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Contents

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National and International Influential determinants with FDI Inflows: Dynamic Panel Data Method

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Abstract

The study aims to evaluate the relationship of various international and national determinants on the foreign direct investment inflow of forty-five Asian nations. A nation's ability to develop economically is dependent on foreign direct investment. It may be various kinds like brownfield FDI, greenfield FDI, vertical FDI, horizontal FDI, inward FDI and outward FDI. Moreover, FDI is not independent; it depends on various determinants that can be divided into two parts: international and national determinants. Dynamic panel data analysis has been considered over twenty-five (1989-2022) years of secondary data. Hence, globalisation, inflation, and trade openness are considered international determinants, whereas the human development index, gross capital formation, market size, and infrastructure are treated as domestic determinants. The result reveals that trade transparency, market size, gross capital formation, and infrastructure have a favourable association with the inflow of FDI. Policymakers should emphasise the promotion of these determinants for the enhancement of the inflow of FDI.

Keywords**:** *Asian Nations, International and Domestic Determinants.*

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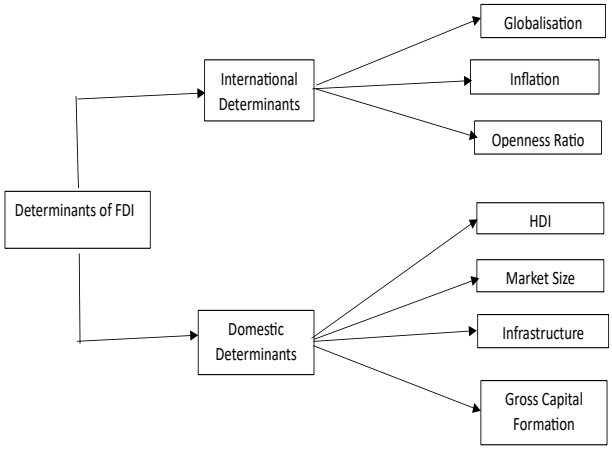
1. Introduction

Capital, quality human resources, technology, and natural resources are the key variables for economic development. Capital is treated as the nerve system of the economy, which positively affects GDP and overall growth subject to proper utilisation. A shortage of capital may be overcome by utilising FDI. It can be treated as a direct investment of a company in another company, purchasing a company, or establishing a new company in another country that contains capital, skills, and technology (Denisia, 2010). FDI takes various forms like vertical, horizontal, conglomerate FDI (based on types of activity), greenfield FDI, foreign takeover (based on type of entry), FDI inward, and FDI outward (based on flow of direction) (Kojima, 1985).

In 2022, the growth rate of FDI is 45% (OECD, Stat), whereas the GDP growth rate is 9.1% (IMF). The majority of the world utilises FDI as a driving force for economic boosts and social upliftment. But FDI inflow depends on various domestic and international determinants like human development, market size, infrastructure, gross capital formation, globalisation, inflation rate, openness ratio, etc. (Chetanbhai & Desai, 2019). So, FDI inflow is not independent; it depends on several determinants. The subsequent figure -1 reflects these.

Figure-1



Hence, globalisation, inflation, and openness ratio are marked as important factors of international determinants, whereas HDI, market size, infrastructure, and gross capital formation are noted as domestic determinants due to various reasons. Globalisation is the integration of the ingress and egress of resources among nations. Presently, it dominates the global economy (Friedman, 2005) and safeguards resource mobility and transparency for maintaining sustainable international trade (Cuterela, 2012), which is defined as the ratio between total exports and imports with respect to the GDP openness ratio. The price of resources for international trade has changed due to the imbalance situation of supply and demand, which is treated as inflation (Baum et al., 1999). So, these three factors can be evaluated as international determinants of the inflow of FDI.

Any nation (Sagar & Najam, 1998) that is capable of treating itself as a domestic element may control the "Human Development Index," which is an integrated form of health, income, and education (Datta & Shing, 2019). Suitable infrastructure is one attractive element that influences the business (Prus & Sikora, 2021). The county's economy will also be dominant in it. Hence, the GDP per capita is the indicator of market size, which depends on total GDP and the total population of the country (Mayer et al., 2014). It also highlights the domestic element. Another side of gross capital formation is the country's own stock (Ntamwiza & Masengesho, 2022), which presents the strength of the nation and can also be treated as a domestic element.

In Asia, FDI flow reached 662 billion dollars in 2022, as per the report of UNCTAD on 5th July 2023. This is also subject to determinants. Various studies (Sridharan & Rao, 2010; Sahoo, 2006) disclose that a set of explanatory variables affects the FDI inflow. But studies relating to Asia regarding this issue during this specified time period are not disclosed. The present study is devoted to seeking the association of FDI inflow and determinants in Asian nations.

The result reveals that globalisation and the openness ratio of international determinants have a positive and significant association with the inflow of FDI. Whereas market size, infrastructure, and gross capital formation of domestic determinants have a favourable and substantial correlation with FDI inflow. But inflation of international determinants has a negative and significant association with the inflow of FDI of Asian nations.

2. Literature Review and Hypotheses Development:

In 1999, Duran conducted a study during the period 1970-1995 by using time series analysis to find out the influential determinants of FDI inflow. The study discloses that market size, growth, economic stability, openness ratio, and savings act as important determinants of the inflow of FDI. In 2013, Kaur and Sharma examined the association between the rate of enhancement of GDP and the inflow of FDI from twenty-nine countries. But they are unable to find out the relationship. Nonnenberg and Mendonca (2004) analyse the thirty-three countries' data during the period 1975-2004 and find out that the size of the market, rate of economic growth, risk rating of the country, and behaviour of the stock market are vital elements of the inflow of FDI. In 2006, Bhati Usha conducted a study on various determinants and FDI inflow of sixty-two nations. The study discloses that during the periods 1989 to 1994, 1995 to 99, and 2000 to 2003, the GDP is substantially and favourably correlated with the inflow of FDI. For the periods 1989 to 1994 and 1995 to 1999, exports had a positive and significant association with FDI inflow, whereas various social and economic elements such as age, education, rate of inflation, and consumption of electric power and FDI had a negligible relationship. In 2006, Sahoo used a panel data co-integration test to look into how a few factors affect the flow of foreign direct investment (FDI). The outcomes demonstrate that trade openness, market size, and labour growth all have an equal long-term relationship with FDI inflow in South Asian countries. In 2008, Demirhan and Masca performed a study to look into the connection between various determinants and FDI inflow in thirty-eight countries that were developing during the period of 2000-2004 through panel data analysis. The result discloses that the per capita growth rate of GDP, openness ratio, and length of telephone line (per 1000 people) are positively and statistically significant associations with the FDI inflow. On the other side, inflation rate and tax rate have a negative and significant association, but political risk and labour cost have an insignificant relationship with FDI inflow. In 2010, Mottaleb and Kalirajan used 'panel data analysis' during the period 2005 to 2007 on sixty-eight developing nations for determining the elements that affect the FDI flow. The result discloses that the GDP enhancement rate, infrastructure, labour and communication system, foreign aid, and business environment are significantly and positively associated with the FDI inflows. In 2010, Sridharan and Rao explored the various elements of the FDI inflow into BRICS nations for the time frame 1975–2007 by applying panel data analysis. The outcome discloses that the size of the market, gross formation of capital, cost of labour, rate of exchange, and infrastructure are treated as important elements of FDI inflows in BRICS countries. On the other side, stable economies and openness ratios have a statistically insignificant relationship. In 2011, Ranjan and Agrawal investigated the elements of inflows of FDI into BRICS countries during 1975–2009 on thirty-five nations by using a random effect model of panel data analysis. The result discloses that openness ratio, market size, labour cost, facility of infrastructure, and economic enhancement are the elements of FDI inflows. Hence, economic growth and stability don't really affect anything, whereas labour costs and gross capital have an insignificant relationship. In 2011, Shylajan investigated the important determinants that affect the FDI inflow in India for the period 1993-2006 through the application of analysis of multiple regressions. The study reveals that the FDI inflow is positively associated with the gross domestic product, whereas it is negatively associated with FDI outflows. In 2011, Seetanah and Rojid explore the elements of FDI inflow in Mauritius. Hence, the result of the study was analysed by using the differenced vector autoregressive model. It noted that labour quality and openness ratio are the vital elements of FDI inflow in Mauritius. Another side is that size of market has a lower impact on FDI inflow. In 2012, Khachoo and Khan investigated the determinants of the inflows of FDI during the period 1982–2008 in thirty-two nations by using the OLS method, Panel Unit Root, and co-integration tests. Results reveal that the size of the market, cost of labour, openness ratio, and infrastructure have strong associations with FDI inflows. Sahni (2012) conducts a study on the elements of FDI inflow into India between 1992–1993 and 2008–2009 by using 'Time series analyses. The result discloses that inflation, GDP, and trade openness ratio have an

influential impact on FDI inflows in India, whereas the foreign exchange rate is reflected as insignificant. Jadhav (2012) conducts a study for exploring the determinants regarding institutional, economic, and political factors that attract FDI inflows through the panel data method during the tenure of 2000–2009 in BRICS nations. Natural resources, openness ratio, and market size are considered economic determinants, whereas inflation rate, stability of politics, quality of regulatory authority, effectiveness of government, rule of law, voice and accountability, and control of corruption are treated as institutional and political variables for influencing the FDI. Results disclose that the size of the market has a significant positive effect on the inflow of FDI; it implies that foreign investment is attracted due to the market size of BRICS nations. Openness ratio has a significant and positive effect on FDI inflows. Rule for law, accountability & voice, and availability of natural resources have significant impact. Hence, the result also concludes that the determinants relating to economics are more significant than political and institutional variables in BRICS nations. In 2018, Pattayat uses VAR, co-integration analysis, the augmented Dicky-Duller test for evaluating the relationship with FDI inflows, and a few variables that are independent, like GDP, inflation rate, external debt, rate of exchange, etc. Among these, the inflation rate is positively and significantly associated with the FDI inflow of India. Bandekar (2019) examines the association between various determinants and the inflow of FDI from India during 1995–2014 by using time series analysis and VAR analysis. The result reveals that exchange rate, imports, reserves, Nifty 50, and internet users are related to FDI inflows and statistically significant, whereas GDP growth, inflation rate, and labour force participation rate are statistically insignificant variables. Bandekar and Sankaranarayanan (2014) use the data for the period 1991 to 2012 by applying the OLS method of regression analysis for determining the important factors that attract FDI in India and China. It also compares the variables to find out the attractiveness. Results disclose that in India market size, high market growth, globalisation policy, and lower cost of capital attract FDI, whereas in China market size, infrastructure, and economic development are the influential variables for FDI inflows. Market size is a popular element for the FDI flows for China and India. Saini and Singhania (2018) conducted a study on eleven developed and nine developing nations during the tenure 2004–2013 by applying the panel data method to examine the impact of various elements of FDI inflows. The findings show that in developed countries, FDI is affected by increasing GDP, trade openness, and the freedom index. On the other hand, in developing countries, FDI is linked to factors that increase fixed capital formation, trade openness, and labour efficiency. In 2019, Uddin et al. examine the relationship between institutional elements and FDI inflows in Pakistan. The study considered various institutional variables, among them government size, legal structure, freedom of trade, and liberty relating to civil liberties, which are treated as influential elements for FDI inflows. The study also noted that in the post-liberalisation period, institutional determinants act as vital forces for attracting FDI inflows in Pakistan. This also adds that the government of the military is more attractive than the government of the democratic for FDI inflows in Pakistan.

Literature relating to FDI determinants has disclosed various directions of determinants for specific areas and time periods. But studies relating to international determinants like globalisation, inflation, openness ratio, and domestic determinants like HDI, market size, infrastructure, and gross capital formation for Asian nations during the period 1998 to 2022 are not accessible. The present study will try to reveal the relationship of these determinants with FDI inflow for the said nations and time. It may add to the value of existing literature.

Among various international determinants, globalisation plays a vital role for economic growth. In 2016, Zekarias conducted a study on Portugal during the period 1990–2008 by using the GMM model for identifying the association between FDI and globalisation. The result reveals that a positive relationship between these two elements exists. Coulibaly (2018) also finds a positive association between FDI and globalisation. In 2008, Dreher et al. argued in their study that globalisation promotes FDI. Incekara and Savrul (2012) find a positive association between FDI and globalisation. A study by Aluko et

al. (2021) used the Dumitresu-Hurlin panel Granger causality test on 50 countries from 1996 to 2016 to find out how globalisation affected FDI and found that there is a positive relationship. Bitzenis (2012) describes how globalisation is positively associated with FDI. Dima (2016) conducted a study on Romania over 25 years to identify the association between FDI and globalisation. The study reveals the positive relationship. Singh (2019) also examines the positive association between FDI and globalisation. So, there should be an association between FDI inflow and globalisation.

Hypothesis 1 (H_1): *There is an association between globalisation and the inflow of FDI.*

The inflation rate indicates the stability of the price. It acts as a determinant of the inflows of FDI. In 2010, Kaur and Sharma conducted a study on India and revealed that the inflation rate has a significant impact on the inflows of FDI. In another study, Sharma and Rishad (2020) prove that the inflation rate has a significant impact on FDI inflow by using the ARIMA model. But in the study of Shylajan (2011), the reverse result is reflected between these two variables. In 2015, Malik investigated the positive relationship between the inflow of FDI and inflation in Pakistan. Sahni (2012) investigates the positive association of FDI inflows and inflation rate in India by applying the time series analysis method. He also noted that it is the most attractive variable for FDI inflows. In Pakistan, this is also positively associated (Jawaid & Saleem, 2017). In India, Parul (2021) noted that these are positively and insignificantly related. In the study of Madaan and Chowdhry (2016), a positive and insignificant association was reflected between FDI inflows and the inflation rate. So, based on these arguments, the following hypothesis can be drawn.

Hypothesis 2 (H_2): *There is an association between inflation and FDI inflow.*

Openness ratio is the combined form of export, import, and GDP, which has a relationship with FDI inflows. In 2002, Asiedu proved that openness ration acts as a statistically significant element for promoting the inflows of FDI. It depicts the positive effect on the inflows of FDI in the study of Addison and Heshmati in 2003. Quazi and Mahmud (2006) argue in their study that economic freedom and openness affect the inflows of FDI positively. According to a study by Moreira (2009) that used literature as its foundation, the openness ratio favourably affects FDI inflows. Seetanah and Rojjd (2011) conducted their study on Mauritius and found that the openness ratio is the most vital element for the flows of FDI. Additionally, Singh's 2019 study shows that the openness ratio in BRICS countries affects FDI inflows. In 2023, Wang et al. disclose the long-term positive association between inflows of FDI and the openness ratio. Saini and Singhania (2018) examine the association between the inflows of FDI and openness ration in developing nations. Kumar and Ramana (2023) investigate the positive and significant association between these two in India. These arguments can help to establish the hypothesis as follows:

Hypothesis 3 (H_3): *FDI inflow and openness ratio are related to each other.*

All activities relating to development depend on human development. It measures through an index, which is the combination of income, education, and health. Offiong (2020) establishes the association of HDI and FDI in his study, which was conducted between 1995 and 2019 by using the ARDL and other appropriate tests. Two-fold results highlight the relationship. These are long term positive relationships that exist between them, but in the short run there is a negative relationship. Gokmenoglu et al. (2018) conduct a study for identifying the association between FDI and HDI during the period 1972–2013 of Nigeria. The cointegration test of Johansen reveals the long-run association between these two elements. Kaukab and Surwandono (2021) conduct a study on ASEAN countries to find out the relationship between HDI and FDI through panel data analysis during the period 2013-2017. They investigate the positive relationship between these two elements. Mahmood (2012) finds out a positive relationship between HDI and FDI by using the ordinary least squares method during the period 1975 to 2008 in Pakistan. In 2004, Sharma and Gani investigated the positive effect of HDI on FDI for lower- and middle-income countries during the period 1975 to 1999 by using panel data analysis. Tamer (2013) identifies the positive and significant effect of HDI on FDI in African nations. Mwanga

(2022) reveals a positive relationship between HDI and FDI among 124 countries during the period 2009 to 2013 by applying the GMM model. So, HDI and FDI should have a relationship, and the following hypothesis can be depicted.

Hypothesis 4 (H_4): *There is an association between the Human Development Index and FDI inflow.*

Per capita GDP is considered the market size (Vijayakumar et al., 2010). As per Hill and Munday (1992) and Lucas (1993), the size of the market is a vital element for FDI inflows. In 1994, Tsai examined that size of market has a significant and positive impact on the FDI inflow in India. Chen (2010), in his study, proves that market size is a significant element for the inflows of FDI in developing nations. In Europe, this is considered an important element for the inflow of FDI (Mateev, 2009). In 1998, Clegg and Scott-Green examined the data during the period 1951 to 1990 in their study, but the results revealed that there is no significant relationship between size and FDI inflows. The result is reversed when the data is split into two stages, i.e., 1951 to 1972 and 1973 to 1990. Market size and the inflows of FDI are positively and significantly related in the second stage, i.e., 1973-1990. In 2001, Chakrabarti investigated the association between the size of the market and the inflows of FDI in developing nations, and the results strongly supported this association. Asiedu (2002) argues that market size is not an insignificant element for promoting the inflows of FDI. In 2012, Singh and Chauhan proved in their study that market size is an important variable for attracting inflows of FDI in BRICS nations. In India, this has a long-term relationship (Bandekar, 2019). GDP per capita significantly and positively affects the FDI inflows in Pakistan (Saini, Madan, & Batra, 2016). Shaari et al. (2023) conclude in their study that the size of the market has a significant and positive association with the inflows of FDI in ASEAN +3 countries. Hence, these arguments help to draw the hypothesis as below.

Hypothesis 5 (H_5): *There is an association between the size of the market and the inflow of FDI.*

Infrastructure is another vital element of attracting the inflows of FDI. In 1966, Vernon argues that a host country should have sufficient infrastructure facilities to attract the flows of FDI. In 2014, Shah identified in their study that infrastructure has a positive and significant effect on the FDI inflows. Mottaleb and Kalirajan (2010) examine in their study that infrastructure and communication play an effective role in attracting FDI flows. In 2012, Khachoo and Khan argue that infrastructure is a vital element for the inflows of FDI. Infrastructural facilities in India are positively associated with FDI inflows (Dhanora et al., 2016). Mensah and Traore (2023) examine the effect of internet and network infrastructural facilities on FDI inflows. The result depicts the positive association. So the following hypothesis can be drawn on the basis of these arguments.

Hypothesis 6 (H_6): *There is an association between infrastructure and FDI inflow.*

Gross capital formation plays a vital role in economic development (Swamy & Narayanamurthy, 2018). In the study of Krkoska (2003) and Lipsey (2004), it was identified that the gross capital formation of developing countries has a significant effect on FDI. Tabakis et al. (2006) conducted a study based on panel integration and co-integration tests on thirty developing nations during the period 1992 to 2002. This study discloses that gross capital formation and FDI are significantly associated with each other. In 2011, Lean and Tan conducted a study on Malaysian data during the period 1970 to 2099, and they revealed that there is a positive relationship between capital formation and the flow of FDI. A study has been conducted during the period 1970 to 2000 by Al-Sadig (2013) for identifying the association between capital formation and FDI of developing nations. This reveals a positive association between these two elements. So, an association is expected between FDI and gross capital formation.

Hypothesis 7 (H_7): *An association exists between gross capital formation and FDI inflow.*

3. Data and Methodology:

3.1. Sample Design

Twenty-five years (1998-2022) of secondary data from forty-five Asian nations are considered for the study. Countries are selected based on the highest GDP.

Data relating to FDI inflow, openness ratio, size of market, inflation rate, infrastructure, and gross capital formation are collected from the official website of the World Bank Database. Whereas data relating to globalisation is collected from the KOF Swiss Economic Institute, and UNDP is considered a source of HDI-related data. Based on the availability of data, five indicators are considered for calculating the infrastructure index. These indicators are individuals using the Internet, fixed broadband subscriptions, rail lines, air transport, registered carrier departures worldwide, and electric power consumption.

3.2. Description of Variables

FDI inflows are considered a dependent variable, whereas globalisation, inflation, openness ratio, HDI, market size, infrastructure, and gross capital formation are treated as independent elements. As a result, the US Dollar serves as a proxy for FDI inflows, the index reflects globalisation and inflation, the openness ratio is the sum of export and import with respect to GDP, and HDI is a composite measure of health, income, and education (Fries, 1983). The per capita GDP is a measure of market size (Vijayakumar, 2010). The infrastructure index is calculated by using five indicators of infrastructure (Vijayakumar, 2010). Formation of gross capital is considered a percentage of GDP.

3.3. Model Specification and Econometric Estimations

Descriptive statistics have been used for determining the min value, max value, standard division, and mean value of the sample data. Tests of diagnostic statistics, i.e., multicollinearity and heteroskedasticity, are conducted. The regression model has been depicted as follows for determining the relationship between dependent and independent variables.

$FDI_{it} = \alpha + \beta_1 (GLO) + \beta_2 (INFL) + \beta_3 (OPR) + \beta_4 (HDI) + \beta_5 (MS) + \beta_6 (INF) + \beta_7 (GCF) + \varepsilon_{it}$

$LFDI_{it} = \alpha + \beta_1 (LGLO) + \beta_2 (LINFL) + \beta_3 (LOPR) + \beta_4 (LHDI) + \beta_5 (LMS) + \beta_6 (LINF) + \beta_7 (LGCF) + \varepsilon_{it}$ [Taking logs on both sides] …….(1)

…… (2)

FDI_{it} presents the foreign direct investment inflows of the *i*th country at the time t. α denotes the term of constant. β_1 to β_7 highlight the independent variable's coefficient. GLO, INFL, OPR, HDI, MS, INF, and GCF present globalisation, inflation, openness ratio, human development index, market size, infrastructure, and gross capital formation. The error term is represented by $\varepsilon_{it.}$ Equation no. 2 represents the dynamic panel model, where presents the dependent variable lag value.

Dynamic relationships among dependent and independent elements are evaluated by applying the dynamic panel data method. Arellano and Bond's (1991) dynamic panel data analysis methods have been used to find out how the independent elements affect the dependent elements as a whole, as well as the endogeneity of the independent elements and the laggedness of the dependent variable.

Hence, cross-sectional data value is larger than time series data, which is appropriate for using the dynamic panel data method as per rule of thumb. Due to the non-essentiality of a larger time series value for obtaining consistent estimators, it supports the estimation method (Mishra, 2008). The dependent variable of lagged value is considered an independent variable in this model (Altaf & Shah, 2018). Hence, the one-year lag of FDI is considered an independent variable in this model to avoid the endogeneity issue (Wooldridge, 2009).

The dynamic panel data analysis method (Arellano and Bond, 1991) is used under Generalised Method of Movement (GMM). One year lagged value of the inflow of FDI and other independent factors are used as instruments for maintaining the unbiased and consistent results (Basant & Mishra, 2013). Hence, autocorrelation is investigated by using the Arellano-Bond test, whereas validity and overidentification are tested by using the Sargan test (1958).

One- and two-step estimators' methods are being applied under the analysis of dynamic panel data. The Wald Chi-square test and the Sargan test, respectively, evaluate the significance of the overall model and over-identification. We look into this model by looking at dynamism for endogeneity issue analysis. This leads to the strongest conclusions and most reliable estimates.

4. Data Analysis and Findings:

4.1. Descriptive statistics

Basic statistical ingredients of the sample data are tested through mean, standard division, maximum, and minimum values. Table 1 has been used to depict the results of these ingredients. The mean value of the dependent variable is 9.021, which indicates the average inflows of FDI in Asian nations. However, the standard deviation of FDI inflows is 1.004, which emphasises the existence of a moderate degree of dispersion, and the data value ranges from 11.536 to 5.230. The mean value of other independent variables lies between 10.143 and 0.720. The standard deviation is various from 1.005 to 0.086, and the dispersion value of gross capital formation is higher than other independent variables.

Table 1:

Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
LFDI	9.021	1.004	5.230	11.536
LGLO	1.728	0.118	1.371	1.926
LINFL	0.720	0.362	-0.174	2.189
LOPR	1.781	0.240	0.983	2.535
LHDI	1.834	0.086	1.509	1.974
LMS	3.590	0.664	2.015	4.991
LINF	4.623	0 .682	3.089	6.705
LGCF	10.143	1.005	7.741	12.897

Source: *Calculated by Authors*

4.2. Diagnostic Tests

Variance inflation factor (VIF) analysis is applied for detecting the multicollinearity. By the general rule of thumb, if the VIF value is less than 10, then it signifies the data set is free from multicollinearity problems. In line with Klein (1962), if VIF is more than 1/(1–R2) or the importance of tolerance is lower than (1–R2), then it can be said that the presence of multicollinearity is statistically significant.

Table- 2:

Variance Inflation Factor

Independent Variables	VIF
LGLO	3.35
LINFL	1.20
LOPR	1.29
LHDI	5.68
LGDP	4.66
LINF	1.93
LGCF	2.46

Source: Calculated by Authors

The result of the VIF is reflected in Table 2. Results of VIF disclose the numerical value less than 10 and tolerance value greater than 0.1. These results denote the multicollinearity free explanatory elements.

It is assumed that under the regression model, the term of error is not correlated, and the variance of this error term is constant that fits under the homoskedasticity condition. It can also be said that when the term of error is not constant, then it clears the existence of heteroskedasticity, which creates problems regarding the regression model. A test of heteroskedasticity has been implemented, which is reflected in Table 3.

Table- 3:

Test of Heteroskedasticity

Test	Null-hypothesis	Results
Breusch-Pagan / Cook-Weisberg test	Homoskedasticity	7.93***
White's Information Matrix test	Homoskedasticity	308.21***

Source: Calculated by Authors

*Notes: * denotes the significance level is 1 percent.*

The Breusch-Pagan/Cook-Weisberg test and White's (1980) are used to find out the existence of the heteroskedasticity problem. Both tests suggest that there is the existence of heteroskedasticity due to disproving the null hypothesis due to the probability values of both tests being not more than 1 percent level.

4.3. Dynamic panel data estimation

Arellano and Bond's (1991) dynamic data analysis method of panel (Table 6) is to be used for eliminating the problem regarding endogeneity. This dynamic panel data model considers the autocorrelation problem test and the test of validity.

Table 4:

Results of Arellano-Bond GMM-based Dynamic Panel Data Model

Variables	One Step Estimates		Two Step Estimates	
	Coefficient	**z-Stat**	**Coefficient**	**z-Stat**
Intercept	3.75	1.30	6.25***	2.90
$LFDI_{it-1}$	0.45***	4.09	0.46***	6.84
LGLO	-2.69*	-1.75	1.93*	2.25
LINFL	0.07	1.31	-0.10**	-2.71
LOPR	0.56*	2.23	0.38*	2.13
LHDI	0.08	0.03	-2.24	-1.12
LGDP	0.61*	2.14	0.49*	2.50
LINF	0.03	0.20	0 .04*	0.58
LGCF	0.28	1.38	0.34*	2.38
Wald–Chi^2	179.69***		399.57***	
Sargan Test for over-identification			25.166 (p=0.289)	
Arellano Bond Test for AR (1)	-3.85 (p=0.0001)		-3.85 (p= 0.0001)	
Arellano Bond Test for AR (2)	-0.296 (p=0.7672)		-.296 (p= 0.767)	

*Note: I. means statistically the significance level is 1 percent. indicates statistically the level of significance is 5 percent. ** signifies statistically the significance level is 10 percent. II. Robust standard error is the base z-statistic for controlling the heteroskedasticity and autocorrelation.*

Source: Calculated by the authors

Over-identification of statistics is measured through the Sargan test [25.166 (p = 0.289)]. This result signifies the model is free from over-identification related problems. The test of the null hypothesis is not rejected that clears the instruments that are used in the estimation are treated as valid. These instruments do not correlate with the disturbance term (Mahakud & Misra, 2009).

On the other side, it can be said that second-order autocorrelation is not presented in this model due to the insignificant result of the Arellano-Bond test for AR (2). This condition is favourable for the framework of system-GMM, and it can proceed (Kathavate & Mallik, 2012). It was also found that Wald Chi2 is significant for both parts of the dynamic panel data method, which is a strong sign that these models are important. Moreover, the two-step estimator is more robust regarding autocorrelation and heteroskedasticity related issues (Blundell et al., 2000), which stimulates considering a two-step estimator for the study.

5. Results and Discussion:

The study discloses the impact of international and national variables on FDI inflow in Asian nations. The dynamic panel data analysis model shows that globalisation, openness ratio, market size, Infrastructure and gross capital formation significantly and positively influence foreign direct investment (FDI). Conversely, inflation exerts a significant and detrimental impact.

In the study of Dima (2016), a positive and significant association of globalisation and FDI inflow in Romania is reflected. Hence, in Asian nations, globalisation and FDI inflow are also positively associated. Higher degree of globalisation enhances the inflow of FDI. Globalisation procedures place emphasis on various treaties among nations that stimulate the flow of FDI. Openness ratio, size of market size (GDP), and infrastructure have significant and positive effects on FDI inflows. These results were also reflected in the study of Khachoo and Khan (2012). A large number of exports and imports is a reflection of financial strength, which attracts the FDI inflow. Similarly, the market size of any country may influence the market seeking FDI inflow. Generally, sound infrastructure stimulates foreign and national investors to invest in the country. In 2016, Megbowon et al. investigated in their study that the gross capital formation positively and significantly affects the FDI inflow. The same result is reflected in this study. A better position of gross capital formation signifies a good economic environment where foreign investors easily invest

their amount. FDI inflow is adversely affected by inflation. Inflation indicates the economic level of the country. A higher degree of inflation is not good for the economic health of the country, which demotivates the investors and vice versa. In the study of Sayek (2009), this negative and significant result is reflected. Another study of Valli and Masih (2014), which is conducted on African countries during the period 1970 to 2012, reflects the same result. So, money value plays a vital role in the attraction of FDI inflow.

6. Conclusion and Policy Recommendations:

Study conducted on forty-five Asian nations for twenty-five years that discloses the relationship of international and domestic determinants with FDI inflow by using dynamic panel data analysis. International determinants like globalisation, openness ratio, market size, infrastructure, and gross capital formation are significantly and favourably correlated. effect on the FDI inflow. It reveals the enhancement of these variables promotes the inflow of FDI in Asian nations.

Policymakers should place the stress on the flow of globalisation, openness ratio, market size, infrastructure, and gross capital formation for improving the flow of FDI in Asina nations. Inflation reduces the real value of money, which signifies degradation of the real value of the host country's money and reduces the FDI inflow. In this respect, it is better to maintain the minimum inflation to safeguard the economy of a nation. Infrastructure is a vital ingredient for the attraction of FDI inflow. It has a positive effect on FDI inflow, which helps to make decisions about upgrading infrastructure. The results for openness ratio, market size (GDP per capita), and gross capital formation show that increasing the flow of FDI depends on making these variables grow. Policy regarding promotion of FDI inflow should emphasise the improvement of these explanatory variables.

Finaly, the study draws the inference based on the data of sample Asian nations and a specific time period. It provides results that may differ if another sample is used. So, these results are not universally true, and the determinants that are considered in the present study may not be enough. There are a large number of variables that may influence the inflow of FDI in Asian nations. Hence, we considered only a few important determinants that have essentiality for the promotion of FDI inflow. Further study would be based on other important determinants and for another region of the world.

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Macroeconomic Dynamics and their Impact on Bank Profitability

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Abstract

The study utilizes data from a diverse sample of 20 commercial banks operating in the Indian economy. The inflation rate, interest rate, and GDP growth rate are independent variables. Return on Assets and Return on Equity are the dependent variables. The panel data regression analysis allows for examining cross-sectional and time-series dimensions, facilitating an inclusive understanding of the relationship between macroeconomic variables and banks' profitability. The random effect model is utilized to control for unobserved heterogeneity. The results reveal a positive influence of GDP and inflation on banks' profitability, while interest rates do not significantly impact bank profitability. This study is unique in its exploration of how interest rates, inflation, and GDP affect Indian banks' profitability from 2011 to 2021. It finds that only inflation and GDP impact profitability.

Keywords: *GDP, Return on Assets, Macroeconomic variables,Inflation, Return on Equity*

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1. Introduction

Commercial banks have a major and diverse role in economic development. Commercial banks are essential in aggregating savings and directing these funds toward productive investments, stimulating economic growth and development. Banks benefit from a growing economy as it creates opportunities for increased lending and demand for financial services. Economic growth leads to increased business activities, investment, and consumption, generating a higher demand for credit and banking services. Banks can experience higher loan volumes, increased deposit inflows, and improved overall profitability as the economy expands. By growing their bank and generating non-interest revenue, banks can increase their profitability while lowering the ratio of lending to assets. A higher real interest rate can increase bank profitability (Haddad et al., 2022). Banks in financially developed economies, or those with high GDP, interest, and inflation rates, offer more attractive profit potential (Saif-Alyousfi, 2022).

A well-developed financial market with diverse instruments and products supports banks' growth. The larger the economic system, the less profitable the banks are (Ozili & Ndah, 2021). Regulatory frameworks and policies governing the banking sector significantly impact a bank's growth. Sound regulatory frameworks also contribute to financial stability, which is essential for sustained growth. Regulations encouraging transparency, risk management, and capital adequacy enhance banks' credibility and support their growth prospects. Economic factors such as economic growth, interest rates, inflation, financial market development, regulatory environment, technological advancements, demographic characteristics, and global economic integration all contribute to the growth and development of banks. Banks that effectively direct these economic factors can capitalise on opportunities, adapt to challenges, and drive sustainable growth in the dynamic banking industry.

2. Study Variables

Inflation can influence banks' profitability through several channels. High inflation rates may prompt banks to increase loan interest rates to maintain actual returns, potentially widening net interest margins and boosting profitability (Aulia & Arif, 2023; Dewi & Sudarsono, 2021). It can also spur loan demand as borrowers seek to hedge against rising prices. However, it may erode borrowers' repayment capacity, leading to higher default rates and increased provisions for loan losses, thus negatively impacting profitability (Alam et al., 2022).

Interest rates affect various aspects, such as net interest margins, loan demand, funding costs, asset quality, and investment income of the banks. When interest rates increase, banks can often widen their net interest margin by raising loan rates faster than deposit rates, which boosts profitability (Haddad et al., 2022). Negative interest rate policy influences the performance of the banking system (Molyneux et al., 2019); declining interest rates may squeeze net interest margin but can stimulate loan demand, offsetting margin pressures.

GDP positively influences bank profitability by driving loan demand and interest income during periods of economic growth, improving credit quality, and reducing loan defaults. Salike and Ao (2018) found that solid equity capital, operational efficiency, and the ratio of banking sector deposits to gross domestic product substantially improved bank profitability. GDP growth can stimulate investment banking activities and enhance market sentiment, indirectly benefiting banks by increasing fee income and investment returns.

Return on Assets (ROA) is a key profitability metric for banks, measuring how much profit they generate from their assets. It is one of the standard metrics to measure companies' financial performance in different sectors, namely supply chain (Galankashi & Rafiei, 2022) and human resource investments (Šebestová & Popescu, 2022). ROA reflects a bank's efficiency in using resources to create income and allows for competitor comparisons.

RoE measures how effectively a bank provides profit from shareholders' investments. A high ROE indicates that the bank efficiently uses shareholder capital to create returns (Meng & Ugut, 2022). Ensuring sufficient equity is especially crucial for banks, given their reliance on it to uphold capital adequacy

ratios mandated by regulators. This underscores the importance of the notable correlation between capital adequacy and return on equity (ROE), emphasising its significance (Ifeacho & Ngalawa, 2014). ROE also allows investors to compare profitability between banks and assess their potential for future growth based on their ability to generate returns on invested capital.

