 below and then employ the Granger causality method showing its results in the following table.

Lag	FPE	AIC	SIC	HQ
0	2.88e-10	-16.29212	-16.28557*	-16.28970*
1	2.88e-10	-16.29396	-16.27430	-16.28667
2	2.87e-10	-16.29548	-16.26272	-16.28334
3	2.88e-10	-16.29188	-16.24601	-16.27487
4	2.88e-10	-16.29296	-16.23398	-16.27109
5	2.85e-10	-16.30213	-16.23005	-16.27998
6	2.83e-10	-16.31157	-16.22638	-16.27928
7	2.81e-10	-16.31572	-16.21743	-16.27928
8	2.80e-10	-16.32081	-16.20942	-16.27951
9	2.79e-10	-16.32301	-16.19851	-16.27685
10	2.79e-10	-16.32408	-16.18648	-16.27306
11	2.78e-10	-16.32847	-16.17776	-16.27259
12	2.79e-10	-16.32438	-16.16057	-16.26365
13	2.76e-10*	-16.33474*	-16.15782	-16.26914
14	2.76e-10	-16.33370	-16.14368	-16.26325
15	2.77e-10	-16.33179	-16.12866	-16.25648
16	2.77e-10	-16.33037	-16.11414	-16.25020
17	2.78e-10	-16.32880	-16.09946	-16.24378
18	2.76e-10	-16.33379	-16.09134	-16.24390
19	2.77e-10	-16.33134	-16.07579	-16.23659
20	2.77e-10	-16.33080	-16.06216	-16.23121

Table 5: Lag Order Selection Criteria for VAR Model

Source: Author's computation using 'EVIEWS' software

Table 5 details the optimal lag order as per the four criteria: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Criterion. We considered the optimal lag order 13 as suggested by both the FPE and AIC criteria for our VAR based models of causality and cointegration.

Table 6:	Pairwise	Granger	Causality	Test Result	c
Table 0.	I all wise	Oranger	Causanty	Itst Ittsuits	

Null Hypothesis	Observations	'F'(Computed)	Probability	Result
ESG index returns does not	1658	1.69287	0.0564	Fail to reject Null
cause BSE index returns				Hypothesis
BSE index returns does not	1658	1.47370	0.1197	Fail to reject Null
cause ESG index returns				Hypothesis

Note: (1) Lag Determination Criterion: Akaike Information Criterion (AIC). (2) No. of Lags=13. (3) Source: Author's computation using 'EVIEWS' software. Table 6 presents the two null hypotheses of Pairwise Granger Causality Test: (1) H0: Returns on ESG index does not cause Returns on BSE index. (2) H1: Returns on BSE index does not cause Returns on ESG index. The computed probability values for both the hypotheses is greater than the p-value (0.05) at 5% significant level. Hence, the results suggest that there is no short-term causality effect between the two indices. In other words, in short run neither ESG index causes variability in BSE index returns nor the BSE index returns effect the ESG index returns in short.

## 5.5 VAR Model Stability test

We test the stability of the VAR model by constructing an inverse root of AR characteristic plot as shown below:





Source: Author's computation using 'EVIEWS' software

Fig.3 depicts that all the characteristic roots are within the circle in the area  $\pm 1$  clearly demonstrates the stability of the VAR model.

#### 5.6 VAR Impulse Response

Now in fig 4 and 5 we present the plots constructed under impulse function with the objective to explain how the VAR models' dependent variable reacts to a unit shock (1 S.D.) applied to the other variable.

#### Fig.4: Impulse response of Index to ESG

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 analytic asymptotic S.E.s

Response of BSE\_INDEX\_LOG\_RETURNS to ESG\_LOG\_RETURNS Innovation



Source: Author's computation using 'EVIEWS' software

#### Fig.5: Impulse response of ESG to index



Source: Author's computation using 'EVIEWS' software

Fig. 4 shows that a positive shock to ESG leads to a slight positive response to BSE, but it quickly dies out in one or two days. And Fig. 5 reflects that a unit shock in BSE leads to sharp negative decline in one day, but it rises soon and stabilises immediately in next day or two at the most. It concludes that the shock fades away shortly and does not persist reflecting that ESG investors do not get panic for long for shocks in BSE as they have short term memory to these impulses.

#### 5.7 No Serial Correlation (BGLM Test)

Independence of the error term is one of the key assumptions of the linear regression model. Hence, we check our model for satisfying this assumption, i.e. if the residuals from our regression model are serially correlated or not. For this, we apply the Breusch-Godfrey serial correlation test in the residuals of our linear regression equation. The null hypothesis of the test states that there is no autocorrelation in the residuals of the regression model.

## Table 7: Breusch-Godfrey Serial Correlation LM Test Results

Null Hypothe	Result			
F-statistic	1.357719	Prob. F	0.2575	Fail to re-
		(2,1662)		ject Null
Obs*R-	2.722428	Prob. Chi-	0.2563	Hypoth-
squared		square (2)		esis

Source: Author's computation using 'EVIEWS' software

Table 7 presents that probability of F-statistics (0.2575) is greater than p-value (.05) at 5% significance level. The test results fail to reject the H-not and concludes that no serial correlation is found among the residuals of the regression model. Thus, the BGLM test results supports that the model coefficients are efficient, and model can be used for predictive values.

## 5.8 Model Stability (Cusum Test)

We perform the Cumulative Sum (CUSUM) test (with forward direction) to examine the model stability i.e., if the regression coefficients are stable over time. The null being regression coefficients are stable.



**Figure 6: CUSUM Test Results** 

Source: Author's computation using 'EVIEWS' software

Figure 6 presents the V- mask CUSUM graph. It displays (Cusum statistics shown on Y-axis) that the CUSUM series lies within the critical lines (at

significance level: .05) and does not cross the decision intervals. This indicates that the process mean is stable. Therefore, results fail to reject the null hypothesis of stable regression coefficients. It concludes that our model is efficient as parameter estimates are unbiased.

## 5.9 Homoscedastic Residuals (Harvey Test)

The homogeneity of residuals is examined for the model using Harvey method to ensure the variance among the residuals is constant across the sample. The H0: Residuals are homoscedastic as against the H1: Residuals are heteroskedastic.

Table 8: Result of Heteroskedasticity: Harvey Test

F-statistic	0.382500	Prob.F(4,1664)	0.8213
Obs*R-	1.533189	Prob. Chi-	0.8207
squared		Square (4)	
Scaled	1.682215	Prob. Chi-	0.7939
explained SS		Square (4)	

Source: Author's	computation	using	'EVIEWS	' software
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Table 8 displays findings of residuals diagnostic test about their homoskedasticity. As the probability of F-statistic (0.8213 > 0.05) and Chi-Square (0.8207 > 0.05) are not significant. Hence the results again fail to reject the null hypothesis. The Harvey test satisfies that no heterogeneity among the residuals of the model ensuring that model results are valid.

## 6. Conclusions and Implications

Worldwide, the investing community's rapidly growing awareness and sensitivity towards environmental, social, and governance issues necessitate continuous empirical research in the field of sustainability. Hence, the study aims to identify the interlinkages and causal relations between the two indexes over the short- and long run. This study analyses the performance of sustainability index represented by ESG index against one of the major benchmark indices in the Indian securities market, viz. BSE 100 Index in Bombay Stock Exchange. We first examine the risks-returns profile of these indexes and later develop a regression model and tests for prerequisites and diagnostics. It is observed that the BSE index yielded almost similar returns but lower risk in comparison to the ESG index. It reveals that the ESG index has not delivered a performance superior to that of the BSE index. So, risk-averse investors may still prefer traditional stocks. ESG may not be an attractive choice among investors. However, a slightly lower coefficient of variation (risk-adjusted return) in favour of the ESG index gives an encouraging signal for sustainability investing among ESG-conscious investors. The study identified that the returns on two indices are cointegrated in the long run. However, the two indices have no causal relationship in the short run. The results are in sharp contrast to our previous study, which examined the cointegration and causal relationship between the NSE 100 ESG and NSE 500 market index in the National Stock Exchange of India. And no cointegrating relationship between returns from the NSE 100 ESG index and the NSE 500 index was established. However, the earlier study found short-run causality between the study variables. It indicates that ESG investing is not equally popular among all investors in India. It concludes that the sustainability concept is still in an emerging stage in the Indian economy, unlike in the developed markets where investment in ESG stocks is generally favoured by investors. Further, this research also provide evidence in line with past literature that no firm conclusion can be stated about the superior performance of the ESG investing while comparing with traditional investing.

The study results have practical implications for investors, professionals and legal institutions. The knowledge of cointegrating behaviour between the ESG and market indices is important for investors and fund managers, particularly those interested in BSE stock exchange companies, in understanding the spread dynamics in pair trading and designing their portfolio strategy accordingly and can take the positions to buy the low and sell the high. Further, the research findings can be especially helpful for index arbitrageurs and sustainability-conscious investors, who prefer index habitats and pursue passive portfolio strategies in index funds. Policymakers can also use empirical evidence of cointegration between the ESG and market indices when formulating sustainability-encouraging strategies.

The research is limited to the two index variables from the Mumbai Stock Exchange. Future research can cover a broad spectrum by considering different sustainability indices, such as green energy and green bonds, and comparing them with other stock indices in India and emerging markets.

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## Impact of Environmental Disclosure Practices on Financial Performance: A Systematic Exploration of Literature

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## Abstract

In a constant quest for profitability, the companies across the globe are making desired and undesired (residual) contributions to the planet's ecosystem. An important way of instilling sustainability in the businesses is by inclusion of environmental disclosure practises in the financial statements of the corporate enterprises. The integration of reporting environmental disclosures with corporate strategy can yield win-win results for the company as well as the stakeholders by reflecting their commitment towards sustainable development and at the same time delivering better value to their shareholders. This paper attempts a systematic review of literature on impact of environmental disclosure practices on financial performance. The studies reviewed in this paper were selected on the basis of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines with clearly defined eligibility criteria. The study finds that Bloomberg ESG disclosure score has been the leading parameter to measure environmental disclosure practices and financial performance has been primarily measure on accounting-based ratios and on the basis of market value. It also lists the key parameters used to measure 'environmental disclosures' (ED) and 'firm's performance' (FP) used in developed and developing countries. The review suggests that 'environmental disclosures' had a significant and positive impact on majority 'firm's performance' in both developed and

developing countries. However, variations in terms of results have also been found in sizeable number of studies. The study will be beneficial to regulatory bodies, researchers and accounting professionals to develop the current understanding of work done and build upon the gaps.