Research Questions

RQ 1: What is the relationship between specific macroeconomic variables and the Return on Assets of Indian banks?

RQ 2: How do fluctuations in macroeconomic variables impact the profitability of selected Indian banks?

3. Literature review, conceptual model and hypotheses development

A series of studies conducted by various researchers explored the complex dynamics influencing the banks' financial standing across diverse global landscapes (Chowdhury et al., 2022; Khan, 2022; Kumar & Bird, 2022; Jerish, 2021). Chowdhury et al. (2022) scrutinised Bangladesh's commercial banks, both Islamic and conventional, analysing their performance indicators and highlighting the subtle effects of macroeconomic, industry-specific, and bank-centric factors. Identically, Khan (2022) investigated the factors influencing banks' profitability in the Gulf Cooperation Council (GCC) nations, uncovering connections between bank size, GDP growth, and adverse effects from inadequate capital and poor asset quality. Meanwhile, Kumar and Bird's (2022) analysis of Chinese and Indian banks revealed the significance of cost management, bank size, and credit quality on profitability.

Bank Profitability and Macroeconomic Factors

Jerish (2021) emphasised the role of macroeconomic factors on Bangladeshi banks' profitability, contrasting the impacts of GDP growth and inflation. Patti and Palazzo (2020) emphasised how GDP growth affects European Union banks differently depending on their lending portfolios. Almaqtari et al. (2019) found that the profitability of Indian banks is significantly impacted by macroeconomic factors. Firm size, liquidity, asset tangibility, capital adequacy, leverage, and GDP growth boost bank profitability, while firm age and inflation have no significant impact (Isayas, 2022). COVID-19 negatively impacted Ugandan bank profitability in the long run. Short-run profitability declines with non-performing loans and liquidity risks, but it benefits from higher lending and treasury bill rates. Inflation has no significant effect (Katusiime, 2021). Gazi et al.(2024) examined the profitability determinants of Bangladeshi Shariah-based banks, finding that asset management quality, liquidity, and credit risk positively impact profitability, while capital adequacy, operational efficiency, and bank size have adverse effects.

Capital Adequacy, Bank Size, and Stability

Al-Qudah (2020) and Abdo et al. (2021) studied the influences on Islamic banks in Jordan, identifying significant impacts of capital and liquidity ratios. Alharbi (2017) found that capital ratio, GDP, and bank size have a positive impact on Islamic banks. Tennant and Folawewo (2009) highlighted factors impacting the banking industry in countries with low and medium incomes, and Tan and Floros (2012) focused on determinants of bank profitability in China. Higher non-performing advances and operating costs reduce Indian bank profitability, while non-interest income, interest income, capital adequacy, and GDP growth boost profits (Das & Uppal, 2021). Higher profits and capitalisation enhance Indian bank stability, while large size and high management costs reduce it; forex reserves boost stability, but unemployment weakens it (Kaur & Kaur, 2025).

Financial Inclusion and Income Diversification

Finally, Vu and Nahm (2013) emphasised the complex relationship between bank efficiency and various influencing factors. Financial inclusion, banking stability, macroeconomic factors, socioeconomic determinants, commercial banks, non-performing loans, profitability, capital adequacy, economic growth, monetary policy transmission, operating costs, bank resilience, and financial performance are key considerations in this domain (Khan & Sahu, 2025). Income diversification in Indian banks is positively influenced by bank size, technology, market competition, and inflation, while capital ratio, GDP, and financial intermediation ratio negatively affect it.

Asset quality and liquidity ratio have no direct impact (Thakur & Arora, 2024).

Stock Market and Macroeconomic Linkages

Indian stock prices are strongly linked to macroeconomic factors like GDP, disposable income, and Foreign Institutional Investor (FII) participation, while interest rates, policies, exchange rates, and inflation negatively impact returns (Keswani et al., 2024). The Malaysian stock index (KLCI) shows a significant relationship with macroeconomic variables. Cointegration results indicate a long-term association, while VAR and IRF analysis reveal that the stock index responds negatively to money supply, inflation, and PPI. However, it reacts positively to exchange rate fluctuations (Mohnot et al., 2024)

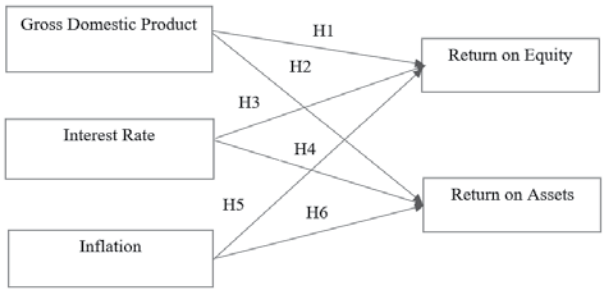

Figure 1.

Theoretical model

4. Hypotheses Development

Investigating e-banking's impact on Bangladeshi banks' performance, focusing on Net Interest Margin, Return on Assets, and Return on Equity, suggests a positive contribution to Return on Equity with a two-year lag and raises implications for bank management and policymakers in developing countries (Siddik et al., 2016). In a fixed effects regression model, negative significant impacts are observed from credit risk, operating efficiency, and GDP growth rate on banks' ROE. The inflation rate demonstrates positive and statistically significant effects on both ROE and ROA, suggesting Islamic banks in Bahrain should fully leverage economies of scale and prioritise credit risk management, particularly in controlling and monitoring non-performing loans (Elseoud et al., 2020). The connection between a country's Gross Domestic Product (GDP) and the financial performance of banks is a crucial area of financial research. GDP serves as an indicator of fiscal health, and its fluctuations can significantly influence the Return on Equity (ROE)of banks either positively or negatively (Alharbi, 2017; Al-Qudah, 2020; Jeris, 2021; Ozili & Ndah, 2021; Patti & Palazzo, 2020). A robust GDP often correlates with increased economic activity, leading to higher loan demand and potentially enhancing ROE for banks.

H1: GDP has a significant positive influence on ROE

GDP and ROA

Examining how macroeconomic conditions directly impact company performance, mainly Return on Assets (ROA), while accounting for previous ROA and investigating the factors influencing profitability in Hong Kong and Singapore, considering prior profitability. Key indicators such as ROA, ROE, and Tobin's Q are used. Results confirm that company size, debt levels, and past profitability are significant predictors of performance (Cheong & Hoang, 2021). A model reveals a significant positive correlation between bank size and ROA, while operational efficiency and GDP growth are associated with lower ROA for banks (Elseoud et al., 2020).

H2: GDP has a significant positive influence on ROA

Interest rates and ROE

Several studies in the past have reported a direct link between the interest rate spread and bank effectiveness (Kabajeh et al., 2012; Musah et al., 2018; Pennacchi & Santos, 2021). For example, banks in Ghana experienced high profitability by charging high-interest rates on the loans offered. Despite reforms that enhance competition and efficiency in the banking sector to lower borrowing rates, these findings highlight Ghana's persistent high-interest rate spread (Musah et al., 2018)—relaxation of intra-state and inter-state bank branching rules in the 1980s and 1990s heightened bank competition. Also, banks benefited from under-priced deposit insurance. In such circumstances, banks aiming to maximise shareholder value would prioritise ROE performance over EPS, reflecting managerial focus on ROE as a performance metric (Pennacchi & Santos, 2021). The pooled analysis of the three ratios of ROA,

ROE, and ROI together revealed a solid and positive relationship with share prices (Kabajeh et al., 2012).

H3: Interest Rates have a significant and positive influence on ROE.

Interest rates and ROA

The correlation between bank performance and interest rates is essential to financial analysis. Interest rate fluctuations significantly impact a bank's return on assets (ROA) and equity (ROE). Credit risk and interest rate also significantly influenced ROA (Riaz & Mehar, 2013). The financial performance of banks can be enhanced by interest rates (Almaqtari et al., 2019; Haddad et al., 2022; Saif Alyousfi, 2022).

H4: ROA is significantly and favourably impacted by Interest Rates

Inflation and ROE

Analysing the influence of inflation rate changes on banks' performance is an important aspect of economic analysis (Fabian & Kočišová, 2023). Increased interest rates brought on by higher inflation may have an effect on borrowing costs and profitability indicators like ROE. Making wise financial decisions requires an awareness of and comprehension of this dynamic relationship between inflation and bank performance. Positive correlation exists between banks' profitability and Inflation (Abdo et al., 2021; Alfadli & Rjoub, 2020; Khan, 2022; Tan & Floros, 2012).

H5: Inflation has a significant positive influence on ROE

Inflation and ROA

Inflation is anticipated to have a favourable influence on ROA, similar to ROE. Discussions with credit officers and managers highlight that during high inflation periods, planning activities increase, contributing to effective asset utilisation (Khan et al., 2014). In times of inflation, central banks often raise interest rates to control escalating prices. Banks earn higher returns on assets, particularly on interest-bearing assets such as loans and securities. Also, inflation can inflate the value of banks' assets like real estate and securities, enhancing their overall return on assets (ROA). Anticipated inflation can also impact lending practices and interest rate spreads, potentially benefiting ROA when managed effectively. Additionally, moderate inflation tends to coincide with economic growth, fostering increased loan demand and economic activity, and boosting banks' returns on assets. The findings identified by previous authors strongly demonstrate a positive relationship between inflation and return on assets (Arifian & Noor, 2022; Maria & Hussain, 2023; Suseno & Bamahriz, 2017; Trang et al., 2021).

H6: Inflation and ROA have a positive relationship

5. Research Methodology

The study used balanced panel data from 2011 to 2021, covering 20 commercial banks in India, and ten private and ten public sector banks, chosen based on market capitalisation. Data from the World Bank's open data and Money Control platforms has been collected for examination. Our focus was on the dependent variables Return on Assets and Return on Equity, while adding independent macroeconomic variables: Gross Domestic Product, Inflation and Interest rate. The pooled Ordinary Least square method was applied to find out the significant relationship between macroeconomic variables and profitability. The choice of panel data analysis is justified by its ability to control for both cross-sectional and time-series variations, providing a more comprehensive understanding of the relationships compared to using cross-sectional or time-series data alone. This approach also addresses potential issues of omitted variable bias and endogeneity.

Table 1
Sources for Variables used

Variables used	Source
Gross Domestic Product	(Abadeh, 2018 ; Ali et al., 2018; Butt & Strtak, 2020; de Leon, 2020; Milhem & Yahya et al., 2017;)
Inflation Rate	(Jeevitha R et al., 2019; Hooshyari & Moghanloo, 2015; Senan et al., 2021; Sufian, 2012; Sufian & Habibullah, 2009)
Interest Rate	(Dineshbhai, 2022; Fabian & Kočišová, 2023; Musah et al., 2018; Sarfo-Kantanka et al., 2022; Sari, 2022)

6. Econometric Model

Using an econometric model, the effects of GDP, inflation, and interest rates are defined.

$$ROA_{it}=\beta_0 + \beta_1 GDP_{it} + \beta_2 INFL_{it} + \beta_3 INT_{it}+\epsilon \ldots(1)$$

$$ROE_{it}=\beta_0 + \beta_1 GDP_{it} + \beta_2 INFL_{it} + \beta_3 INT_{it}+\epsilon \ldots(2)$$

Where

ROA – Return on Assets

ROE – Return on Equity

GDP – Gross Domestic Product

INFL – Inflation

INT – Interest rate

7. Tools Used

Descriptive statistics were employed to gain initial insights into the data, followed by a unit root test to assess data stationarity, confirming the suitability of time series analysis.

The unit root test, specifically the Im, Pesaran, and Shin (IPS) test and the Fisher-type test (ADF and PP), was chosen for its ability to handle unbalanced panels and account for cross-sectional dependence, which are common in macroeconomic panel data. Pearson correlation matrix was utilized to find out the relationships between macroeconomic variables. Panel data regression analysis was used to

Panel data regression analysis to search the relation between macroeconomic variables and profitability of the banks. The choice between Fixed Effects (FE) and Random Effects (RE) models was determined using the Hausman test. The FE model controls for time-invariant unobserved heterogeneity, while the RE model assumes that the unobserved heterogeneity is uncorrelated with the regressors. The Hausman test helps decide which of these assumptions is more appropriate for the data. Chow test used to check the suitability of model selection. The Chow test assesses whether the coefficients in a regression model are the same across different groups. If the test rejects the null hypothesis, it suggests that a model with different coefficients for each group (e.g., fixed effects model) is more appropriate than a pooled model.

The suitability of model selection was verified using a Chow test, endogeneity was measured to differentiate fixed effect and random effect model using Hausman test. The Artificial Neural Network (ANN) model used to identify the non-linear relationship between macroeconomic factors and profitabilitiy measures of banks. The ANN model was selected to capture potential non-linear relationships between macroeconomic variables and bank profitability. ANNs are capable of modeling complex interactions and patterns that linear regression models may overlook. The specific architecture (e.g., number of layers and nodes) was determined through experimentation and cross-validation to optimize predictive performance.

8. Analysis and Results

8.1. Descriptive Statistics

Descriptive statistics were computed for Return on Assets and Return on Equity for the 20 commercial banks, and macroeconomic variables of the Indian economy were presented in Table 2.

Table 2
Descriptive Statistics

Variable	*GDP*	*INFL*	*INT*	*ROA*	*ROE*
Mean	5.4636	6.1528	4.36	0.5201	5.3678
Std. Dev.	4.0809	2.2795	2.5654	1.0255	1.0023
Kurtosis	4.2197	-1.1942	-0.4150	9.3686	6.5456
Skewness	-2.2627	0.4934	-0.7239	-2.0961	-2.2289

As illustrated in Table 2, on average, the total ROA of selected banks was 0.52%. Besides, the average inflation rate stood at 6.15% during this period. In terms of the real interest rate, banks maintained an average rate of approximately 4.36%. The average growth rate of the Indian economy over the years 2011-2021 was 5.46%. A standard deviation of 1.02 for Return on Assets suggests a certain level of volatility in the bank's profitability and returns to shareholders, respectively.

8.2. Pearson Correlation among the Macroeconomic and Banking Variables

The result of the Pearson Correlation among the Macroeconomic and Banking variables is presented in Table 3.

Table 3

Correlation Matrix

	GDP	INFL	INT	ROA	ROE
GDP	1.00				
INFL	-0.13*	1.00			
INT	0.08	-0.43**	1.00		
ROA	0.23**	0.29**	-0.07	1.00	
ROE	0.22**	0.39**	-0.13*	0.93**	1.00

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

As per statistics in Table (3) majority of the variables have a negative or poor correlation. The correlation matrix reveals relationships between Gross Domestic Product (GDP), Inflation (INFL), Interest Rates (INT), Return on Assets (ROA), and Return on Equity (ROE). There is a weak negative correlation between GDP and inflation (-0.1335) and a weak positive correlation between GDP and interest rates (0.0774). Inflation and interest rates exhibit a moderately negative correlation (-0.4307), while both GDP and inflation moderately correlate positively with ROA and ROE. The positive correlation between macroeconomic variables and the Return on Assets of a bank indicates that changes in those macroeconomic factors tend to coincide with a higher Return on Assets for the bank.

8.3. Variance Inflation Factor

With the Variance Inflation Factor, regression analysis is carried out among the independent variables. For every independent variable in the model, the VIF is computed. Greater VIF values signify an increased level of multicollinearity, suggesting that the independent variable is strongly correlated with other independent variables within the model. Table 4 displays the Variable inflation factors of the independent variables.

Table 4

Variance Inflation Factor

Variables	VIF
GDP	4.90
Infl	1.68
Int	1.39

Table 4 illustrates the assessment of multicollinearity in regression analysis. In broad terms, a VIF equal to one indicates no correlation among the selected independent variables, while values between 1 to 5 suggest moderate correlation, and values exceeding 10 indicate high correlation. An increase in VIF corresponds to decreased reliability of the regression results. According to Hair et al. (2011), multicollinearity is considered present when the VIF value exceeds 5. The consideration of multicollinearity is a vital step in constructing the regression model. As illustrated in Table 4 the variables Inflation (1.68) and Interest (1.39) exhibit relatively low multicollinearity with GDP (4.90), which is generally acceptable in regression analysis. The VIF values were assessed to ensure that multicollinearity did not unduly influence the regression results. The moderate VIF value for GDP suggests that while there is some correlation with other independent variables, it is within an acceptable range and does not significantly distort the regression estimates.

Panel Unit Root Test

Panel unit root test used to determine the stationarity properties of variables in panel datasets. If variables are non-stationary, it can affect the validity and interpretation of the estimated coefficients. The results of the Stationarity test are shown in Table 5.

Table 5

Stationarity Test Result

Variable	Method	I(0)	I(1)
GDP	IPS	0.9607	0.0000*
	Fisher	0.9990	0.0000*

	LLC	1.0000	1.0000
Infl	IPS	0.3015	0.0001*
	Fisher	0.7167	0.0000*
	LLC	0.0000*	0.0941
Int	IPS	0.6845	0.0000*
	Fisher	0.9785	0.0000*
	LLC	0.9997	0.0000*
RoA	IPS	0.5075	0.0005*
	Fisher	0.6900	0.0001*
	LLC	0.0008*	0.9334
RoE	IPS	0.7900	0.0000*
	Fisher	0.9448	0.0000*
	LLC	0.1784	0.0000*

As shown in Table (5) the panel unit root test result indicates that all the variables achieve stationarity at the first difference, I (1). The finding that all variables are stationary at the first difference justifies the use of differenced data in subsequent panel regression analyses. This transformation ensures that the regressions are not spurious and that the estimated coefficients provide reliable estimates of the relationships between the variables.

Table 6

Chow Test Result

Redundant Fixed Effects Tests				
Test cross-section fixed effects				
Effects Test	Statistic (ROA)	Statistic (ROE)	d.f.	Prob.
Cross-section F	9.64008	5.25577	-19,197	0.0000
Cross-section Chi-square	144.626	90.2123	19	0.0000

Chow test results are presented in Table 6. The cross-section chi-square test with a statistic of 144.63 (ROA), 90.2123 (ROE) and a p-value of 0.0000 indicates strong evidence against the null hypothesis, suggesting significant differences in coefficients across various cross-sections or groups within the data. These results imply that employing fixed effects, which accommodate unique variations specific to each cross-section, might be more suitable than assuming uniform effects across all groups. Thus, considering the substantial evidence of differences in coefficients among groups, integrating fixed effects into the model appears warranted to capture the individual nuances present within each cross-section. The rejection of the null hypothesis in the Chow test provides a strong statistical basis for choosing a fixed effects model over a pooled model. This ensures that the regression analysis accounts for unobserved heterogeneity across banks, leading to more accurate and reliable estimates of the effects of macroeconomic variables on bank profitability.

Table 7

Hausman Test Result

Correlated Random Effects - Hausman Test			
Test cross-section random effects			
Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	0.00000	3	1.0000

The Hausman test, with a chi-square statistic of 0.00000 and a p-value of 1.0000, indicates that the differences in coefficients between the correlated random effects model and the fixed effects model are not statistically significant. This means that any variations in coefficients between these models are probably just random and not because of systematic differences. Both models (illustrated in Tables 6 and 7) give similar coefficient estimates, and as per the computed results, the correlated random effects model might be preferred for its efficiency (Islam, 2023). The result of the Hausman test justifies the choice of the random effects model for the panel regression analysis.

8.5. Panel Regression Analysis

Table 8

Impact of Macro factors on ROE & ROA

	RoE -t-statistic				RoA t-statistic			
Variable	**Coeff.**	**PLS Ests.**	**FE**	**RE**	**Coeff.**	**PLS Ests.**	**FE**	**RE**
C	-0.978	-4.444	-3.35	-3.744	-18.888	-4.643	-5.443	-4.966
GDP	0.068*	5.782	4.358	5.782	1.0121*	4.613	5.408	5.408
INFL	0.163*	6.965	5.25	6.965	2.895*	6.674	7.824	7.824
INT	0.026	1.295	0.976	1.295	0.208	0.543	0.637	0.637
R^2		0.568	0.166	0.26		0.231	0.167	0.292
Adjusted R^2		0.519	0.155	0.25		0.22	0.155	0.282
Prob (F-statistic)		0.000	0.000	0.000		0.000	0.000	0.000
DW stat		1.584	0.82	1.444		1.088	0.821	1.496

Variables with coefficients marked * are statistically significant at the 5% level.

When examining the impact of macroeconomic variables on profitability metrics like Return on Assets (ROA) and Return on Equity (ROE), consistent trends become evident. Gross Domestic Product (GDP) consistently exhibits a positive effect on financial performance, which agrees with (Kosmidou, 2008). For instance, considering ROA and ROE, a one-unit increase in GDP corresponds to an increase in profitability. However, the influence seems more pronounced on ROE compared to ROA. Specifically, for ROA, the coefficients for GDP range around 0.06, while for ROE, these coefficients are notably higher, approximately 1.01. This indicates a stronger relationship between GDP and the return generated on equity compared to assets. Inflation (INFL) similarly shows a positive correlation with profitability metrics. While it positively impacts ROA, its effect on ROE is notably stronger, which is consistent with (Almaqtari et al., 2019). For instance, the coefficients for INFL range around 0.16 for ROA, whereas for ROE, they are substantially higher, approximately 2.90. This suggests that changes in inflation rates have a much more considerable influence on the return generated on equity compared to assets.

On the other hand, Interest Rates (INT) demonstrate a relatively smaller impact and lack statistical significance across profitability metrics. The coefficients for INT are minimal, around 0.02 for ROA and approximately 0.21 for ROE, indicating that changes in interest rates have limited effects on both ROA and ROE, failing to establish a significant correlation with either financial metric, which resembles the results of (Cornellya et al., 2022).

The panel least squares method fits the data better, as shown by its higher R-squared and Adjusted R-squared values compared to other methods. These findings highlight the importance of considering GDP and inflation as key drivers of bank profitability in India.

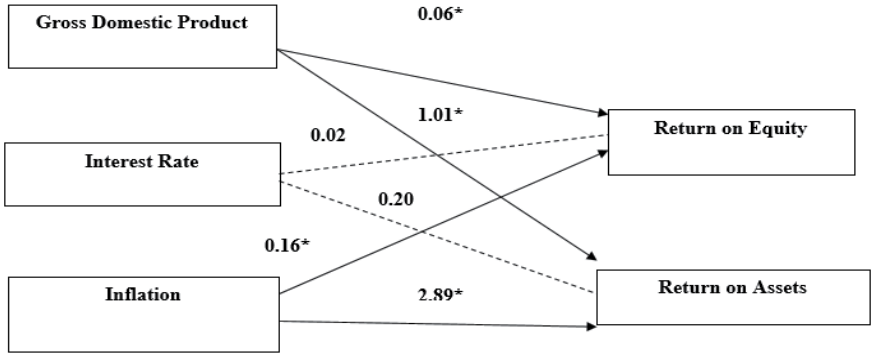

Figure 2.

Empirical Model

8.6. Relationship between Macroeconomic Factors and Return on Assets

ANN model examines how economic factors like GDP, inflation, and interest rates influence Return on Assets by assigning weights to each factor. It suggests that higher GDP is generally associated with an increase in ROA, as indicated by the positive weight (0.321) in the Input Layer, although the negative weight (-0.417) in Hidden Layer 1 shows a more complex relationship. Inflation has a positive weight (0.178) in the Input Layer but a negative weight (-0.293) in Hidden Layer 1, suggesting a complex influence potentially moderated by other factors. Likewise, the Interest Rate shows a positive weight (0.391) in the Input Layer, indicating a possible increase in ROA with higher rates, but a negative weight (-0.438) in Hidden Layer 2, indicating a more complex relationship.

The scatter plot accompanying this diagram shows actual Return on Assets (ROA) values (likely ranging from around the values indicated in the Input Layer, -7.5 to 2.5) on the x-axis and the model's predicted ROA values on the y-axis. The weight estimates and the scatter plot together suggest that the model might perform better at predicting ROA for positive values, possibly due to the stronger influence of GDP and the complex interplay of Inflation and Interest Rate.

Network diagram Parameter Estimates for a Neural Network Predicting Return on Assets (ROA) presented in Figure 3

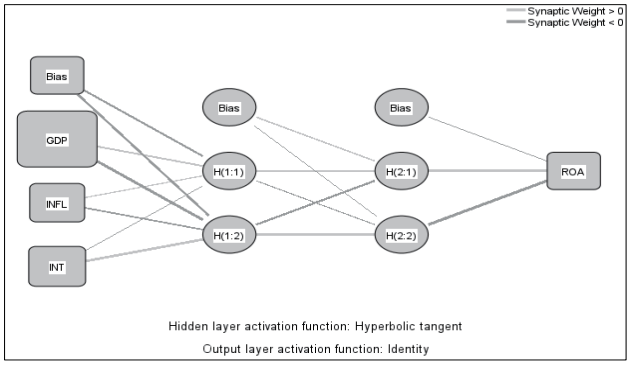

Figure 3.

Estimates for a Neural Network Predicting Return on Assets (ROA)

Parameter Estimates for a Neural Network Predicting Return on Assets (ROA) is presented in Table 9

Table 9

Parameter Estimates for a Neural Network Predicting Return on Assets (ROA)

Predictor		Predicted				
		Hidden Layer 1		Hidden Layer 2		Output Layer
		H(1:1)	H(1:2)	H(2:1)	H(2:2)	ROA
Input Layer	(Bias)	-.335	-.377			
	GDP	.321	-.417			
	INFL	.178	-.293			
	INT	-.012	.391			
Hidden Layer 1	(Bias)			.265	-.054	
	H(1:1)			.208	-.145	
	H(1:2)			-.347	.521	
Hidden Layer 2	(Bias)					-.113
	H(2:1)					.390
	H(2:2)					-.438

Predicted values presented in Figure 4

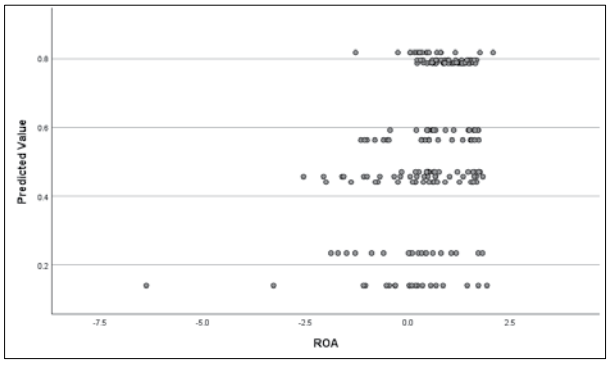

Figure 4.

Predicted Values

Independent variable importance is presented in Table 10

Table 10

Independent Variable Importance

	Importance	Normalized Importance
GDP	0.477	100.00%
INFL	0.253	53.10%
INT	0.27	56.70%

Normalized importance figure shows that GDP as the influential factor for predicting Return on Assets (ROA) in this neural network model. Its normalized importance of 100% signifies a stronger influence compared to Inflation (53.1%) and Interest Rate (56.7%). While both Inflation and Interest Rate hold moderate importance, GDP emerges as the key driver of ROA predictions within this specific model. Normalized importance presented in Figure 5.

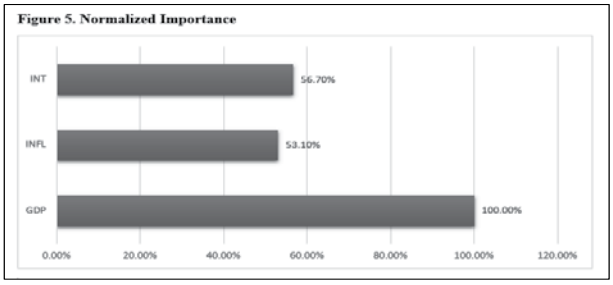

Figure 5.

Normalized Importance

8.7. Relationship between Macroeconomic factors and Return on Equity

This ANN model analyzes the relationship between economic factors and Return on Equity (ROE), assigning weights to factors like GDP, Inflation, and Interest Rates. It indicates that GDP and Inflation positively influence ROE, with respective weights of 0.685 and higher, while Interest Rate has a negative influence with a weight of -0.340. Inflation seems to wield the strongest influence with a weight of 0.984, followed by GDP. As GDP increases or inflation rises, ROE is likely to increase, but when interest rates go up, ROE tends to decrease.

The model portrays Inflation as the most influential factor on ROE prediction, followed by GDP, while Interest Rate has the least effect. The scatter plot shows actual ROE values (ranging from about -75 to 25) on the x-axis and predicted values (ranging from about -5 to 20) on the y-axis. There are distinct clusters, such as around 0 for negative ROE values and around 10 to 15 for positive ROE values. This indicates that the model predicts higher values for positive ROE and more scattered, generally lower values for negative ROE.

Network diagram Parameter Estimates for a Neural Network Predicting Return on Assets (ROA) presented in Figure 6

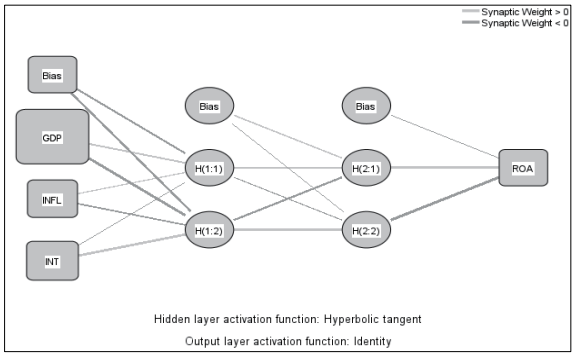

Figure 6.

Estimates for a Neural Network Predicting Return on Equity (ROE

Parameter Estimates for a Neural Network Predicting Return on Assets (ROA) is presented in Table 11

Table 11

Parameter Estimates for a Neural Network Predicting Return on Equity (ROE)

Predictor		Predicted				
		Hidden Layer 1		Hidden Layer 2		Output Layer
		H(1:1)	H(1:2)	H(2:1)	H(2:2)	ROE
Input Layer	(Bias)	-.238	-.244			
	GDP	.685	.680			
	INFL	.724	.984			
	INT	.269	-.340			
Hidden Layer 1	(Bias)			-.246	.171	
	H(1:1)			-.659	.073	
	H(1:2)			-.353	.285	
Hidden Layer 2	(Bias)					.061
	H(2:1)					-.832
	H(2:2)					.000

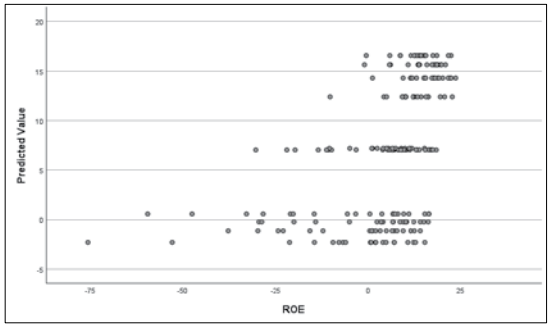

Figure 7.

Predicted Values

Independent variable importance is presented in Table 12

Table 12

Independent Variable Importance

	Importance	Normalized Importance
GDP	.414	78.3%
INFL	.529	100.0%
INT	.056	10.6%

Normalized importance chart highlights that, Inflation (100%) is the most critical factor for predicting ROE (Return on Equity) within this specific model. While GDP (78.3%) and Interest Rate (10.6%) hold some importance. Normalized importance presented in Figure 8.

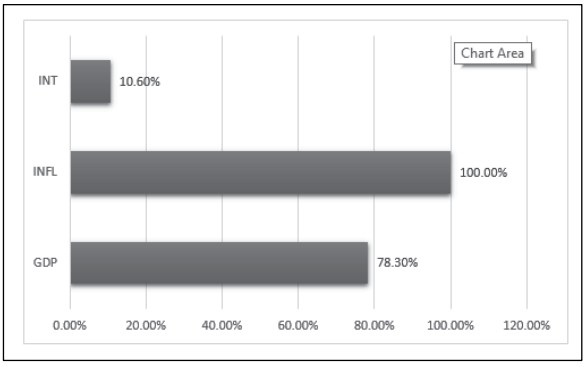

Figure 8.

Normalized Importance

9. Discussion

The banking sector plays a pivotal role in shaping the country's economy which serves as a significant mediator between the flow of capital and growth of various sectors. If we deeply look into the GDP, it is rising, and the inflation is fluctuating often, and it is very crucial for studying how these macroeconomic indicators influence the profitability of the bank. This is very important for the policymakers and top-level leaders of the industry. A bank is not only a lending centre; it is a financial health indicator of any country. The country's stability shall be assessed using the relationship between the profitability of the bank and the GDP, inflation, and interest rates. The present study shows that GDP and inflation are the most significant macroeconomic indicators which impact the bank's profitability. Since the GDP is rising, the demand for loans is increasing which shows a favourable environment, in turn showing a positive influence on the return on assets (ROA) and Return on Equity (ROE). This association shows that the banking sector is fuelling economic growth by providing the necessary financial sources during the change in the consumption basket. The analysis demonstrates a clear relationship between specific macroeconomic indicators and the profitability metrics of Indian banks, particularly in terms of ROA and ROE. GDP and Inflation emerged as significant factors affecting bank profitability. GDP positively correlated with ROA and ROE, indicating its strong influence on banking sector profitability. Similarly, Inflation showcased a positive association with ROA and a notably stronger impact on ROE, emphasizing its substantial influence on the return generated on equity compared to assets. Interest Rates demonstrated a relatively limited impact and lacked statistical significance across profitability metrics, suggesting a minimal influence on ROA and ROE. Despite being a critical macroeconomic factor, interest rates were not found to correlate strongly with the profitability metrics of the selected Indian banks which challenge the traditional view. These findings suggest that banks may be more resilient to interest rate changes than previously thought, possibly due to improved risk management practices. This finding aligns with the earlier example. After the 2008 crisis, managing GDP and inflation helped maintain profitability despite the challenges. India has not been significantly impacted by the financial turmoil in developed countries. (Mohan, 2008).

10. Theoretical implications

The theoretical implications of the study shed light on the complex connection between GDP growth rate, Inflation, and Interest rate on the profitability of Indian Banks. One of the essential contributions this study made was understanding the relationship between GDP and banks' profitability. Changes in GDP demonstrate an effect on bank profitability. Economic growth can lead to a surge in loan demand and improve asset quality, boosting profits. Increased competition and inflation could affect the profit margins.

11. Practical implications

This study provides a logical connection between the macroeconomic indicators and the financial viability of banks in India. The analysis shows the significance of GDP and Inflation in impacting the performance of the banking sector, particularly in terms of ROA and ROE. These findings demonstrate the potential to bring a practical implication for decision-making and strategic planning within the industry. For leaders in this industry, this study clearly shows that trends in GDP and the forecast of inflation should be the prime indicators for profit optimisation. As per the earlier study conducted by Sarkar & Rakshit (2023), the study evidenced a strong association between GDP and bank profitability, which shows a need for macroeconomic stability to ensure the healthiness of the banking sector. Policymakers shall encourage the banks to adopt the AI-based advanced risk management tools which can predict how GDP fluctuations could affect the industry in terms of default risk and financial health.(Hassan et al., 2023; Milojević & Redzepagic, 2021)

12. Limitations

This study is having limitation in terms of narrow focus on a limited set of macroeconomic variables, namely inflation rate, interest rate, and GDP. The study period between 2011 and 2021 which covered only for a decade. The panel data analysis might have yet to explore the complex relationships.

13. Scope for Future Research

Future research could be incorporated with the variables namely exchange rates, unemployment rates, and fiscal policies. Advanced financial analysis like Structural Equation modelling and Machine learning shall be applied for forecasting. Future studies could also expand the sample of banks to ensure greater representativeness and applicability of the findings to the broader banking industry, thereby enriching the academic discourse on this topic.

14. Conclusion

This research work emphasizes the importance of economic indicators like GDP, interest rate, and Inflation in determining the financial results of banks and its impact on ROA and ROE. The correlation established in this study is useful for the stakeholders, policy makers and financial institutions. The results provide that there is a strong correlation between the GDP and the profitability of the banks which implies that the government should continue in attracting foreign direct investments and supporting new start-ups like how it is presently doing.

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Influence Effectuation in Fashion Marketing: Analyzing Mediated Relationships Between Expertise, Credibility, and Consumer Purchase Intentions Among Indian Consumers

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Abstract

This research examines how different influencer attributes impact consumer purchase intentions in the Indian fashion market. This research focuses on six primary constructs: expertise, credibility, argument quality, interaction between influencer and audience, physical attractiveness of influencers, and matching attitudes between influencers and their followers. Using a quantitative cross-sectional research design, the research employs Structural Equation Modeling (SEM) to examine data from 393 consumers who engage with fashion influencers on Instagram and YouTube. Consumer engagement acts as a crucial intermediary that increases the impact of influencers on their audiences. Future research must explore how influencer marketing affects brand loyalty over extended periods. The presented insights offer helpful strategic direction for fashion marketers seeking to enhance influencer partnerships, which will help boost sales and consumer engagement.

Abstract

Keywords: *Influencer marketing; Consumer purchase intentions; Fashion industry; Expertise; Credibility; Argument quality; Interaction; Physical attractiveness; Consumer engagement; Mediation analysis*

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1. Introduction

Digital advertising now features influencer marketing as a significant strategy within the fashion industry because visual appeal and trust play essential roles in consumer decision-making processes. Marketing communication underwent significant changes when social media platforms like Instagram enabled influencers to engage directly with consumers (Sokolova & Kefi, 2020; Hsu & Lin, 2020). According to Statista 2023 data, India has surpassed 448 million social media users, making it one of the most significant world and most rapidly expanding digital markets (Ismail, 2017). Studies show that influencer qualities like expertise attractiveness, credibility, and interaction affect consumer trust and engagement (Martínez-López et al., 2020; Sanz-Blas et al., 2019; Bigné et al., 2001; Okazaki & Taylor, 2013). The latest research demonstrates that product-influencer alignment shapes consumer perceptions of advertisements and influencer trustworthiness, affecting purchase behaviours (Janssen, Schouten, & Croes, 2022; Arora et al., 2019). The research fills an existing void by exploring the interaction between cognitive factors like credibility, expertise, and argument quality with affective factors such as attractiveness and parasocial interaction to understand their combined effect on consumer engagement and purchase intent in India's fashion market. This study develops a complete framework for influencer effectiveness based on the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986), Source Credibility Theory (Hovland & Weiss, 1951), and Parasocial Interaction Theory (Horton & Wohl, 1956).

Numerous studies document that influencer credibility, expertise, and argument quality influence how consumers perceive content. The Elaboration Likelihood Model (ELM) posits that persuasion occurs through two routes: The central route involves consumers analysing argument quality and expertise, while the peripheral route depends on superficial cues like attractiveness and parasocial relationships to influence consumer behaviour (Petty & Cacioppo, 1986; Lou & Yuan, 2019). Source Credibility Theory demonstrates that an influencer's expertise, trustworthiness, and attractiveness increase their persuasive power (Hovland & Weiss, 1951). Study findings indicate that consumers engage more deeply and show increased purchase intent when they perceive influencers as credible and experienced (Kim et al., 2023). An influencer's perceived credibility is partly determined by their follower count, leading to macro-influencers having more influence than micro-influencers in luxury fashion marketing (De Veirman, Cauberghe, & Hudders, 2017). Influencers' trustworthiness suffers when they participate in too many commercial partnerships because it damages their perceived authenticity (Audrezet, Kerviler & Moulard, 2020). Endorsements that show a strong product match increase consumer engagement and trust more effectively than those that seem overly commercialised or poorly aligned (Breves et al., 2019;Luceri & Latusi, 2015). The research fills existing research gaps by incorporating consumer engagement as a mediator to assess how expertise, argument quality, attractiveness, credibility, and parasocial interaction influence purchase behavior.

The research makes practical advancements in influencer marketing strategy while moving past theoretical insights. The latest research demonstrates engagement as the primary factor of purchase decisions, particularly for Gen Z and millennial consumers who seek authentic and interactive experiences (Kim et al., 2023; Djafarova & Bowes, 2021; Casaló et al., 2018;Rehman et al,2014). According to research, influencers who maintain regular two-way communication with their audiences achieve greater relatability and influence, resulting in stronger brand loyalty (Colliander & Dahlén, 2011; Bagozzi & Dholakia, 2006; Boerman, 2019). The success of influencer endorsements depends on trust-building strategies, which include transparent disclosures and personal storytelling to boost consumer identification and persuasion (Dhanesh & Duthler, 2019). When the influencer matches well with the product they endorse (product-influencer fit), it leads to a better brand assessment. According to research from Schouten, Janssen, and Verspaget (2020), influencers need to match their promotional content to their specialization to achieve greater engagement levels; influencers need to match their promotional content to their specialisation to achieve greater engagement levels, influencers need to match their promotional content to their specialization to achieve greater engagement levels. Martínez-López et al. (2020) discovered that Instagram interactive features, including polls and Q&A sessions, and direct influencer responses, increase consumer trust and

loyalty. Research demonstrates that Indian market consumers give higher importance to trust than visual appeal, which contrasts with Western digital markets where attractiveness takes precedence (Sokolova & Kefi, 2020). Consumers evaluate influencer credibility through metrics like follower count and engagement but find that too much commercialisation damages trust (Kay, Mulcahy, & Parkinson, 2020). This research establishes an all-encompassing framework that fashion brands can employ to build influencer credibility through social commerce insights and persuasion theory while increasing consumer interaction and boosting purchase conversion rates.

2. Review of Literature

2.1. Theoretical framework

The expanding reach of social media and digital marketing now requires theoretical models to clarify consumer behaviour patterns within digital marketplaces. The Elaboration Likelihood Model (ELM) is a foundational model that defines how consumers interpret persuasive messages through logical analysis or heuristic cues (Petty & Cacioppo, 1986). The effectiveness of influencer marketing relies mainly on the peripheral route of persuasion because consumers make decisions based on the influencer's attractiveness and credibility, combined with their ability to connect with audiences. Trust is the most important aspect of influencer marketing because authentic engagement drives audience loyalty and increases purchase intentions (Su, Cheng, & Huang, 2021). The Source Credibility Theory supports this view by demonstrating how consumer influencer message assessments are affected by expertise, consumer influencer message assessments are affected by expertise, trustworthiness, and attractiveness (Torres, Augusto, & Matos, 2019). The Parasocial Interaction (PSI) Theory demonstrates how users build one-sided connections with influencers they see as relatable friends (Horton & Wohl, 1956). PSI strengthens the brand image and increases buying intention, especially among youth audiences, according to Sokolova & Kefi (2020). Through social interactions like comments and likes, consumers develop trust and community bonds with influencers, enhancing their influence power (Labrecque, 2014). Researchers will thoroughly investigate influencers' strategic use of credibility and engagement to direct consumer behaviour in digital commerce.

Conceptual framework

2.2.1. Argument Quality

Argument Quality (ARQ) encompasses how powerful and clear an influencer's message is at influencing consumers and includes its ability to persuade (Petty & Cacioppo, 1986). The Elaboration Likelihood Model (ELM) demonstrates that messages with well-structured arguments trigger central route processing, which subsequently produces stronger purchase intentions, according to Martínez-López et al. (2020). Studies reveal that influencers who deliver factual reviews and testimonials and perform comparative analyses achieve excellent trustworthiness and audience involvement (Lou & Yuan, 2019). Fashion marketing research demonstrates that product details combined with sustainability claims and expert opinions boost perceived authenticity, which drives purchase intent (Haikel-Elsabeh et al., 2023; Sokolova & Perez, 2021). In India, consumers value influencers who deliver detailed stories based on personal experiences when deciding on purchases (Gupta et al., 2023). Research by Kim et al. (2023) shows that influencer posts gain trust from their audience when they feature user-generated content and customer testimonials to support their arguments. High-quality arguments generate social validation, which results in higher engagement rates, as demonstrated by Erkan & Evans (2021). The results indicate that influencers who utilise robust reasoning techniques in their content creation show better success rates in impacting consumer purchasing decisions.

H1: Higher argument quality in influencer marketing positively influences consumer purchase intention.

2.2.2. Physical Attractiveness

Physical attractiveness (PAT) describes an influencer's visual appeal, which improves their perceived credibility and audience engagement because of the Halo Effect. According to this psychological phenomenon, consumers perceive attractive people as possessing positive characteristics (Nisbett & Wilson, 1977). Studies confirm that influencers who possess physical attractiveness gain higher levels of likes and shares and greater trust from their audience, which results in increased purchase intentions (Djafarova & Bowes, 2021; Schouten et al., 2020). Visually appealing content is essential for

brand exposure and fostering consumer loyalty on platforms such as Instagram, where aesthetic appeal is essential, according to Sanz-Blas et al. (2019). Indian consumers value authenticity more than attractiveness and view relatability and credibility as essential elements that drive their purchase decisions (Gupta et al., 2023). The initial appeal of attractive influencers draws attention, but their sustained influence depends primarily on the informational value and engagement methods of their content of their content (Tiwari et al., 2024). Kim and Kim's 2023 research indicates that consumer trust strengthens when physical attractiveness pairs with credibility and expertise. The study shows that aesthetic appeal does not lead to purchases but is a secondary signal that backs essential purchasing decisions based on trustworthiness and argument quality.

H2: Influencer's physical attractiveness positively affects consumer trust and purchase intention.

2.2.3. Attitude Homophily

The concept of attitude homophily (ATT) describes how influencers reflect similar values and lifestyle choices to their consumer audience. According to Byrne (1971), similarities in values and beliefs help build relatability between individuals, leading to trust and further engagement. According to Djafarova and Bowes (2021) and Schouten et al. (2020), people tend to follow and purchase from influencers who match their personal tastes and social identity; people tend to follow and purchase from influencers who match their personal tastes and social identity, people tend to follow and purchase from influencers who match their personal tastes and social identity. The research presented by Sokolova and Perez (2021) illustrates that influencer effectiveness improves when homophily creates an emotional connection with the audience. Research reveals that influencers achieve higher engagement rates when they match their language and style preferences to their audience's (Haikel-Elsabeh et al., 2023). Research demonstrates that consumers are more likely to purchase when they experience increased community bonding and trust through homophily (Kim et al., 2023). The marketing power of influencers grows stronger because consumers trust influencers who share similar values (Casaló et al., 2020). These insights demonstrate that homophily is key to influencer marketing success.

H3: Attitude homophily strengthens consumer trust and enhances purchase intention.

2.2.4. Influencer Expertise

Consumer trust and purchase intention heavily depend on an influencer's expertise (EXP). This concept evaluates how consumers perceive an influencer's professional competence and expertise, according to the research by Hovland and Weiss (1951). Source Credibility Theory maintains that consumers demonstrate increased trust toward influencers they perceive as knowledgeable and follow their recommendations (Ohanian, 1990). Marketing research reveals that fashion-focused influencers who show competence in styling techniques, fabric quality assessment, and trend analysis substantially drive consumer behaviour (Martínez-López et al., 2020; Sokolova & Kefi, 2020). Research shows that Indian consumers favour influencers who demonstrate expertise above those who are just popular. Consumer preferences lean towards influencers delivering comprehensive product evaluations and personalised style recommendations (Kim et al., 2023; Gupta et al., 2023). According to the Elaboration Likelihood Model (ELM), expert content triggers central route processing, increasing the persuasiveness of factual information delivered by influencers (Petty & Cacioppo, 1986; Lou & Yuan, 2019). Studies indicate that micro-influencers with 50,000 to 200,000 followers generally show higher expertise and trustworthiness than celebrity influencers. Casaló et al. (2020) say this increases engagement and conversion rates. Expertise is important in India's fashion market because consumers demand products that align with current trends and cultural relevance while maintaining authentic quality (Djafarova & Bowes, 2021). The research proposes that expertise directly affects expertise directly affects consumer trust and purchase intention, demonstrating, demonstrating that fashion marketing benefits from knowledgeable influencers.

H4: Influencer expertise positively affects consumer trust and purchase intention.

2.2.5. Source Credibility

In influencer marketing, credibility (CRE) represents an essential attribute through its components of trustworthiness and honesty combined with

perceived expertise, which plays a significant role in shaping consumer trust and buying decisions based on research by Hovland & Weiss (1951). Studies reveal that influencers who establish credibility can better persuade audiences, resulting better persuade audiences, resulting in increased consumer trust in their endorsements (Martínez-López et al., 2020; Tiwari et al., 2024). Research indicates that Indian consumers value trustworthy information more than visual appeal since they appreciate straightforward and genuine reviews (Gupta et al., 2023; Erkan & Evans, 2021; Evans et al., 2017). Partnerships Between brands and credible influencers result in superior brand loyalty and engagement (Casaló et al., 2020). The likelihood of consumer purchases increases when an influencer possesses genuine experience within a specific product category, according to Djafarova and Bowes (2021). Fashion micro-influencers who maintain engaged followership receive better perceptions of relatability and trustworthiness (Schouten et al., 2020).

H5: Higher influencer credibility leads to increased consumer engagement and purchase intention.

2.2.6. Parasocial Interaction.

Parasocial Interaction (PSI) involves the one-sided relationships consumers create with influencers, impacting their engagement, trust levels, and purchasing decisions (Horton & Wohl, 1956). Consumers view influencers as similar to real people, which helps them form emotional bonds that mimic face-to-face social connections (Jin et al., 2019; Djafarova & Bowes, 2021). According to research by Sokolova & Perez (2021) and Kim et al. (2023), consumers exhibit stronger brand loyalty and purchase behavior when experiencing higher degrees of Parasocial Interaction (PSI). Research findings indicate that audiences who develop emotional bonds with brands show higher brand commitment and trust toward influencer endorsements (Haikel-Elsabeh et al., 2023). Casaló et al. (2020) note that Instagram stories and live Q&A sessions enable brands to strengthen consumer engagement through direct interaction. The fashion industry relies heavily on PSI to create brand affinity since Gen Z and millennials prefer genuine digital connections over prefer genuine digital connections over traditional advertising methods (Tiwari et al., 2024). The research demonstrates that parasocial interactions significantly strengthen consumer trust and influence digital purchase decisions.

H6: Parasocial interaction mediates the relationship between influencer credibility and consumer purchase intention.

2.2.7. Consumer Engagement (CEG) serves as a crucial mediator

Consumer Engagement (CEG) strengthens the link between influencer characteristics and consumer buying decisions by building trust and facilitating brand interaction and active participation (Casaló et al., 2018). The most common metrics for measurement include likes, shares, comments, and direct messages, which drive increased conversion rates (Martínez-López et al., 2020). Indian consumers respond positively to engagement-driven marketing because social interaction forms a core part of their digital behavior patterns (Gupta et al., 2023; Jiménez-Castillo & Sánchez-Fernández, 2019). According to the Elaboration Likelihood Model (ELM) proposed by Petty & Cacioppo (1986), engagement boosts both central and peripheral processing, enhancing influencer attributes. Increased engagement results in improved influencer credibility and enhances purchase probability, according to Haikel-Elsabeh and colleagues (2023). The development of parasocial relationships through this process makes consumers more open to endorsements (Sokolova & Perez, 2021; Arora et al., 2019). The fashion industry relies on engagement to build brand communities that support trust in influencer recommendations (Schouten et al., 2020). This research proposes that consumer engagement mediates the influence of credibility, expertise, argument quality, attractiveness, and parasocial interaction on purchase intention (De Veirman & Hudders, 2019).

2.2.8. Purchase Intention as the Dependent Variable

Purchase Intention (PUI) represents the final stage in the digital marketing funnel, which describes the consumer's likelihood of purchasing a product following an influencer's endorsement (Lou & Yuan, 2019). Credibility, engagement, and expertise are the core factors that drive purchase intent, underscoring the importance of trust within influencer marketing (Schouten et al., 2020; Martínez-López et al.,

2020). According to the Theory of Reasoned Action (TRA), consumer purchase intentions develop from their attitudes and subjective norms; therefore, influencers' credibility, attractiveness, and engagement significantly affect consumer decisions (Ajzen & Fishbein, 1980). Indian audiences respond best to influencers who deliver honest reviews and engaging materials, according to research by Gupta et al. (2023). The alignment between influencers and products and authenticity strongly determines how well engagement translates into sales, according to Kim et al. (2023). Purchase intentions receive reinforcement from different social proof types, including testimonials from influencers and audience interactions, according to Tiwari et al. (2024). Fashion brands boost consumer purchase intentions when influencers collaborate with brands to promote their merchandise through discounts and exclusive time-sensitive offers (Casaló et al., 2020). Sokolova and Perez (2021) found that influencers who maintain high engagement levels and credibility achieve tremendous success in encouraging purchases. The research demonstrates influencer marketing effectiveness by showing that purchase intention strengthens with credibility, engagement, argument quality, expertise, and parasocial interaction. (Bigné et al., 2001).

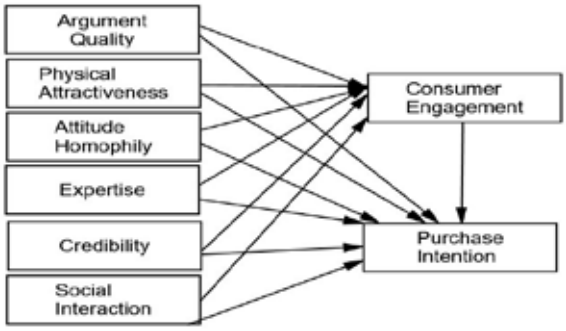

Figure 1

Conceptual framework

3. Research Methodology

3.1. Research Design and Approach

This research uses a quantitative cross-sectional approach to evaluate how influencer characteristics affect purchasing intentions among consumers in India's fashion market. Influencer marketing research frequently employs cross-sectional methodologies to measure consumer perceptions and behaviours at one moment (Jin et al., 2019; Sokolova & Kefi, 2020). Quantitative methodology enables structured data collection and hypothesis testing while ensuring the generalizability of results (Hair et al., 2021). Current research underscores the strong impact of digital channels on buying choices in fashion, which depends heavily on user interaction and trustworthiness as key factors in shaping customer attitudes (Blanche et al., 2021; Ong et al., 2024). The study addressed common method bias in its cross-sectional analysis through procedural measures such as counterbalancing questionnaire sections and adding reverse-coded items (Podsakoff et al., 2003). Harman's single-factor test confirmed that no single construct was responsible for over 50% of the variance, demonstrating that common method bias did not substantially influence the findings (Kock, 2015; Hair et al., 2021).

3.2. Sample Selection and Demographic Profile

The research team used purposive sampling to select social media users who actively interact with fashion influencers. This non-probability sampling technique is used in influencer marketing research because it enables researchers to examine individuals with firsthand experience with influencer-driven purchases (Casaló et al., 2018; Djafarova & Rushworth, 2017). To qualify for the study, participants needed to be active social media users who spent a minimum of two hours daily on platforms such as Instagram, YouTube, and Facebook while following at least one fashion influencer with 50,000 or more followers and actively interacting with the influencer content through likes, shares, comments or purchases within the previous six months. Researchers selected participants between 18 and 35 years old because studies show this age group is most impacted by fashion marketing through social media (Kim et al., 2021; Ong et al., 2024). The study's selection criteria filtered participants to obtain pertinent consumer insights while excluding those who were passive social media users or showed minimal interaction with influencer content. This research examines how social media influencers market clothing and beauty products within the Indian fashion industry. The sector's importance stems from its heavy dependency on visual content, making influencer marketing vital for brand promotion (Kadekova & Holienčinova, 2018). The fashion e-commerce market in India will

expand at an exceptional annual rate of 13.5%, while social media platforms will shape more than 60% of these transactions (Statista, 2023). The study targets Millennials and Gen Z individuals between 18 and 35 years as its primary active demographic, validating the research's focus on this vibrant market segment (Belanche et al., 2021; Kim & Kim, 2021). The study collected data by implementing structured online surveys strategically distributed through social media platforms, email services, and fashion communities to reach followers of fashion influencers and people who used specific Instagram hashtags (Ong et al., 2024). During its one-month availability period, the survey received 393 valid responses from the 500 distributed copies. The survey showed that most respondents fell within the 18-35 age bracket and comprised 70% females, 28% males, and 2% non-binary participants. Half of the study participants had achieved undergraduate education levels, demonstrating the educational variety among respondents. Sixty per cent of survey participants originated from metropolitan cities, providing extensive insight into the shopping practices of urban and semi-urban populations across India.

3.3. Measurement of Constructs

We adapted measurement scales from established, validated constructs used in previous influencer marketing studies to ensure content validity. The research utilised a 7-point Likert scale that ranges from 1 representing Strongly Disagree to 7 representing Strongly Agree, which has broad acceptance for its ability to capture detailed consumer perceptions (Revilla et al., 2014; Ong et al., 2024). The study measured credibility alongside parasocial interaction and argument quality, while engagement was a mediator in predicting purchase intention. Researchers modified Ohanian's (1990) credibility scale and integrated elements from Chetioui et al. (2019) for their study. Scholars used the scales introduced by Horton and Wohl (1956) alongside Sokolova and Kefi (2020) to measure parasocial interaction. Researchers assessed argument quality using criteria from Petty and Cacioppo (1986) and Casaló et al. guidelines (2018). The concept of engagement as a mediator was developed from research by Lou and Yuan (2019) and Kim et al. (2021). The modeling of purchase intention in this study was based on frameworks established by Martins et al. (2017) and Djafarova and Rushworth (2017). The study employed Cronbach's Alpha to test reliability and validity and found that all constructs displayed internal consistency values exceeding 0.7, according to Nunnally & Bernstein (1994). The research team calculated Composite Reliability (CR) and Average Variance Extracted (AVE) to confirm that each construct accurately represented its targeted variable through convergent validity procedures.

3.4. Statistical Analysis

Structural Equation Modelling (SEM) performed in AMOS and SPSS served as the analytical method because it is a standard approach in influencer marketing research to examine complex variable relationships (Fornell & Bookstein, 1982). The research applied Exploratory Factor Analysis (EFA) to identify distinct factor structures before using Confirmatory Factor Analysis (CFA) to establish measurement model validity and construct validity testing. Researchers confirmed the model's statistical validity by evaluating fit indices against GFI (>0.90), RMSEA (<0.06), and CFI (>0.95) standards (Hair et al., 2021). The study tested the indirect effects of influencer credibility on purchase intention through consumer engagement by conducting a mediation analysis with 5,000 bootstrapped resamples following the method of Preacher & Hayes (2008). This study produces dependable findings through advanced statistical techniques that provide important insights into influencer marketing's effects on consumer behaviour within India's fashion sector.

3.5. Ethical considerations

Each participant received information about the study and agreed to participate through their consent. Researchers implemented rigorous ethical standards throughout data collection to safeguard respondent confidentiality and privacy. The study participants received confirmation that their data would stay anonymous and serve solely academic research ends. The research adhered strictly to the ethical standards established by the [Institutional Review Board] to ensure all procedures followed the highest ethical research standards (Sean & Bougie, 2011).

4. Data analysis

4.1. Demographic profile

The study began its data analysis by examining the demographic characteristics of 393 respondents from different parts of India. Women accounted for 76.6% of the participants, while men represented 15.8%, and

7.6% opted to keep their gender private. The survey shows that 66.4% of participants were between 18 and 27 years old, proving that young adults are the leading group interacting with influencer-based fashion marketing. The group of respondents aged 28 to 40 accounted for 18.1%, followed by 11.2% younger than 18 and 4.3% older than 40. The survey showed that 50.1% of participants had undergraduate degrees, 23.7% finished junior college, and 20.4% achieved postgraduate qualifications—a minimal segment of respondents, representing 3.3%, achieved a doctorate or equivalent degree. Geographically, the respondents were well-distributed: Most % lived in urban areas, 62.1%, 26.7% were based in rural regions, and 11.2% lived in suburban areas. The varied sample strengthens the generalizability of the findings, which represent a wide range of consumers interacting with social media influencers in the Indian fashion sector (Ong et al., 2024; Djafarova & Rushworth, 2017) and creates a robust basis for further statistical evaluation.

4.2. Exploratory factor analysis

After completing descriptive statistical analysis, researchers used exploratory factor analysis (EFA) to uncover hidden constructs while minimising dimensions by grouping related variables and confirming an accurate construct representation for each measurement item (Hair et al., 2010). The researchers used EFA to test the structural validity of items by assessing factor loadings to ensure significant loading on respective factors while avoiding excessive cross-loadings with other constructs (Tabachnick & Fidell, 2007). The initial item analysis resulted in 24 modified items for measuring the study constructs. Exploratory Factor Analysis (EFA) led to the non-elimination of any items because they displayed recommended factor loadings and internal consistency. (see Annexure)

Table 2.

Exploratory factor analysis and cross-loading assessment.

Constructs	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability (CR)	AVE	MSV
Argument Quality	ARQ1	0.732	0.678	0.872	0.537	0.366
	ARQ2	0.750				
	ARQ3	0.703				
Physical Attractiveness	PAT1	0.649	0.725	0.886	0.607	0.381
	PAT2	0.832				
	PAT3	0.785				
Attitude Homophily	ATT2	0.707	0.742	0.880	0.542	0.372
	ATT3	0.785				
	ATT4	0.735				
Interaction	INT1	0.732	0.713	0.865	0.527	0.360
	INT2	0.782				
	INT3	0.690				
Expertise	EXP2	0.662	0.711	0.861	0.503	0.355
	EXP3	0.768				
	EXP4	0.695				
Credibility	CRE1	0.751	0.746	0.891	0.562	0.389
	CRE2	0.798				
	CRE3	0.686				
Purchase Intention	PUI1	0.697	0.713	0.865	0.530	0.360
	PUI2	0.668				
	PUI3	0.756				
Consumer Engagement	CEG1	0.667	0.745	0.888	0.533	0.388
	CEG2	0.775				
	CEG3	0.721				

The validation step proved essential for distinguishing each factor and improving the measurement model's overall strength. The argument quality items showed strong construct representation with loadings of ARQ1 = 0.732, ARQ2 = 0.750, and ARQ3 = 0.703, and the physical attractiveness items demonstrated significant loadings with PAT1 = 0.649, PAT2 = 0.832, and PAT3 = 0.785. All constructs passed the internal consistency check because their Cronbach's alpha values surpassed the 0.70 minimum requirements, demonstrating reliable measurement according to Nunnally & Bernstein (1994). High reliability was reflected through a Cronbach's alpha of 0.746 for the credibility construct. All constructs displayed composite reliability (CR) values above 0.70, demonstrating internal reliability according to Fornell & Larcker (1981). The interaction construct demonstrated high reliability with a composite reliability score of 0.865. AVE values surpassed the 0.50 minimum requirement, which confirmed convergent validity, while MSV values stayed below AVE to support discriminant validity, according to Hair et al. (2010). The EFA and cross-loading assessments establish the reliability and distinction between constructs, confirming that the dataset is appropriate for additional statistical analysis.

4.3. Validity concerns – Convergent and discriminant validity

After completing the exploratory factor analysis (EFA) and cross-loading assessments, researchers evaluated their measurement model's convergent and discriminant validity. When items measuring the same construct display strong correlations, and the average variance extracted (AVE) surpasses 0.50, it indicates convergent validity because over half of the construct's variance is accounted for by its indicators (Fornell & Larcker, 1981). Internal consistency of constructs is confirmed by composite reliability (CR) values, which must be above 0.70, according to Hair et al. (2010). Discriminant validity demonstrates the theoretical and statistical distinction between constructs when maximum shared variance (MSV) stays below average variance extracted (AVE), and the square root of AVE for each construct surpasses its correlations with other constructs (Fornell & Larcker, 1981). The validity assessments ensure that the measurement model maintains both reliability and validity, allowing researchers to interpret accurately characteristics that affect consumer purchase intentions accurately.

Table 3.

Convergent and discriminant validity.

Cons	CR	AVE	MaXR (H)	ARQ	PAT	ATT	INT	EXP	CRE	CEG	PUI
ARQ	0.870	0.536	1.021	0.861							
PAT	0.881	0.602	0.990	0.512	0.821						
ATT	0.890	0.540	0.951	0.314	0.300	0.837					
INT	0.856	0.525	0.990	0.268	0.279	0.338	0.757				
EXP	0.816	0.509	0.983	0.376	0.539	0.543	0.547	0.713			
CRE	0.819	0.526	1.019	0.410	0.423	0.302	0.411	0.402	0.745		
CEG	0.824	0.530	1.017	0.509	0.311	0.544	0.522	0.552	0.631	0.750	
PUI	0.854	0.538	0.978	0.545	0.511	0.464	0.442	0.545	0.589	0.710	0.788

Table 3 demonstrates convergent and discriminant validity for constructs such as argument quality (ARQ), physical attractiveness (PAT), attitude homophily (ATT), interaction (INT), expertise (EXP), credibility (CRE), consumer engagement (CEG), and purchase intention (PUI). The composite reliability (CR) scores for all constructs exceeded the 0.70 benchmark, which shows strong internal consistency, according to Hair et al. (2010). The credibility (CRE) construct demonstrated the highest composite reliability (CR) at 0.891, which validated the reliability of this construct's measurement. Physical attractiveness (PAT) reached its peak AVE value at 0.607, indicating that its measurement items demonstrate strong intercorrelations. The discriminant validity of all constructs was confirmed because their respective maximum shared variance (MSV) values fell below their average variance extracted (AVE) values as per Fornell & Larcker (1981). The interaction (INT) construct achieved an AVE of 0.527 and an MSV of 0.238, which shows its distinctiveness from other constructs. (Henseler et al., 2014; Henseler, 2017).

4.4. Model fit assessment

After validating both convergent and discriminant dimensions, the researchers evaluated model fit indices to assess the alignment between the proposed theoretical framework and observed data. This step is pivotal in confirming if the structural equation model (SEM) effectively represents construct relationships while maintaining robust and generalizable findings (Hu & Bentler, 1999; Kline, 2015). The model demonstrates acceptable fit when the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) reach minimum values of 0.90. At the same time, the Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR) remain at or below 0.06 and 0.08, respectively (Hu & Bentler, 1999; Barrett, 2007). The established thresholds ensure the model accurately represents latent relationships, confirming its theoretical and empirical validity for subsequent structural analysis. (Bentler, 1990)

Table 4.

Model fit indices

Parameter	Output	Threshold	Reference
CMIN/DF	2.325	Between 1 and 3	Barrett (2007); Kline (2015); Ullman (2001)
CFI	0.937	≥ 0.95	Hu and Bentler (1999); Bentler (1990); Byrne (2016)
TLI	0.95	≥ 0.95	Tucker and Lewis (1973); Marsh et al. (2004); Bentler (1990)
NFI	0.94	≥ 0.90	Bentler and Bonett (1980); Bollen (1989); Schumacker and Lomax (2004)
AGFI	0.89	≥ 0.90	Jöreskog and Sörbom (1984); Schumacker and Lomax (2004)
SRMR	0.042	≤ 0.08	Hu and Bentler (1999); Kline (2015); Schumacker and Lomax (2004)
RMSEA	0.058	≤ 0.06	Hu and Bentler (1999); Steiger (1990); Browne and Cudeck (1993)
PClose	0.020	≥ 0.05	Jöreskog and Sörbom (1993); Muthén and Muthén (2002); Brown (2015)

Table 4 shows that the proposed model meets most goodness-of-fit criteria, proving its appropriateness for hypothesis testing. The CMIN/DF statistic at 2.325 falls between the acceptable range of 1 and 3, which indicates the model demonstrates reasonable fit according to Barrett (2007) and Kline (2015). The Comparative Fit Index (CFI) value of 0.937 falls marginally below the optimal cutoff point of 0.95 yet demonstrates sufficient model fit, according to Hu & Bentler (1999). The model demonstrates structural robustness with a TLI value of 0.95 that aligns with recommended standards. The model demonstrates adequate fit as the Normed Fit Index (NFI) of 0.94 surpasses the minimum requirement of 0.90 (Bentler & Bonett, 1980). The AGFI result of 0.89 falls short of the 0.90 standard, which indicates that the model might benefit from minor improvements (Jöreskog & Sörbom, 1984). The model fits well with the observed data because both SRMR at 0.042 and RMSEA at 0.058 fall within acceptable limits (Hu & Bentler, 1999). Despite the PClose value being outside the recommended range with a score of 0.020 compared to the standard of ≥ 0.05, the model achieves a satisfactory overall fit, validating its statistical reliability and practical relevance for subsequent hypothesis testing and mediation analysis. (Bentler & Bonett, 1980)

4.5. Hypothesis Testing

Following their model fit assessment, the researchers began hypothesis testing through path analysis using structural equation modeling (SEM). SEM represents a multivariate statistical method that enables researchers to analyse multiple relationships between independent and dependent variables while adjusting for measurement errors (Kline, 2015). The analysis estimated standardised regression weights (β) to assess the hypothesised relationships' strength and direction. Researchers evaluated the importance of these estimates with t-values and p-values to establish statistical validity for the proposed relationships (Hu & Bentler, 1999; Byrne, 2016). The study used bootstrapping with 5,000 resamples to improve the robustness and reliability of its results. The technique effectively reduces sampling errors while delivering precise confidence intervals for direct and indirect effects and mediation effects, according to Preacher & Hayes (2008). The study employed a 95% confidence interval (CI) to determine the significance of indirect effects, confirming that the mediation pathways were statistically meaningful (MacKinnon, 2012). Bootstrapping enhances the study findings by minimising standard error biases and providing a more detailed understanding of how variables indirectly affect consumer behaviour (Hayes, 2013). The rigorous methodology ensures empirical support for the structural model, which enables an accurate interpretation of influencer attributes' impact on consumer purchase intentions.

Table 5.

Hypothesis testing

Path	Coefficients (β)	t	p	Decision
Attitude Homophily (ATT) -> Consumer Purchase Intentions (PUI)	0.083	0.884	0.003	Accepted
Credibility (CRE) -> Consumer Purchase Intentions (PUI)	0.247	3.098	0.002	Accepted

Argument Quality (ARQ) -> Consumer Purchase Intentions (PUI)	0.253	2.857	0.004	Accepted
Interaction (INT) -> Consumer Purchase Intentions (PUI)	0.117	1.449	0.003	Accepted
Physical Attractiveness (PAT) -> Consumer Purchase Intentions (PUI)	0.072	0.965	0.003	Accepted
Expertise (EXP) -> Consumer Purchase Intentions (PUI)	0.416	3.886	***	Accepted
Consumer Engagement (CEG) -> Consumer Purchase Intentions (PUI)	0.055	0.585	0.003	Accepted

The path analysis results displayed in Table 5 show that all hypotheses reached statistical significance by illustrating substantial links between independent variables and consumer purchase intentions (PUI). The expertise (EXP) variable demonstrated the most substantial impact on purchase intentions ($\beta = 0.416$, $t = 3.886$, $p < 0.001$), which illustrates how influencer expertise plays an essential role in shaping consumer purchasing decisions. The statistical analysis revealed that argument quality (ARQ) significantly affected purchase intentions with a coefficient of 0.253, demonstrating that well-structured and persuasive arguments are vital for shaping consumer preferences. The substantial impact of credibility (CRE) ($\beta = 0.247$, $t = 3.098$, $p = 0.002$) demonstrates that consumers trust influencers who build confidence through their recommendations. The positive correlation between attitude homophily (ATT) and purchase intentions ($\beta = 0.083$, $t = 0.884$, $p = 0.003$) reveals that consumers trust influencers whose values align with their preferences. The research offers robust empirical support for the theoretical model by demonstrating that consumer purchase intentions are influenced by expertise, credibility, argument quality, and interaction, and fashion brands, and marketers ought to focus on influencer collaborations that convey expertise and trustworthiness since these attributes demonstrate the most significant effect on consumer behavior, according to statistical hypothesis testing results. The research emphasises how meaningful engagement and interaction between influencers and consumers create potent connections that improve purchase decisions.