*Keywords:* Environmental Disclosure Practices, Environmental Reporting, Financial Performance, Sustainability

JEL Classification: Q56, M41

## 1. Introduction

Environmental crisis with increasing average annual temperatures, melting of glaciers, forest fires, increased toxicity due to pollutants in air clearly reflecting global environmental crises, has rarely been as pertinent. International, regional, national and institutional efforts towards preserving and protecting environment through multifaceted ways has for long been the bottom-line of efforts towards sustainable development. Global organisations like United Nations, World Bank, IMF, International accounting associations and regulatory frameworks of various countries and regions have been working hard in taking concrete steps towards sustainability. Though a sizeable number of companies have been practising this voluntarily, it is still not a mandatory exercise world over. Further, whether these

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disclosures affect financial figures of the company or not is of keen interest with the researchers, policy, makers, companies, investors and stakeholders at large. Corporate sector primarily works with the objective of shareholders wealth maximisation. A move towards environmental disclosure practices can produce concrete results either when they are forced mandatorily or when such disclosures and accounting reporting yield positive financial benefits and aid in further growth and maximisation of shareholder's wealth.

Integrated reporting, inclusion of Environmental disclosure practices, increased transparency and accountability, alignment to global standards and efforts towards sustainable development goals (SDGs) are considered as the facets of corporate social responsibility (CSR) and have been increasingly recommended in academic researches, working papers, and matters of public policy as a means to advance sustainable development.

Though such efforts have found their place in almost every economy of the world, the efforts in developed economies might differ significantly from the efforts of their developing counterparts. A multitude of reasons, including awareness among stakeholders, robust regulatory framework, accountability for tasks and open systems concept leads to variations in environmental disclosure practises of the companies operating in such countries. Environmental reporting would include reporting and disclosing environmental matters in the annual report of the company. This may include voluntary disclosures by the company and mandatory releases of information. Researches comparing developed and developing countries often find differences in these parameters due to varying regulatory environments, stakeholder pressures, and levels of environmental awareness. Developed countries' firms might exhibit more advanced practices in terms of quality, adherence to international standards, and higher stakeholder expectations. In contrast, firms

in developing countries may be at different stages of adopting such practices.

Therefore, further research is needed to identify determinants of environmental reporting in developing vs. developing countries. Several studies on Environmental Disclosures (ED) reporting have been conducted including dimensions like type and extent of ED, alignment with GRI standards, impact of ED on financial performance (FP), environmental performance, and ED as part of ESG disclosures. It is pertinent to review the extensive current literature on this aspect of environmental reporting. Further, a comparative study analyzing the key determinants of ED and financial performance and impact of ED on FP, in the results of research from developed and developing countries can yield fruitful results. With this backdrop, this study conducts a systematic literature review on key parameters of EDP (environmental disclosure practices) and financial performance and any significant difference among the impact of ED on financial performance with respect to developed vs developing countries. Consequently, this research will be a reference for future research on this theme and will aid the stakeholders in the decision-making process related to ESG planning and allocating funds towards environmental issues and their due reporting in accounting. The paper begins with introduction on the subject in Section 1 followed by background and literature review in Section 2. The next two sections present the objectives of the study and research methodology. Section 5 presents the research results; and Section 6 concludes the research.

#### 2. Review of Existing Literature

# 2.1 Studies on environmental disclosure and financial reporting

(Porchelvi, 2019) suggests that environmental disclosure reporting is primarily classified into three categories:

- Descriptive and performance reporting: Such reporting was led by UK companies that included description of environmental policies and corporate activity along with data on performance in environmental areas as emission control and energy savings.
- 2. Quantitative environmental accounting: Such reporting encompasses "quantitative input-output analysis".
- 3. Financial environmental reporting: These companies prepare comprehensive report specifying the content of standard environmental report which serves the stakeholders and companies.

Though there is a difference in the types of disclosure practices adopted by companies, still the criticality of these practices and their reflection on an organization's FP is a key area of thrust. These disclosures play a catalyst's role in narrowing the information gap between companies and their shareholders. In fact, stakeholders including employees, customers, regulatory authorities and the public are also served with relevant information. International and national accounting bodies along with the governments have been working on crystallizing the paradigm shift from voluntary disclosures to comprehensive, standardized and mandatory reporting frameworks, driven by increased pressure from stakeholders, NGOs, ticking issue of global warming and massive increase in environmental awareness.

(Tilt, 2001)discussed that during the early years of evolution of environmental disclosures, the firms often reported positive environmental actions to positively impact their corporate image. But these initial disclosures lacked standardization and were often criticized for their limited scope and lack of verifiability. Early twenty-first century witnessed growth in environmental awareness and move towards comprehensive, standardized and reliable disclosures where regulatory bodies played a significant role. Researchers have highlighted how regulatory mandates have led to more comprehensive environmental reporting, moving companies toward greater degree of transparency and accountability through reporting of their environmental practices. Further, the introduction of global standards and guidelines, such as the Global Reporting Initiative (GRI), has helped in standardizing environmental disclosures. (Cho et al., 2015) examine the impact of adopting GRI standards on the quality of environmental disclosures. The study concluded that such standards improve the environmental disclosure reporting. (Harte & Owen, 1991) focused on the disclosure of the information relating to the external environmental impact of corporate activity and concluded that most of the environmental reporting was still at a general level and very close to a mere general commitment to green issues.

Hence, (Porchelvi, 2019) summarizes that environmental disclosure practices have evolved from voluntary, often superficial reports to more structured, mandatory, and standardized disclosures. This evolution has been driven by regulatory pressures, stakeholder demands, and the strategic interests of companies in demonstrating their commitment to environmental sustainability.

#### 2.2 Systematic literature review (SLR)

SLR entails extensive research of existing literature on a given theme in a structured and standardized manner. It is a systematic process to identify relevant literature of a key area and synthesizes the results and status of research. It is a useful tool to lay down the foundation of work already done and future scope of research.

(Hazwani Hassan et al., 2021) studied the status of carbon disclosure and reporting literature and analysed the determinants involved in the carbon disclosure and reporting researches using Preferred Reporting Items Systematic Reviews and Meta-Analysis (PRISMA) method. They explained and discussed how each factor motivated the carbon disclosure in various studies. (Hazwani Hassan et al., 2021) concluded that "carbon disclosure is still not mandatory in most countries globally, and many firms have developed different practices and approaches concerning the disclosure of carbon emissions".

## 3. Objectives

This research aims to synthesize the research on environmental disclosures and financial performance and intends to be a reference point for further research. The research objectives are as follows:

- To develop an understanding on impact of environmental disclosures (ED) on financial performance (FP).
- To examine the present status of research in developed vs developing economies.

## 4. Research Methodology

The present Systematic Literature Review was conducted in February 2024 using "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) guidelines. The shortlisted articles were further reviewed using relational content analysis to meet the research objectives. The following three subsections detail the eligibility criteria framed for the study, databases used to gather information, search query and data collection process based on inclusion and exclusion criteria.

## 4.1 Eligibility Criteria (EC)

Eligibility (inclusion/exclusion) criteria laid down for the purpose of this study is as follows:

• EC1: Articles that were published in peer-reviewed journals were included.

- EC2: Only English language articles to be included.
- EC3: All articles should be open access so that full text to enable further study and analysis.
- EC4: The article should cover the impact of ED practices on FP of the companies.

## 4.2 Databases Referred and search items

A total of three reliable databases of peer-reviewed journals were accessed. The search results listed 468 articles by running a search query of the title, abstract, and keywords (TITLE-ABS-KEY ("environmental disclosure" OR "environmental reporting") AND TITLE-ABS-KEY ("financial performance")) of articles indexed by Web of Science, Scopus and Science Direct.

## 4.3 Search Results

Further, limits were added to search query to meet eligibility criteria 1 and 2 which brought down the number of eligible articles to 402. EC3 recommends only open access journals to keep the articles available for further studies. This criterion further refined the number of results to 131. Additionally, 35 duplicate entries of articles were removed due to indexation in more than one database. The remaining 96 articles were screened by authors through content analysis of Title and abstract. Only the articles focusing on impact of ED practices on FP were included. Hence, EC4 led to exclusion of 61 articles. This research paper is based on a systematic literature review of 35 studies of this field, that were able to meet the criteria laid down for selection.





Source: Authors' compilation

The number of publications in this area have shown a consistent increase over the last decade except a dip during the COVID-19 period. However, the most cited

papers on ED practices and their relationship with FP are from the year 2016, followed by 2018 and 2020 respectively.

<b>Publication Year</b>	Articles	Citations
2015	3	47
2016	2	486
2018	4	227
2019	2	54
2020	9	209
2021	3	170
2022	4	91
2023	7	10
2024	1	0
Grand Total	35	1294

Source: Authors' compilation

## 5. Results and Discussion

This section has been divided into three main subsections encompassing the main theme of this literature review. The first subsection enlists the key parameters used by researchers worldwide for measuring environmental disclosure practices or environmental reporting practices. The second subsection provides details of the major parameters used for measuring financial performance of the company. These are

primarily measured through accounting-based measures and market value-based measures respectively. The last section provides details of all the research papers included in the study and the relationship found by them between ED practices and FP. Further, the study also makes an attempt to provide a comparative analysis in all these three sections with respect to developed and developing economies.

Article Citation	Database	Country and Sample	Statistical Tools Employed	Impact of EDP on FP
(Turturea, 2015)	Scopus	18 companies of France, Germany and United Kingdom	Evaluation scheme along with Likert Scale	Extent of ED and SD were studied but no specific variables
(Hossain et al., 2015)	Scopus	131 companies, Bangladesh	Regression models	CSR has an insignificant negative association with FP (market value based) but is significant and positive when related to FP (accounting based)
(Dobre et al., 2015)	Scopus	30 Companies	Panel data Regression	Negative and insignificant
(Qiu et al., 2016)	Scopus, Web of Science	FTSE350 index companies of UK	Regressions	No relationship between ED and FP
(Chen et al., 2016)	Scopus, Web of Science	Listed construction companies from developed countries	ANOVA analysis and stepwise regression	EP has significant impact on FP
(L. W. Lu & Taylor, 2018)	Scopus	500 largest US companies	Simultaneous Equations Approach	EP and FP have negative relationship and EP and ED have positive relationship. The impact of ED on FP was not studied.
(Baboukardos, 2018)	Scopus, Web of Science	692 French companies	Linear price-level model	Negative impact of environmental performance ratings on FP
(Hassan & Romilly, 2018)	Scopus, Web of Science	1392 companies from 45 Countries	Simultaneous Equations with Granger causality test	ED and current FP is highly significant in all samples, however its negative for developed countries & positive for total and developing country

Table 2: List of reviewed articles with key findings

(Sampong et al., 2018)	Scopus, Web of Science	Single (South Africa), 126 companies	Panel data Regression with Fixed effects	Negative and insignificant relationship between ED and FP
(Kim & Oh, 2019)	Scopus, Web of Science	214 listed Indian companies	Panel data Regression and t-test	CSR and FP have U-shaped relationship
(Wasara & Ganda, 2019)	Scopus, Web of Science	Single (South Africa), 10 companies	Panel data Regression with Fixed & Random effects	Negative relationship between ED and FP
(Pereira et al., 2020)	Scopus	69 Brazilian companies	Panel data Regression with Random effects	Positive and significant relationship between CSP and FP but disclosure doesn't intensify this relationship. ED impact not studied separately
(Azzam et al., 2020)	Scopus	Single (Jordan), 1705 firm-year observations	Panel data Regression with Fixed effects	While SD is positively associated with FP, ED does not have this association.
(Oluseyi- Sowunmi et al., 2020)	Scopus	46 listed Nigerian companies	Ordinary Least Square (OLS) Regression	Positive and significant impact of ED on FP
(Atasel et al., 2020)	Scopus	39 Turkish companies	Panel data Regression	Positive and significant impact of ED on FP
(Madaleno & Vieira, 2020)	Scopus, Web of Science	47 listed companies from Spain and Portugal	GMM- generalized method of moments	Positive and significant impact of ED on FP
(Wahyuningrum et al., 2020)	Scopus	36 listed Indonesian companies	Multiple Regression	EP and FP does not impact ED significantly
(Albitar et al., 2020)	Scopus	FTSE350 index companies of UK	Panel data Regression with Fixed effects	ESG score and IR has significant positive impact on FP
(Hardiningsih et al., 2020)	Scopus	39 companies of Indonesia, Malaysia	Regression analysis with Warp PLS	ED and SD have significant positive relationship with FP
(Ammer et al., 2020)	Scopus, Web of Science	Single (Saudi Arabian)	Panel data Regression with Fixed & Random effects	Positive and significant impact of ED on FP
(Gerged, Beddewela, et al., 2021)	Scopus, Web of Science	405 companies from GCC countries	2SLS and GMM with Panel Data	ED is significantly positive with respect to firm's value
(W. T. Lu et al., 2021)	Scopus, Web of Science	752 Chinese companies	Multiple Regression	Negative impact of ED on FP for carbon-intensive but significant in non-carbon intensive industries
(Masliza et al., 2021)	ScienceDirect	Single (Malaysia)	Cluster Regression Analysis	Positive and significant impact of ED on FP

(Saygili et al., 2022)	Scopus, ScienceDirect	36 public companies of Turkey	Pooled ordinary least squares (OLS) model	Negative impact of ED on FP
(Al-Waeli et al., 2022)	Scopus	25 Iraqi companies	Multiple Regression	Positive and significant impact of ED on FP
(Chouaibi et al., 2022)	Scopus, Web of Science	Multi (North American and West European), 523 companies	Panel data Regressions with Fixed effects	Positive and significant impact of ED on FP
(Pulino et al., 2022)	Scopus, Web of Science	Single (Italy)	Panel data Regressions with Random effects	Positive and significant impact of ED on FP
(Maria Kristari & Yusram Teruna, 2023)	Scopus	39 Indonesian companies	Panel data Regressions with Fixed effects	Negative impact of ED (carbon emission) on FP. CSR disclosures do not impact FP positively
(Firmansyah et al., 2023)	Scopus	26 Saudi Arabian listed companies	Panel data Regression	ED has an insignificant negative association with FP (market value based) but is significantly and positively related to FP (accounting based)
(Wu & Li, 2023)	Scopus, Web of Science	531 Chinese companies	Hierarchical linear model (HLM)	Positive and significant impact of ED on FP
(Mintah & Gulko, 2023)	Scopus	8 airline companies of UK	Coding structure is based on the GRI guideline	Covid 19 has negatively significant and increased disclosures have significant positive relationship with FP
(Malik et al., 2023)	Scopus, Web of Science	Single (China), 8,619 unique observations over 12 years	Multiple Regression	Positive and significant impact of ED on FP
(Lehenchuk et al., 2023)	Scopus, Web of Science	Single (Turkey), 48 companies	OVER and SEP models	Impact of ED on FP is not studied separately
(Wang et al., 2023)	Scopus, Web of Science	Single (China)	Multiple Regression with Fixed effects	U-shaped relationship between environmental protection investment and FP
(Escamilla- Solano et al., 2024)	Scopus, Web of Science	103 listed Spanish companies	Partial least squares structural equation modelling	ED is neither positively nor negatively significant with FP hence study concludes that environmental dimension does not harm business profitability

SD: Social Disclosures, ED: Environmental Disclosures, FP: Financial performance,

EP: Environmental Performance

Source: Authors' compilation

few studies.

Table 2 shows that the existing literature on the effect of EDP on FP have covered diverse countries across the globe with different structural parameters. A majority of the existing studies have utilized panel data econometric techniques, viz. Pooled OLS, Panel OLS with fixed effects and random effects, and panel GMM. Simultaneous Equations approach has been adopted by

## 5.1 Key Parameters of Environmental Disclosure

Table 3 lists various key parameters of environmental disclosure used by researchers to evaluate the firm's reporting practices. Bloomberg ESG disclosure

score, Greenhouse gas emissions, Carbon emission disclosures, Carbon Disclosure Leader Index (CDLI), Sustainability reports, Disclosure index, content analysis, Environmental disclosure and environmental performance ratings, GRI G4 Sustainability Reporting Guidelines, Financial statement notes in Annual reports and PROPER ratings are the key parameters used in majority of the studies. Bloomberg ESG disclosure score has been the most frequently used parameter with (Albitar et al., 2020; Ammer et al., 2020; Chouaibi et al., 2022; Gerged, Beddewela, et al., 2021) reporting its positive impact on the firm's financial performance.

Key Parameters	Developed/	Result (+/-)	Previous Articles
	Developing		
Bloomberg ESG	Developed	Positive and significant	(Albitar et al., 2020; Chouaibi et al., 2022;
disclosure score			Ammer et al., 2020; Gerged, Matthews, et al., 2021)
	Developed and	Both -Positive and	(Firmansyah et al., 2023; Hassan &
	Developing	Negative with different parameters.	Romilly, 2018; Masliza et al., 2021)
Greenhouse gas emissions	Developed	Negative	(Turturea, 2015)
Carbon emission	Developing	Negative	(Maria Kristari & Yusram Teruna, 2023)
disclosures			
Carbon Disclosure	Developing	Negative	(W. T. Lu et al., 2021)
Leader Index			
Sustainability reports	Developed	Positive	(Escamilla-Solano et al., 2024; Madaleno & Vieira, 2020)
	Developed	Negative	(Lehenchuk et al., 2023)
	Developing	Positive and significant	(Pereira et al., 2020)
	Developing	Negative	(Sampong et al., 2018; Wasara & Ganda,
			2019)
Disclosure index-	Developed	Positive and significant	(Pulino et al., 2022)
Annual reports	Developing	Negative	(Azzam et al., 2020)
	Developing	Both -Positive &	(Hossain et al., 2015)
		Negative with different	
		parameters.	

Table 3. F	Kev Determinants	of Environmental	Disclosures
1 auto 3.1			Disclosures

Environmental	Developed	Positive	(Pulino et al., 2022; Qiu et al., 2016)
disclosure scores	Developed	Negative	(Baboukardos, 2018)
and Environmental	Developing	U-shaped	(Kim & Oh, 2019)
performance ratings	Developing	Positive and significant	(Hardiningsih et al., 2020; Wu & Li, 2023)
GRI G4 Sustainability	Developed	Negative	(Saygili et al., 2022)
Reporting Guidelines	Developed	Positive	(Atasel et al., 2020; Mintah & Gulko, 2023)
Content Analysis of	Developed	Significant	(Chen et al., 2016)
Annual Reports	Developed	Negative and insignificant	(Dobre et al., 2015)
	Developing	Positive and significant	(Al-Waeli et al., 2022; Oluseyi-Sowunmi et
			al., 2020)
Annual reports-	Developing	U-shaped	(Wang et al., 2023)
Financial statement			
notes			
PROPER ratings	Developing	Negative	(Wahyuningrum et al., 2020)

#### Source: Authors' compilation

Further, GRI G4 Sustainability Reporting Guidelines were used to measure the impact by three developed country samples and found to be negatively impacting FP (Saygili et al., 2022), but positive impact on FP shown in (Atasel et al., 2020; Mintah & Gulko, 2023). The measures of Greenhouse gas emissions, Carbon emission disclosures and Carbon Disclosure Leader Index (CDLI) had a negative impact on FP (W. T. Lu et al., 2021; Maria Kristari & Yusram Teruna, 2023; Turturea, 2015). Six of the studies have assessed environmental disclosure through content analysis of annual reports, sustainability reports and disclosure index and these disclosure parameters were found to be positively impacted FP (Al-Waeli et al., 2022; Oluseyi-Sowunmi et al., 2020; Pulino et al., 2022) but the same were found to be negatively related in the studies by (Azzam et al., 2020; Dobre et al., 2015). ED measured through PROPER ratings tool was applied by (Wahyuningrum et al., 2020) and stated the negative impact. Two studies reported U shape relationship with the determinants of Environmental disclosure scores (Kim & Oh, 2019) and financial statement notes(Wang

#### et al., 2023).

## 5.2 Key Determinants of Financial Reporting

Table 4 shows the variables used to measure financial performance while calculating impact of ED practices on the FP of the sample firms. The variables are primarily categorized into three categories including accounting-ratios based measures, market value-based measures and a combination of both.

It is interesting to note that as much as nine developing countries applied accounting-based measures to capture financial performance. While (Al-Waeli et al., 2022; Oluseyi-Sowunmi et al., 2020; Wu & Li, 2023) found a positive impact of environment disclosures on FP, the studies by (Azzam et al., 2020; W. T. Lu et al., 2021; Maria Kristari & Yusram Teruna, 2023; Wahyuningrum et al., 2020; Wasara & Ganda, 2019) established a negative relationship with the same measures. Hence, accounting based measures were found to be negatively impacted by ED in majority of the developing country studies.