4.6. Mediation analysis

After their direct hypothesis testing, the researchers performed mediation analysis to determine if a mediating variable explained the relationship between an independent variable and consumer purchase intentions (PUI). Mediation analysis helps researchers understand if the independent variable's impact reaches the dependent variable through a mediator, which reveals essential mechanisms in consumer decision-making processes (Baron & Kenny, 1986). The research separates direct and indirect effects to thoroughly examine influencer characteristics and their effects on consumer buying decisions, according to Preacher & Hayes (2008). MacKinnon (2012) reported that this statistical approach delivers more accurate confidence intervals while decreasing estimation biases in mediation pathway analyses. The researchers used this strong statistical method to improve the reliability of their findings and reduce standard errors while clarifying the indirect relationships between influencer attributes and purchase intentions (Hayes, 2013).

Table 6.

Mediation analysis

Path	Total Effect (β)	Sig.	Indirect Effect (β)	Sig.	Direct Effect (β)	Sig.	Type
Expertise (EXP) -> Consumer Purchase Intentions (PUI)	0.417	0.000	0.17	0.000	0.400	0.000	Partial
Physical Attractiveness (PAT) -> Consumer Purchase Intentions (PUI)	0.085	0.085	0.18	0.003	0.083	0.003	Partial
Interaction (INT) -> Consumer Purchase Intentions (PUI)	0.137	0.003	0.20	0.003	0.117	0.003	Partial
Argument Quality (ARQ) -> Consumer Purchase Intentions (PUI)	0.263	0.000	0.62	0.003	0.201	0.000	Partial

Credibility (CRE) -> Consumer Purchase Intentions (PUI)	0.252	0.000	0.50	0.003	0.202	0.003	Partial
Attitude Homophily (ATT) -> Consumer Purchase Intentions (PUI)	0.085	0.000	0.05	0.000	0.050	0.050	Partial

Table 6 demonstrates the mediation analysis results, which show that all independent variables significantly affect consumer purchase intentions through partial mediation. Expertise (EXP) achieved the highest total influence (β = 0.417) through an indirect effect of 0.17 and a direct effect of 0.400, revealing that its impact on purchase decisions includes a significant mediated component. Physical attractiveness (PAT) produced a total effect of 0.085 through both an indirect effect of 0.18 and a direct effect of 0.083, demonstrating that attractiveness exerts minimal direct influence but operates more effectively when mediated. The partial mediation of interaction (INT) is demonstrated through its total effect of 0.137, while its indirect effect of 0.20 and direct effect of 0.117 highlight its indirect impact on consumer purchasing behaviour. The effectiveness of well-constructed arguments with a total effect of 0.263 becomes notably stronger through mediation because of its substantial indirect effect of 0.62 alongside a direct effect of 0.201. The influencer's credibility through partial mediation demonstrated that trustworthiness significantly impacts purchasing choices because of its mediated role, with a total effect of 0.252 and an indirect effect of 0.50 against a direct effect of 0.202. The partial mediation effect of attitude homophily (ATT) at 0.085 shows both direct at 0.050 and indirect effects at 0.05, demonstrating increased trust levels among consumers toward influencers who share similar values when engagement mechanisms exist. All tested constructs demonstrated indirect effects, highlighting the necessity of building robust influencer-consumer relationships through engagement to turn influencer content into purchase decisions. Brands and marketers can benefit from these insights because influencer partnerships need to integrate direct measures of credibility and expertise with engagement tactics that build trust and promote consumer decision-making participation.

5. Findings and discussion

5.1. Findings and discussion on Direct effects

Hypothesis testing results show strong links between influencer characteristics and consumer purchase intentions in fashion commerce, emphasising growing reliance on influencer marketing strategies. The research confirms that EXP emerged as the leading factor influencing purchase intentions (β = 0.416, $p < 0.001$), supporting Djafarova and Rushworth's discovery from 2017. Consumers regard the expertise of fashion influencers as a crucial factor when deciding on purchases. The quality of argumentation (ARQ) showed a substantial impact (β = 0.253, p = 0.004), proving that persuasive and well-organised messaging plays a vital role in consumer behaviour, as Lou and Yuan (2019) highlighted. Influencer credibility (CRE) significantly affects consumer purchase intentions, which boosts consumer confidence and drives purchase behaviour, as De Vries et al. (2012) established. (2012). Despite having comparatively more minor effects (β = 0.117 for INT and β = 0.072 for PAT), interaction and physical attractiveness show statistical importance, supporting their role in influencing purchasing decisions on platforms like Instagram, according to Jin & Ryu (2020). Research findings demonstrate that consumers primarily depend on expertise, credibility, and argument quality for decision-making. Interaction and physical appeal serve important secondary roles in consumer decision-making, with their significance varying across different platforms and contexts.

5.2. Findings and Discussion for the Mediation Table

The mediation analysis reveals a further understanding of the indirect effects that influencer attributes have on consumer purchase intentions (PUI) and identifies partial mediation across every examined construct. The analysis revealed that Expertise (EXP) led to the most substantial total effect (0.417), combining both direct (0.400) and significant indirect effects (0.17), showcasing how expertise affects consumer decisions directly while mediating effects through perceived trust and engagement strengthen its influence (Lou & Yuan, 2019). Argument quality (ARQ) showed substantial indirect influence (0.62) and direct influence (0.201),

which demonstrates that persuasive communication strategies significantly affect consumer behaviour when supported by credibility and engagement mediators (Sokolova & Kefi, 2020; Breves et al., 2019). The strong partial mediation effect of credibility (CRE) with an indirect effect of 0.50 and a total effect of 0.252 validated the vital influence of influencer trustworthiness on consumer perceptions, according to De Vries et al. (2012. The indirect impact of physical attractiveness (PAT) reached 0.18, demonstrating that attractiveness boosts consumer perceptions of expertise and indirectly affects purchase behaviour even with limited direct influence (Jin & Phua, 2014). The study by Jin & Ryu (2020) showed that engagement through interactive content creates stronger consumer-influencer relationships, boosting purchase likelihood, with a total interaction effect of 0.137 and an indirect effect of 0.20. The partial mediation of attitude homophily (ATT) showed a total effect of 0.085, while its indirect effect was 0.05 and direct effect was 0.050, confirming that consumers tend to follow influencers who share their fashion preferences (Lee & Watkins, 2016). Research demonstrates that fashion influencers sway consumer purchasing behaviour through direct interactions and complex intermediary processes, highlighting digital marketing's intricate nature. (Amos et al., 2008)

6.1. Managerial and practical implications

This study delivers important information that fashion brands and marketers can use to improve influencer marketing approaches. Managers should prioritise partnering with influencers because their expertise and credibility significantly affect consumer trust and purchasing decisions (Alalwan et al.,2017; Elseminas et al., 2015; Godey et al., 2016). Brands should motivate influencers to deliver persuasive and structured product messages because argument quality is essential in successful marketing (Abidin,2016). When communication is both practical and persuasive, it increases consumer interaction while simultaneously improving purchase likelihood. Interactive content creation must be prioritised because platforms like Instagram demonstrate that more significant interaction strengthens consumer-influencer bonds, ultimately leading to increased sales. (Raji et al., 2019) Physical attractiveness draws consumer interest, which strengthens when combined with expertise and trustworthiness. Brands must choose influencers who combine visual appeal with professional expertise (Tafesse & Wood, 2020; Taillon et al., 2020). Selecting influencers who match the fashion preferences of their target audience creates attitude homophily, which leads to better consumer engagement since individuals tend to connect with those who share their style preferences (Stubb et al., 2019; Adeola et al., 2020). Fashion brands that employ these strategies will build more credibility while creating deeper consumer relationships, leading to higher sales.

6.2. Practical Implications

Fashion brands need to leverage these insights to create influencer marketing strategies that boost consumer interaction and lead to increased purchase rates. Brands must work with fashion industry experts because their followers generally show stronger trust and engagement (Vinerean et al., 2013). Brands must motivate influencers to produce engaging content that captures audience attention and demonstrates how effective communication can drive consumer purchase decisions. Physical attractiveness continues to be important, but its effects become much more potent when combined with credibility and expertise, demonstrating why influencer selection must be multi-faceted. Fashion brands must guarantee that influencer collaborations reflect their target audience's style preferences (Sasmita & Suki, 2015; Yadav & Rahman, 2017b). Brands that tap into attitude homophily can build stronger bonds with consumers and develop lasting brand loyalty. Fashion brands achieve improved influencer marketing results and increased consumer trust, resulting in better sales when they concentrate on these strategic elements in the competitive marketplace.

7.1. Limitations of the study and scope for further research

Limitations of the study

The study presents valuable insights, including several aspects that require acknowledgement. The study's sample size of 393 respondents ensures statistical validity but limits the generalization of findings to broader consumer segments within the multi-faceted fashion industry. Using non-probabilistic sampling methods could result in a bias that fails to represent all consumer demographics outside the primary target group. Because the sample mainly

consisted of urban and suburban participants, the study might have missed unique social media and fashion influencer interactions among rural consumers. Using self-reported data increases the possibility of response bias concerning subjective elements like engagement and perceived credibility, which may compromise research findings.

7.2. Scope for Further Study

Future research can build upon this study by examining additional theoretical frameworks, like Social Identity Theory, to discover how consumers' connections with influencer personas impact their buying decisions. New mediating factors like emotional connection and brand loyalty could help researchers better understand the development of durable relationships between influencers and their audiences. Subsequent research should investigate how fashion consciousness and consumer involvement are moderators that influence the relationship between personal preferences and influencer marketing outcomes. Research that includes multiple geographical areas and cultural contexts will provide meaningful knowledge about influencer marketing dynamics throughout different consumer markets that extend past urban digital purchasers. Longitudinal research can assess how influencer marketing impacts brand loyalty and repeat purchases over time to provide a complete picture of influencer success. The proposed extensions will help brands develop better strategies for maximum effectiveness by expanding their knowledge of influencer marketing within the transforming digital fashion sector.

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Annexure A

Construct	Item	Final Item Description
Argument Quality (ARQ)	ARQ1	The influencer presents their endorsements with transparent and rational explanations.
	ARQ2	The influencer presents product features through organised and logical arguments.
	ARQ3	The influencer shares content that shows extensive details and strong persuasive elements.
Physical Attractiveness (PAT)	PAT1	I find the influencer's visual appearance attractive.
	PAT2	The influencer's unique style strengthens the trustworthiness of their content.
	PAT3	The influencer produces visually appealing photos and videos.
Attitude Homophily (ATT)	ATT1	Our fashion values and preferences show a strong similarity between me and the influencer.
	ATT2	I see my attitudes and beliefs mirrored in the way the influencer lives.
	ATT3	The influencer's viewpoints and interests resonate with me on a personal level.
Interaction (INT)	INT1	The influencer maintains active communication by responding to followers and commenting on their posts.
	INT2	The influencer promotes follower engagement through question and answer sessions as well as polls and live broadcasts.
	INT3	I have a sense of belonging within this influencer's digital community.
Expertise (EXP)	EXP1	The influencer exhibits professional understanding of fashion products together with current trends.
	EXP2	The influencer shows extensive knowledge of fashion styling through their recommendations.
	EXP3	The influencer's fashion expertise holds more credibility for me than typical advertisements do.
Credibility (CRE)	CRE1	The influencer seems honest when recommending products.
	CRE2	This influencer presents reliable product reviews and opinions.
	CRE3	The influencer's product reviews appear to be true and impartial.
Consumer Engagement (CEG)	CEG1	I actively engage with the influencer's posts through likes/comments/shares.
	CEG2	Engagement between influencers and their audience builds my connection to brands.
	CEG3	The influencer's posts inspire me to either engage in conversations or provide my own feedback.
Purchase Intention (PUI)	PUI1	My purchasing decisions often include fashion products endorsed by this influencer.
	PUI2	The endorsement of a product by this influencer makes me consider purchasing it.
	PUI3	When the influencer features a product it makes me more inclined to purchase it.

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Work-from-Home in the IT Sector: A Bibliometric Review of Global Research on Productivity, Utilization, and Engagement (2019–2024)

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Abstract

The outbreak of COVID-19 significantly accelerated the widespread implementation of Work-from-Home (WFH) practices, especially within the Information Technology (IT) sector. This transformation has led to a growing body of scholarly work examining how remote work influences employee productivity, engagement, and resource utilization. Despite this expanding literature, a comprehensive bibliometric synthesis remains limited. This paper addresses that gap by systematically reviewing 345 Scopus-indexed, peer-reviewed articles published between 2019 and 2024, using the Bibliometrix R package. The analysis explores patterns in publication output, key contributing authors and countries, thematic clusters, and the conceptual progression of WFH research. The results highlight notable academic output from countries like India and the United States, increased attention to mental health and digital collaboration, and a thematic evolution from emergency-driven adaptations to more strategic hybrid workforce models. By mapping this intellectual landscape, the study identifies opportunities for future inquiry and offers insights that are valuable to both researchers and practitioners navigating the post-pandemic digital work environment.

Keywords: *Remotework, ITindustry, Work-from-home , Employee productivity, Engagement, Bibliometric study, Thematic development, Scopus*

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1. Introduction

1.1. Background of the study

The post-pandemic era has marked a significant shift in how organizations operate globally, with remote work transitioning from a niche arrangement to a widely accepted standard. This shift was most evident in the Information Technology (IT) sector, where companies swiftly implemented Work-from-Home (WFH) strategies to maintain business operations, support employee safety, and align with the growing digitalization of work processes.

What began as a temporary response to an emergency has since evolved into a deliberate workforce strategy. The IT industry—characterized by its robust digital ecosystems, agile workflows, and cross-border team structures—is especially well-suited to evaluate the long-term consequences of remote work. Nevertheless, this evolution has introduced new challenges surrounding employee effectiveness, optimal use of resources, sustained motivation, psychological well-being, and responsive leadership. Scholars from diverse academic disciplines—including management, HR, information systems, and organizational behavior—have increasingly examined these complexities, offering a range of empirical and conceptual insights into the changing world of work.

Despite the growing volume of scholarly contributions, there exists a fragmented understanding of how research on WFH in the IT context has evolved over time, what topics have gained prominence, and where future work should be directed. Most prior reviews have adopted narrative or systematic literature review methods, lacking a bibliometric lens to quantify and visualize intellectual structures, citation patterns, and thematic trajectories.

1.2. Research Problem

There is currently no comprehensive bibliometric analysis that maps the evolution of WFH research specifically within the IT sector. Given the sector's pivotal role in global economies and its digital readiness, understanding the research landscape is vital for both academia and practice. This study aims to fill this gap by conducting a detailed bibliometric analysis of global WFH literature from 2019 to 2024.

1.3. Research Objectives

This study is guided by the following objectives:

- To analyze the volume and growth trends of WFH research in the IT sector.
- To identify leading authors, institutions, journals, and countries contributing to this field.
- To examine thematic evolution, keyword co-occurrences, and intellectual structure.
- To highlight research gaps and propose future research directions.

1.4. Significance of the Study

This bibliometric review provides a consolidated research map for scholars, HR practitioners, and IT leaders. By leveraging bibliometric tools such as Bibliometrix in RStudio, the study not only offers insights into the structure and productivity of existing scholarship but also identifies underexplored areas such as leadership in virtual teams, digital burnout, and sustainability of hybrid work models.

2. Evolution of Work-from-Home (WFH) Research

The Work-from-Home (WFH) concept has experienced a significant transformation over the past decade. Initially seen as a flexible option for freelancers and select technology roles, remote work became a global necessity during the COVID-19 pandemic. Earlier studies—pre-2020—primarily examined telecommuting as a lifestyle enhancement or cost-saving mechanism (Messenger & Gschwind, 2016). However, the pandemic institutionalized WFH across sectors, with the IT industry leading this shift.

Post-2020, the academic focus expanded to explore the effects of large-scale remote work on both individuals and organizations. Early investigations highlighted issues like digital preparedness, infrastructure limitations, and continuity plans (Prasad et al., 2020). As WFH evolved into a long-term strategy, research shifted towards human resource factors such as employee well-being, collaboration, engagement, and performance (Evans, 2020) and (Barhate & Dirani, 2022). This change reflects a growing maturity in the discourse—from immediate adaptation to strategic alignment.

2.1. Productivity in WFH Environments

Productivity remains a core metric in assessing the effectiveness of remote work models. Existing literature highlights various enablers and constraints, including access to technology, employee self-discipline, leadership support, and the nature of tasks involved. Studies suggest that productivity often improves due to reduced commuting and flexible schedules (Bloom et al., 2015), but these benefits are offset by distractions, lack of structure, and limited supervision.

The Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007) has been widely used to assess how task demands and organizational support influence outcomes in remote settings. Recent research supports the positive role of asynchronous tools, collaboration platforms, and digital workflow systems in sustaining productivity (Singh et al., 2021). Yet, excessive screen exposure and fragmented work patterns can negatively affect efficiency, particularly in mentally demanding roles within the IT sector.

2.2. Utilization and Remote Work Efficiency

Utilization—understood as how effectively employees apply their time and effort—is more complex to measure in a remote setting. Traditional indicators such as physical presence or logged hours often fall short in evaluating productivity off-site. Scholars now emphasize output-based evaluation systems, especially for project-based sectors like IT (Nazir et al., 2019)

Under remote conditions, utilization depends heavily on mutual trust, personal discipline, and the level of monitoring. While digital tools like dashboards and time trackers improve visibility, they may also impact morale and autonomy. Recent literature advocates for hybrid evaluation models combining both measurable output and qualitative factors such as task difficulty and innovation (Mumtaz, 2024).

2.3. Engagement and the Employee Experience

Employee engagement—defined as a psychological and emotional commitment to work—has emerged as a major focus area in remote work literature. Kahn's (1990) engagement theory identifies three key elements: meaningfulness, safety, and availability, all of which are influenced by remote work dynamics such as autonomy, feedback, and managerial recognition.

Researchers highlight the importance of virtual interactions, peer support, and digital reward systems in building engagement. Tools like online town halls, regular check-ins, and pulse surveys are widely used to simulate in-person interaction. Still, challenges persist—especially for junior staff or recent hires with limited exposure to pre-pandemic workplace norms.

Remote disengagement, evident through trends like "quiet quitting," multitasking, or reduced responsiveness, reflects the need for revised engagement metrics suited to hybrid or remote workplaces.

2.4. Technological and Managerial Enablers

Technological capability and leadership adaptability are crucial to successful WFH models in IT. Platforms that support real-time collaboration, transparent task tracking, and remote knowledge sharing are key performance drivers. However, overuse of synchronous platforms such as video calls has led to increasing concerns around digital fatigue (Fosslien & Duffy, 2020).

Leadership agility—particularly the capacity to shift styles for virtual teams—has gained prominence. Approaches involving transformational leadership, decentralization, and empathetic communication are positively associated with higher morale and performance (Barhate & Dirani, 2022). Additionally, AI-based productivity monitoring and HR analytics are gaining traction, though ethical issues around privacy and surveillance remain areas of concern.

2.5 Synthesis of Thematic Gaps

Despite the volume of emerging research, several conceptual and methodological gaps continue to exist:

- Isolated Constructs: Productivity, engagement, and utilization are often studied separately, limiting the development of integrated frameworks.

- Regional Concentration: The majority of studies originate from North America and Europe, with emerging economies like India being underrepresented.
- Lack of Longitudinal Studies: Cross-sectional approaches dominate, offering little insight into sustained WFH impacts or hybrid transition dynamics.
- Underuse of Behavioral Theories: Limited application of frameworks such as Social Exchange Theory or Conservation of Resources Theory restricts deeper understanding.
- Sector-Specific Underrepresentation: Specific challenges of IT—like agile coordination, client interfacing, and distributed project management—are inadequately examined.

In conclusion, the literature on WFH in the IT sector is growing but remains fragmented. While earlier work concentrated on infrastructure and crisis management, newer studies focus on psychological well-being, engagement, and hybrid models. A bibliometric review helps bridge these silos, offering a more structured synthesis and identifying directions for impactful future research.

3. Research Methodology

3.1. Research Design and Approach

This study adopts a bibliometric methodology—a structured and quantitative technique used to assess the evolution, structure, and academic patterns of a research domain. Unlike traditional literature reviews that may involve subjective interpretations, bibliometric methods provide objective, reproducible insights by analyzing publication metadata, including keywords, citations, co-authorships, and thematic clusters.

Given the growing volume of literature on Work-from-Home (WFH) in the IT industry, especially around productivity, engagement, and resource utilization, this method enables systematic detection of scholarly trends and gaps. The approach is guided by the principles of science mapping proposed by Zupic and Čater (2015) and implemented through the Bibliometrix package in R, developed by Aria and Cuccurullo (2017).

3.2. Data Source and Search Strategy

To ensure inclusion of high-quality, peer-reviewed research, the Scopus database was chosen as the primary data source. Scopus is a comprehensive and multidisciplinary repository of scholarly articles, conference proceedings, and review papers, frequently used in bibliometric research within business and IT domains.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was employed to ensure a structured and transparent selection process. A total of 345 articles were identified through database searches.

The following Boolean search string was applied:

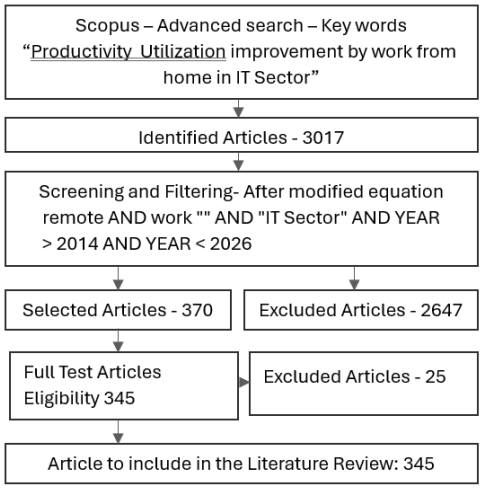
("Work-from-Home" OR "Remote Work" OR "Telecommuting") AND ("Productivity" OR "Utilization" OR "Engagement") AND ("Information Technology" OR "IT Sector")

Inclusion Criteria:

- Publication Years: 2019 to 2024
- Document Types: Peer-reviewed journal articles and conference papers
- Language: English only
- Subject Areas: Business, Management, Social Sciences, and Computer Science

The search was executed in April 2025, retrieving a total of 345 documents, and shown in Table

Figure 1: PRISMA Flow of Article Selection for Bibliometric



3.3. Data Cleaning and Preprocessing

The bibliographic records were downloaded in BibTeX format and imported into RStudio using the convert2df() function from the Bibliometrix package. The following preprocessing steps were undertaken:

- Duplicate Removal: Cross-checked using DOI, title, and first author.
- Non-Research Content Exclusion: Editorials, book reviews, errata, and opinion pieces were removed.
- Manual Screening: Abstracts and titles were reviewed to ensure relevance to WFH in the IT context.
- Metadata Structuring: Data was converted into a structured DataFrame for quantitative analysis.

Final Dataset Profile:

- Documents: 345
- Unique Journals and Sources: 283
- Total Authors: 1,001
- Author Keywords: 1,130
- References Cited: 26,000+
- Average Co-Authors per Document: 3.08
- Annual Growth Rate: 24.1%
- Average Document Age: 2.05 years

This refined dataset formed the basis for all subsequent analyses.

3.4. Analytical Tools and Techniques

The bibliometric analysis was conducted using R (version ≥4.1.0) within the RStudio environment. The primary tools and packages included:

- Bibliometrix: Core package for bibliographic data analysis
- Biblioshiny: Web-based GUI for visual bibliometric exploration
- ggplot2 and dplyr: Used for advanced data visualization and manipulation

The analysis covered multiple bibliometric dimensions as shown in Table 2.

Table 2: Bibliometric dimensions

Technique	Purpose
biblioAnalysis()	Descriptive statistics for authors, sources, and articles
summary()	Highlights top authors, institutions, and citations
networkPlot()	Visualizes co-authorship and keyword networks
thematicEvolution()	Tracks the evolution of keyword clusters
conceptualStructure()	Uses MCA to identify conceptual clusters
histNetwork()	Maps intellectual lineage and citation pathways
trendTopics()	Displays shifts in research focus over time

3.5. Explanation of Bibliometric Metrics Used in the Study

This study employs a broad range of bibliometric indicators to provide a nuanced understanding of research trends, author influence, institutional participation, and thematic evolution in the context of Work-from-Home (WFH) research in the IT sector. The data were derived from Biblioshiny outputs across multiple worksheets, and the key metrics are grouped and discussed as follows:

3.5.1. Scientific Production and Citation Trends

- Annual Scientific Production tracks how many papers are published each year, offering insight into the rising interest in WFH topics, particularly post-2020.
- Annual Citations per Year captures the average number of citations received annually, highlighting the impact and visibility of research outputs over time.
- Source Productivity Over Time reveals how specific journals have engaged with the topic consistently or intermittently, which helps identify core and emerging publication venues.

These metrics collectively reflect both the temporal growth and influence trajectory of WFH scholarship.

3.5.2. Source-Level Impact Indicators

- Most Relevant Sources identifies journals contributing the highest number of WFH publications.
- Source Local Impact uses h-index, g-index, and total citation counts to assess the influence of journals at the topic level.

This analysis helps recognize which journals are not only productive but also influential, guiding future publication strategies.

3.5.3. Author-Level Metrics

- Most Relevant Authors lists key contributors based on publication volume.
- Author Productivity Over Time tracks how actively top authors have published over the years.
- Lotka's Law examines the frequency distribution of authors' contributions, typically confirming the 80/20 pattern—i.e., a few authors account for a majority of the papers.

These indicators shed light on individual scholarly impact and concentration of knowledge production.

3.5.4. Institutional and Geographical Contributions

- Most Relevant Affiliations highlights institutions with major contributions to WFH literature.
- Corresponding Author's Country maps the global footprint of research contributors.
- Collaboration Network and World Map visualize inter-country or inter-institutional research partnerships.

These metrics underscore who is leading the research and where the knowledge hubs are located, providing a global view of collaboration dynamics.

3.5.5. Thematic and Keyword Mapping

- Most Frequent Words, Word Clouds, and TreeMaps illustrate recurring keywords and concepts, giving a snapshot of dominant research themes.
- Trend Topics identify which terms have grown or declined in popularity over time, reflecting shifting research priorities.

Such visual and frequency-based analysis helps map the intellectual landscape of the WFH discourse.

3.5.6. Three-Field and Relational Mapping

Three-Fields Plot connects Authors, Keywords, and Sources, demonstrating how content production flows across contributors and journals.

This intersectional view helps in understanding the structure and dynamics of the field.

3.5.7. Citation and Co-Citation Structures

- Co-Citation Networks uncover relationships between frequently co-cited articles, offering insights into theoretical or methodological clusters.
- Historiographs trace the chronological citation flow, identifying seminal contributions that shaped the field.

These metrics reveal the knowledge structure and influential scholarly paths within the WFH literature.Together, these bibliometric indicators offer a comprehensive, multidimensional view of WFH research. They not only capture what is being published and by whom but also show how knowledge is structured, shared, and evolved over time. This strengthens the credibility and depth of the literature review and allows researchers and practitioners to navigate the WFH discourse with strategic clarity.

3.6. Methodological Validity and Reliability

This bibliometric approach ensures internal validity through transparent sourcing, standardized indicators (e.g., citation counts, co-authorship metrics), and reproducible procedures. The selection of Scopus as a data source enhances external validity by covering high-impact, peer-reviewed literature. Moreover, the entire analysis is reproducible, with documented steps allowing replication using the same data and tools.

3.7. Limitations of the Methodology

While bibliometric methods are robust, they are not without constraints:

- Database Limitation: Only Scopus-indexed literature was analyzed, excluding Web of Science, IEEE Xplore, and Google Scholar content.
- Lack of Qualitative Depth: The method does not assess theoretical rigor or contextual richness of individual papers.
- Citation Lag: New publications may have fewer citations, resulting in their underrepresentation.
- Terminological Scope: Variations such as "distributed work" or "digital nomadism" may fall outside the search parameters.

Future studies could benefit from integrating multiple databases and combining bibliometric reviews with qualitative methods such as systematic literature reviews (SLRs) or meta-analyses.

4. Bibliometric Results and Analysis

This chapter presents the bibliometric findings based on 345 peer-reviewed publications retrieved from the Scopus database, covering the period from 2019 to 2025. The results are structured across key analytical categories: general publication trends, citation impact, author and journal influence, institutional contributions, geographic distribution, keyword analysis, historiographic mapping, and collaboration networks. Each subsection interprets quantitative patterns and their strategic relevance within the evolving WFH research landscape.

4.1. General Scientific Production and Growth Trends

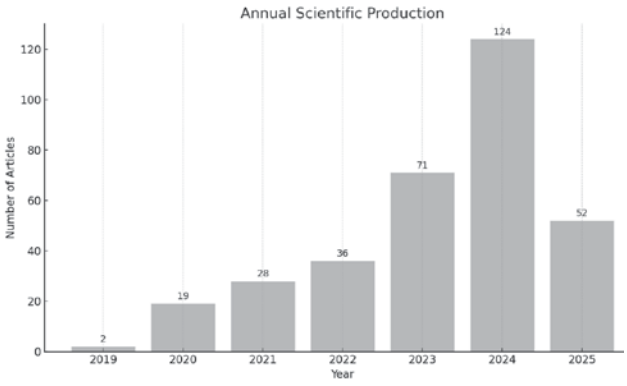
4.1.1. Annual Scientific Output

Publication output on WFH in the IT sector has increased steadily since 2019, peaking in 2024 with 124 articles. By mid-2025, 52 publications were already recorded, indicating continued research interest. This upward trajectory reflects strong academic engagement driven by post-pandemic transitions and digital workplace reforms.

The calculated annual growth rate of approximately 180% confirms that WFH has emerged as a fast-growing research domain, especially within technology and knowledge-driven sectors.

Figure 1:

Annual Scientific Output on WFH in the IT Sector (2019–2025)



4.1.2. Document Characteristics

- Total Documents: 345
- Sources (Journals/Conferences): 270
- Average Citations per Document: 6.41
- Document Types: 198 journal articles, 62 conference papers, 15 reviews, 19 books/chapters

4.2. Citation Impact and Article Influence

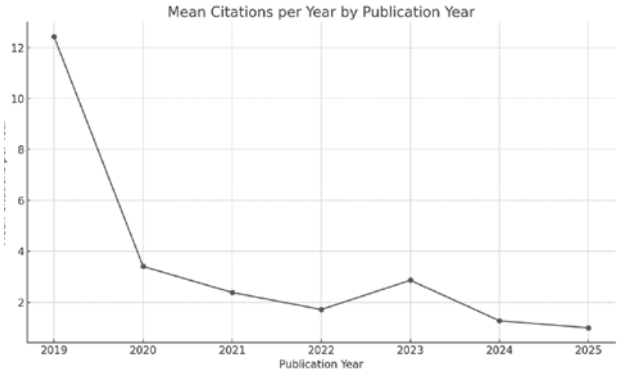
4.2.1. Citation Distribution by Year

While older studies naturally accumulate more citations, recent publications (2023–2025) are also gaining traction—indicating that the topic remains highly relevant. The historiograph highlights influential works such as Nazir (2019) on organizational justice (83 citations), Prasad (2020) on workplace climate, and Evans (2020) on technological adaptation during the pandemic.

The citation lag is evident for newer articles, but consistent upward citation curves through 2023–2024 suggest ongoing scholarly engagement.

Figure 2:

Average Citations and Most Influential WFH Papers by Year



4.3. Three-Field Analysis

A three-field plot linking top journals, keywords, and authors was constructed to visualize intellectual linkages. Authors such as Gupta, Singh, and Chatterjee have emerged as key contributors, with dominant keywords including remote work, productivity, and employee engagement.

The alignment between source, content, and contributor provides a strategic view of thought leadership and topic focus areas.

Figure 3:

Top 5 Resources, Keywords and Authors

4.4. Core Journals and Source Impact

Top journals were assessed using publication volume, h-index, g-index, and citation count, as shown in Table 3.

Table 3: Most Influential Journals by h-index, g-index, and Total Citations

Journal Name	h-index	g-index	Total Citations
Employee Relations	3	3	125
Sustainability (Switzerland)	3	4	44
Management Decision	3	4	19

The relatively modest h-index and citation counts are consistent with the recent nature of WFH research. These journals span disciplines such as human resource management, sustainability studies, and organizational behavior—reflecting the multidisciplinary nature of WFH research. Their inclusion points to varied academic entry points into the discourse, from managerial effectiveness to workplace ethics and digital well-being The inclusion of both management and interdisciplinary journals underscores the diverse entry points into WFH research.

4.5. Institutional Contributions

Indian institutions lead the volume of output, reflecting both research focus and practitioner interest. Details are shown in Table 4.

Table 4: Top Contributing Institutions in WFH Research (2019–2024)

Institution	Publications
Symbiosis International (Deemed University)	20
Aligarh Muslim University	10
Chitkara University	7
GITAM School of Business	7
King Faisal University	7

Notably, over **29.8% of publications** originate from India, confirming its prominence in the global WFH discourse.

4.6. Country-Level Analysis and Collaborations

Table 5: Country-Level Contributions and International Collaborations

Country	Articles	Multi-Country Papers (MCP)	MCP %
India	99	10	10.1%
Malaysia	12	6	50.0%
USA	9	4	44.4%
Poland	9	1	11.1%
Indonesia	7	3	42.9%

The **India–USA and India–Malaysia collaborations** are the strongest, suggesting emerging South-South and South-North research linkages.

4.7. Keyword Co-occurrence and Thematic Trends

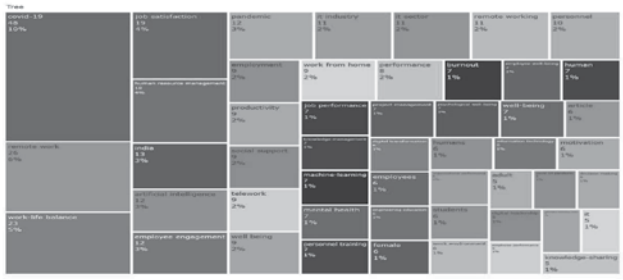
A total of **1,130 unique author keywords** were analyzed for thematic clustering and temporal progression.

Table 6: Most Frequent Keywords in WFH–IT Research (2019–2024)

Keyword	Occurrences
COVID-19	48
Remote Work	26
Work-Life Balance	23
Employee Engagement	19
Human Resource Management	18

Figure 4:

Tree Map of Keywords



4.8. Temporal Trends

- **2020**: Focus on digital infrastructure, psychological well-being
- **2021–2022**: Shift to job satisfaction, ICT use, leadership adaptation
- **2023–2024**: Emphasis on hybrid models, autonomy, and digital fatigue

This evolution indicates a clear movement from reactive studies to proactive models for sustainable remote work.