Key Parameters to measure Financial performance	Developed/ Developing Countries	Impact on ED (+/-)	Previous Articles
Accounting based parameter	ers		
Return on assets (ROA) and Return on equity (ROE)	Developed	Negative and insignificant	(Dobre et al., 2015; Saygili et al., 2022)
	Developing	Both -Positive and Negative results with different parameters.	(Hossain et al., 2015)
	Developing	Negative	(Azzam et al., 2020; Maria Kristari & Yusram Teruna, 2023; Wahyuningrum et al., 2020; Wasara & Ganda, 2019)
	Developing	Positive and significant	(Al-Waeli et al., 2022; Oluseyi- Sowunmi et al., 2020)
Net profit margin and Debt to asset ratio	Developing	Negative impact for carbon- intensive industries.	(W. T. Lu et al., 2021)
EBIT and ROA	Developed	Positive and significant	(Pulino et al., 2022)
EPS, ROA and ROE	Developing	Positive	(Wu & Li, 2023)
Profitability, liquidity and leverage	Developed	Positive and significant	(Mintah & Gulko, 2023)
EBITDA, ROA, ROE, assets turnover ratio	Developed	Negative	(Lehenchuk et al., 2023)
ROS and EPS	Developed	Positive	(Qiu et al., 2016)
Market based parameters			
Market value of the Firm	Developed	Negative	(Baboukardos, 2018)
	Developing	Positive and significant	(Pereira et al., 2020)
Tobin's Q	Developed	Negative	(L. W. Lu & Taylor, 2018) *Negative relationship with EP &FP.
	Developed	Not studied the impact of ED on FP	(Turturea, 2015)

Table 4: Key paran	neters measuring Fina	ncial Reporting
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Combination of accounting	and market v	value based parameters	
Tobin's Q: ROA Return on assets.	Developed	Positive and significant	(Albitar et al., 2020; Gerged, Beddewela, et al., 2021; Ammer et al., 2020; Madaleno & Vieira, 2020)
	Developed	Negative	(Escamilla-Solano et al., 2024)
	Developed and Developing	Both Positive and Negative	(Hassan & Romilly, 2018)
	Developing	Positive and significant	(Hardiningsih et al., 2020; Masliza et al., 2021)
	Developing	Negative and insignificant	(Sampong et al., 2018)
	Developing	U-shaped	(Kim & Oh, 2019; Wang et al., 2023)
Tobin's Q and ROE	Developed	Both -Positive and Negative results with different parameters.	(Firmansyah et al., 2023)
ROA,ROE and Market value	Developing	Positive and significant	(Malik et al., 2023)
of the Firm	Developed	Positive	(Atasel et al., 2020)
Tobin's Q, ROA, ROE, Market Value of Firm's Market value of the Firm	Developed	Positive and significant	(Chouaibi et al., 2022)
ROA, ROS and Tobin's Q	Developed	Positive	(Chen et al., 2016)

## Source: Authors' compilation

Additionally, there are six developed countries that used accounting-based measures to calculate firms' performance. While (Mintah & Gulko, 2023; Pulino et al., 2022; Qiu et al., 2016)found environmental disclosures to be positively impacting financial performance, (Dobre et al., 2015; Lehenchuk et al., 2023; Saygili et al., 2022) found the negative impact of ED on FP. The next major parameter market-based tools were applied by (Baboukardos, 2018; L. W. Lu & Taylor, 2018) and showed a negative impact in the two developed countries samples taken by the respective study. However, (Pereira et al., 2020) being a developing country sample showed a positive relationship.

Majority of studies belonging to developed countries samples used factors like return on sales, Tobin's Q, return on assets, return on equity, market value and found a positive impact of environmental disclosure on FP ((Albitar et al., 2020; Ammer et al., 2020; Atasel et al., 2020; Chen et al., 2016; Chouaibi et al., 2022; Gerged, Beddewela, et al., 2021; Madaleno & Vieira, 2020)). Both positive and negative impacts were shown in (Hassan & Romilly, 2018) and (Firmansyah et al., 2023)both being developed country-based samples and (Escamilla-Solano et al., 2024) showed the negative impact with reference to a developed country.

(Hardiningsih et al., 2020; Malik et al., 2023; Masliza et al., 2021) belonging to developing countries samples used a combination of accounting and market-based measures and found positive relationship with environmental disclosures. While two of the studies (Kim & Oh, 2019) and (Wang et al., 2023) found a U-shaped relationship, (Sampong et al., 2018) found a negative impact of ED on FP.

There are inconsistencies between the measures used to record financial performance and results displayed through developed and developing country samples. Though accounting-based measures have been positively impacted by environmental disclosures in majority of developed countries' studies yet no other conclusive evidence regarding developing countries or the role of market-based parameters has been distinctively identified.

# 5.3 Impact of Environmental Disclosure on Financial Reporting

This section presents an overview and discussion with several studies that have examined the impact of ED practices on financial reporting of the firms. Moreover, the variations in measurement of environmental disclosure practices and parameter are used for financial reporting also led to different results in different studies. The study included a total of 35 research papers spanning over a decade listed in the table below as per the eligibility criteria specified earlier. There were eighteen studies from developed and sixteen research papers from developing countries with one research paper on comparative analysis of developed vs developing country. Due to the nature and evolutionary stage of environmental disclosure practices and their coverage in the annual reports, it becomes pertinent to analyse whether the impact of such disclosures varies due to the development status of a nation.

#### 5.3.1 Developing Countries

A deeper look into the results of studies based on developing country samples reveal that ED practices have a significant impact on FP of the companies. As much as ten studies ((Al-Waeli et al., 2022; Hardiningsih et al., 2020; Hassan & Romilly, 2018; Hossain et al., 2015; W. T. Lu et al., 2021; Malik et al., 2023; Masliza et al., 2021; Oluseyi-Sowunmi et al., 2020; Pereira et al., 2020; Wu & Li, 2023)) have found a positively significant impact of environmental disclosures on financial performance and only three studies ((W. T. Lu et al., 2021; Maria Kristari & Yusram Teruna, 2023; Wasara & Ganda, 2019)) have concluded a negatively significant relationship. It is pertinent to note here that (Pereira et al., 2020) analysed the impact of corporate social performance on financial performance instead of environmental disclosures. Also, (W. T. Lu et al., 2021) found a positively significant impact of ED on FP for 'non carbon intensive' companies' sample and negatively significant relationship for 'carbon intensive' companies' sample.

Hence, we find that majority of the studies from developing countries have reinstated faith in positive and significant role of environmental disclosure practices on firm's financial performance except (Hossain et al., 2015) and (Sampong et al., 2018) where negative but insignificant impact was noticed.

Also, (Wang et al., 2023) and (Kim & Oh, 2019) concluded that ED has a U-shaped relationship with financial performance instead of a linear one. Only (Azzam et al., 2020) held that there was no relationship between ED and FP.

## 5.3.2 Developed Countries

The research results from developed countries support the hypothesis of positively significant impact of environmental disclosures on financial performance ((Albitar et al., 2020; Atasel et al., 2020; Chen et al., 2016; Chouaibi et al., 2022; Firmansyah et al., 2023; Gerged, Beddewela, et al., 2021; Hardiningsih et al., 2020; Madaleno & Vieira, 2020; Mintah & Gulko, 2023; Pulino et al., 2022)). Here, (Firmansyah et al., 2023) concluded with positive and significant relationship when FP was measured through accounting-based measures. Hence, we find that majority of the studies from developed countries have reinstated faith in positive and significant role of environmental disclosure practices on firm's financial performance except (Hossain et al., 2015) and (Sampong et al., 2018). Only four studies including (Baboukardos, 2018; Hassan & Romilly, 2018; L. W. Lu & Taylor, 2018; Saygili et al., 2022) have found negative and significant impact of ED on FP. It is interesting to note that (Qiu et al., 2016)

concluded that there is absence of relationship between ED and FP. Even (Escamilla-Solano et al., 2024) didn't find any significant relation and concluded that absence of negative relationship indicates that ED doesn't harm profitability. A negative but insignificant impact of ED on financial performance was concluded by (Dobre et al., 2015) and (Firmansyah et al., 2023) while using market value-based measure of firm's performance.

## 6. Conclusion

Concerted efforts at international and national levels towards fair environmental disclosures and better environmental performance clearly resonate with the worldwide concerns over environment and sustainability. Both developed and developing countries are aware of the significance and ill-effects that reckless efforts can lead to. This study has been an attempt to draw a comprehensive picture of worldwide efforts and understanding differences in approaches adopted by developed and developing nations, if any. Although there are consistent efforts, developing countries still struggle with regulatory, awareness and economic issues. The study makes a significant contribution by concluding that in majority of the studies reviewed, ED practices have a positive and significant impact on FP. The results have been equally supportive for both developed and developing countries. Additionally, despite the costs involved in shifting to environmentally conscious approach, markets have shown positivity towards companies' responsible efforts. However, some select studies have also concluded negative impact of ED on financial performance. These inconsistencies can be taken up for further research by conducting a more comprehensive review of literature and/or by using larger samples with more parameters and longer study periods. Environmental performance and its disclosures grab attention of regulatory bodies and activists alike. However, increase regulatory requirements can significantly contribute towards quicker shift to environmentally conscious efforts and their inclusion in the annual reports. Moreover, harmonization at global level can bring uniformity in the presentation of environmental disclosure making comparisons easier.

A more environmentally conscious firm can contribute towards a more inclusive and sustainable economy and can in turn achieve 3Ps (profit, people and planet). This paper has both theoretical and practical implications. Environmental disclosure reporting by firms in developed and developing countries and its influence on financial performance forms the theoretical view on the accounting literature. Practically the content discussed in this paper may influence corporates and government to frame environmental reporting standards and strong regulations to conserve the natural resources.

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## A Cross-Sectional Analysis of Fertility Patterns in India: Evidence from NFHS-5

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#### Abstract

The present study examines some dimensions of fertility patterns across states in India using recent data on key indicators obtained from Round 5 of NFHS. The analysis of data shows considerable statelevel heterogeneity in total fertility rate, total wanted fertility rate, early childbearing, and preference for sons. The study establishes that the state-level fertility patterns are correlated with socioeconomic covariates, like wealth, rural population, literacy levels, exposure to media, early marriage, and use of modern family planning practices. The classification of states based on total fertility, early marriage, adoption of modern family planning practices, and early childbearing indicates that fertility patterns are better understood in the context of the prevailing diversity in India's socioeconomic and cultural features. Using the NFHS classification of states into six regions- central, east, north, northeast, south, and west regions, the differences in means of observed fertility across regions are not found to be statistically significant for total fertility rate and total wanted fertility rate. We find the difference between east and northeast regions vs north region to be statistically significant for early childbearing and, east and west regions vs south to be significant in case of the preference for sons. Overall, the presence of overwhelming differences in regional patterns in the fertility indicators is not seen and we find no statistically significant evidence of a North-South divide. Our analysis shows that recognizing

within-region variations in fertility provides a better understanding of fertility patterns and is useful and relevant for policy purposes.