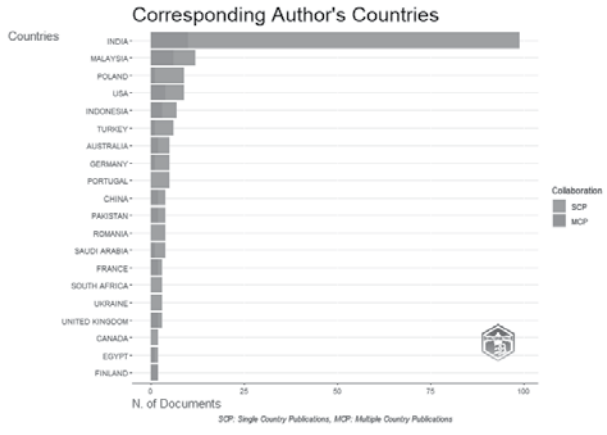
4.9. Collaboration Pattern

Collaboration patterns show that most research in this field comes from India, making up about 30% of all publications. Other key contributors include the USA, Malaysia, Poland, and Indonesia, with countries like the USA and Malaysia involved in many international collaborations.

Further analysis shows that countries such as Australia, UAE, Finland, Netherlands, and France also work closely with others across borders. These global partnerships bring diverse perspectives, which help improve the quality of research on remote work, productivity, and employee engagement. Such international networks are important for building a shared understanding of work-from-home practices and digital transformation worldwide.

Figure 5:

Authors countries



4.10. Historiographic Mapping of Influential Works

A historiograph was created using Global Citation Scores (GCS) to trace the intellectual lineage of WFH research.

Table 7: Key Influential Papers in the Intellectual Lineage of WFH Research

Year	Author	Contribution	GCS
2019	Nazir S.	Organizational Justice & Innovation	83
2020	Prasad KDV	Psychological Well-being of IT Professionals	81
2021	Jamal MT	Job Demands–Resources Model in WFH	97
2022	Barhate B.	Cross-Cultural Leadership Challenges	11
2023	Mishra N.	Social Support in Hybrid Work	19

The historiograph confirms a three-phase progression:

- Foundation Phase (2019–2020): Organizational justice and crisis management
- Maturity Phase (2021–2022): Models of performance and well-being
- Strategic Phase (2023–2025): Digital fatigue, hybrid work, and employee resilience

4.11. Co-Authorship and Collaboration Networks

Using networkPlot(), co-authorship networks revealed regional clusters centered around Indian, Malaysian, and U.S. institutions.

Table 8: Co-authorship Patterns and International Collaboration Clusters

Metric	Value / Insight
Average Co-authors per Paper	3.13
International Collaboration Rate	22.59%
Strongest Regional Clusters	Gupta–Singh–Chatterjee (India); Faisal–Mohamad (Malaysia)

4.12. Thematic Map

The thematic map illustrates four clusters of research focus within the Work-from-Home literature. Thematic mapping revealed four major research zones:

- Motor Themes: COVID-19, remote work, and work-life balance
- Niche Themes: Digital leadership, resilience, mental health
- Basic Themes: Employee engagement, India-centric studies
- Emerging/Declining: Cloud computing, bibliometric reviews

2025 Trends:

- Sustained interest in COVID-19 and hybrid work
- Rise of AI and systematic reviews as analytical lenses
- Continued centrality of India in empirical focus

The keyword co-occurrence network visually maps the most prominent terms used across 345 publications on Work-from-Home (WFH) in the IT sector. Larger nodes indicate higher frequency, while thicker connecting lines represent strong co-occurrence relationships.

Figure 6:

Thematic Map 1

At the core of the network, keywords such as “COVID-19,” “work-life balance,” “employee well-being,” “remote work,” “IT sector,” and “India” emerge as dominant. These form dense clusters interconnected with supporting terms like “social support,” “digital transformation,” “artificial intelligence,” and “telecommuting.” The network

structure highlights the interdisciplinary nature of WFH research, encompassing psychological, technological, and organizational themes. The presence of diverse, color-coded clusters further indicates topic specialization and methodological variety in the literature.

Figure 7:

Thematic Map 2

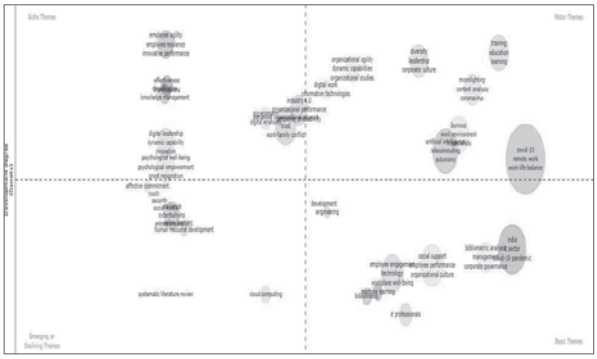
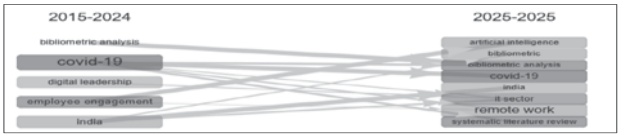


Figure 8:

Trend Shift post 2024



This thematic evolution map illustrates the transition of core research themes in the Work-from-Home (WFH) and digital workplace literature:

- The theme "COVID-19", dominant from 2015 to 2024, continues to be a major focus in 2025, indicating its ongoing influence on digital work studies.
- Themes like "employee engagement" and "digital leadership" have diversified into "remote work," "IT sector," and "systematic literature review", suggesting that these earlier concepts have matured and now feed into more specialized analyses.
- "India" has remained a consistent geographic and contextual focus, evolving into deeper explorations of sector-specific (e.g., IT sector) implications.
- The emergence of "artificial intelligence" and "bibliometric" as 2025 themes points toward a growing interest in technological augmentation and meta-analytical studies of this research area.

4.13. Summary of Key Insights

Table 9: Summary of Key Bibliometric Insights

Publication Peak	2024 (124 articles), followed by 2025 (52 articles so far)
Leading Authors	Gupta S., Singh S., Chatterjee S.
Top Journals	*Employee Relations*, *Sustainability*, *International Journal of Organizational Analysis (IJOA)*
Geographic Leaders	India, USA, Malaysia, Poland, Indonesia
Dominant Keywords	Remote work, COVID-19, engagement, hybrid work, artificial intelligence
Research Gaps Noted	Digital transformation, agile practices, AI integration, utilization
Citation Leaders	Nazir (2019), Jamal (2021), Prasad (2020), Mishra (2024)

5. Discussion and Implications

5.1. Interpretation of Findings

The review of 345 scholarly articles (2019–2025) presents a comprehensive picture of the evolving research landscape on Work-from-Home (WFH) in the IT sector. Trends in publication volume, theme evolution, and international collaboration suggest both growing interest and strategic maturity in the field. What began as a reactive focus during the COVID-19 crisis has gradually transitioned into a broader, future-oriented discourse.

5.1.1. Evolving Nature of WFH Research

A marked increase in academic output after 2020 indicates a conceptual shift: from short-term, crisis-driven studies on digital preparedness to strategic research on remote work design. Recent studies now focus more on themes such as employee engagement, hybrid work, digital fatigue, and psychosocial well-being, reflecting a broader, system-level understanding of WFH.

5.1.2. Dominance of Productivity, Engagement, and Utilization

Although the concepts of productivity, utilization, and engagement are frequently studied, they are often addressed in silos. This fragmented approach limits understanding of their interdependencies. There is a need for integrated frameworks that examine how these variables interact within remote and hybrid environments—particularly in IT settings where digital work is complex and collaborative.

5.1.3. Geographic and Institutional Leadership

India emerges as a leading contributor to the Work-from-Home (WFH) literature, reflecting the country's pivotal role in this domain. This prominence is likely attributed to its robust IT industry, active academic community, and significant involvement in global outsourcing operations. Additionally, the presence of international collaborations—particularly with countries like the United States and Malaysia—signals an increasing trend toward globalized research efforts on remote work..

5.1.4. Emerging Themes and Intellectual Gaps

Thematic maps and keyword analysis reveal growing interest in hybrid work, AI monitoring, remote leadership, and psychological empowerment. However, several areas remain underexplored—such as agile methodologies in remote IT teams, longitudinal studies on remote engagement, and sectoral comparisons beyond the Indian context.

5.2. Theoretical Implications

This study contributes to theory-building by mapping the fragmentation and convergence of research in WFH literature. Several implications emerge for academic scholars:

- Need for Integrated Models: Existing studies tend to address productivity, engagement, and utilization independently. The field requires comprehensive models—potentially anchored in the Job Demands-Resources (JD-R) framework or Social Exchange Theory (SET)—that incorporate multi-dimensional constructs and feedback loops.
- Underuse of Behavioral Theories: While psychological aspects like burnout and motivation are frequently discussed, the application of behavioral and organizational theories remains sparse. Incorporating frameworks such as Conservation of Resources (COR) or Self-Determination Theory (SDT) could enhance explanatory power.
- Temporal Gaps in Research: Most studies use cross-sectional data; very few explore longitudinal changes in behavior, productivity, or digital engagement. Longitudinal and mixed-method approaches are essential to capture transitions from emergency remote work to stable hybrid arrangements.

5.3. Practical Implications for Managers and Organizations

For HR practitioners, team leaders, and senior managers, the findings offer critical insights:

- Redefining Productivity: Organizations must shift from activity-based monitoring to outcome-oriented metrics. Tools like real-time dashboards, paired with psychological safety and autonomy, can support sustainable performance.
- Enhancing Engagement: Strategies such as digital recognition, regular virtual check-ins, and pulse surveys are shown to improve remote engagement. However, these need to be personalized, frequent, and trust-oriented to be effective.
- Utilization without Surveillance: Excessive monitoring undermines morale. Instead, empowering employees through trust, flexible goals, and self-managed workflows is more effective in IT-based WFH roles.
- Supporting Managerial Agility: Training programs focused on empathy, digital leadership, and decentralized decision-making are essential. Managers who can lead without proximity are better positioned to retain and engage remote talent.

- Addressing Digital Fatigue: Organizations must implement guardrails to protect mental bandwidth. Asynchronous communication, "no-meeting" days, and technology detox interventions are increasingly necessary.

5.4. Policy-Level Implications

Governments and regulatory bodies play a crucial role in shaping the future of remote work. The findings from this analysis highlight several areas requiring policy attention:

- Inclusion in Labor Codes: WFH arrangements need formal recognition in employment law, including stipulations for digital rights, right to disconnect, and occupational well-being.
- Support for Infrastructure and Broadband: Equitable remote work depends on robust digital infrastructure, especially in rural and semi-urban regions. Public-private partnerships can close the digital divide.
- Guidelines for Data Privacy and Monitoring: As organizations deploy AI-driven surveillance tools to monitor remote workers, clear regulatory frameworks must govern ethical usage and employee consent.
- Standardization of Hybrid Work Norms: National-level guidelines around work hours, ergonomics, leave policies, and performance metrics for hybrid models can provide clarity for both employers and employees.

5.5. Research Agenda: Future Directions

Based on the findings, several underdeveloped or emerging themes warrant future research attention:

Table 10: Research Gaps

Focus Area	Research Gap Identified	Suggested Direction
Integrated WFH Frameworks	Siloed research on productivity, engagement, etc.	Develop multi-variable models using JD-R/SET
Agile Practices in WFH	Underrepresented in IT sector studies	Explore Agile team dynamics in remote delivery
Digital Trust and Surveillance	Weak theoretical linkages	Study effects of algorithmic monitoring on morale
Hybrid Work Models	Conceptually isolated in current literature	Longitudinal studies on transition from WFH
Socio-Cultural Dimensions	India-centric; other regions underrepresented	Compare WFH dynamics in Africa, LATAM, and EU
Psychological Safety and Burnout	Gaps in intervention studies	Test digital fatigue mitigation strategies
Gender, Age, and Equity	Scattered insights	Investigate intersectional experiences of WFH

In summary, WFH in the IT sector has transformed from a temporary solution to a permanent reconfiguration of work. Although the academic response has been rich, theoretical grounding and sectoral diversity still need expansion. For industry, balancing flexibility with accountability is a central challenge, while policy-makers must address ethical, legal, and infrastructural concerns.

As WFH evolves into hybrid and decentralized work futures, academic research must evolve too—moving from descriptive analysis to predictive and normative frameworks that help shape what work could and should look like in the digital era.

5.6. Conclusion and Future Research Directions

This bibliometric analysis examined global scholarship on Work-from-Home (WFH) within the Information Technology (IT) sector from 2019 to 2025, emphasizing themes of productivity, utilization, and engagement. Based on a review of 345 peer-reviewed publications, the study identified major thematic clusters, regional contributions, and the evolving conceptual focus of WFH research. India stood out as a key knowledge contributor, while emerging topics such as hybrid work arrangements, digital fatigue, and employee engagement gained traction over time.

Despite the growing volume of literature, the field continues to exhibit fragmentation, with

core constructs like productivity and engagement frequently explored in isolation. Limited theoretical cohesion and a lack of longitudinal studies suggest room for more integrated, future-oriented research. This study offers a structured foundation to support both academic inquiry and organizational strategy, advocating for a shift from short-term remote solutions to enduring, people-centric digital work ecosystems.

6.1. Contributions to Literature and Practice

This study makes three distinct contributions:

a) To the Literature

- Offers a structured and quantitative synthesis of five years of global WFH research in IT.
- Identifies thematic clusters, intellectual turning points, and conceptual gaps in the literature.
- Advances understanding of how WFH research has evolved in response to changing organizational realities.

b) To Practice

- Provides insights for IT managers, HR professionals, and organizational leaders on the evolving determinants of productivity, engagement, and utilization in remote settings.
- Highlights emerging concerns around digital fatigue, remote disengagement, and algorithmic surveillance.
- Supports evidence-based policy formulation around hybrid work practices, performance appraisal, and digital well-being.

c) To Methodology

- Demonstrates the efficacy of bibliometric analysis using the Bibliometrix package in R for mapping research landscapes.
- Incorporates historiographic mapping, thematic evolution, and conceptual clustering to go beyond basic metrics.

6.2. Limitations of the Study

While the study provides a robust and replicable analysis, it has the following limitations:

- **Database Limitation**: The analysis is confined to Scopus-indexed literature. Studies from Web of Science, Google Scholar, and discipline-specific databases may offer additional insights.
- **Citation Bias**: Older articles tend to have more citations due to longer exposure, which may distort influence rankings.
- **Language and Region Filter**: Only English-language publications were considered, possibly excluding relevant non-English literature.
- **Scope Narrowing**: The focus on the IT sector, while justified, limits generalizability to other industries such as healthcare, education, or manufacturing.

These limitations do not detract from the validity of the findings but highlight areas for methodological expansion in future studies.

6.3. Future Research Directions

Based on the findings and gaps identified, future research can be guided by the following directions:

Table 11: Future Research directions

Area	Suggested Focus
Integrated Theoretical Models	Develop frameworks that connect productivity, engagement, and utilization in WFH environments
Hybrid Work Systems	Study transitions from remote to hybrid work using longitudinal designs
Digital Transformation & Leadership	Examine the role of agile leadership, AI tools, and employee autonomy in remote settings
Well-being and Mental Health	Explore the long-term psychological effects of digital fatigue, burnout, and work detachment

Cultural and Demographic Diversity	Investigate how factors such as gender, age, culture, and socio-economic status shape WFH outcomes
Sectoral Comparisons	Extend bibliometric or empirical analysis to other sectors for comparative insights
Policy Impact Studies	Analyze how organizational and national WFH policies affect employee outcomes and firm performance
Multi-method Approaches	Combine bibliometrics with systematic reviews, meta-analyses, and qualitative case studies

The accelerated adoption of remote work has redefined the contours of employment, collaboration, and organizational performance. While WFH was born out of necessity, its permanence in corporate strategy demands nuanced understanding and ongoing evaluation. This bibliometric study contributes to this discourse by organizing the fragmented body of knowledge and illuminating paths for scholarly and managerial progression.

In a world increasingly mediated by digital tools, it is imperative that work systems balance technological efficiency with human-centric values. The future of work will not be determined by infrastructure alone, but by how well organizations can align productivity goals with employee engagement, flexibility, and well-being in a sustainable manner. This study serves as a foundation to build that alignment.

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A Study of HR Practices and Cultural Adaptability of Employees during Mergers and Acquisitions

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Abstract

While the cultural adaptability of employees is acknowledged as a crucial factor in cross-border mergers and acquisitions (M&As), it has not been rigorously tested. Consequently, its relationships with other HR aspects in M&As remain underexplored. This study examines the role of HR practices—(a) training opportunities, (b) communication, (c) HR support, and (d) job autonomy—in predicting employees' cultural adaptability during M&As. A causal survey methodology was employed to capture employee perspectives through quantitative data analysis. Data were collected from a sample of 388 employees across five M&As that occurred within the past two years in the Delhi-NCR region of India. Communication, training opportunities, and HR support emerged as significant predictors of cultural adaptability. The findings highlight the importance of HR practices in facilitating cultural adaptability during M&As. Organisations should prioritise structured communication, targeted training, and HR support in cross-border integration processes. This study contributes to the limited empirical research on cultural adaptability in M&As by establishing its key HR practices. The findings provide actionable insights for HR practitioners involved in managing cross-border M&As.

Keywords: *culture adaptability, cross-border M&As, cultural*

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1. Introduction

Mergers and acquisitions (M&As) have become increasingly common in the business world today. Many companies embrace cross-border M&A transactions as a vital growth and development strategy (Deng & Yang, 2015). M&A facilitate business growth by combining resources, expanding market presence, and fostering innovation (Cheng & Yang, 2017). They enable cost synergies, economies of scale, and improved competitiveness. M&A can also provide access to new technologies and talent and diversify revenue streams, enhancing organisational resilience and shareholder value (Gaughan, 2017). Over the past 10 years, the volume and value of M&A transactions have increased significantly, generally reflecting the health of the world economy (Statista, 2023). However, a dip is observed in 2022 due to high inflation, increased interest rates, geopolitical tensions, and increased regulatory oversight in the global markets (Baird, 2023). Compared to other regions, the volume and value of strategic M&A deals hit record highs in India in 2022 (Singh & Chandrashekhar, 2023). This has been due to notable adjustments to several regulations and administrative procedures by the Indian government, including the ongoing relaxation of foreign exchange laws for inward and outbound investors and the drive towards digitisation (Anthony et al., 2023).

Despite the increase in M&As, most face significant challenges and fail to achieve the intended objectives. The causes of failure are many, like clashing organisational cultures, disjointed marketing tactics, excessively optimistic financial expectations, and the absence of capable and devoted leaders who look after all the integration efforts and manage employees' concerns (Fealy & Kompare, 2003; Sagner, 2011). In terms of talent retention, in comparison to the 30% global average, 38% of executives headquartered in India reported frequent trouble keeping talent on board after the deal was completed (Singh & Chandrashekhar, 2023). Cultural differences and resistance to cultural change are frequently cited as barriers to post-M&A integration success in the extant literature (Rottig et al., 2014; Bijlsma-Frankema, 2001). Culture represents an important element of the M&A process, and its full strength is seen during a cross-border deal when two divergent cultures have to become one. Acculturation is the commonly used term for denoting the merging of diverse cultures (Rottig et al., 2013). Culture formation is neither a random event nor an action dependent solely on the personalities of founders or current leaders, but it is an internal reaction to external imperatives (Schraeder & Self, 2003). It is hardly surprising that multiple studies imply that M&As fail mostly because managers underestimate the people aspect and cultural fit (Lodorfos & Boateng, 2006; Razzetti, 2023). Despite its wide recognition by academicians and practitioners, no studies provide a framework to effectively manage and integrate culturally diverse organisations (Rottig et al., 2014).

Many cultural constructs are identified in the literature, such as cultural fit, cultural distance, cultural clash/conflict/shock, cultural difference, cultural compatibility, cultural adaptability, culture alignment, and multicultivation during M&As. While cultural shock, cultural clash, and cultural conflict represent adverse normal employee reactions to an alien cultural environment, cultural fit, cultural distance, cultural difference, cultural compatibility, and cultural alignment are the efforts of organisations to align the culture of the merging organisations to embrace the differences. Cultural adaptability is often considered broader in scope compared to cultural compatibility and cultural alignment, as cultural compatibility and cultural alignment focus on the degree of similarity or congruence between individual or organisational cultures. In contrast, cultural adaptability encompasses the ability to navigate and thrive in diverse cultural environments, regardless of whether there is perfect compatibility or alignment (Corritore et al., 2020). Cultural adaptability embodies a proactive stance towards embracing diversity and fostering cohesion amidst differences. In cross-border M&As, cultural adaptability is crucial because it enables employees to manage cultural diversity, resolve conflicts, and foster collaboration across cultural boundaries (Bijlsma-Frankema, 2001). It allows for a more inclusive and dynamic approach to cultural integration, recognising that diversity can be a source of strength and innovation (Fantaguzzi & Handscomb, 2024).

Human resource practices can be crucial in managing cultural issues and increasing the cultural adaptability of employees during cross-cultural M&As (Muhammad, 2020). Marks & Mirvis (2011) outlined HR strategies for four different cultural scenarios: pluralism, where partner companies coexist; integration, where cultures merge; assimilation, where one company absorbs another; and transformation, where companies adopt new values and norms while abandoning some existing cultural elements. However, there is no literature study analysing the impact of HR practices on the cultural adaptability of employees during M&A in one frame. HR practices like cross-cultural training opportunities, cross-cultural affective communication, providing job autonomy, flexible HR policies and support can help employees navigate cultural clashes (Hofer, 2022; Villalobos et al., 2020; Vasilaki et al., 2016; Huang et al., 2023). Hence, our study aims to unravel the best human resource management practices to effectively deal with cultural issues and ensure cultural adaptability in one framework. Based on this, the present study has the following research questions:

RQ1: How do HR practices influence employees' cultural adaptability during cross-border M&A integration?

RQ2: Which HR practices are the most significant predictors of employees' cultural adaptability during cross-border M&A integration?

2. Review of Literature

The literature surrounding the role of HR practices in fostering cultural adaptability during M&A is fragmented and lacks a comprehensive framework. While cultural integration is often highlighted as a critical success factor in M&A, studies rarely offer a structured approach to understanding how HR practices facilitate cultural adaptability in this context. Although existing research acknowledges that HR interventions such as cross-cultural training, communication, and job autonomy can enhance cultural adaptability (Mandal, 2024; Borderlesshr, 2024; Half, 2023; Villalobos et al., 2020), these insights are often dispersed across different fields and not specifically tailored to post-M&A integration. This gap in the literature makes it difficult to draw conclusive connections between HR practices and the successful cultural adaptation of merged organisations. The present study structured the review into two distinct but interconnected sections: a) cultural adaptability and b) the role of HR practices in supporting the cultural adaptability of employees. By examining these areas separately, the study aims to show how organisations can better manage the complexities of cultural integration and how strategic HR practices can influence cultural adaptability during the M&A process.

2.1. Cultural Adaptability

Cultural adaptability is *"the ability to understand one's and others' cognitive biases and to adapt, as necessary, to ensure successful team performance"* (Sutton et al., 2006, p. 144). It is the expertise of organisations involved in the transaction to understand, manage, and integrate the diverse cultural elements of their respective organisational cultures (Fantaguzzi & Handscomb, 2024). It is the capacity to swiftly absorb and adhere to changing organisational values (Talent Intelligence, 2023). Cultural adaptability comprises three elements: a) competence, b) teamwork, and c) adaptability. Cultural competence involves acknowledging that thoughts and actions often stem from cultural influences; teamwork involves individual and team competence, accountability, and rewards; and the third component, adaptability, entails recognising culturally based behaviours, understanding their implications, and actively choosing to adjust one's behaviour when working with individuals from different cultures (Sutton et al., 2006).

In the context of M&As, the challenge of cultural adaptation arises from merging diverse cultures into a cohesive structure that ensures productivity within the newly established organisation (Bijlsma-Frankema, 2001; Ahern et al., 2015). Employees from previously independent entities must familiarise themselves with each other's cultural norms and seek methods to reconcile differences, thereby preventing conflicts that could undermine the integration process. Employees who are adapters maintain a close cultural fit even when the organisational culture changes as a result of M&As. It emphasises aligning values, communication styles, and work practices to ensure a smooth integration

process (Luckner, 2016). Successful cultural adaptability includes assessing cultural compatibility during due diligence, identifying desired cultural fit, building ownership structure, and incorporating management throughout the transition process (Luckner, 2016). Cultural compatibility in M&A can improve collaboration, employee engagement, and overall integration success (Horne Capital, 2024). Cultural adaptability is a skill that can be learned by employees with the help of HR practices like imparting cross-cultural Training, communication, and job autonomy (Mandal, 2024; Borderless hr, 2024; Half, 2023; Villalobos et al., 2020). Therefore, the following section discusses the roles of Training, job autonomy, communication, and HR support in predicting employees' cultural adaptability during M&A. The proposed framework of the study is provided in Figure 1.

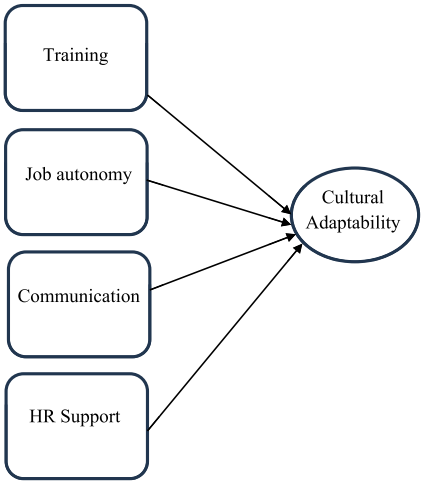

Figure 1:

Proposed framework

2.2. Training Opportunities and Cultural Adaptability

Training during M&As fosters cultural adaptability and ensures smooth integration (Hofer, 2022). When merging, companies often undergo significant cultural shifts, combining different organisational structures, values, and work cultures. Training programs to enhance cultural adaptability should focus on several key areas. Firstly, educating employees about both merging entities' cultural backgrounds and values can foster understanding and empathy (Rober, 2024). Secondly, providing cross-cultural communication training helps employees navigate differences in communication styles, norms, and expectations (Mandal, 2024). By investing in comprehensive training initiatives, companies can promote a culture of collaboration, respect, and adaptability, which is essential for successful M&A and long-term organisational success (Thakur & Bansal, 2015).

H_a1 - There is a significant relationship between training opportunities and the cultural adaptability of employees

2.3. Job autonomy and cultural adaptability

Autonomy in job roles promotes cultural adaptability through empowerment, allowing employees to make decisions aligned with their strengths and preferences (Villalobos et al., 2020). Personal flexibility fosters creativity and innovation, aiding in navigating cultural shifts (Nguyen et al., 2010). Additionally, a sense of ownership and commitment emerges, encouraging integration into new cultural environments (CCL, 2024). Moreover, autonomous employees are better equipped to self-regulate and navigate cultural differences with self-awareness (Gagné & Bhave, 2011). Autonomy in job roles cultivates adaptability by empowering individuals, fostering creativity, instilling ownership, and enabling effective self-direction amidst cultural changes (Villalobos et al., 2020; Gagné & Bhave, 2011).

HA2 - There is a significant relationship between job autonomy and the cultural adaptability of employees

2.3. Communication and cultural adaptability

During M&As, both factual information (managing logical concerns) and identity communication (handling cultural and identity questions) are required (Goodman & Balle, 2008). The stress caused by M&As is driven by job insecurity, discontinuity, uncertainty, and lack of autonomy. Previous researchers have stressed the importance of management communication in reducing stress anxiety, creating easy transition, creating a shared vision, providing a sense of meaning and reducing the detrimental reliance on gossip and rumours (Vasilaki et al., 2016; Jimmieson & White, 2011). Employees who believe they have received timely and accurate information about the change reported stronger intentions to

engage in change-supportive behaviours involving adaptive and proactive intentions to support the change (Jimmieson et al., 2008). It is connected to cognitions like uncertainty reduction, better self-efficacy to cope with change and awareness about the cultural diversity of the merging entity (Balle, 2008; Bordia et al., 2004; Jimmieson et al., 2004). HR professionals mediate, bridging cultural gaps and promoting transparent communication within merging teams. Through a deep understanding of cultural intricacies, effective HR communication can promptly resolve misunderstandings, avert potential conflicts and improve the cultural adaptability of employees (Borderlesshr, 2024; Half, 2023).

HA3 - There is a significant relationship between communication and the cultural adaptability of employees.

2.4. HR support and cultural adaptability

During M&As, HR support significantly impacts employees' cultural adaptability and overall integration success (McCarthy, 2020). Flexible HR policies, such as personalised training programs and adaptive work arrangements, help employees navigate the changes smoothly (Huang et al., 2023). HR support encompasses a broad range of services and activities that the Human Resources (HR) department provides to assist employees in various aspects of socio-cultural integration, like international experience, get-togethers, and navigating employee cross-cultural concerns (TigiHR, 2023). Culture-sensitive HR practices, including effective communication, culture exchange programs and accessible counselling services, address employee concerns and foster trust. This, in turn, enhances cultural adaptability by encouraging openness to new practices and values (borderlesshr, 2024). Employees who feel supported and empowered are more likely to embrace the post-merged entity's culture.

HA4 - There is a significant relationship between HR support and the cultural adaptability of employees.

3. Method

3.1. Procedure and data collection: A cross-sectional survey was conducted to gather quantitative data from a selected sample of M&As that took place in India over the past two years. The survey was designed to assess the influence of four HR practices-communication, training, job autonomy, and HR support on the cultural adaptability of employees involved in these M&A processes. This approach allows us to evaluate the direct impact of specific HR interventions on fostering cultural adaptability within the unique context of Indian M&A activities.

3.2. Sample and response rate: To test the hypothesis, the researcher contacted the HR managers of five cross-border M&As in Delhi-NCR in the last two years. Each M&A belongs to a different sector (bank, IT/consulting, aviation, railways, and healthcare). HR managers facilitated the collection of responses from their employees. The response rate was 80%, and there were no missing values. The final sample collected is n=388.

3.3. Measures: All the test measurement tools are on a five-point Likert scale from 'strongly disagree' to 'strongly agree'. For cultural adaptability, we have adapted four items from the Cultural Intelligence Scale by Ang et al. (2007); for instance, the items included "I am able to adapt to new cultural environments" and "I am comfortable working with individuals from diverse cultural backgrounds". We have adapted five items from Dass (2008) for communication, like "During the M&A, I felt adequately informed about the merging company" and "During the M&A, I was given adequate information about what to expect when working with employees from the merging company". Regarding training opportunities, we have adapted five items from Thakur et al. (2016), such as "I have been given cross-cultural training opportunities during the M&A process" and "I have been given awareness training opportunities (knowledge and information about the changes taking place) during M&A process". For job autonomy, we have adapted three items from Peccei & Rosenthal (1997), for example, "I can use my personal judgement in carrying out my job" and "I have the freedom to decide what I do on my job". Lastly, for HR support, we have adapted six items from Wickramasinghe & Karunaratne (2009) and Thakur et al. (2022), like "My HR department introduced integrated HR plan for the M&A", "My HR department organized staff events such as get-togethers and trips involving employees from both companies that intended to M&A", and "My HR go

out of its way to help employees during M&A". Table 1 shows mean, standard deviation (SD), composite reliability (CR), average variance extracted (AVE), and correlation matrix for each construct in the study. The mean values indicate average responses for each construct, while the standard deviation shows the variability in responses.

Table 1.

Reliability and Validity of Measurement Tools

Construct	Mean	SD	CR	AVE	CA	TR	COM	JA	HRFS
Cultural adaptability (CA)	3.6	1.05	0.95	0.770	**0.878**				
Training (TR)	3.4	1.04	0.87	0.690	0.610	**0.830**			
Communication (COM)	3.4	1.06	0.86	0.640	0.779	0.236	**0.800**		
Job Autonomy (JA)	2.9	0.98	0.93	0.734	0.508	0.276	0.400	**0.857**	
HR Support (HRS)	3.2	1.24	0.85	0.769	0.678	0.267	0.703	0.541	**0.877**

Cronbach's Alpha values range from 0.85 to 0.95, indicating good to excellent internal consistency and reliability for all constructs measured. The Correlation Matrix shows the correlations between the constructs (CA, TR, COM, JA, and HRFS). Diagonal elements (bold in Table 1) represent the square root of AVE for each construct, used to assess discriminant validity through the Fornell-Larcker Criterion. Off-diagonal elements represent the correlations between different constructs. According to the results, there is no issue in the correlation matrix, and all the values are significant at $p < 0.001$. There is no issue under the reliability and validity metrics as well.

4. Results

4.1 Employee Demographics: Table 2 presents the demographic composition of the sample (n=388), delineated in percentages. Within the sample, a majority of 74% are male. Regarding the organisational hierarchy, 49% occupy non-managerial positions, and 31% hold mid-level managerial positions. Regarding the sectoral distribution, 25% of the sample emanates from the IT/Consulting sector, and 20% originates from the banking sector. Additionally, 45% of the sample belongs to 50-50 merger companies. Tenure-wise, 24% of respondents served 1-2 years in the company when M&A was announced, and 20% served less than a year.

Table 2:

Employee Demographics

		Per cent
Tenure when M&A was announced	Less than 1 year	20
	1-2 years	24
	2-3 years	13
	3-4 years	12
	4-5 years	11
	5-10 years	12
	More than 10 years	7
Gender	Male	74
	Female	26

Manager level	Lower-level manager	10
	Mid-level manager	31
	Top-level manager	10
	Non-managerial	49
Merger Type	50-50 merger	45
	Acquired (Selling) Company	27
	Acquiring (Buying/Purchasing) Company	28
Industry	Banking	20
	IT/Consulting	25
	Aviation	18
	Healthcare	19
	Railways	18

4.2. HR Practices and Cultural Adaptability:

The entire sample response was divided into training and testing data sets with an 80:20 split. A generalized linear model was then applied to the training data set (Table 3). Based on the model analysis, the RMSE (Root Mean Square Error) value was determined to be 0.0598863. This optimal value was achieved after performing regression analysis and eliminating variables that were not significant. Variable selection was based on the p-values obtained for each variable and their intercept values from the regression model. A significance level of 0.05 was used to determine the significance of the predictors. The significant predictors for recoverability, ranked in decreasing order of significance, were Communication, Training, HR support, and job autonomy. The reduction in deviance from null to residual, along with the AIC value, suggests the model improves the fit over a model with no predictors, balancing predictive power with model complexity.

Table 3.

Linear Regression of Cultural Adaptability and its Predictor using RStudio

Call:					
Glm (formula = = CA ~TR+ COM + JA+ HRS, data = train_1))					
Deviance Residuals:					
Min	1Q	Median	3Q	Max	
-1.4537	-0.4579	0.0129	0.4355	1.9221	
Coefficients:					
	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.783326	0.134166	5.838	3.53e-0.6	***
TR	0.186350	0.070843	2.630	0.0028202	**
COM	0.277381	0.0402451	6.892	3.65e-0.8	***
HRS	0.223311	0.080577	2.771	0.00593	**
JA	0.091981	0.051690	1.779	0.07617	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
(Dispersion parameter for Gaussian family taken to be 0.23129576)					
Null deviance: 190.73 on 311 degrees of freedom Residual deviance: 124.30 on 301 degrees of freedom AIC: 422.28 Number of Fisher Scoring iterations: 2					
AIC: 422.28					

Four predictors were used in the model, which was trained on 80 per cent of the data, leaving 20 per cent for testing. In the RandomForest model, two key hyperparameters needed optimization: the total number of regression trees (ntree, with a default value of 500) and the number of predictors per node (mtry). The default value for mtry is typically 1/3 of the total number of predictors, which in this case was approximately 1 (since 4/3 ≈ 1.33). Other mtry values were also tested (mtry = 2, 3, and 4) to check for optimal RMSE or R-squared values. RMSE (Root Mean Squared Error) is a metric that gives more weight to more significant errors, making it helpful in understanding the impact of outliers. A lower RMSE suggests good predictive accuracy. R-square indicates the proportion of variance in the dependent variable that is predictable from the independent variables. After multiple iterations, the optimal values for ntree and mtry were selected based on the lowest RMSE obtained. The RMSE values for different mtry values are in Table 4). The optimal mtry value was determined to be 2, as it resulted in the lowest RMSE value (Wang et al., 2016). The corresponding R-squared value was 0.8170848, which means that the model explained about 82% of the variability in the outcome. MAE (Mean Absolute Error) is 0.1378766; it measures the average magnitude of errors in the model's predictions without considering their direction. A lower MAE indicates better model performance.

Table 4:

Random Forest Model Fit & Error Metrics of Cultural Adaptability using RStudio

312 samples 4 predictor			
No pre-processing Resampling:Bootstrapped(25 reps) Summary of sample sizes:282,282,282,282,282,282,.....			
Resampling results across tuning parameters:			
Mtry	**RMSE**	**Rsquared**	**MAE**
1	0.2316322	0.8167867	0.1398787
2	0.2308567	0.8170848	0.1378766
3	0.2320564	0.8157869	0.1423787
4	0.2400023	0.81490808	0.1498090

Table 5 shows hyper-parameters indicators like mtry (Number of variables randomly sampled as candidates at each split: 2, 3, 5). The value of mtry used in the model was 2. This means that two variables were considered at each split in the decision trees. Number of trees (ntree) is 500 which means that the model used 500 trees to make predictions. More trees generally improve the model's performance but increase computational cost. Min_samples_ leaf (minimum number of samples required to be at a leaf node) is set as 5 to prevent overfitting by ensuring that leaf nodes have at least five samples. Min_samples_split (minimum number of samples required to split an internal node) is set as 3 to control the minimum number of samples required to split a node. It helps in controlling overfitting. The significant predictors for cultural adaptability were communication, Training, HR support, and job autonomy, ranked in order of significance. According to the model, these variables are the most influential in predicting cultural adaptability. The correlation between testing and Training data is 0.826. This value indicates how well the model predictions correlate with actual values. A high correlation suggests that the model generalises well from Training to testing data.

Table 5:

Random Forest and Predictor Analysis of Cultural Adaptability using RStudio (Result with relevant hyperparameters, error metrics, and leading features)

Error Metrics (at mtry=2)	MAE	0.1378766
	RMSE	0.2308567
	Rsquared	0.8170848
Hyper-parameters	mtry(Random Variable selected)	(2,3,5)
	No. of trees(ntree)	500
	min_samples_leaf	5
	min_samples_split	3
Significant predictors	Most significant variable	Communication
	The second most significant variable	Training

	Third most significant variable	HR Flexibility & Support
	The fourth most significant variable	Job Autonomy
Model Accuracy	Correlation between testing and training data	0.8262502

5. Discussion and Conclusion

Employees' Cultural adaptability is crucial for successful cross-border M&A integration, where divergent organisational cultures must merge seamlessly (Rottig et al., 2013). However, the literature lacks a comprehensive framework for managing cultural issues during M&As, leaving organizations vulnerable to integration pitfalls (Rottig et al., 2014). The concept of cultural adaptability encompasses the capacity of organisations to understand, manage, and integrate diverse cultural elements, ensuring successful team performance and organisational cohesion (Sutton et al., 2006; Fantaguzzi & Handscomb, 2024). Successful cultural adaptability involves aligning values, communication styles, and work practices to facilitate a smooth integration process (Luckner, 2016). To address RQ1, the study concludes that HR practices, such as cross-cultural Training, flexibility, support, communication, and job autonomy, play a crucial role in enhancing employees' cultural adaptability during M&As (Mandal, 2024; Borderlesshr, 2024). Training programs educate employees about cultural backgrounds, values, and communication styles, fostering collaboration and respect (Rober, 2024). Job autonomy promotes adaptability by empowering individuals, fostering creativity, and instilling ownership amidst cultural changes (Villalobos et al., 2020). Effective HR communication reduces stress, promotes shared vision, and enhances employees' awareness of cultural diversity, improving cultural adaptability (Vasilaki et al., 2016).

Additionally, through personalised training programs and socialisation activities, HR support encourages openness and trust, facilitating employees' embrace of the culture of the post-merged entity (TigiHR, 2023; McCarthy, 2020). To address RQ2, the study identified significant predictor variables for cultural adaptability, such as Training, communication, job autonomy, and HR support. The model results support HA1 and HA3 by highlighting the significance of predictors related to Training and communication on cultural adaptability. HA4 is partially supported, indicating a significant but lesser role of HR support. HA2 cannot be confirmed or denied based on the available data since job autonomy was not explicitly identified as a significant predictor. Therefore, the present study contributes to the academic literature by highlighting that cultural adaptability is not solely an individual characteristic but rather a skill that HR can nurture and develop by implementing best practices.

6. Implication

6.1. Theoretical Implication

This study highlights a gap in existing research concerning best HR practices and cultural adaptability within the M&A context, suggesting avenues for future investigation. By identifying communication, training, and HR support as significant predictors of cultural adaptability, this study offers insights that could prompt researchers to delve deeper into the HR dimensions of cultural adaptability during M&As, potentially enriching the discourse on this subject. Furthermore, if job autonomy is not a significant predictor, it raises questions about its relevance in cultural adaptation, warranting further academic inquiry.

6.2. Practical Implication

This research sheds light on vital considerations for organizations navigating M&As. Given the prevalence of M&As in today's globalized business landscape, it underscores the expanded role of HR in facilitating the cultural adaptability of employees. Since communication and training emerge as significant predictors of cultural adaptability, organizations should focus on improving communication strategies and training programs. Effective communication and targeted training can enhance employees' ability to adapt to diverse cultural environments. Additionally, the significant role of HR support in predicting cultural adaptability suggests that HR practices should be adaptable and responsive. Organizations may benefit from flexible HR policies that address diverse employee needs and support cultural integration.

7. Limitation

First, self-reporting questionnaires utilized in the current study are susceptible to social desirability bias, where respondents may tailor their responses to align with societal expectations rather than providing accurate accounts of their experiences or behaviours. Additionally, self-reported data are prone to common method bias, further complicating the interpretation of results. Second, the scarcity of the literature on HR practices and cultural adaptability from the M&A context limits the generalizability of the results. Third, only the role of HR practices is studied, while cultural adaptability is also influenced by individual factors like education, upbringing, culture awareness, cultural intelligence and travel experience.

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Bibliometric Exploration of Innovation and Entrepreneurship in the Context of Sustainable Development Goals

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Abstract

This bibliometric review explores the intersection of sustainability, innovation, and entrepreneurship within the framework of the Sustainable Development Goals (SDGs), offering an in-depth analysis of research trends, key contributors, and thematic evolution. Drawing on data from Scopus and Web of Science, the study examines English-language articles published in leading journals. It identifies prolific authors like Wang X and Wang Y, influential sources such as Sustainability, and countries like China, the USA, and the UK as central to shaping the discourse. The review reveals a significant growth in research output since 2015, reflecting the rising global emphasis on sustainability. Thematic analysis highlights an evolution from foundational concepts of sustainable development to advanced applications, including "digital transformation" and "green innovation." Collaborative networks and co-occurrence mapping underscore this field's interdisciplinary and global nature, strongly focusing on bridging innovation, entrepreneurship, and sustainability. However, the study also identifies limitations, such as regional imbalances and underexplored emerging themes, which present opportunities for future research. This review provides valuable insights for academics, practitioners, and policymakers seeking to advance sustainable innovation and entrepreneurial practices to address pressing global challenges.

Keywords: *Sustainability, Innovation, Entrepreneurship, Sustainable Development Goals (SDGs), Bibliometric Analysis, Green Innovation, Digital Transformation.*

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1. Introduction

During the 21st century, the creation of new ideas and their implementation into reality is the key point as they contribute towards firms achieving their goals and mission. For organizational growth and innovation, creativity in actions is needed (Audretsch et al, 2006).The studies of Antonites and Yuvren (2005) & Li and Yu (2018) defined creativity which means the generation of ideas and innovation as the implication of ideas into reality are important for economic growth. These elements are needed nowadays in education system, but very few vocational schools offer this type of education that promotes creativity among youth (Yusuf, 2007). Schumpeter (2000) defined entrepreneurship as innovation which means school education must focus on creativity and innovation, and take steps to avoid disharmony in creativity. Innovation helps to create new ideas, new solutions to problems, and new activities related to the environment, which helps to achieve sustainable development. With the help of innovation and entrepreneurship, cost can be reduced and sustainable growth can be achieved. Every culture must adopt creativity in their ideas when they start businesses. According to Jack and Anderson (1999), the demand for vocational education increased from the 1980s to 1990s and has the main focus on the advantages of entrepreneurship in economic growth. During the 1960s society wasn't aware about the cons of environmental destruction done for the development of beings. Due to environmental destruction, society faces various problems such as weather changes, floods, drought, poverty, etc. Green innovation is a form of innovation in entrepreneurship that helps to minimize greenhouse gases and also helps to increase productivity (Chen et al., 2006). According to Peattie and Ratnayaka (1992), the primary focus of the green movement 1980s was environmentally sustainable development and the UN's 2000 introduction of the Millennium Development Goals ignited a global debate over how to improve society sustainably (Jones & Lubinski, 2014). The seventeen SDGs are presented by the United Nations as human development initiatives. Storey et al. (2017) emphasized that SDGs are currently considered one of the main factors influencing the conversion of private enterprise. According to the studies of Adam (2004) & Galera and Borzaga (2009), In a few years, the idea of social initiative gained popularity. Social entrepreneurship defined as a gauge of civic engagement and awareness, has also gained traction. Pache and Chowdhury (2012) & Lee (2020) explained that if social enterprise is misaligned, the application of the SDGs will not prosper. The innovative contributions made by social entrepreneurs are vital in explaining the challenges associated with mortality. The fundamental idea of social enterprise does not arise spontaneously since it defines the logic of traditional capitalism. Tracey and Phillips (2007) & Pache and Chowdhury (2012) depicted that the knowledge to commence a social enterprise may be included in school courses on entrepreneurship. As a result, it is essential to incorporate the SDGs into the vocational educational system which promotes creativity. In addition to global cross-regional partnerships, the SDGs focus on five primary mechanisms: promoting people's well-being; fostering society's attitude towards future social development; addressing the ecology; and promoting similarity in institutions. The advancement in cleaner production technologies can help in achieving sustainable development (Batool et al., 2019). Agenda 2030 of sustainability development are unpredictable (Davidson, 2014; Van Tulder & Keen, 2018). Sustainability development aims to reduce inequalities, end poverty, and provide neat and clean energy and work environments to the people of nations (Dalampira & Nastis, 2020; Elalfy et al., 2020). The UNGA adopted 17 sustainable development goals as an intergovernmental agreement between nations at the global level that will guide nations for sustainable development (Jonas et al., 2018; Van Zanten & Van Tulder, 2018). According to Voegtlin and Scherer (2017), innovation is a necessity for sustainable development, and business units are a significant source of innovation. It is the social responsibility of businesses or organizations to support public issues and to act in such a way that will help to achieve sustainable development. Business organizations must consider the dimensions of sustainability and should act to achieve sustainable development through innovation (Candia et al., 2019). In this way, innovation and entrepreneurship play a significant role in achieving sustainable development.

The paper is organized as follows: it begins by outlining the research methodology, followed by presenting the key findings from the bibliometric analysis. Finally, it concludes with recommendations for future research.

2. Research Methodology

The primary objective of this research is to examine the role of innovation and entrepreneurship in driving sustainability within the framework of SDGs. The study addresses the following research questions (RQ) to explore deeper into the study.

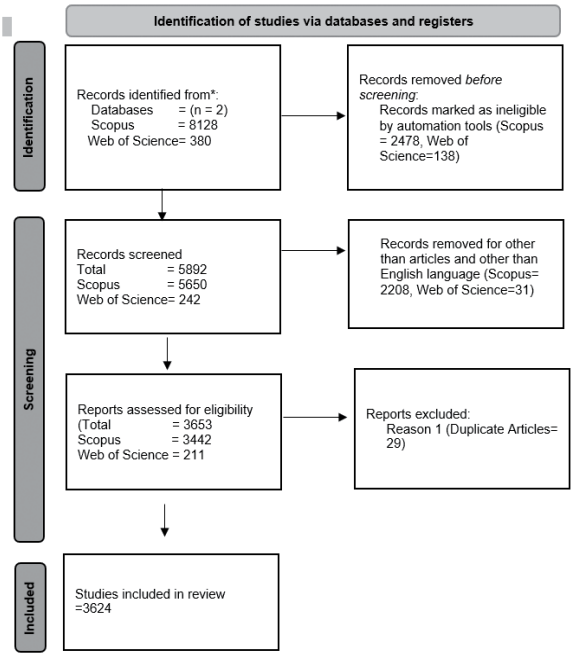

Figure 1

Flowchart showing the selection of data taken into consideration for the study

RQ 1: What is the annual scientific production of sustainability, innovation, and entrepreneurship?

RQ 2: Which are the top authors, countries, sources, and articles contributing to sustainability, innovation, and entrepreneurship?

RQ 3: How is evolution examined using study topics such as sustainability, innovation, and entrepreneurship?

RQ 4: Which countries are involved in researching sustainability, innovation, and entrepreneurship? RQ 5 What are the most dominant keywords related to research on sustainability, innovation, and entrepreneurship?

RQ 6: What is the impact of journals in the field of sustainability, innovation, and entrepreneurship? RQ7: What are the trending topics in the field of research on sustainability, innovation, and entrepreneurship? To analyze the published topics, journals, authors, and other things bibliometric analysis approach is used in the study. The bibliometric approach is a method to analyse published data through the quantitative approach using different software (Pritchard, 1969). This approach provides an overview of different domains such as the most relevant author, relevant document, top cited document, keyword occurrence, top cited countries, etc. This approach is recently developed due to computers and good network connections. To get an overview of Sustainable development in innovation and entrepreneurship, this work mainly focuses on data from the Scopus and Web of Science (WOS). 3624 articles are taken into consideration for the study. The datasets from Scopus and Web of Science were combined using R Studio, a powerful tool for statistical computing and data analysis. During the merging process, duplicate entries were carefully removed to create a unified dataset that offered comprehensive coverage of the research area. Once merged, the dataset was exported and analyzed through Biblioshiny, a user-friendly interface of the Bibliometrix R package. This streamlined approach enabled detailed bibliometric analysis and visualization, preparing the data for the next stages of the study. The software Biblioshiny of R studio is used to conduct the study.

Data was collected on 3rd December 2024 through the Scopus and Web of Science databases. The search string used in the study has been limited by applying the query of title, abstract, and keywords: (“SUSTAINABLE DEVELOPMENT GOAL” OR “SDG’S” OR “UNITED NATION SUSTAINABLE DEVELOPMENT GOALS” AND “BUSINESS” OR “ENTREPRENEUR” OR “INNOVATION”). This paper followed a structure PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis (Moher et al, 2015). A total of 3624 articles are

included in the study after the PRISMA framework which includes four stages in:

i. Identification of studies from the database
ii. Screening of studies based on exclusion criteria
iii. All documents published from the First day to 2024 are included, subject fields are also used as inclusion-exclusion criteria, only studies related to environmental science, Green sustainable science technology, Environmental Studies, Business, management, and Economics were included in the research. Documents other than articles were excluded.
iv. The data from Scopus and Web of Science was combined using R Studio, and the merged dataset was subsequently extracted through Biblioshiny for further analysis.

The research process began with the extraction of articles from two major academic databases, Scopus and Web of Science. A total of 8,182 articles were retrieved from Scopus, while 380 articles were extracted from Web of Science. Following the initial extraction, an automation filter was applied to both datasets to refine the selection based on specific criteria such as subject area, and relevant keywords. Subsequently, the language filter was applied to filter out articles not published in the desired language so that only those studies that are understandable and relevant are included. The datasets of both databases were then merged using R Studio, thus forming a single dataset. After merging, the dataset was also cross-checked for duplicates, resulting in the elimination of 29 duplicate articles. The whole process came down to 3,624 unique articles that finally fit the required inclusion criteria. In its entirety, from selection through filtering and further refinement of the articles, all of the process was documented within the PRISMA framework to facilitate clarity and transparency in the methodology.

3. Discussion

a. Most Relevant Authors

Figure 2 focuses on the most prolific authors contributing to the research domain under consideration. It presents a horizontal bar graph ranking authors by the number of documents they have published. Among the top contributors, "Wang X" and "Wang Y" stand out with the highest number of documents, 20 each. Following them are authors such as "Li Y" and "Liu Y," each with 16 publications, and "Khan M," "Zhang X," and others with slightly fewer contributions. This visualization highlights the dominance of a few key authors and underscores their significant influence within the research domain.

b. Most Relevant Sources

Figure 3 highlights the most prominent journal and publication sources in the field. "Sustainability" is by far the leading source, boasting 593 documents, indicating its critical role in disseminating research on sustainability-related topics. Other significant journals include the "Journal of Cleaner Production" with 156 papers and "Sustainable Development" with 65 publications. Other journals like "Business Strategy and the Environment" and "Environment, Development and Sustainability" are also major contributors, emphasizing the diversity of sources available for scholarly work in this area. This chart showcases where scholars prefer to publish their work.

c. Annual Scientific Production

Figure 4 tracks the growth of annual scientific publications over time. Initially, the production remained negligible until around 2010. However, a sharp upward trend is observed starting from 2015, reflecting an explosion of research activity. This trend likely aligns with a global increase in awareness and prioritization of sustainability, climate change, and other modern challenges. Interestingly, the peak appears around 2023, after which there is a sharp decline in the represented dataset for 2024, which could be due to incomplete data collection for the current year.

d. Thematic Evolution (2000–2025)

The thematic evolution visualization (Figure 5) outlines how research themes have evolved in sustainability, innovation, and entrepreneurship over the decades. During 2000–2008, the primary focus was on "sustainable development," reflecting an early-stage understanding of sustainability as a core objective. As time progressed (2009–2016),

the discourse expanded to the concepts like "word-of-mouth," "planning," and "flax," demonstrating diversification in sustainability-related strategies and practices. This era shows a growing interest in integrating sustainable practices into planning and communication, revealing a shift towards wider adoption and community engagement. 2017–2025 marks even more rapidly changing landscape, with "sustainable development goals," following directly along the UN's agenda set out globally for all, joining "social media" and "models" as headliner topics. This is a sign of development when digitally enabled platforms and conceptual frameworks are used throughout for broad engagement in sustainability. These transitions show a transparent trajectory: from basic concepts to innovative applications that are more integrative and use digital tools in community networks, all aspects speaking to a holistic approach to entrepreneurship and innovation.

e. Three-Field Plot: Journals, Keywords, and Countries

The three-field plot (figure 6) connects sources (journals), keywords (research themes), and countries (authors' affiliations), showing the interdisciplinary and global nature of sustainability and entrepreneurship research. Key journals like Sustainability, Technological Forecasting and Social Change, and Sustainable Development dominate the discourse, forming foundational platforms for knowledge dissemination. Keywords such as "sustainable development goals," "sustainability," and "innovation" are central, bridging different disciplines. On the geographical front, China, India, the USA, and the UK are leading contributors, thereby indicating their influence in the research landscape. This interconnected Visualization further shows how specific Journals and keywords are central to global research output, illustrating the integration of innovation into sustainability practices. Cross-country collaboration provides these studies with greater practical applicability and underlines entrepreneurial models that are globally scalable but locally impactful.

f. Country Collaboration Map

The collaboration map depicted in Figure 7 presents research collaborations among partners across nations over sustainability, innovation, and entrepreneurial themes. Some of the partnerships are showing strong connection with more than two collaborating nations. Partnerships involving collaborations between groups of countries provide the needed opportunities for spreading inventions and innovations about sustainable endeavors. In light of this mapping, some main hubs are present in regions - North America, Europe, and Asia - from which most innovations within sustainability emerge. This interconnectedness indicates the importance of sharing expertise and resources to address global challenges. For instance, a combination of manufacturing innovation in China and the USA's technological strengths shows that disparate strengths complement each other to tackle sustainability goals. Moreover, newer collaborations with Africa and South America are pointing to an increasingly greater representation of divergent perspectives. These partnerships highlight entrepreneurship as a means to foster sustainable development, emphasizing the significance of global cooperation in innovation-driven solutions.

g. Co-occurrence Network Visualization

The co-occurrence network graph 8 highlights the interconnected themes in the domains of sustainability, innovation, and entrepreneurship. At its core, the concepts of "sustainable development" and "sustainable development goals" dominate, represented by their central placement and larger node size. This indicates their pivotal role as foundational topics in academic and applied discussions. Peripheral themes like "digital transformation," "circular economy," and "green finance" are interconnected, reflecting their relevance in achieving sustainability through innovation. Especially, the isolation of "purchase intention" and "online reviews" suggests niche sub-domains with less direct overlap with the core sustainability framework but are nevertheless relevant in entrepreneurship and consumer behaviour research. This network underscores the interdisciplinary nature of sustainability studies, linking economic growth, technological advancements, and socio-environmental priorities. Such a map serves as a valuable tool for identifying research gaps and exploring underexplored interconnections among the disciplines.

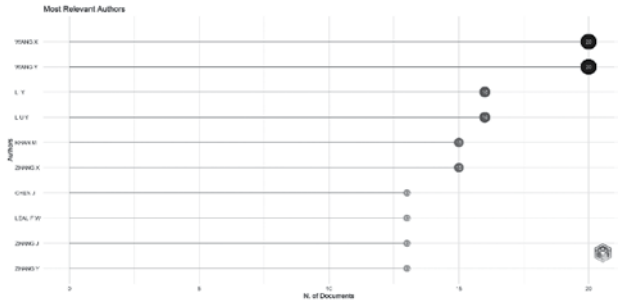

Figure 2

Relevant authors in Sustainability, innovation, and entrepreneurship.

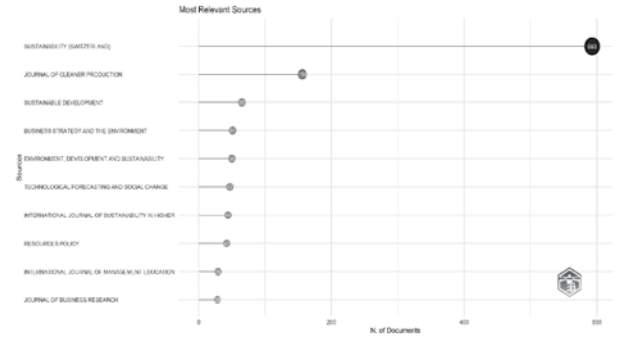

Figure 3

Relevant sources in Sustainability, innovation, and entrepreneurship.

h. Word Cloud Representation

The word cloud (figure 9) visualizes the frequency of terms in the sustainability, innovation, and entrepreneurship literature. Dominant terms like "sustainability," "sustainable development," and "SDGs" (Sustainable Development Goals) reflect their prevalence and criticality in the discourse. Terms like "innovation," "circular economy," "climate change," and "corporate social responsibility" also appear prominently, indicating their essential roles in addressing sustainability challenges. Additionally, emerging topics such as "digitalization," "green innovation," and "renewable energy" highlight the integration of technological and economic solutions into sustainable practices. The prominence of "COVID-19" emphasizes the pandemic's impact on reshaping sustainability agendas, especially in entrepreneurship and higher education. This visualization effectively encapsulates the breadth and depth of the field, offering a snapshot of evolving priorities and trends.

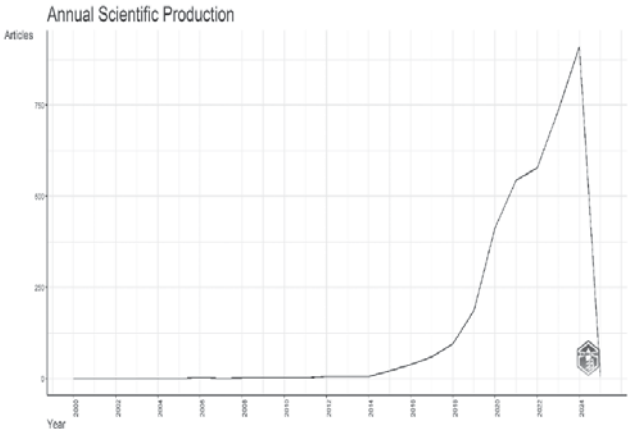

Figure 4

Annual scientific production in Sustainability, innovation, and entrepreneurship.

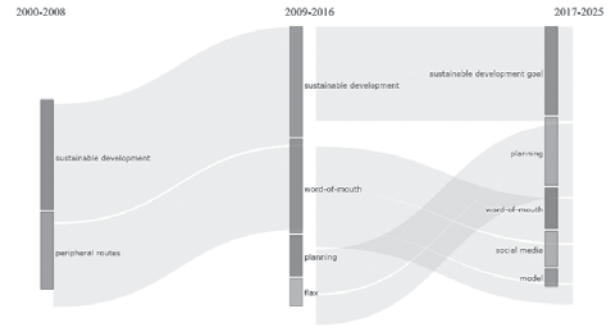

Figure 5

Thematic Evolution (2000–2025) of Sustainability, innovation, and entrepreneurship.

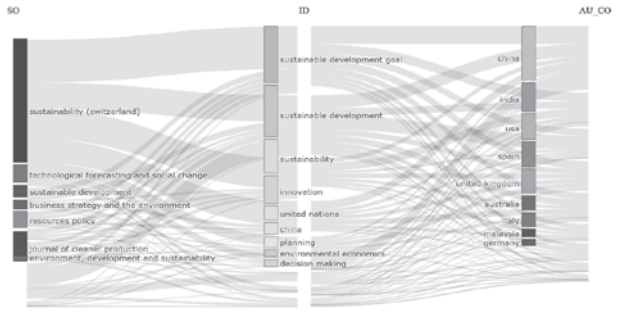

Figure 6

Three-field Plot: Journals, Keywords, and Countries of Sustainability, innovation, and entrepreneurship.

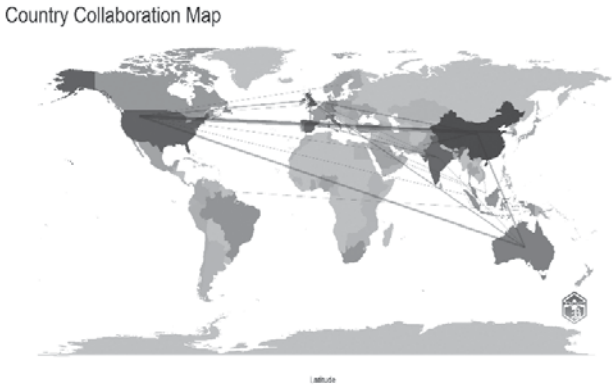

Figure 7

Collaboration map of Sustainability, innovation, and entrepreneurship.

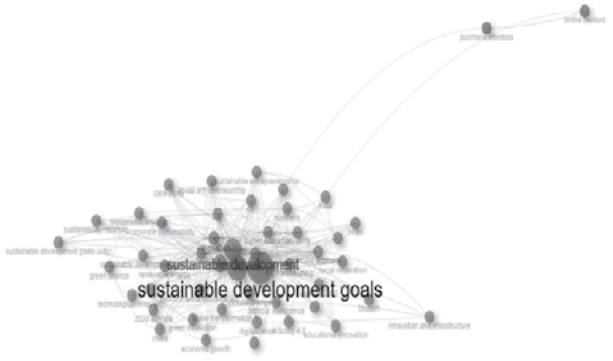

Figure 8

Co-occurrence network of Sustainability, innovation, and entrepreneurship.

Figure 9

Word cloud of Sustainability, innovation, and entrepreneurship.

i. Most Cited Countries

The bar graph showcasing the most cited countries (Figure 10) illustrates the global distribution of influential research in sustainability and innovation. China emerges as the leader, with over 10,000 citations, demonstrating its robust academic and practical contributions, particularly in green technology and policy implementation. The United Kingdom, USA, and Italy follow, reflecting their strong focus on sustainability through innovation and policy research. India's growing citation count highlights its increasing engagement in sustainable entrepreneurship, aligned with its developmental goals. Interestingly, the Netherlands and Korea are also included, showing their niche yet impactful contributions to sustainability-related studies. This visualization gives insight into regional strengths and academic collaboration opportunities, which shows the diversity of global efforts toward sustainable development.

J. Globally Cited Documents: Leaders in Sustainability Research

Table 1 shows the most globally cited documents in sustainability, innovation, and entrepreneurship. These works represent pivotal contributions to advancing knowledge in these areas. The document by Mudambi (2010) leads the list, published in MIS Quarterly, with 1,769 citations. This work's impact lies in its exploration of knowledge creation and value generation within sustainable business practices, making it a foundational resource for strategic management. Other influential papers include Park et al. (2007) in the International Journal of Electronic Commerce and Sachs (2019) in Nature Sustainability, with 1,143 and 1,128 citations, respectively. These papers explore technology's transformative role in fostering sustainable commerce and global sustainability frameworks. This includes Schot (2018) in Research Policy and Di Vaio (2020) in the Journal of Business Research, emphasising the integration of policy-making and entrepreneurship towards urgent global challenges, which this truly picturesque research landscape adds more to.

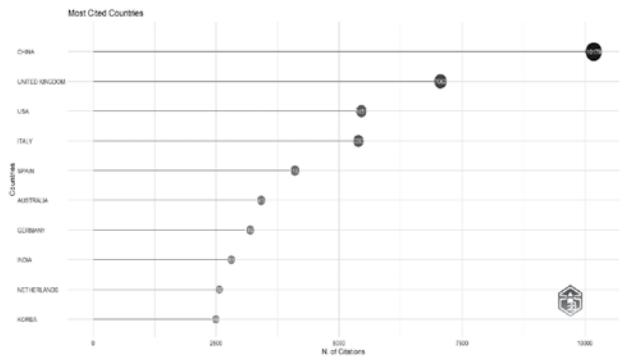

Figure 10

Most cited nations of Sustainability, innovation, and entrepreneurship.

k. Journal Impact: H-Index as a Measure of Influence

Table 2 specifically addresses journals by H-index, which lists the most impactful publication platforms for sustainability-related research. Sustainability (Switzerland) tops the list with an H-index of 51, refocusingitsroleasacentralrepositoryforhigh-quality research, diversely spread throughout problems of sustainability. It is followed by the Journal of Cleaner Production with an H-index of 45. That journal has a special interest in sustainable production techniques and the circular economy. Another group of popular journals comprises Technological Forecasting and Social Change, along with Sustainable Development, supporting strategic visioning in approaching the challenge of sustainability, coupled with a holistic system view. Business-focused journals such as the Journal of Business Research and Business Strategy and the Environment provide vital insights into how entrepreneurship can be a driving force for innovation while aligning with environmental and social goals. These journals collectively offer a wealth of knowledge for academics and practitioners alike, fostering the evolution of sustainable business practices and research.

l. Geographical Contributions: Global Research Dynamics

Figure 11 highlights the geographical distribution of corresponding authors, showcasing the regions that lead in research output and collaboration. China emerges as the top contributor, reflecting its growing focus on sustainability-driven innovation and leadership in global research. The majority of its publications are single-country studies, though it also actively participates in international collaborations. Spain, the United Kingdom, and India follow closely, emphasising their strong research ecosystems and focus on solving sustainability challenges through innovation and entrepreneurship. The United States and Italy exhibit a notable balance between domestic research and global partnerships, contributing significantly to the field. Emerging economies such as Malaysia, Brazil, and South Africa also play important roles, addressing region-specific sustainability challenges like biodiversity loss and equitable economic development. This global diversity underscores the universal relevance of sustainability research and highlights the need for collective action across borders.

4. Conclusion

The field of sustainability, innovation, and entrepreneurship is changing fast because of the global need to address urgent environmental, economic, and social challenges. This bibliometric review provides insights into the most important trends, themes, and contributions shaping this interdisciplinary domain and offers a comprehensive understanding of its current landscape. Some of the findings from this literature review include how sustainability is fast becoming the mainstream theme of discussions in academic community and the practical fields. The growth of publications and citations shows the global acceptance of sustainability in innovation and entrepreneurship. Journals such as Sustainability and the Journal of Cleaner Production have emerged as critical platforms for disseminating impactful research. The evolution of themes over time reveals the dynamic nature of this field. The thematic diversification is a sign of a shift from theoretical explorations to practical, innovative applications that address real-world challenges. Geographically, the study reveals that sustainability research is a global affair. Countries such as China, the USA, and the UK have become leaders in terms of both productivity and influence, contributing significantly to the global discourse. The three-field plot is also an element of the co-occurrence network, which emphasises the confluence of innovation, entrepreneurship, and technology within sustainability. Such key concepts

as “circular economy,” “green finance,” and “digital transformation” are the bridges that cross disciplines, allowing for interdisciplinary research and practice. Overall, the review points out the transformative power of sustainability, innovation, and entrepreneurship in the face of such pressing global challenges as we move forward, the insights of this review will serve as a roadmap for researchers, practitioners, and policymakers to continue efforts toward a more sustainable and inclusive future.