**Keywords:** Total Fertility; Total wanted fertility; Early childbearing; Son preference; Socioeconomic features; Regional variations

## 1. Introduction

While India's overall fertility rate of 2.0 children per woman is slightly lower than the replacement rate, there are wide spatial differences within the country. Several studies have examined fertility patterns and preferences and their determinants at the all-India level and for selected states. However, there is limited literature on the study of fertility patterns and behaviour across all 36 states and union territories (UTs) of India using the most recent data on such patterns. The present study seeks to fill the research gap by using recent nationallevel survey data from NFHS-5 to study fertility patterns across all states/UTs in India. The objectives of the study are (a) an empirical assessment of fertility variations across states/UTs in India in the dimensions of total fertility rate (TFR), total wanted fertility rate (TWFR), early childbearing given by teenage pregnancy and preference for sons by men and women (b) to examine the statistical significance of socioeconomic correlates of fertility behaviours like wealth, rural population, literacy levels, exposure to media, early marriage, and use of modern family planning practices etc., and (c) to statistically test for regional patterns in fertility

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behaviours to better understand fertility variations across the six regions as per NFHS classification, namely, central, east, north, northeast, south, and west regions.

In section 2 we provide a brief review of literature. In section 3, the data and methods used in the study are elaborated. Section 4.1 describes the spatial variations in fertility and related parameters. Section 4.2 presents the results from the correlation analysis of fertility behaviour and socioeconomic characteristics. Section 4.3 attempts to classify states/UTs based on fertility behaviour patterns followed by statistical tests for regional variations in fertility behaviour across the six regions of India in Section 4.4. Section 5 presents the discussion of the results and Section 6 concludes.

## 2. Literature Review

This paper examines state-level patterns in some important dimensions of fertility namely total fertility rate (TFR), total wanted fertility rate (TWFR), early childbearing given by teenage pregnancy i.e. women aged 15-19 who begin childbearing, and preference for sons by men and women. Literature has emphasized the role of individual or family socioeconomic features like literacy, wealth or income of the household, location i.e. rural or urban, status of women, religion, caste, etc. as being significant in influencing these dimensions of fertility patterns and preferences. In addition, relative bargaining power and negotiation between partners is also seen as influencing fertility preferences and patterns. The availability of family planning health systems is also a key factor in the adoption of contraception to determine spacing and limiting of fertility.

The prevalence of spatial variations in fertility preferences and births in India is well-documented (Chatterjee and Desai, 2020; Singh et al., 2022). Studies have shown the significance of economic and women's status in explaining fertility patterns and in explaining North-South differences (Dommaraju and Agadjanian, 2009) while variations between EAG state and other states have also been documented (Chatterjee and Desai, 2020). Tharun and Muniswamy (2022) examine the trends in Wanted Total Fertility Rate, Unwanted Total Fertility Rate and Total Fertility Rate as per NFHS-2, 3, and 4 for southern states of India, namely Andhra Pradesh, Tamil Nadu, Kerala, and Karnataka. The study found a declining trend in all states along with a high unwanted fertility among rural, SC/ST, Muslim and non-working women reiterating the need to strengthen family planning programmes. Roy et al (2016) study the trends in fertility rates in Uttar Pradesh for NFHS-1, 2 and 3. The study finds higher wanted, unwanted and actual fertility rates among women in rural areas, illiterate, Muslim, ST, non-working, and lower income group females. Shekar et al (2018) point out the spread of states below replacement level across the country and explain fertility transitions through sociocultural factors, shift away from agriculture, family planning programmes, women's education, empowerment, urbanisation, media exposure and access to health services. Singh et al (2022) find evidence of spatial heterogeneity in son preference across Indian districts, that is often masked by state level estimates. Fertility gap, which is the difference between preferred and actual fertility, is dependent on context specific experiences both within and outside the household (Dommaraju and Agadjanian, 2009). Within the household, it has been shown that husband's preferences also matter and significantly shape the fertility gap (Mishra and Parasnis, 2021). Across countries a strong relationship has been established between female empowerment and fertility (Doepke & Tertilt, 2018). Female empowerment which leads to greater women's bargaining power has been shown to lead to a decrease in fertility while a literature review study of 60 studies by Upadhyay et al. (2014) found some positive associations between women's empowerment and lower fertility, longer birth intervals, and lower rates of unintended pregnancy in a vast majority of studies but their review also showed variation in results. In many studies that were reviewed, they find a negative or an absence of a significant relationship between female empowerment and fertility levels pointing to the significance of the measure of empowerment used, sociopolitical or gender environment and sub-population studied. Son preference due to deep-rooted cultural attitudes and for financial reasons as security in old-age often leads to gender-specific fertility stopping and gender-biased fertility strategies have been shown to lead to gender inequalities in education (Congdon Fors & Lindskog, 2023). Bose and Das (2024) in a study for rural India show that fertility increases with increased women's agency. They argue that son preference and lack of access to abortion services in rural areas leads empowered women to achieve their desired fertility and preferred number of sons through the stopping rule. Despite nearuniversal marriage and early childbearing, average fertility levels in India have declined to low levels due to earlier termination of childbearing via sterilization following the birth of two children (Park et al., 2023). Thus Park et al., (2023) argue that the pathways to a decline in fertility in India have been unique and that even with early and universal marriage and early childbearing, the adoption of family planning practices have led to limiting fertility after two births. Their study highlights the limitations of traditional socioeconomic indicators in explaining fertility declines.

## 3. Data and Methods

The study uses state/UT level data on fertility and socioeconomic indicators from the National Family Health Survey (NFHS-5) (IIPS, 2021). The NFHS surveys are conducted by the International Institute of Population Studies under the purview of the Ministry of Health and Family Welfare (MoHFW), Government of India. The NFHS surveys are large sample surveys that adopt a uniform sample design that is representative at the national, state/UT, and district levels. NFHS-5 was conducted in two stages between 2019-21 across 707 districts, 28 states, and eight UTs of India and survey information was gathered from 636,699 households comprising 724,115 women, and 101,839 men across states and UTs in India. The study follows the NFHS classification of states/UTs into six regions. The North region comprises nine states/UTs namely Chandigarh,

Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Ladakh, Punjab, Rajasthan, and Uttarakhand. The Central region comprises three states of Chhattisgarh, Madhya Pradesh, and Uttar Pradesh. The East region consists of four states, namely Bihar, Jharkhand, Odisha, and West Bengal. The eight states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura constitute the Northeast region. The West region constitutes Dadra & Nagar Haveli and Daman & Diu, Goa, Gujarat, and Maharashtra. The South region comprises eight states/UTs - Andaman & Nicobar Islands, Andhra Pradesh, Karnataka, Kerala, Lakshadweep, Puducherry, Tamil Nadu, and Telangana.

The study is based on secondary data. Graphs and statistical tests are used for analysis. Graphical representation is used to depict variations in fertility patterns across states/UTs and regional variations are shown through maps. We use correlation analysis to test association of fertility outcomes and preferences with their proximate socioeconomic determinants. Robust Analysis of Variance (ANOVA) is used to test the regionwise difference in means of fertility indicators across the six regions. Two robust ANOVA statistics-Welch's and Brown-Forsythe's are used to accommodate unequal variances across regions. Additionally, the Bonferroni method for pairwise comparison of means is used to determine the statistical significance across regions.

#### 4. Results

## 4.1 Variations in fertility parameters across states/ UTs in India

This section presents the state-level differences in fertility rates, namely TFR, TWFR, age at marriage as also the age of commencement of childbearing, adoption of Modern Family Planning Methods, the extent of unmet need for family planning, and preference for sons. We also analyze state-level variations in Total Unwanted Fertility Rate (TUFR) computed as the gap between TFR and TWFR.

The mean number of children born to women aged 40-49 by background characteristics at all-India level

are presented in Fig. 1. Childbearing is observed to be higher in rural areas, and among women with least literacy levels and those belonging to lower wealth quintiles, and Muslim and SC/ST/OBC households.

TWFR in India ranges from 0.9 in Sikkim to 2.7 in Meghalaya. The lowest observed total fertility rate

(TFR) is 1.0 in Sikkim. The highest TFR of 3.0 is observed in Bihar followed by Meghalaya (2.9), Uttar Pradesh, Jharkhand (2.3) and Manipur (2.2) (Fig. 2). All other states/UTs other than these five states have attained TFR below the replacement level of 2.1. TUFR is found to be highest in Bihar (0.8) followed by Uttar Pradesh (0.5), while the corresponding all-India figure is 0.4.

Fig. 1. Mean number of children born to women aged 40-49 at all-India level by socioeconomic characteristics.



Source: Authors' construction based on data from NFHS-5.



Fig. 2. TFR, TWFR and TUFR by states/UTs in India.

Source: Authors' construction based on data from NFHS-5.

An important determinant of fertility patterns is the age at marriage as also the age of commencement of childbearing. In India, the minimum legal age of marriage is 18 years for women and 21 years for men.

However, 24.7% women and 15.2% of men aged 18-29 at all-India level were married before they attained 18 and 21 years respectively. There is a huge variation across states in early marriage ranging from 3.8% women in Lakshadweep to more than 25% in Madhya Pradesh and Telangana, Assam, Andhra Pradesh, Jharkhand, and Tripura; and exceeding 40% in Bihar and West Bengal (Fig. 3). Most states exhibit a greater prevalence of early marriage among women than men except six states of Jammu and Kashmir, Ladakh, Mizoram, Manipur, Arunachal Pradesh, and Gujarat.



Fig. 3. Early marriage and early child bearing by states/UTs in India (%).

Source: Authors' construction based on data from NFHS-5.

Early childbearing refers to teenage pregnancy, that is, women aged 15-19 who begin childbearing. It is observed to be highest in Tripura (21.9%) followed by West Bengal (16.4%), Andhra Pradesh (12.6%), Assam (11.7%) and Bihar (11%). It is interesting to note the contrasting patterns in Bihar and Uttar Pradesh. While the two states exhibit highest TUFR, Bihar also has a much higher prevalence of early marriage among women (40.3%) as well as early child bearing (11%) whereas only 18.8% of women get married early in Uttar Pradesh and 2.9% women have early childbearingFertility patterns are also affected by the adoption of Modern Family Planning Methods and the extent of unmet need of family planning. Lowest adoption of modern family planning methods and larger unmet need is observed in Manipur (18.2%) followed by Meghalaya (22.5%) and Lakshadweep (30%), and highest in Andhra Pradesh (70.8%) followed by Karnataka and Telangana (see Fig. 4). It is interesting to note that while the five states with TFR of 2.1 and above namely Bihar, Meghalaya, Jharkhand, Uttar Pradesh, and Manipur are also the states with low use of modern family practices, not all states with low adoption of modern family planning practices have high TFR- examples being Lakshadweep and Ladakh.



Fig. 4. Adoption of modern family planning methods and unmet need by states/UTs in India.

Source: Authors' construction based on data from NFHS-5.

In India, a major feature of fertility preferences is the preference for sons. Preference for a son is captured by data on the percentage of women and men who want more sons than daughters. Preference for a son among women is strongest in Bihar followed by Mizoram, Arunachal Pradesh, and Jharkhand. The percentage of men wanting more sons than daughters is highest in Mizoram (37.3%) and lowest in Goa (3.1%). In most states, preference for sons than daughters is relatively stronger among men than among women except in the states of Goa, Madhya Pradesh, Uttar Pradesh, Jharkhand, Arunachal Pradesh and Bihar.

Fig. 5. Percent of women and men wanting more sons than daughters by states/UTs in India.



Source: Authors' construction based on data from NFHS-5.

## 4.2 Correlation Analysis of Fertility Behaviour and Socioeconomic Characteristics

We next examine the correlation of fertility outcomes (TFR and early childbearing) and preferences (TWFR

and preference for a son) with state-level socioeconomic characteristics. The correlation coefficients along with

their significance level are presented in Table 1. All four fertility behaviours are observed to be significantly and positively correlated with poverty and rural population and negatively correlated with male and female education levels and women's exposure to media. The percentage of SC and ST populations are not found to be associated with fertility levels and early childbearing. A higher son preference is observed in states with a larger ST population. The percentage of Muslim population, women's participation in the labour force as well as women's empowerment, as captured by participation of women in three major household decisions regarding own healthcare, making major household purchases or visiting her family and friends are not found to be significantly correlated with fertility outcome as well as preferences. Usage of modern family planning methods is significantly and negatively associated with fertility outcomes.

	TFR	TWFR	Early	Preference for son
			childbearing	(among women)
Percentage of population in lowest	0.6031***	0.5435***	0.5713***	0.5837***
wealth quintile	(0.0001)	(0.0006)	(0.0003)	(0.0002)
Percentage of rural population	0.4717***	0.4420***	0.4173**	0.3675**
	(0.0037)	(0.0070)	(0.0113)	(0.0275)
Percentage of SC population	0.1355	-0.0134	0.2538	-0.2293
	(0.4309)	(0.9383)	(0.1353)	(0.1785)
Percentage of ST population	0.0989	0.2381	-0.0856	0.4085**
	(0.5659)	(0.1619)	(0.6197)	(0.0134)
Percentage of Muslim population	-0.2204	-0.2275	-0.1717	0.0978
	(0.1964)	(0.1820)	(0.3166)	(0.5706)
Women literacy	-0.3896**	-0.2204	-0.3158*	-0.4253***
	(0.0188)	(0.1964)	(0.0606)	(0.0097)
Women educated at least till class	-0.4824***	-0.4317***	-0.6311***	-0.4761***
12	(0.0033)	(0.0096)	(0.0000)	(0.0038)
Male literacy rate	-0.4443***	-0.3507**	-0.7964***	-0.2415
	(0.0066)	(0.0360)	(0.0000)	(0.1558)
Women labour force participation	0.0801	0.2579	0.0453	0.1063
rate	(0.6426)	(0.1289)	(0.7932)	(0.5370)
Women participation in major	0.0369	0.0955	-0.0193	-0.0609
household decisions	(0.8309)	(0.5795)	(0.9110)	(0.7244)
Early marriage	0.4366***	0.3501**	0.8241	0.1708
	(0.0078)	(0.0363)	(0.0000)	(0.3192)
Use of modern family planning	-0.3978**	-0.4772**	-0.0341	-0.5238
methods	(0.0163)	(0.0033)	(0.8433)	(0.0010)
Women with no regular exposure	0.5966***	0.4780***	0.3663**	0.7176
to media	(0.0001)	(0.0032)	(0.0280)	(0.0000)

Table 1. Correlation analysis between fertility indicators and socioeconomic characteristics.

Source: Authors' estimation based on data from NFHS-5.

Note: \* implies p<0.1, \*\* implies p<0.5 and \*\*\* implies p<0.01

# 4.3 Classification of States/UTs based on Fertility Behaviour Patterns

All states/UTs are classified as per their performance on four fertility indicators- TFR, early marriage, use of modern family planning methods, and preference for a son. The rationale for choosing these parameters is that they reflect several underlying fertility-related processes. The performance on each of the four parameters is classified into three categories. TFR is classified into three ranges-less than 1.5, 1.5 to replacement level, that is, 2.1, and 2.1 and above. The prevalence of early marriage is categorized into low, medium and high, the percentage of women married before the age of 18 being less than 10%, 10-25% and 25% and above respectively. Low, medium and high use of modern family planning methods refer to the percentage of women using these methods being less than 50%, 50-60% and 60% and above respectively. Low, medium and high son preference is defined as the percentage of women preferring more sons than daughters being less than 10%, 10-20%, and 20% and above respectively.

The state of Goa is the best performer with low TFR, low prevalence of early marriages, high levels of family planning and low preference for a son followed by Himachal Pradesh and Puducherry. In contrast, Bihar and Jharkhand are the worst performers with high TFR, high early marriage, high preference for sons and low levels of family planning. Meghalaya, Manipur, and Uttar Pradesh, with TFR above 2.1 are the states with medium prevalence of early marriage, low incidence of family planning and medium to high son preference. These five states need a policy mix focusing on increased adoption of modern family planning methods, reducing early marriages, and changing the traditional attitudes towards strong preference for a son. Despite low use of modern family planning methods, the state of Lakshadweep exhibits a low TFR that can be attributed, to some extent, to low early marriages and low preference for sons that makes it easier to limit the family size. Assam and Tripura have high fertility less than replacement level but have high early marriage and medium son preference. Although the states of Andhra Pradesh, MP, Telangana, and West Bengal have achieved TFR below replacement level, they cannot be dismissed as 'doing fine' even with progress on three parameters in the desired pattern as the issue of early marriage needs to be urgently addressed in these states.

		TFR: Less	than 1.5		TFR: 1.5 – 2.	1	TFR: 2.1	& above
	Early 1	Marriage		Early Marri	age	Early M	arriage	
	Low	Medium	Low	Medium	High	Medium	High	
High use of modern	Low son preference	Goa		Himachal Pradesh, Puducherry	Maharashtra, Tamil Nadu	Andhra Pradesh		
family planning methods	Medium son preference				Chhattisgarh, Haryana, Karnataka, Rajasthan	Madhya Pradesh, Telangana, West Bengal		

Table 2. Classification of states/UTs in India by TFR, early marriage, use of modernFP practices and son preference

Medium use of modern family planning methods	Low son preference	Chandigarh	Sikkim, A&N Islands	Kerala, Punjab	Delhi, Uttarakhand	D&N Haveli and Daman & Diu		
	Medium son preference				Gujarat			
	High son preference	Jammu & Kashmir						
Low use of modern family planning methods	Low son preference	Lakshadweep						
	Medium son preference			Nagaland	Odisha	Assam, Tripura	Meghalaya	
	High son preference	Ladakh		Mizoram	Arunachal Pradesh		Manipur, Uttar Pradesh	Bihar, Jharkhand

Source: Authors' classification based on data from NFHS-5.

## 4.4 Regional Variations in Fertility Behaviour

Next, statistical tests are performed to examine the presence of regional differences in fertility indicators. Table 3, column 2 presents two robust ANOVA statistics-Brown-Forsythe's F test statistic and Welch's F test statistic. None of the two statistics are significant for TFR. Although Welch's F test statistic is significant at 10% for TWFR, Bonferroni pairwise means comparisons test reveals no pairs of regions where the differences in mean TWFR are significant (see Table 3, column 3). While both Brown-Forsythe's F test

statistic and Welch's F test statistics are significant for early childbearing and son preference, each of these behaviours turns out to be significantly different in only two out of fifteen pairs of regions, namely east and northeast regions lagging north region for former, and east and west regions lagging behind south region for the latter. Thus, overall, the presence of overwhelming regional differences in the fertility indicators is not observed.

Fertility Indicator	Robust ANOVA Test statistics (Col 2)	Pairwise comparisons of means between regions (Col 3)
TFR	BF: 1.8104 (0.1886) W: 1.7107 (0.2240)	NIL
TWFR	BF: 2.0612 (2.0612) W: 2.8105* (0.0749)	NIL
Higher early childbearing	BF: 4.9241*** (0.0055) W: 4.7787** (0.0168)	East vs North Northeast vs North
Son preference - Women wanting more sons than daughters	BF: 3.5216** (0.0357) W: 4.4991** (0.0229)	East vs South West vs South

Table 3. Robust ANOVA-Means Comparisons Test for fertility indicators by regions.

Source: Authors' estimation based on data from NFHS-5.

Note: BF: Brown-Forsythe's test statistic, W: Welch's test statistic, values in parentheses are p-vales,

\* implies p<0.1, \*\* implies p<0.5 and \*\*\* implies p<0.01

The cartographic representations of fertility variations in Fig. 7 confirm our results from Table 3 as there is no evidence of a typical 'North-South divide' often mentioned in the literature. In each of the four fertility indicators we find no pattern that enables a classification by region.

Fig. 7. TFR, TWFR, early childbearing, and son preference across states/UTs in India.



Source: Authors' construction using https://www.mapchart.net/ india.html. Maps not to scale

## 5. Discussion

The analysis of fertility indicators and key related indicators shows spatial heterogeneity at the state level. The study finds a significant correlation between TFR, TWFR, early childbearing, and son preference with wealth, location i.e. rural residence, and women's education. Early marriage and the use of modern family planning are associated with TFR and TWFR. Exposure to media is correlated with TFR, TWFR and early childbearing but does not affect son preference. Religion and percentage of the SC population show no association with fertility indicators while the ST population percentage affects son preference. Women's labour force participation and women's empowerment are also not significantly associated with any of the four fertility indicators. States with high TUFR that are not able to translate their wanted fertility rate into actual fertility rate include Bihar, Uttar Pradesh, Jharkhand, Madhya Pradesh, Gujarat, Rajasthan, and Haryana. Bihar and Uttar Pradesh have high TFR while the remaining states have TFR in the range of 1.5 to 2.1. Again, Bihar and Uttar Pradesh have high son preference and low use of modern family planning methods, but while Bihar has high early marriage, Uttar Pradesh has a medium prevalence of early marriage. Madhya Pradesh has high early marriage and medium son preference but also has a high use of modern family planning. Rajasthan and Haryana have high adoption of family planning but they need to make the transition in terms of early marriage and son preference from medium to low. Gujarat has medium adoption of family planning and needs to perform better in this aspect besides changes in attitudes to improve early marriage and son preference bias. Thus, the multitude of interconnections between various socioeconomic factors results in differential fertility patterns at the state/UT level as evident from Table 2.

The classification of states/UTs in India reveals

the diversity among states in fertility patterns. The experience of states/UTs attaining TFR less than 2.1 is quite diverse and includes the son preference, adoption of family planning, and early marriage ranging from low to high. It demonstrates the significance of socioeconomic differences, cultural attitudes and social norms that influence fertility patterns and can be very useful in policy formulation. Our study confirms that there is an absence of any clear divide based on regions.