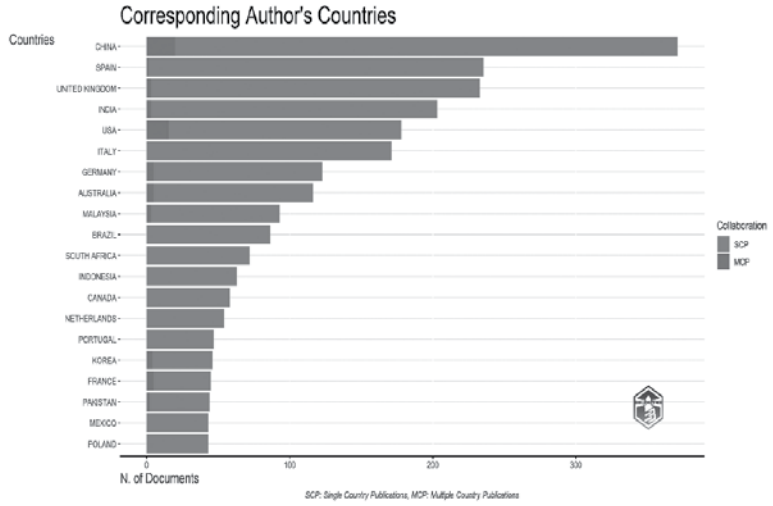

Figure 11

Chart of the most relevant countries of Sustainability, innovation, and entrepreneurship

Table 1:

Globally cited documents

Paper	DOI	Total Citations	TC per Year	Normalized TC
MUDAMBI SM, 2010, MIS QUART	NA	1769	117.93	1.98
PARK DH, 2007, INT J ELECTRON COMM	10.2753/JEC1086-4415110405	1143	63.50	1.00
SACHS JD, 2019, NATURE SUSTAIN	10.1038/s41893-019-0352-9	1128	188.00	23.01
SCHOT J, 2018, RES POLICY	10.1016/j.respol.2018.08.011	950	135.71	15.88
CHEUNG CMK, 2012, DECIS SUPPORT SYST	10.1016/j.dss.2012.06.008	815	62.69	5.43
BEBBINGTON J, 2018, ACCOUNT AUDIT ACCOUNT J	10.1108/AAAJ-05-2017-2929	590	84.29	9.86
DI VAIO A, 2020, J BUS RES	10.1016/j.jbusres.2020.08.019	511	102.20	13.00
AHMAD M, 2020, RESOUR POLICY	10.1016/j.resourpol.2020.101817	495	99.00	12.59
SCHEYVENS R, 2016, SUSTAINABLE DEV	10.1002/sd.1623	485	53.89	10.52
PARK DH, 2008, ELECTRON COMMER R A	10.1016/j.elerap.2007.12.001	454	26.71	1.04

TABLE 2:

Impact of Journals

Element	h_index	g_index	m_index	TC	NP	PY_start
SUSTAINABILITY (SWITZERLAND)	51	79	5.1	11225	593	2015
JOURNAL OF CLEANER PRODUCTION	45	83	2.813	7441	156	2009
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	23	46	4.6	2193	47	2020
SUSTAINABLE DEVELOPMENT	22	43	2.444	1927	65	2016
BUSINESS STRATEGY AND THE ENVIRONMENT	19	44	2.375	1945	51	2017
JOURNAL OF BUSINESS RESEARCH	19	28	1.9	2038	28	2015
INTERNATIONAL JOURNAL OF MANAGEMENT EDUCATION	17	29	2.125	1178	29	2017
JOURNAL OF RETAILING AND CONSUMER SERVICES	16	22	1.778	964	22	2016
INTERNATIONAL JOURNAL OF SUSTAINABILITY IN HIGHER EDUCATION	14	27	2.333	803	44	2019
RESOURCES POLICY	14	33	2.8	1122	42	2020

5. Implications

This review provides critical insights into the nexus of sustainability, innovation, and entrepreneurship, which has vast policy implications for policymakers, academics, and practitioners alike. The findings rest mainly on the importance of incorporating sustainability in business models and innovation strategies for the SDGs. These findings can be utilized by policymakers in formulating relevant policies on topics like “circular economy” and “green finance” for the benefit of sustainable practice by industries. Results for practitioners-entrepreneurs, particularly present the opportunity to encircle digital transformation and renewable energy in their business venture, leading to scalable, impactful business models. The identified trends can be useful for academics to guide future research directions, promote interdisciplinary collaboration, and address emerging global challenges such as climate change and social equity. This study also provides valuable information for scholars looking to publish impactful work or build international research collaborations by highlighting the dominance of specific journals, authors, and countries.

6. Limitations And Scope For Future Research

This study has several limitations that must be acknowledged. Firstly, the study included only English-language articles. This linguistic constraint could have omitted vital knowledge which is published in articles other than English language. Additionally, the application of RStudio as the principal tool for the analysis was technically limiting. Since VOS viewer software, is not compatible with the merged dataset of Web of Science and Scopus in the Excel format, it could not be applied to the dataset. Therefore, the visualisation and network analysis that VOS viewer could have enriched were not utilised in this study. Last, the study relies heavily on quantitative patterns and trends and, therefore, opens up a possibility of qualitative insights that could have brought out more detailed research dynamics and contextual nuances. Future studies may address these limitations by including diversified data sources, multilingual content, and more analytical tools that can increase the robustness and comprehensiveness of the findings.

Future research in sustainability, innovation, and entrepreneurship should be directed toward filling gaps emerging from the review. This includes integrating artificial intelligence and machine learning into the execution of sustainable practices, and the role social media plays in fostering awareness. Another promising

direction involves the exploration of regional and cultural variations in the adoption of sustainable innovation, which could provide insights into localised strategies for achieving SDGs. By bridging these gaps, future studies can contribute to a more comprehensive and globally inclusive understanding of sustainability.

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Analysing the Variables Influencing Attitudes towards Cryptocurrency in a Lower-Middle Income Country: A Study of India

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Abstract

This study investigates the very unpredictable character of the cryptocurrency market, attributing its volatility to variables such as news events, market sentiment, and price deception. The study focuses on the Indian environment and explores people's attitudes and experiences with cryptocurrencies, utilising a questionnaire to collect data on knowledge, trust, understanding, and other key investing characteristics. The report goes on to assess the impact of various media, communication platforms, YouTubers, statistics, and investment advisors on cryptocurrency trading habits and price volatility. The major goal is to obtain a more nuanced knowledge of Indian investors' motivations for investing in cryptocurrencies and their propensity to utilise them for diverse purposes. By explaining customer motives and concerns, this study hopes to help businesses, policymakers, and investors make informed decisions in the volatile cryptocurrency ecosystem. Finally, the study aims to contribute to the construction of an enhanced, accountable, and long-lasting digital currency system that aligns with the values and expectations of customers and audiences.

Keywords: *Cryptocurrency, Digital, Investment, Digital Assets*

How to Cite: *Akter, N., & Bhattacharjee, A. (2025). Analysing the variables influencing attitudes towards cryptocurrency in a lower-middle income country: A study of India. Journal of Management and Entrepreneurship, 19(2), 89–101.*

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Introduction

Cryptocurrencies have become an influential player in the world of finance, upending established economic systems and altering how we see and exchange wealth. To secure valid and legitimate transactions, it uses cryptographic methods to transport digital information (Farell, 2015). Investing, sending money, and making payments online are just a few uses for cryptocurrencies. However, their inherent volatility and associated high risks make it a contentious and frequently debated topic within the financial domain (Frankenfield, 2023).

Even though cryptocurrencies are becoming more popular around the world, different countries have different views and reactions to this decentralised digital asset because of their surroundings, culture, beliefs, expectations, personalities, social practices, laws, etc. India, characterised by its robust economic growth, presents an intriguing case study for investigating the factors shaping individuals' perspectives on cryptocurrencies. In the context of a survey conducted by Chainalysis to gauge global cryptocurrency adoption in 2022, India notably secured the fourth position among 154 nations in the comprehensive index rating. The survey identified Vietnam as the leading country, followed by the Philippines and Ukraine, respectively. Remarkably, half of the top 20 nations featured in the ranking are situated in Asia, emphasising the regional prominence of cryptocurrency engagement. Analysing the survey findings, it is evident that a growing number of young Indians are actively participating in cryptocurrency investments, with notable interests in assets such as Bitcoin, Ether, and Dogecoin (Chainalysis: The 2023 Global Crypto Adoption Index, 2023). This shift in investment preferences among the younger demographic underscores the evolving landscape of financial markets in India, adding depth to the exploration of the country's cryptocurrency adoption patterns.

The World Bank classified countries based on their income in 2022-2023, and India is clasified as a lower-middle-income country (Hamadeh et al., 2023). The countries of lower-middle-income and upper-middle-income are dominating the high ranks of the crypto adoption index. People in these nations use cryptocurrencies for a variety of reasons, including sending and receiving remittances, protecting funds from fiat currency fluctuations, and meeting other financial demands (Chainalysis: The 2023 Global Crypto Adoption Index, 2023).

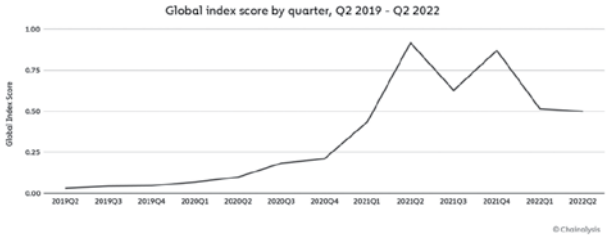


Figure 1:

The global adoption growth of cryptocurrencies over time (Chainalysis: The 2023 Global Crypto Adoption Index, 2023)

Even though the future of the digital coin economy in India remains uncertain, at least 1.5 crore Indians currently possess cryptocurrency assets valued in the billions (Das, 2021). Delhi boasts the highest number of crypto users in India, followed by Bangalore and Hyderabad (Anand, 2022). In 2023, the user base constituted 14.5% of the population, and projections anticipate an increase to 22.4% by 2027, encompassing a staggering 328.70 million people (Cryptocurrencies - India | Statista Market Forecast). It points to the rapid adoption potential of cryptocurrencies in a country where individuals often put their money in gold or other secure assets.

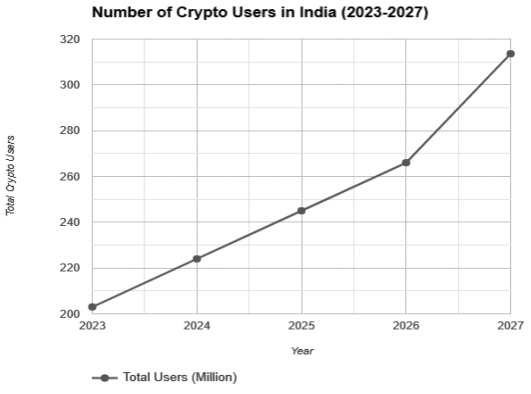


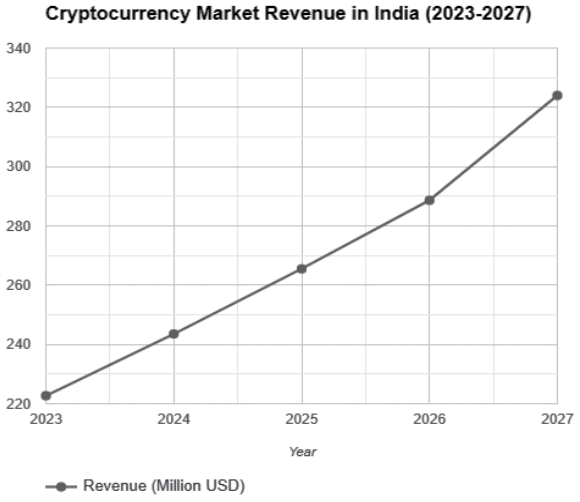
Figure 2:

Estimated number of Indian cryptocurrency users

Furthermore, the cryptocurrency market in India generated revenue of $222.70 million in 2023, with an anticipated compound annual growth rate of 9.83% from 2023 to 2027. This trajectory is expected to result in a total market value of US$324,000,000 by 2027 (Cryptocurrencies - India | Statista Market Forecast).

According to a study by Nasscom, India's crypto-tech sector is projected to create 877,000 jobs by 2030. It further highlights that the crypto industry in India holds the potential to generate $184 billion in economic value through investments and cost reductions, marking decentralised systems at the forefront of the digital evolution (Cryptotech Industry in India- Decentralized Systems at the Center stage of Digital Evolution | Nasscom, 2021).

Figure 3:



Prediction of Crypto market revenue in India

Cryptocurrencies have gained popularity in India for several reasons. One argument is their suitability for seamless online international transactions, functioning akin to stocks in financial markets, which enhances their ease of use and transparency (Tiwari, 2020). Additionally, cryptocurrencies offer swift transaction processing. Noteworthy cryptocurrency exchange platforms in India, including WazirX, CoinDCX, Coinbase, Covo Finance, Kucoin, Delta Exchange, Coinswitch Kuber, Bitbns, BuyUcoin, Capital, ZebPay, and Unocoin, contribute to this popularity with their user-friendly features, such as simple registration, intuitive interfaces, and diverse payment methods.

Table 1:

Comparison of Cryptocurrency Exchange Platforms in India

Platform	Number of Users	Transaction Volume	Market Share
WazirX	10 million	$10 billion	20%
CoinDCX	5 million	$5 billion	10%
Coinbase	2 million	$2 billion	5%

The Indian government is approaching the adoption and use of cryptocurrencies cautiously, citing concerns about the lack of regulation, security challenges, and the involvement of fraudulent activities. The Reserve Bank of India (RBI) took its initial stance on cryptocurrencies in 2013 with the release of its first circular addressing the associated risks. In 2018, the RBI issued a circular prohibiting financial institutions from participating in cryptocurrency transactions, leading to a significant downturn in the country's cryptocurrency industry. However, in 2020, the Supreme Court of India overturned the previous order, lifting the restrictions and reinstating the ability for individuals to acquire and trade cryptocurrencies. Subsequently, in early 2021, the government announced its intention to introduce legislation for the creation of a national cryptocurrency coin. This proposed bill also included provisions for a "central bank digital currency" governed by the Reserve Bank of India, along with the prohibition of private cryptocurrencies. Finance Minister Nirmala Sitharaman, in post-budget interviews in 2021, expressed the government's perspective that the cryptocurrency industry could serve as a revenue source. The government leaned towards regulating the cryptocurrency rather than imposing an outright prohibition. In the following year's budget (2022), a 30% tax, along with a 1% TDS (Tax Deducted at Source), was implemented (Smith, 2023).

Table 2

India's path toward cryptocurrency regulation

Year	Event
2013	RBI issued first circular addressing crypto dangers
2018	RBI banned crypto transactions
2020	The Supreme Court overturned the RBI ban
2021	The government announced a crypto bill
2022	30% tax + 1% TDS implemented

Despite its enormous potential and relative simplicity when compared to centralised banking systems, cryptocurrency has struggled to gain widespread adoption. Fear of probable value loss, along with a lack of official recognition as actual legal money, is a substantial barrier to its broad adoption (Sloan, 2022). In the world of cryptocurrency trading, the emphasis is always on value-added acquisitions, with traders seeking opportunities that have an established track record, have been thoroughly scrutinised, and exhibit lower volatility than their competitors (Marcus, 2021).

Numerous studies have looked into the elements that influence digital currency adoption across industries, as well as their pricing dynamics. The increased interest in analysing the cryptocurrency market stems from its intrinsic volatility, which makes it highly susceptible to market sentiment, news events, and rumours, resulting in unexpected and dramatic price movements (Szabo, 2021).

This study aims to investigate the diverse factors driving and deterring crypto purchases, evaluating their impact on the Indian cryptocurrency market. It delves into economic, social, and technical incentive factors, analyses evolving investor perspectives on cryptocurrencies, and contemplates the market's future. The findings are intended to cater to a broad audience, encompassing investors, businesses, policymakers, and academics.

Literature Review

The precise causes of cryptocurrency price volatility are generally uncontrollable. It has become a serious difficulty for researchers to investigate. This article identified a collection of factors that contributed to the price variations of cryptocurrencies, based on the literature reviewed. These parameters were chosen based on prior knowledge gained from previous research. Researchers have been studying the media's impact on society for decades. The media effects refer to the cultural, social, and psychological effects of connection. According to a study by Scheufele and Tewksbury (2007), media consumers have been affected by the framing of prominent issues. Along with media instructing individuals what to think about via agenda-setting effects, framing's characterised information may alter an audience's comprehension and influence. Li and Wang (2017) hypothesised that social media sentiments may be correlated with the volatility of cryptocurrencies. Aggarwal et al. (2019) asserted that the effects of the media on public opinion are a crucial aspect of the interaction between social factors and the cryptocurrency market. Newspapers, radio, television, the Internet, and mobile phone technologies are all forms of mass media communication used to disseminate information to the public. Agenda-setting and framing theories in mass communication focus on the capacity of the press to inform people what to consider, how to think about significant issues, and possibly what to do about them. (Aggarwal et al., 2019).

Shahzad et al. (2018) discovered that knowledge, perceived ease of use, perceived utility, and perceived trustworthiness are positively connected with crypto usage intent among 376 Mainland Chinese persons. Users' value of the feature moderates the usability-adoption relationship. If well-informed and trustworthy, mainland Chinese are eager to utilise Bitcoin, but the study cautions that government disapproval may slow Bitcoin's progress in the global financial system. In 2021, Ter Ji-Xi et al. conducted a survey with 290 participants, and the findings indicate that adding age as a moderator to the equation caused the association between behavioural intention and social influence to become statistically significant.

According to Eswaran et al. (2020), people's desire to earn more money in less time and with less effort in order to avoid physical labour may lead them to invest in cryptocurrencies and other unlawful

activities such as rummy culture, spin ball, etc. In a survey carried out by Morning Consult, sixty-three per cent of crypto owners cite the desire to make more money as their primary motivation for owning cryptocurrency (Mitra, 2022).

Another set of studies has concentrated on how cryptocurrencies can be used for things other than gambling. For instance, Ron and Shamir (2013), Bohr and Bashir (2014), and Athey et al. (2016) provide a thorough analysis of the various Bitcoin transaction types and demonstrate that remittances make up a significant fraction of their use. Studies by Glaser et al. (2014) and Foley et al. (2019) have also looked at the characteristics of Bitcoin use. These examine consumers' interest in digital currencies from both knowledgeable and unaware perspectives, and they discover that uninformed users are more interested in participating in a different way to invest than in a transaction system.

In 2017, Tsvetkova et al. investigated relationships between humans and machines in forecasting markets. They discovered that knowledge and trust are important elements influencing market capitalisation and consumer trust in these interactions. Chary et al. (2022) show that education, occupation, price of the good, online platforms, brand ambassadors, economic standing, workplace conditions, and touchscreen programmes are the most influential factors in consumers' decisions to invest in cryptocurrency.

A study, done in 2020 among 1500 internet users in India by the social media management platform Hootsuite and the digital marketing firm We Are Social, revealed that only 9% of the respondents owned cryptocurrencies. However, the study indicated that interest in cryptocurrencies was growing, with 57% of respondents expressing a desire to learn more about them. (Digital 2020: India, 2020)

Statista conducted a study in 2021, and almost 30% of the Indians who responded stated they had invested in cryptocurrencies. 56% of them invested for the long term, whereas 37% invested for the short term. Furthermore, 43% of Indian respondents who have not yet invested in cryptocurrency stated they want to do so in the future. According to the poll, younger Indians, namely those between the ages of 18 and 34, are more interested in investing in digital currencies. According to Statista, Indian investors preferred Bitcoin and Ethereum over other cryptocurrencies (Cryptocurrencies - India | Statista Market Forecast). Paxful conducted a survey in 2020 and found that investing in crypto was more appealing to Indians than using it as a payment method (Paxful Survey Reveals Future Potential of Cryptocurrency in India, 2021).

Apparao (2022) looked at several cryptocurrency platforms in India and found that the lack of regulatory frameworks could endanger this financial system. Additionally, he commented that the concept of cryptocurrency holds enormous potential for the future, providing numerous opportunities to propel beneficial changes and developments in the fields of e-Business and e-Payment, as more and more retailers are accepting different types of cryptocurrencies as payment methods. However, these studies did not cover the entire cryptocurrency market, focusing only on a few reasonable factors, leaving space to identify and discover additional crucial issues among other audiences.

Objectives of the Study

a. To examine cryptocurrency adoption among Indian consumers.

b. To identify the factors that influence the attitudes of audiences towards the cryptocurrency market.

c. To investigate the most efficient methods for educating and marketing cryptocurrency.

d. To check the reaction to the new regulations on cryptocurrencies in India.

Methodology

This research study in India employs an exploratory qualitative research design to comprehensively investigate customers' attitudes towards cryptocurrency and discern the underlying factors shaping these attitudes. The data for this study were collected through convenience sampling. A total of 450 individuals, both with and without prior cryptocurrency buying experience, from various occupations and age groups expressed their interest in participating in this study. The

structured questionnaire, containing 32 questions with various response options and scales, was administered digitally through Google Forms. The inexperienced respondents answered 10 questions, whereas the experienced respondents answered 24 questions. The study also incorporates secondary data from literature, articles, and online resources to enrich insights. Ethical considerations, including confidentiality and informed consent, were adhered to throughout the research process. The findings from this research are anticipated to contribute valuable insights into the complex landscape of customer attitudes towards cryptocurrency in the Indian context.

Findings

The future of crypto depends on analysing all investing elements that might convince the target audience to purchase and keep cryptocurrency. The collected data told us about the age, gender, and profession of the survey participants. In terms of gender division, 69.8% of the respondents were male and 30.2% were female, which suggests a higher representation of males among the respondents. The majority of participants were between the ages of 25 and 30, making up 44.1% of the total. The remaining age groups had lesser proportions: 20-25 accounted for 33.4%, 30-35 represented 15.4%, 35-40 represented 4.7%, and lastly, individuals aged 40 and above accounted for 2.4% of the sample. The majority of respondents were students, making up 56.9%. 25.1% of the participants had jobs, 5.3% were in business, and the remaining 12.7% of respondents were unemployed at the time of responding to the questionnaire.

The section of questions was different for people who have experience buying crypto and those who do not.

Table 3:

Proportion of buyers and non-buyers

Which of the following statements applies to you?	
I have never held cryptocurrencies	66.8%
I currently hold cryptocurrencies	20.7%
I have previously held cryptocurrencies	12.5%

From Table 3 we can observe that 20.7% of respondents exhibited current cryptocurrency ownership, indicating possession of one or more cryptocurrencies within their digital wallets or accounts at the time of the survey. This segment represents a notable cohort actively engaged in the cryptocurrency market. Conversely, 12.5% of participants reported past ownership but no current holdings, suggesting divestment or sale of their cryptocurrency assets. The largest segment, encompassing 66.8% of the sample, never owned any form of cryptocurrency. This finding highlights a significant portion of the general population who have yet to participate in the cryptocurrency market. Understanding the factors influencing their non-adoption is required to prove valuable in fostering broader cryptocurrency adoption in the future.

Non-Buyer: In the examination of non-buyer attitudes towards cryptocurrency acquisition, a nuanced analysis reveals discernible patterns within the respondent cohort. According to some respondents, using cryptocurrency is unethical, which shows an ethical barrier to entry into the crypto market. Among them, 59.1% declared that a strong ethical stance is indeed very important to them, while 19.6% responded negatively. Additionally, 21.3% indicated that a strong ethical stance is sometimes important for them. An observation emerged from the study that an ethical stance has an impact on individuals' non-purchasing decisions regarding cryptocurrency.

Specifically, 25.2% of individuals classified as non-buyers expressed a willingness to engage with cryptocurrency in the future. This conspicuous inclination signifies an underlying intention to adopt this form of digital asset and proves that a sense of ethical value is not what is stopping them from entering the market. 33.9% of the respondents who said they might buy crypto exhibited uncertainty or hesitancy by not explicitly stating a negative posture. In contrast, 40.9% of participants clearly indicated that they would not buy cryptocurrency in the future. This group expressed an apparent lack of interest or resistance towards engaging with cryptocurrencies as an investment or financial instrument, which indicates that a significant percentage of the population remains unconvinced of the potential benefits or value of cryptocurrency.

This points to the need for awareness and education programmes to overcome the information gaps and concerns that may be preventing greater acceptance of cryptocurrencies.

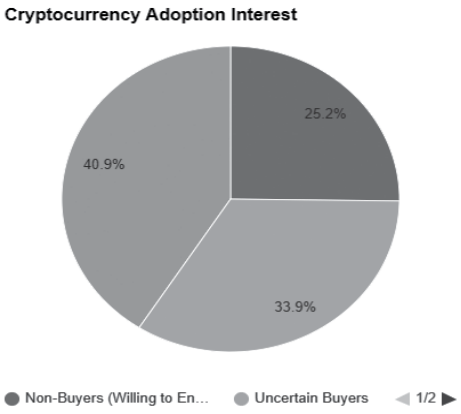


Figure 4:

Future intention of the non-buyers

A significant majority of respondents (89.6%) expressed concerns about investing in cryptocurrency due to perceived risks associated with hacking incidents. This suggests that security remains a top concern for potential cryptocurrency investors. However, a noteworthy minority (10.4%) disagreed with this statement, suggesting a smaller but noteworthy portion holds the belief that blockchain technology ensures the security of cryptocurrency transactions. The prevalence of apprehension regarding hacking incidents underscores a critical concern for the future of financial investments in cryptocurrency.

A whopping 83.4% of respondents expressed significant concerns, deeming it "very dangerous" due to the perceived volatility of cryptocurrency prices. This highlights a prevalent apprehension surrounding the unpredictable nature of these digital assets. However, a contrasting perspective exists amongst a distinct 16.6%. They disagree with the notion of inherent danger, suggesting a greater openness to cryptocurrencies as an investment option. This minority view indicates a potential shift in attitudes towards cryptocurrencies, with some individuals recognising them beyond their volatility and embracing them as viable investment tools.

An analysis of financial ability and psychological factors behind cryptocurrency investment reveals that 45.5% of participants possessed the financial means to invest, yet they opted not to participate. This highlights the presence of psychological barriers that impede investment decisions even in the presence of financial resources. The primary reasons cited for non-investment among financially able participants included trust issues, hesitation, and a delay in mentally adapting to the concept of cryptocurrency. These factors suggest a perceived lack of reliability, uncertainty about the long-term viability of the asset, and discomfort with the novel nature of the technology. This underscores the importance of building trust and financial literacy within the cryptocurrency ecosystem to attract potential investors.

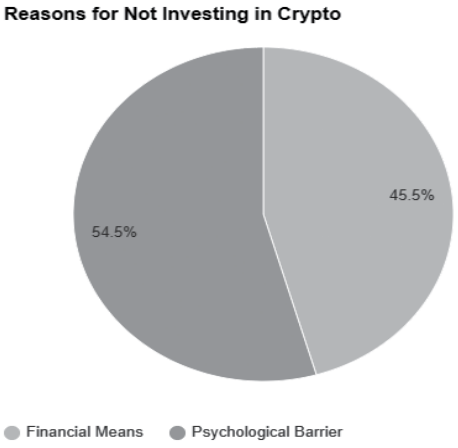


Figure 5:

Demotivating factors

Conversely, 54.5% of participants reported a lack of financial resources as the primary barrier to their non-participation. It is important to note that this group may still hold interest in cryptocurrency and may become potential investors in the future as their financial situations improve.

Half of the respondents (50.2%) lacked the knowledge to trade cryptocurrencies, while the other half (49.8%) claimed to possess the necessary skills. These findings suggest that a significant portion of the population is unprepared to engage in cryptocurrency trading, potentially due to a lack of understanding about the complexities involved. This knowledge gap could be a contributing factor to

the hesitancy observed among many individuals to invest.

Buyers: Survey data on the importance of ethical stance revealed that 43% of respondents deem it "very important," indicating strong ethical considerations. However, 38.3% opt for "sometimes," suggesting situational dependence, and 18.8% consider ethics "not essential." This points to a notable segment of cryptocurrency buyers actively participating despite having ethical concerns.

The empirical examination of survey data discloses a spectrum of inclinations within the respondent cohort, providing valuable insights into the evolving dynamics of cryptocurrency adoption.

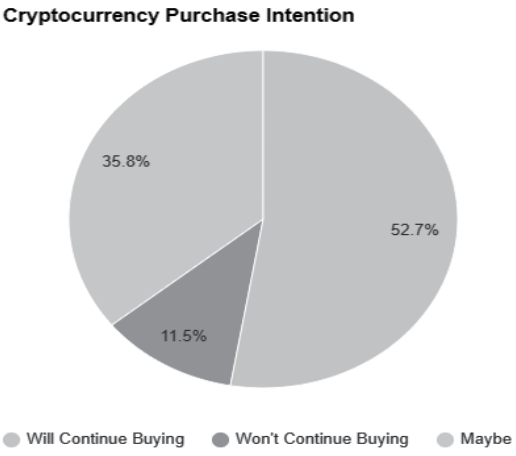


Figure 6:

Future intention of the buyers

A conspicuous 52.7% of respondents articulate an affirmative intent to persist in purchasing cryptocurrencies in the future. This forward-looking stance underscores a prevailing optimism and commitment among a significant segment of participants towards sustained engagement with digital assets. Conversely, 11.5% of participants express a contrarian disposition. Noteworthy is the revelation that this subgroup attributes its decision to prior adverse experiences, specifically citing significant losses in cryptocurrency trading that resulted in a subsequent waning of interest. An intermediate position is occupied by 35.8% of respondents who responded with an ambivalent "maybe." This nuanced response conveys a state of uncertainty among participants, and this cohort's hesitancy may be indicative of a susceptibility to external factors, such as potential financial losses, which could sway their interest in cryptocurrency investments in the coming days.

By analysing survey responses, the study reveals a distribution of preferred learning methods. The analysis identifies YouTube as the dominant learning platform, with a staggering 77.2% of participants citing it as their primary source of information. This dominance likely stems from its vast reach, accessibility, and abundance of video tutorials and instructional content. The prevalence of video-based learning on YouTube demonstrates its effectiveness in engaging users and simplifying complex concepts. While YouTube reigns supreme, other learning methods hold value. Online courses, preferred by 36.9% of respondents, offer a more structured learning experience. Additionally, 18.8% rely on written articles, highlighting the enduring appeal of text-based information, even in a video-dominated landscape. Formal training programmes, mentioned by only 5.4% of participants, appear less accessible or widely disseminated compared to readily available online resources.

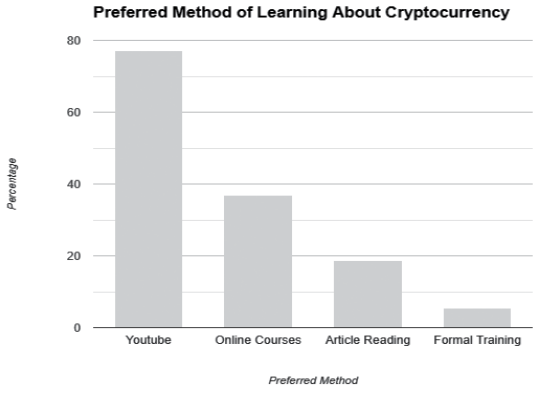


Figure 7

Methods of learning cryptocurrency using

This suggests a potential gap in the market for formal training programmes catering to the growing interest in cryptocurrencies. Further research could explore the specific content types and creators preferred by users on YouTube and investigate the accessibility and effectiveness of formal training programmes in this dynamic field.

The research endeavours to ascertain the courses of action undertaken by cryptocurrency holders in response to a decline in the value of their holdings. The result indicates that 53% chose to sell their coins, reflecting a risk-averse approach. Conversely, 26.8% adopted a passive strategy, displaying patience amid market volatility. Notably, 16.1% increased their holdings, capitalising on price drops. Intriguingly, 4% refrained from future investments, suggesting a loss of faith. These findings provide concise insights into the diverse behavioural patterns of cryptocurrency users during value declines.

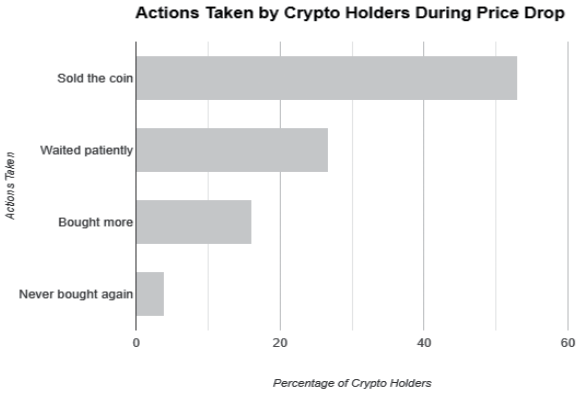


Figure 8:

Reaction to price deception

The collected data indicates that all respondents (100%) are aware of the risks associated with cryptocurrency, which suggests a high level of understanding among the users regarding the potential dangers and pitfalls of engaging in cryptocurrency transactions. Such awareness of risks influences their decision-making and behaviour patterns, potentially leading to more cautious and informed actions in their cryptocurrency transactions.

A significant 64.2% of participants highlighted present price volatility as the primary influencer of traders' decisions. Additionally, 43.9% reported relying on long-term statistical data for crucial trading decisions. The widespread use of quantitative analysis techniques, involving the examination of charts, graphs, and historical data, is evident among traders as they shape and refine their strategies. Notably, 30.4% acknowledged the substantial influence of YouTubers on their trading activities, suggesting that online content creators significantly impact crypto buyers' behavioural patterns. It is also noteworthy that 20.3% of participants attributed the influence of news to their trading behaviour. The study provides compelling evidence supporting the impact of online content creators and news articles on trading decisions in cryptocurrency.

The survey data indicates a variety of usage preferences among participants. Short-term financial gain constitutes the primary motivation, with 77.2% of respondents expressing a strong inclination towards this option. Additionally, 49% view cryptocurrencies as a viable long-term investment strategy. Notably, 20.1% of participants use cryptocurrencies to circumvent traditional taxation systems, highlighting potential regulatory concerns. Inflation mitigation (16.8%) and facilitation of global money transfers (12.1%) emerge as further significant motivations. Only 9.4% of respondents reported using cryptocurrencies for pension-related purposes.

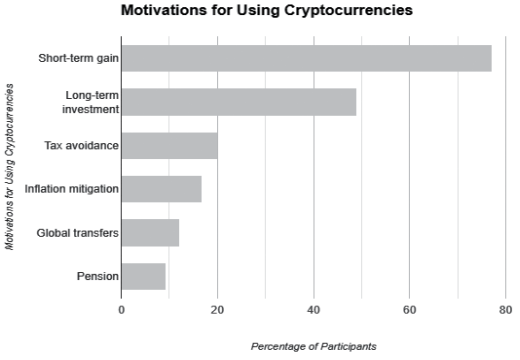


Figure 9:

Various purposes of buying Cryptocurrency

These findings shed light on the multifaceted motivations driving cryptocurrency adoption. While short-term profit potential reigns supreme, long-term investment considerations and alternative use cases, such as tax avoidance and inflation mitigation, play a significant role. The data also underscores the potential of cryptocurrencies to facilitate international transactions. However, the limited use for pension planning suggests a lack of trust or understanding regarding long-term stability.

The finding that 90.5% of participants reported feeling stressed while using cryptocurrencies is noteworthy. This suggests that cryptocurrency use is not without its emotional costs. While the specific reasons for this stress are not explored in the prompt, several potential explanations can be posited. The rapid fluctuations in value, the complexity of cryptocurrency technology, and the lack of regulatory oversight leave users feeling confused and vulnerable.

A recent RBI tax on cryptocurrencies in India sparked discontent among 74.5% of users, fearing financial strain, unclear regulations, and stunted growth. This negativity may lead to reduced participation, risk aversion, and exploration of alternative investments, potentially hampering crypto adoption in India. On the other hand, 25.5% see potential benefits like increased legitimacy and transparency. 56.4% of users favour government control, fearing instability and illegal activity, while 43.6% oppose intervention, likely concerned about stifling innovation and hindering market growth. This result says, although the idea of government regulation on cryptocurrency is mostly embraced, dissatisfaction emerges regarding the latest taxation decision, potentially due to the perceived high taxation rate.

The majority of respondents (69.8%) among crypto currency users favour low-risk, high-return investments. 20.1% are ready to take high risks for large gains. Besides, 8.7% of respondents chose low-risk, low-return investments. In favour of encouraging people to acquire cryptocurrency, 93.3% of crypto users indicated that they would recommend others purchase it. In contrast, only 6.7% of respondents indicated a negative attitude. These results indicate that crypto currency consumers have a high tendency to recommend the purchase of cryptocurrencies to others.

The widespread adoption of cryptocurrency as a viable alternative to traditional fiat currencies remains a topic of intense debate. Proponents envision a future where decentralised digital currencies revolutionise financial transactions, while sceptics highlight concerns regarding volatility, security, and regulatory frameworks. Understanding consumer sentiment towards cryptocurrency adoption is crucial in assessing its potential for widespread integration into daily life. 77% of this study's respondents expressed a desire to make essential purchases with cryptocurrency, suggesting a strong preference for their adoption as a means of exchange, while only 6.8% expressed a lack of interest. A sizeable segment (16.2%) remained neutral; the overall sentiment leans heavily in favour of cryptocurrency integration.