There is an indication of well-known persistence in behavioural patterns and gendered social norms as evident in the preference for sons, the widespread prevalence of early marriage and early childbearing, and the fact that women do not want to limit family size. The differences across states call for a closer evaluation of causal factors that can account for differences in fertility patterns and preferences. Socioeconomic factors like income class, female and male education, place of residence or location i.e. rural vs urban, and caste do play a role. But deep-rooted cultural and social attitudes to early marriage, and adoption of modern family planning also influence fertility preferences. Thus, while socioeconomic diversity and heterogeneity influence fertility patterns and preferences, the study does not find evidence of commonality in fertility behaviours region wise.

## 6. Conclusion

In conclusion, our study uses data from the most recent nationally representative survey in India to examine cross-sectional differences in fertility patterns in states and UTs of India. Our analysis highlights that the prevailing marked diversity in socioeconomic, cultural, and social norms and behaviours is mirrored in the significant heterogeneity in fertility outcome patterns. In particular, fertility levels, son preference, and early childbearing vary significantly across states and are correlated with key proximate socioeconomic determinants. The analysis in the present study provides a useful understanding of fertility behaviours and can help in policy formulation by identifying key correlates of fertility patterns and outcomes. Further, the study argues that fertility patterns in India do not exhibit region wise differences and that such patterns are best understood at the state-level or further levels of disaggregation. The study argues that successful policy intervention needs to address the specific socioeconomic factors that vary from state to state. The major limitation of the study is that it does not establish the causal factors of fertility patterns through use of cross-sectional regression or panel data analysis. The level of aggregation used for the present study is statelevel analysis. Thus, the further scope for study also lies in an analysis at the district, and block/local levels to understand the significance of specific contextual factors.

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## Skill Development and NEP 2020: Shaping a progressive India

Dr. Jasdeep Kaur\*

## Abstract

India's ambition to evolve into a developed nation under the "Viksit Bharat" vision requires a strong educational framework that can cultivate a proficient workforce. The National Education Policy (NEP) of 2020 emerges as a transformative tool in this endeavor, emphasizing the pivotal role of skill development in driving socioeconomic progress. In light of NEP 2020, this article assesses the function of skill development programs, attempting to clarify their significance, difficulties, and possibilities for promoting inclusive growth. The findings emphasize the importance of skill development in aligning education with industry demands and highlight implementation challenges like curriculum alignment and infrastructure constraints. The study offers suggestions to enhance the effectiveness of skill development programs, supporting India's vision for a prosperous and empowered society.

**Keywords:** New Education Policy, NEP 2020, Skill development, Viksit Bharat, Digital literacy

## Introduction

India is on a transformative journey towards achieving the vision of a developed India, known as "Viksit Bharat." This vision seeks to push the country toward socioeconomic success, technological innovation, and inclusive growth, and it is motivated by the aspirations of its people (Jain, 2024). The National Education Policy (NEP) of 2020, which provides a reformative framework, is crucial to this ambition. With the aim of revamping the system to meet the challenges of the twenty-first century and foster a culture of innovation, creativity, and lifelong learning, the NEP 2020 represents a dramatic change in India's educational environment. At the core of India's path to development lies the critical need for skill enhancement. In a swiftly changing global economy marked by technological advancements and shifts in employment trends, acquiring pertinent skills is essential (Basu, 2024). Skill development enhances employability, stimulates entrepreneurship, fosters innovation, and drives economic progress. The NEP 2020 emphasizes integrating skill training and vocational education into the regular school system, recognizing its role in nation-building. This approach aims to equip learners with the skills needed to thrive in a dynamic, competitive environment. However, there is a gap in the literature regarding the evaluation of the skill development courses promoted by NEP 2020. This research seeks to assess the effectiveness and challenges of these initiatives, providing policymakers and educators with insights to improve implementation and shape India's education and skill development agenda.

## NEP 2020: A framework for skill development

India's National Education Policy (NEP) 2020 is a comprehensive framework designed to modernize the educational system in order to address the demands of the twenty-first century. It emphasizes skill development

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heavily because it understands how important it is for promoting innovation, improving employability, and accelerating economic growth. The NEP 2020's main provisions pertaining to skill development are listed below:

- Holistic Education: NEP 2020 aims to provide a holistic education that goes beyond rote learning. It emphasizes on critical thinking, creativity, and problem-solving skills, marking a dramatic transition in the Indian educational system towards a skills-centric approach (Seth et al., n.d.).
- 2) Vocational Education: Vocational education holds undeniable importance in preparing individuals for the workforce by imparting practical skills and knowledge essential across diverse industries. It serves as a potent tool for enhancing youth employability, effectively bridging the skills gap prevalent in the job market, and promoting longterm sustainability. NEP 2020 recognizes the critical role that vocational education plays and emphasizes the importance of incorporating it into the larger educational framework in order to better match educational pursuits with the ever-changing needs of the modern world (Parvanda, 2022).
- 3) Digital Learning Digital literacy is crucial for better academic performance, increased interest in learning, and readiness to tackle future challenges in the digital era (Murtadho et al., 2023). The NEP is committed to using digital learning technology as a tool to advance inclusive education practices, as

evidenced by its emphasis on digital learning. The policy paves the way for a more technologically advanced and inclusive educational environment by acknowledging the contribution of ICT in raising educational standards and providing equitable access to learning opportunities (Binoy et al., 2023).

- 4) **Experiential Learning** NEP 2020 highlights the importance of experiential learning and inquirybased methods in education to nurture critical thinking and practical competencies. By involving students in active participation comprising exploration, reflection, and application, experiential learning enhances communication aptitude, self-assurance, and critical thinking prowess, thereby fostering practical insights and experiences (Sachdeva & Latesh, 2023).
- 5) Business-academia collaboration- With an emphasis on business-academia collaboration to suit industrial objectives, the New Education Policy advocates for a substantial overhaul of education. India's aspiration to succeed internationally depends on this teamwork ('Industry-Academia Collaboration; the Catalyst for India's Education Revolution', 2023). NEP contributes to the economic prosperity of India by improving skill development and graduate employability through the integration of real-world perspectives.

# Literature Review

The literature review has been presented in this section in a tabular format for better clarity and readability:

Author(s) & Year	Key Focus/Findings	<b>Relevance to Skill Development</b>
P.S. Aithal & Shubhrajyotana Aithal	Comparative analysis of NEP 2020	Highlights policy changes in
(2020)	with previous policies, focusing on	higher education to enhance skill
	higher education reforms.	development.
P. Kalyani (2020)	Examined NEP 2020's effects on	Stresses the importance of preparing
	stakeholders and emphasized future	stakeholders for skill-based
	awareness of its impact.	education.
Panditrao MM (2020)	Addressed NEP 2020's principles,	Highlights higher education's role in
	objectives, challenges, and solutions	preparing students for 21st-century
	with emphasis on higher education.	skills.

Wankhade (2021)	Studied higher education's role in	Advocates for inclusive skill
	economic and social mobility, with	development across diverse
	emphasis on inclusivity.	socioeconomic groups.
S.G. Sontakke et al. (2022)	Discussed NEP 2020's focus on	Aligns with the policy's vision to
	preparing youth to face global	equip learners with global skills
	challenges effectively.	
S. Yenugu (2022)	Critiqued NEP 2020, noting	Suggests better implementation for
	many ideas are already in practice	fostering skill-based education
	and emphasized the need for	
	academic, logistical, and financial	
	commitments.	
Chatterjee, Das, & Nandi (2022)	Studied student knowledge of NEP	Revealed gaps in awareness and
	2020 implementation in higher	the need for better dissemination of
	education.	skill-based education policies.
Dwivedi, V., & Joshi, M. (2023).	Explored internationalization of	Highlights the global relevance of
	higher education under NEP 2020.	skills promoted by NEP 2020.
Patil, D. (2024)	Evaluates NEP 2020's impact	Emphasizes NEP 2020's role in
	on skill education, job readiness,	aligning education with industry
	and economic growth. Highlights	needs and preparing a workforce for
	vocational training, experiential	the 21st-century economy.
	learning, and lifelong adaptability	
	for a dynamic job market.	

# **Objectives of the Study**

- 1. To contemplate the role of NEP 2020 in fostering skill development and its contribution to India's socioeconomic progress.
- 2. To assess the significance of skill development programs in aligning education with industry demands through secondary research.
- 3. To provide suggestions for enhancing the effectiveness of skill development programs under NEP 2020.

## Importance of the Study

This study emphasizes how NEP 2020 integrates education with industry demands to improve employability and propel economic success, underscoring the significance of skill development as a pillar of India's "Viksit Bharat" goal. It highlights how skill development may overcome socioeconomic gaps and provide equal opportunities, hence supporting inclusive growth. The paper also highlights important implementation issues, like curriculum misalignment and insufficient infrastructure, and offers practical suggestions to improve the efficacy of skill-development initiatives. This study supports the transformative potential of NEP 2020 in creating a workforce capable of fulfilling the needs of a dynamic global economy by bridging the gap between education and industry, hence helping India's long-term development **Empowerment through skill development** 

In shaping "Viksit Bharat@2047," Prime Minister Narendra Modi charts India's journey towards a 30 trillion-dollar economy by the time the country celebrates its 100 years of independence. To address the evolving needs of the sector and acknowledge the vital contribution of blue-collar workers, the objective is to provide essential skills training to more than 400 million individuals by 2030 and the partnership between new technology, especially artificial intelligence (AI), and the blue-collar workers is essential to this ambition. With this blend of technical innovation and human expertise, India hopes to bridge the skills gap and optimize workforce contributions. With skilled labor and AI integration, this concentrated endeavor aims to position India as a powerful global economic force by 2047 (Krishna, 2024) and to this end, skill development courses play a crucial role. These courses give students hands-on training that is customized to the demands of the industry, giving them the skills, they need to succeed in their positions. India can make sure that its workforce is flexible and competitive in a world that is constantly changing by providing training programs that are both current and easily accessible. People can stay up to date with new developments in technology and market trends by participating in upskilling and continuous learning programs, which will increase their economic contributions.

By 2027, India will have the world's largest workforce with a median age of 28.1 years, underscoring the need for targeted skilling efforts to drive economic growth. Currently, a significant skills gap leads to underemployment and unemployment, which can be mitigated by effective skill interventions. Skill development boosts productivity and efficiency by equipping workers with industry-specific knowledge. It also fosters entrepreneurship, turning individuals into job creators and enhancing regional economies. Additionally, skilled labor is crucial for India's global competitiveness, ensuring the production of goods and services that meet international standards. Prioritizing skill-building programs can unlock the potential of India's labor force and promote long-term economic growth.

The Global Skills Gap Report highlights that the highest skills gap after Brazil are reported in Indian workforce indicating the need for skill development to boost labor productivity and economic growth (Chaturvedi, 2022). India faces issues relating to skills shortage but increased access to opportunities for skill development can help close the widening skills gap in the workforce and employment possibilities and adopting the New Education Policy will make it possible to provide vocation-based training, which will support skill development and vocational education.

NEP 2020 aims to provide high-quality education and skill development opportunities, enabling individuals to pursue diverse career paths, including entrepreneurship. Skill development reduces reliance on traditional job channels, instills confidence, and enhances socioeconomic status. As individuals leverage their skills to drive innovation and progress, they become agents of change, contributing to national resilience and sustainability. NEP 2020's skill development program promotes economic growth, encourages creativity and entrepreneurship, and equips youth to independently contribute to a prosperous India.

In India, empowering young people with skills is essential to establishing self-reliance. NEP 2020 aims to provide high-quality education and skill development opportunities, enabling individuals to pursue diverse career paths, including entrepreneurship. Skill development reduces reliance on traditional job channels, instills confidence, and enhances socioeconomic status as individuals leverage their skills to drive innovation and progress, they become agents of change, contributing to national resilience and sustainability.

# **Transforming education landscape**

NEP 2020's guidelines are expected to greatly increase exposure to vocational education in schools and higher education systems by 2025. The collaborative efforts involving secondary schools, ITIs, polytechnics, and local industry are expected to bring about this shift. Through these collaborations, vocational education will be smoothly incorporated into secondary education, providing students with real-world experience and knowledge pertinent to the business. Moreover, the framework proposed by the University Grants Commission (UGC) aims to align general education with vocational and skill education. This framework serves as a vital tool for identifying skills gaps, mapping local opportunities, and recognizing prior learning experiences. Consequently, it is anticipated that students' job chances will significantly improve. Additionally, the newly implemented credit-based system will make it easier for students to transition between general and vocational education and because of this flexibility, students can easily move between several educational paths and develop a wide range of skills. As a result, students will be more equipped to handle the demands of the dynamic labor market and make a significant contribution to the workforce and economic development of India.

Below are examples of kind of skill development courses introduced under NEP:

- Information Technology (IT) and Computer Science: These courses encompass programming, web development, data analysis, and other soughtafter tech skills.
- 2) Entrepreneurship Training: Designed to equip students with the knowledge and skills necessary for initiating and managing their own ventures.
- Vocational Training in Various Disciplines: This includes carpentry, mechanics, agriculture, healthcare, among others, providing students with practical skills relevant to specific trades.
- Soft Skills Enhancement Programs: Focusing on communication, collaboration, critical thinking, and problem-solving abilities, vital for success across diverse career paths.

#### Importance of skill development

Skill development is at the very heart of Viksit Bharat's forward-thinking strategy for India's all-encompassing advancement. With a clear aim to position India as a frontrunner in the global economic arena through its demographic advantage, the importance of skill enhancement cannot be underestimated and the following points indicates why:

## 1. It enhances employability:

A person's ability to secure employment and progress in their career is contingent upon having pertinent skills in the highly competitive job market of today. People can succeed in a variety of professional fields by developing their technical, cognitive, and interpersonal skills. Through the alignment of educational curricula with the demands of the labor market, skill development efforts serve to bridge the gap between theoretical knowledge and practical application, ultimately improving the employability of job seekers and graduates.

### 2. It boosts economic growth

The advancement of society and the economy are directly impacted by investments in skill development. In addition to being more productive, a trained workforce raises levels of savings, consumption, and revenue creation. The skill development also encourages social inclusion, lowers poverty, and supports equitable development across regions by providing marginalized and disadvantaged populations with marketable skills.

### 3. It fosters entrepreneurship and innovation

Creativity, problem-solving skills, and business acumen are developed through skill development, which promotes an entrepreneurial culture. Viksit Bharat promotes the development of an entrepreneurial mindset, enabling would-be business owners to launch profitable projects, provide employment, and support economic expansion. The policy drives India's progress towards becoming a global innovation hub by encouraging innovation and technology adoption, which in turn catalyzes the development of cuttingedge solutions, products, and services.

# 4. It promoting social inclusion and equality

In order to increase social inclusion and lessen gaps in opportunity access, skill development is essential. The significance of imparting skill training to disadvantaged and marginalized populations, like women, youth, people with disabilities, and rural communities, is emphasized by Viksit Bharat.

## 5. It helps in adjusting to technological disruptions

The nature of employment is always changing at a time of rapid technology growth and digital transformation. While new occupations requiring specific abilities are emerging, traditional work functions are being increasingly automated. A person's ability to adjust to these changes is greatly aided by skill development, which promotes lifelong learning, digital literacy, and technological competency.

To put it simply, skill development is essential to Viksit Bharat's larger goal of transforming India, not merely a means to an end. The policy lays the foundation for a prosperous, empowered, and globally competitive India by making investments in the development of human capital and encouraging a culture of lifelong learning and skill building.

# Impact of skill development courses on various stakeholders

## **Students:**

Students who take skill development courses benefit greatly from having real-world, industry-relevant abilities that improve their employability and career prospects. Students receive practical instruction and opportunities for experience learning, which help them solve problems, become more confident in their skills, and gain important insights into the disciplines they have chosen. Additionally, skill development programs frequently offer opportunities for both professional and personal development, giving students a sense of empowerment and self-efficacy. Graduates of skill development programs are therefore more equipped to launch their businesses, pursue further education, or enter the workforce, all of which contribute to their socioeconomic advancement.

## **Educational institutions:**

For educational institutions, skill development courses present an opportunity to diversify their offerings, attract a broader range of students, and strengthen their ties with industry partners. Institutions can improve their relevance and responsiveness to market demands and guarantee that their graduates are ready for the workforce by incorporating skill development into their curricula. The collaborations with companies and industry associations can also give educational institutions important insights into new developments in technology, skill requirements, and emerging trends. This helps them to successfully modify their programs to meet the demands of both the present and the future.

# **Employers:**

Through access to a pool of competent and skilled applicants who can contribute to their organization's success, employers stand to gain a great deal from skill development efforts. Employers can lessen the difficulty of hiring new employees, cut down on training expenses, and speed up the onboarding process by hiring graduates of skill development programs. Additionally, proficient workers are more likely to be creative, flexible, and productive, all of which improve a company's ability to compete and survive. The relationship between academia and business can help address specific skill gaps within industries, and influence curriculum design through skill development collaborations with educational institutions.

## **Economy:**

The courses in skill development are essential for stimulating economic expansion, encouraging creativity, and lowering unemployment. Technological developments across sectors, investor attraction, and productivity enhancement all depend on having a trained workforce. Furthermore, by coordinating skill development programs with national development priorities, governments may boost entrepreneurship, generate new job opportunities, and improve the economy's overall competitiveness. In addition, a proficient labor force empowers economies to adjust to evolving market conditions, seize new prospects, and handle worldwide obstacles with greater efficiency, all of which support enduring sustainable growth.

### **Challenges and barriers**

Despite the numerous benefits of skill development courses, several challenges and barriers hinder their effective implementation:

- Lack of Awareness: Many individuals, especially in marginalized communities, may lack awareness of available skill development opportunities or may perceive them as less prestigious than traditional academic pathways.
- *Quality Assurance*: Ensuring the quality and relevance of skill development programs remains a significant challenge, particularly in rapidly evolving industries where skill requirements change frequently.
- Infrastructure and Resources: Limited access to adequate infrastructure, equipment, and qualified instructors can impede the delivery of high-quality skill development training, especially in remote and underserved areas.
- Industry Alignment: Maintaining close alignment between skill development curricula and industry needs is crucial but challenging, as industries evolve rapidly, and educational institutions may struggle to keep pace with changing requirements.
- Funding and Sustainability: Skill development initiatives often require substantial financial resources to sustainably operate and scale. Securing funding and ensuring long-term sustainability can be challenging, particularly for non-profit or government-led programs.

 Social Stigma: There may be a social stigma associated with vocational education and skillbased careers, leading to perceptions of inferiority or limited social mobility compared to traditional academic pathways.

Many of these challenges will be addressed through the NEP 2020, which highlights the importance of vocational education and skill development. By integrating skill development into mainstream schooling, many of the obstacles encountered previously can be overcome.

### Effective strategies for improvement

- Linking Corporate Social Responsibility (CSR) to Skill India Movement: Incentives for CSR contributions towards sector-specific skilling projects can be used to encourage corporate sector engagement in the Skill India movement. Companies can meet their social responsibility duties and help to generate a skilled workforce by coordinating their CSR efforts with national skill development initiatives.
- Ensure Policy Frameworks Are Attractive: To encourage educational institutions to work directly with industry partners to equip people in key sectors, create frameworks for appealing policies. This could include subsidies, tax incentives, and recognition programs for educational institutions that actively participate in industry-led skill development initiatives.
- Support for educational institutions: Financial assistance and incentives should be given to educational institutions in order to encourage them to start or grow skill development courses and training programs. Grants, low-interest loans, or subsidies could be made available to help with infrastructure construction, faculty training, and operating costs.
- Facilitate Industry Collaboration: The government ought to encourage more corporate and industry involvement in the development of course curricula for skill-based programs. Set up procedures for

collaborations between industry and academia to co-create and validate course materials, guaranteeing compliance with industry standards and expectations.

- ◆ Market Trends and Opportunities: Promote research projects that pinpoint market trends and opportunities in important industries that are skill development-focused. For example, research funding in the field of information technology may be given to investigate how machine learning and artificial intelligence applications in cybersecurity could be used to counter new and emerging cyber threats.
- Government Funding for Innovation: To encourage innovation in the fields of skill development, the government should offer financial support as well as incentives. Create innovation grants, for instance, to encourage the creation of innovative teaching strategies, technological advancements in education, and learning materials suited to the requirements of business.

# Conclusion

The National Education Policy and a renewed emphasis on skill development are driving initiatives which put India on the verge of a revolutionary journey to restore its historical role as a hub of knowledge and innovation. India has long been known for its vast intellectual capability and rich knowledge legacy. The NEP 2020 aims to capitalize on this natural ability by supporting millions of students in both secondary and higher education nationwide. India hopes to improve the quality and accessibility of education by incorporating technology through programs like online degree programs and digital resources, giving students the information and abilities, they need to succeed in the digital age.

To sum, the skill development programs outlined in NEP 2020 play a vital role in achieving the vision of an empowered and prosperous India, leading the world in innovation and knowledge generation. As India continues its journey towards educational transformation, it is imperative to prioritize skill development as a strategic imperative, ensuring that every individual has the opportunity to unlock their full potential and contribute to the nation's growth and development in the 21st century and beyond.

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