Awareness of cryptocurrency has proliferated through various influential channels. A significant portion (22.8%) heard about cryptocurrencies through online articles, like blogs and news websites. Social media posts from friends and acquaintances also served as a key entry point (20.1%). Casual conversations with everyday people, including family, friends, and colleagues, played a surprisingly relevant role, reaching 20.1% of individuals. Online advertisements (15.4%) and printed articles (8.1%) were quite impactful compared to traditional media. TV or radio programmes, and financial advisors and accountants had a combined influence of only 11.4% on respondents. Notably, academic books and traditional offline advertising through television, radio, print, and billboards had the least influence, reaching only 2%.

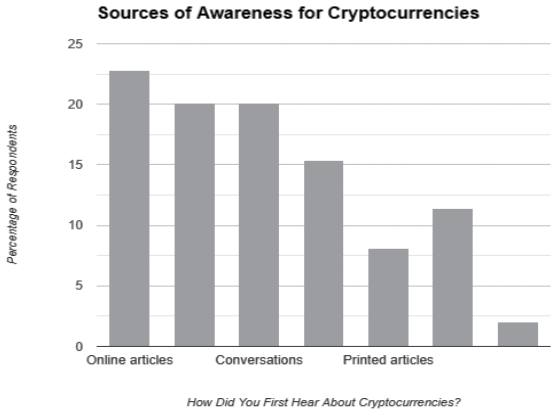


Figure 10:

Effective information channels

It was found that 55.5% of respondents invested in digital assets or cryptocurrencies based on the advice of a third party, while 44.5% did not. This indicates that a substantial proportion of investors in the digital

or cryptocurrency markets rely on external guidance, and recommendations can significantly impact investment decisions in this particular domain.

Besides, 65.5% of the participants believe that cryptocurrency is trendy, and this belief influences their decision to buy it. In contrast, 13.5% of respondents disagreed, stating that the trend has no bearing on their decision to purchase cryptocurrency. Additionally, 20.9% of respondents remained unsure, saying that the trend may have an impact on their purchasing decisions.

The study reveals that individuals are increasingly turning to cryptocurrencies as an investment option, with nearly half (45.6%) utilising their savings for this purpose. This indicates a growing willingness to allocate a portion of personal savings towards cryptocurrencies. A significant portion (32.9%) also reported using their monthly budget, highlighting its integration into regular financial practices. While a smaller percentage (13.4%) opted to sell existing assets, demonstrating strategic fund reallocation, borrowing from friends or family (8.1%) remained less common. Notably, the absence of participants using loans or credit cards suggests a cautious approach towards incurring debt for this potentially risky investment.

An analysis of respondents' knowledge of securing their cryptocurrency reveals varying levels of proficiency. A mere 26.8% assert a high degree of confidence in securing their cryptocurrency, and a more substantial 51% report a solid understanding of the security measures involved. On the contrary, 18.1% admit to possessing limited knowledge in this domain, describing their familiarity with cryptocurrency protection as 'very little.' A notably smaller fraction, comprising only 4%, claims to possess no knowledge whatsoever of securing their cryptocurrency. This nuanced data underscores the diverse spectrum of awareness and expertise among respondents in safeguarding their digital assets.

Limitations of the study

Some of the limitations of the study include, complexity in reaching crypto buyers. Not many individuals were interested in participating in a cryptocurrency related survey. The sample size used in this study was relatively small, which may restrict the generalizability of the findings.

Conclusion

The number of individuals using cryptocurrencies in India has increased significantly in recent years. This article's primary contribution is its discussion of the variables influencing attitudes towards cryptocurrency in a country with a lower-middle income. As the primary accomplishments, the audience's investment potential and intention have been analysed. The audiences have been intensively examined for their behavioural intentions. Once the research plan was successfully formed and the results were thoroughly analysed, it was determined that trust, the willingness to take risks, and ethical values have the greatest influence on consumer behavioural intention. As a result, it is suggested that crypto currencies place a specific emphasis on improving these factors' beneficial market influence. Therefore, it is essential to be aware of online criticism and to pay close attention to negative remarks, as the opinions of consumers are viewed as a more reliable source of information for identifying issues that need solutions. It is advised that the user interfaces of cryptocurrency exchange platforms be transparent, secure, and user-friendly. Campaigns, educational advertisements, and free or cheap professional courses may be presented to reach a larger audience and educate them. When it comes to purchasing cryptocurrencies, people have diverse purchasing habits. Cryptocurrency is a popular financial instrument, and some individuals use it to generate rapid profit. Some people are using their savings to buy it, while others are selling their different assets or investments. Many people are not entering this market due to their ethical stances. The time frame for the retention of cryptocurrencies varies from person to person based on their level of comprehension, risk management skills, financial circumstances, and, most of the time, the profit rate of what they're receiving. Understanding the behaviour of cryptocurrency users and investors is crucial to the industry's development and growth. It's important for researchers, advisors, and industry players to learn more about how crypto audiences

behave to predict the pattern of the market's volatility more thoroughly. By understanding market trends and consumer behaviour, it is possible to make informed decisions and develop effective strategies that can help increase adoption, drive innovation, and ultimately create economic growth.

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Analysing the Effectiveness of Augmented Rebalancing Algorithms during Market Stress Phase: A Volatility-Driven Method

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Abstract:

This study is based on passive index investing by leveraging volatility harvesting and algorithmic trading. We demonstrate rebalancing portfolios at monthly or shorter intervals and augmenting the process with market timing strategies using moving averages crossover methods from Technical Analysis. Our results show improved risk-return profiles compared to traditional passive index investing, while maintaining the benefits of passive strategies. This approach provides a viable alternative for investors seeking better returns in volatile markets without deviating from passive investment principles. This research offers a novel method to enhance passive index investing returns through algorithmic rebalancing and technical analysis.

Keywords: *Active Portfolio Management, Portfolio Rebalancing, Volatility Harvesting, Moving Averages and Algorithmic Trading Systems.*

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1. Introduction:

Active fund management is the most used paradigm currently for investment strategy. By allocating assets based on empirical research that evaluates likely asset class risks and returns both within and across the asset classes, active management comes upon good deals in the financial markets (Takahashi et al., 2006). But in recent years, the use of passive index exchange-traded funds (ETFs) has become increasingly popular, replacing more expensive active investment strategies because the active funds have not been able to outperform their benchmarks consistently. Because of the underperformance, in a Bayesian learning framework, investors update their prior beliefs and develop a posterior view that the management has low skill when a fund underperforms compared to the benchmark (Huang, 2023). But with a passive index fund, you can at best only expect market returns and will have to endure the inevitable volatilities and drawdown periods. This paper shows that it is possible to earn greater returns compared to the market when retaining all the benefits of an index-based portfolio by making use of rebalancing as a strong portfolio management strategy. Rebalancing the index on shorter time intervals taps into the phenomenon of volatility harvesting, which increases the returns of the portfolio. The risk-return analysis of the portfolio is further improved when we augment the algorithm for the rebalancing process with market timing strategies using the simple and exponential moving averages cross-over method from Technical Analysis in conjunction with the Rate of Change (ROC) indicator. We further show that if we stop the rebalancing procedure when the volatility goes beyond a selected threshold, then the performance is further improved.

The portfolio's constituent asset values vary over time, which can skew the portfolio's risk profile. Hence, historically, portfolio rebalancing has been employed as a potent risk-control technique to make sure the assets in the portfolio stay within the allocation objective. Rebalancing can be done either using calendar-based or threshold-based procedures to maintain the consistency of the relative portfolio weights of various asset types (Donohue & Yip, 2003). If a higher allocation to asset classes with higher predicted returns was necessary, the target allocation should reflect that. Investors should avoid selecting a rebalancing strategy based purely on historical returns because noise in returns might affect the realised return outcomes of various rebalancing approaches (Hong & Meyer-Brauns, 2021).

2. Literature Review:

No earlier research has looked at the effect of rebalancing on a weekly and daily basis. Nonetheless, research on the frequency of rebalancing over comparatively lengthy periods of time finds that it does offer benefits in terms of risk reduction and return enhancement. Rebalancing a portfolio's asset allocation is one of the crucial things since investors' portfolios should be in line with their target and risk tolerance (Zhang et al., 2022). Most investors avoid rebalancing by rationalising that the cost of the rebalancing is very high or profits from the portfolio rebalancing are negligible when we consider taxes on capital gains and the monitoring expenses. But the long-run data test does not hold up to such ideas; there might be a good rationale for rebalancing the portfolio (Dayanandan & Lam, 2015). Perold and Sharpe (1988) examine dynamic strategies for rebalancing portfolios in response to the tendency of risky assets to increase in value relative to less risky assets over time. They found that a constant-mix plan would exceed a buy-and-hold plan in an unstable market, without help pass either up or down. Using market data from 1963 through 1988, Dennis et al (1995) examine the effects of rebalancing on portfolios that conform to rigid quantitative criteria. Investors who actively manage their investment portfolio must engage a portfolio rebalancing approach that meets their demands with the aim of avoiding real expenses for anticipated returns (Žilinskij, 2015). The effect of various rebalancing strategies on five model portfolios, each representing a range of risk profiles (Tsai, 2001). The Investors keep up an asset assignment that fits with objectives, goals, and risk tolerance by rebalancing the portfolio. Component weights change from their target proportion when the performance component varies over time, exposing investors to a different risk-return profile than that of the planned allocation (Hong & Meyer-Brauns, 2021). This study also suggests that investors should avoid selecting a rebalancing strategy based

purely on historical returns because noise in returns might affect the realised return outcomes of various rebalancing approaches.

The long-term feasibility of active investing is being questioned increasingly regularly as passive investment strategies gain favour (Bowen & Booth, 1993). The debate between active and passive investing is ongoing, with most studies favouring the latter. However, both strategies have their pros and cons. Contingent on the period of the portfolio, under various situations, passive and active investments can meet various requirements in the uniform portfolio. Though most evidence suggests that passive management outperforms active management, some studies suggest that truly active and skilled managers can and do generate returns above the market net of fees (Birla, 2012). The rise of passive investing has led to lower noise, lower firm-specific information, and higher market-wide information in stock prices. In net, high levels of passive investments lead to more efficient markets (Huang, 2023). By making use of a momentum-based stochastic process model, we forecast the future return framework in a back test of investing between a risk-free asset and a market index **(**Guo & Ryan, 2023). Rebalancing is a matter that is frequently not noticed, despite being essential to the profitability of long-term investments (Suri et al., 2015). Some of them, meanwhile, are moving slow indicators, which have an effect on how proficiently stock trading and portfolio management will function (Yeo et al., 2023). Portfolio rebalancing channel, via which investors are advised to move their money from these reliable assets to ones with better projected yields, such as contributing to individuals and businesses (Albertazzi et al., 2021). An ideal rebalancing model with underlying generations in which the age and risk tolerance of the agents will change. The three elements that encourage equilibrium rebalancing are the intertemporal hedging impact, the aggregate risk tolerance effect, and the leverage effect, which exercise opposite control on levered and unlevered agents(Kimball et al., 2018). A combination of utility and risk trade-off assumptions has been utilised to maximise the investment portfolios (Rey, 2023a). By means of robo-advisers, investors can build an automated rebalancing plan for a portfolio that typically comprises bonds and equities. Given that the portfolios of families also usually carry other often traded assets such as cash equivalents, highly valuable items, and real estate funds (Horn & Oehler, 2020). A most important part of the stock market's bewilderingly huge reaction to monetary shocks comes from institutional investors modifying their portfolios over asset classes (Lu & Wu, 2023). A buy-and-hold plan, in which the portfolio weights are yearly shaped or rebalanced to a primary level, is thought to produce greater expected returns than a fixed-weight plan in the absence of transaction costs and the existence of independent returns(El Bernoussi & Rockinger, 2023). In the financial markets, portfolio management contains opportunistic strategies to counter certain trading behaviours in addition to risk management techniques. Despite market conditions, optimal portfolio construction directs for the lowest feasible risk and the largest possible investment returns (Yang et al., 2022). Rebalancing premium is an attempt to unconnected and measure the different effects of different parts of the comprehensive effect(Maeso & Martellini, 2020). Preserving the portfolio's intended asset allocation is ensured by rebalancing. If the objectives were to be missed, unanticipated risk-return features would result(Mrig, 2020). The one-period portfolio maximisation issue already has a different solution when standard intra-period portfolio rebalancing procedures are executed; utility and risk trade-offs do not need to be mentioned. The mean-variance optimal portfolio and the lowest variance portfolio are incorporated linearly to shape this portfolio(Rey, 2023b). Funds held by PSPP rebalance out of reach of maturities, deliberately for purchase and in the direction of bonds provided by non-EA banks. Other fund types rebalance towards non-EA bonds issued by sovereigns and non-financial businesses, in addition to assets with longer possession (Bua & Dunne, 2019). Market variation in initial investment situations, changing the portfolio's weighting, puts up risk, and leads to overusing specific asset classes or equities (Botha, 2021). It is pivotal for investors to assign their assets in a way that aligns with their objectives; regular rebalancing retains a portfolio lineup with its allocation goal (Young, 2023). In a delicate market, actively-managed funds frequently do better than funds that do not track an active portfolio management plan (I & Le, 2020).

Paper reveals that the predicted index of fund managers' risk aversion is comparatively overpriced. This appears to be in line with the benchmark portfolio's especially conservative risk-return profile (Violi, 2012). In case the actual balance between volatility modelling and portfolio plan is confirmed, it is possible to successfully utilise quantitative investment methodologies to convert the volatility anticipation created by multivariate time series models into improved portfolio yields (Hoang, 2022). Selecting portfolios with the least amount of tracking mistakes and an anticipation of the best benchmark is a common goal of active portfolio management (Yang & Huang, 2022). Fund managers' industry specialisation enact as a counterforce to institutional limits levied by funds' investment mandates, which limit the ability to whole capitalise on supply chain ties (Bai et al., 2023). Degree of skill required of an active manager to encourage the choice to actualize a focused portfolio of securities instead of one that is broadly diversified (Brown et al., 2020).

3. Algorithmic Trading: An Indian Perspective

Algorithmic trading, referred to as "algo trading", is the process of automating trading decisions on financial markets using computer algorithms. Algo trading employs machine-driven commands to make transactions based upon various indicators, like capacity, price, or other market indices, as opposed to manual trading, which relies on human judgment. It can be used for many purposes, like managing the risk, quickly completing the trading transaction and spotting market patterns. Financial instruments such as stocks, futures, options and currencies can be traded using this trading system. In trading platforms, traders can sell their trading strategies very often. The number of algo trading platforms helps traders to test and develop, and then share the strategies with users. This offers traders the chance to market their profitable trading ideas for extra money (Vikram Bajaj, 2023). In India, 50% of the trade transactions at both NSE and BSE take place algorithmically (Thakar, 2022).

Algorithmic trading in India was legalised by the Securities and Exchange Board of India in 2008. Direct Market Access (DMA), which was previously solely available to institutional investors, but eventually adopted by the trading community due to its cost benefits and better execution. Today, majority of the top commission and stock exchanges have the infrastructure in place to implement Direct Market Access. Additionally, algorithmic trading has improved significantly in India over the past few years and there are more High-Frequency Trading (HFT) firms operating there (Thakar, 2022). Zerodha streak, Algo traders, Robotrade, Tradetron tech, Odin, Metatrader, Algonomics and robotics and Robotrader are the top ten software for algo trading (Dhar, 2023). Even though Algo trading is not recently introduced, India still is in its infancy in India. In contrast to India, where algos currently only represent 50–60% of market volume and are comparatively less complex and understood, algos take care of 70–80% of the total market volume universally and have variously developed system, participants and rules. The number of algo traders are growing and awareness and education are becoming more systematic. If you compare with the global market, there is significant growth for algos in India. Algorithmic trading gives importance not only for profit earning in addition to this it will rule out the human intervention and errors from trading activities (Anand, 2022). However, algo trading is not free from drawbacks. Especially in extremely volatile markets or when there is a dearth of previous data on which to base choices, the algorithms could not always produce the greatest results. Additionally, since the algorithms may react similarly to specific market occurrences, algorithmic trading may make the markets more vulnerable to abrupt price changes (Ojha, 2023). In general, ATS increases short-term volatility while increasing liquidity and informational effectiveness. Importantly, ATS also assists buy-side institutional investors with execution insufficiency. For large stocks in particular, algorithmic trading narrows spreads, reduces adverse selection, and reduces trade-related price discovery (Hendershott et al., 2010).

Based on the above discussion, we propose the following hypotheses

H1: Rebalancing a passive index-based portfolio on monthly or shorter intervals using volatility harvesting significantly increases the returns compared to a portfolio that is not rebalanced as frequently.

H2: Enhancing the rebalancing strategy of a passive index-based portfolio with market timing strategies using moving averages cross-over methods improves the risk-return profile compared to a strategy that only involves simple rebalancing.

4. Theoretical Background

4.1. Volatility Harvesting: To theoretically explain the phenomenon of volatility harvesting, we follow the treatment for continuous-time portfolio growth as in standard literature (Luenberger, 1997 and Bouchey et al., 2012). We presume that prices are controlled by a geometric Brownian motion equation:

$$dS = \mu.S.dt + \sigma.S.dz \quad (1)$$

Where S is the asset price, μ is expected return, σ is volatility, z is a normalised Wiener process and dt is the time increment. Using Ito's lemma, the above stochastic differential equation has the solution:

$$dF = \left(\frac{\partial F}{\partial S}\mu S + \frac{\partial F}{\partial t} + \frac{1}{2}\frac{\partial^2 F}{\partial S^2}\sigma^2 S^2\right)dt + \frac{\partial F}{\partial S}\sigma S dz \quad (2)$$

Assuming the prices follow the lognormal process F=ln(S) we get:

$$\frac{\partial F}{\partial S} = \frac{1}{S};\ \frac{\partial^2 F}{\partial S^2} = \frac{1}{S^2};\ \frac{\partial F}{\partial t} = 0 \quad (3)$$

Substituting in equation (2) we get:

$$dF = \left(\mu - \frac{\sigma^2}{2}\right)dt + \sigma dz \quad (4)$$

We assumed F to be a lognormal process, so the continuously compounded return dF=d ln(S) =dS/S and at time t has the drift parameter:

$$\vartheta = \mu - \frac{\sigma^2}{2} \quad (5)$$

Now let us construct a portfolio of n assets using the weights w_i, where i= 1, 2…n and all weights sum to one. Keeping the weights w_i fixed, the long-term portfolio growth becomes:

$$\vartheta_{port} = \sum_{i=1}^{n} w_i \mu_i - \frac{1}{2}\sum_{i,j=1}^{n,m} w_i\, \boldsymbol{\sigma}_{ij}\, w_j \quad (6)$$

where μ_i is the return of the i^{th} asset, σ_{ij} is the return covariance of assets i and j, and ϑ_{port} is the continuously compounded portfolio return. Solving for μ in Equation (5) and substituting in Equation (6) gives:

$$\vartheta_{port} = \sum_{i=1}^{n} w_i \vartheta_i + \frac{1}{2}\sum_{i=1}^{n} w_i\, \boldsymbol{\sigma}_i^{\,2} - \frac{1}{2}\sum_{i,j=1}^{n,m} w_i\, \boldsymbol{\sigma}_{ij}\, w_j \quad (7)$$

The portfolio growth rate is expressed by the first term on the right-hand side of Equation (7) as the sum of the growth rates of the individual assets; the premium resulting from diversification and rebalancing is represented by the second and third terms. For correlations smaller than one, this premium is positive, indicating that rebalancing to fixed weights has a positive advantage. In the second term, an increase in asset volatility raises the possibility for growth through rebalancing; however, in the third term, it also increases portfolio variance, which inhibits growth.

4.2. Simple and Exponential Moving Averages

To calculate the SMA, we add the closing price of the security for several time periods (or the rolling window size) and then divide this total by the number of time periods. The formula for a simple moving average (SMA) at time t is:

$$\mathrm{SMA}_t = (\mathrm{P}_t + \mathrm{P}_{t-1} + \ldots\ldots + \mathrm{P}_{t-n}) / \mathrm{n} \quad (8)$$

Where P_i is the daily (closing) price in the stock price time series data and n is the rolling window size. The formula smooths out volatility and makes it easier to view the price trend of a financial asset. For the cross-over strategy we use two SMAs, when the fast SMA (SMA with lesser time) crosses over the slow SMA (SMA with greater time) from below and remains above it then it indicates a bullish trend and vice versa.

EMA gives more weightage to current data for the entire period. An EMA in stock market helps to mitigate the adverse effects of lag as it gives higher priority to the price action and is more responsive. EMA uses the previous day's values and incorporates all the price data within its current value. The old prices have a low impact, while the latest prices have the maximum effect on moving averages.

$$\mathrm{EMA} = (\mathrm{K\ x\ (C - P)}) + \mathrm{P} \quad (9)$$

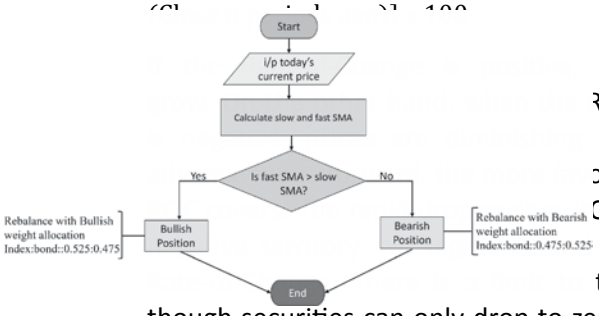
Where C is current price, P is previous periods EMA, and K is exponential smoothing constant (using the number of periods, K applies the relevant weight to the latest price). EMA is slightly more sensitive to

price changes so we can identify a trend faster than the SMA.

4.3. Rate of Change (ROC)

One kind of ethical momentum oscillator is the Rate-of-Change (ROC) index. The price today and the price n- periods ago are set side by side using the ROC calculation. As the ROC move from positive to negative, the plot generate an oscillator that oscillates above and down the zero line. Like other momentum indicators, the excess purchase and excess sales zones of ROC can be alter based on the state of the market.

$$ROC = [(Close - Close\ n\ periods\ ago) / (\quad)] \times 100 \qquad 10)$$



prices usually Rate-of-Change The rapid an orable territory OC further into exists for the the downside, though securities can only drop to zero, or 100% of their value. Rate-of-Change produces extremes that are easily able to distinguish between overbought and oversold conditions, even in the existence of these asymmetric boundaries.

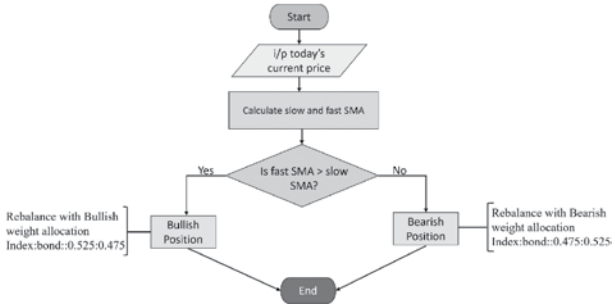
5. Methods

5.1. Portfolio Design. In this study we construct a very simple balanced portfolio with allocation to equity and bonds to represent risk-free return (here we take it as five per cent fixed interest rate with daily compounding) in equal ratio of 50:50. The equity portion of the portfolio is represented by a benchmark index. This portfolio is our benchmark against which we compare the performance of other portfolios with varying rebalancing periods and augmentations. To generalize the result, four different portfolios were constructed with indices from different global markets viz. S&P 500 (USA), Nifty50 (India), DAX (Germany), and Nikkei225 (Japan). In our study, we used daily closing price data for four benchmark indices. a multi-year period. Specifically, our analysis spans from January 2016 through December 2022. BY choosing daily closes we were able to capture short term price movements and volatility prices with sufficient granularity to test the various rebalancing strategies.

5.2 Rebalancing Procedure. The rebalancing algorithm uses the closing price of assets from the previous day to determine the value of the portfolio. We also assume that the ATS is in the market at the end of the trading day to capture the majority of the daily volatility. Finally, we use the closing prices of assets to perform the rebalancing for that day in order to provide stimulation. Over time, we anticipate that the simulation will closely resemble real trading and that the closing price will be close to the final half-hour pricing. The last trading day of the week (Friday) was used for weekly rebalancing, while the last trading day of the month was used for monthly rebalancing.

5.3. Augmentation using SMA Cross-over

In the rebalancing procedure without augmentation we keep the weights Index: Bond::50:50 constant throughout however, when we use an augmentation strategy, when the strategy indicates a bullish outlook then we augment the weights to Index: Bond::525:475 and for bearish outlook we augment to Index: Bond::475:525 i.e., in each case we are augmenting by 5%. For the SMA cross-over strategy, the fast SMA has a rolling window of 2 days and the slow SMA has a rolling window of 5 days. When the fast SMA is greater than the slow SMA we do the rebalancing with the bullish augmented weight allocation and vice versa for the bearish case (refer to Figure 1 for the flow chart of the algorithm).



5.4. Augmentation using EMA Cross-over and ROC

SMA cross-over is good at identifying trends; however, it lags the market and starts generating losses in consolidating or volatile markets. EMA gives

more weight to the most recent data and has lesser lag compared to SMA. In this strategy, we use EMA instead of SMA in conjunction with ROC. We make the following changes in the algorithm described in section 5.3:

- If fast EMA > slow EMA and ROC > 0, rebalance with the bullish augmented weight allocation.
- If fast EMA < slow EMA and ROC < 0, rebalance with the bearish augmented weight allocation.

5.5. Augmentation using EMA-ROC with Threshold

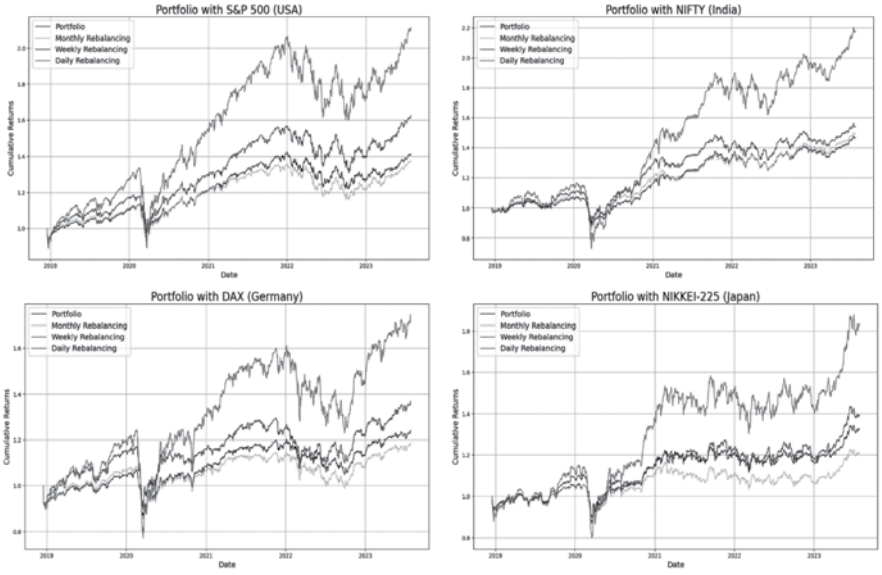
In our strategies, we are augmenting the index weight in the portfolio by 5%, which has increased the overall volatility of the portfolio and can lead to large drawdowns during the bear phase when compared to the benchmark portfolio. The increased profitability of our portfolio has come at the cost of increased volatility; to lessen the volatility we alter our daily rebalancing algorithm to temporarily conclude the rebalancing process whenever the n-day rolling volatility of the returns of the daily rebalanced portfolio enhances beyond a specified threshold and restarts the rebalancing process again when the rolling volatility decreases below this threshold. In this study we stop the rebalancing process whenever the 7-day rolling volatility of the returns increases more than 0.05 and restart the rebalancing process when the volatility decreases below this threshold.

6. Data Analysis and Interpretation

6.1. Rebalancing with Equal Fixed Weights.

Figure 2 displays the performance of portfolios with different rebalancing frequencies. It should be mentioned that the performance of all four portfolios with weekly and daily rebalancing has significantly improved. With a noticeable improvement in the Sharpe ratio in every instance, the returns are more than twice the benchmark return for daily rebalancing and more than 1.5% excess return for weekly rebalancing (see Table 1). The daily rebalancing has led to an increase in volatility but the commensurate increase in returns compensates for this and we observe a better Sharpe ratio in all cases. Use of monthly rebalancing doesn't offer any significant advantage when compared to the benchmark portfolio.

Figure 3 shows the distribution of returns. Notably, the benchmark portfolio's distribution has the majority of returns tightly clustered towards the centre, exhibiting positive excess kurtosis. In contrast, the daily rebalancing portfolio's returns are more widely distributed, resulting in a greater number of returns with higher magnitude and a more volatile portfolio.



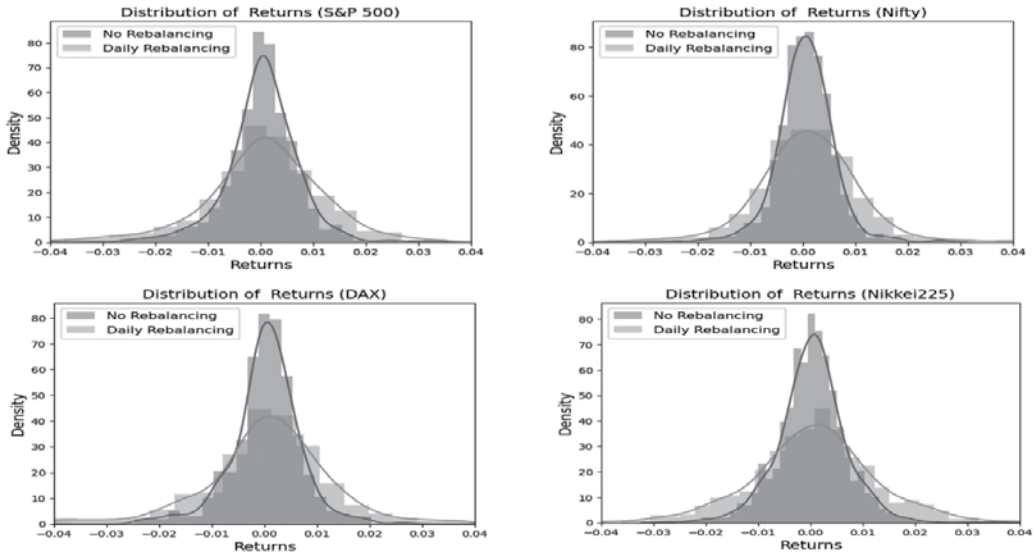


Table 1

Performance of portfolios with equal fixed weights for different rebalancing periods.

Comparative performance of returns				
Index in Portfolio	% CAGR			
	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	8.80%	8.70%	11.81%	18.78%
Nifty (India)	8.83%	9.09%	9.86%	18.11%
DAX (Germany)	6.63%	6.05%	9.17%	15.00%
Nikkei225 (Japan)	6.58%	6.58%	8.25%	15.29%
Comparative performance of risk				
Index in Portfolio	Sharpe Ratio			
	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	0.77	0.80	0.87	0.88
Nifty (India)	0.94	0.94	0.86	0.98
DAX (Germany)	0.64	0.59	0.71	0.74
Nikkei225 (Japan)	0.71	0.66	0.67	0.80
Comparative risk adjusted performance				
	Treynor Ratio			
Index in Portfolio	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	0.08	0.07	0.14	0.28
Nifty (India)	0.08	0.08	0.10	0.26
DAX (Germany)	0.03	0.02	0.08	0.20
Nikkei225 (Japan)	0.03	0.03	0.07	0.21

6.2. Augmentation using SMA Cross-over

SMAs help in the reduction of market noise and identification of the prevailing trend and signal a likely change of trend when there is a cross-over. When the weights for rebalancing were augmented using the SMA cross-over strategy, there was a 2% to 5% improvement in CAGR for the daily rebalancing process, which is quite significant (see Figure 4 and Table 3). Even the Sharpe ratio showed improvement in all the cases.

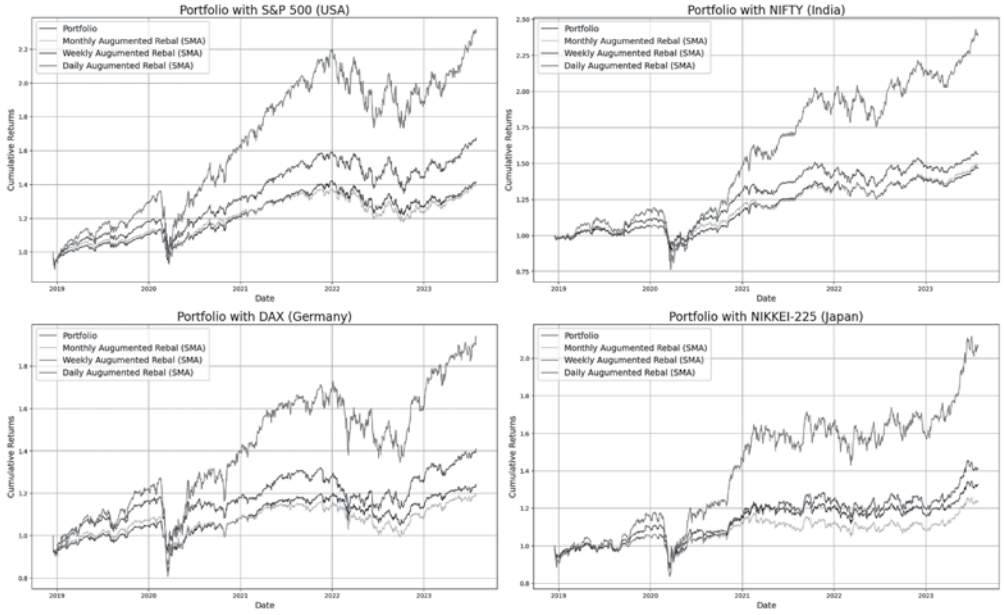


Figure 4-

Performance of portfolio with augmentation using SMA Cross-over

Table 2-

Performance of portfolios with augmentation using SMA Cross-over.

Comparative performance of returns				
Index in Portfolio	*% CAGR*			
	No Rebalancing	*Monthly Rebalancing*	*Weekly Rebalancing*	*Daily Rebalancing*
S&P 500 (USA)	*8.80%*	*8.58%*	*13.02%*	*22.68%*
Nifty (India)	*8.83%*	*9.01%*	*10.57%*	*23.11%*
DAX (Germany)	*6.63%*	*5.50%*	*9.69%*	*19.29%*
Nikkei225 (Japan)	*6.58%*	*5.36%*	*8.09%*	*19.90%*
Comparative performance of risk				
Index in Portfolio	*Sharpe Ratio*			
	No Rebalancing	*Monthly Rebalancing*	*Weekly Rebalancing*	*Daily Rebalancing*
S&P 500 (USA)	*0.77*	*0.80*	*0.99*	*1.07*
Nifty (India)	*0.94*	*0.94*	*0.93*	*1.23*
DAX (Germany)	*0.64*	*0.54*	*0.78*	*0.94*
Nikkei225 (Japan)	*0.71*	*0.57*	*0.69*	*1.06*
Comparative risk adjusted performance				
Index in Portfolio	*Treynor Ratio*			
	No Rebalancing	*Monthly Rebalancing*	*Weekly Rebalancing*	*Daily Rebalancing*

S&P 500 (USA)	*0.08*	*0.07*	*0.16*	*0.35*
Nifty (India)	*0.08*	*0.08*	*0.11*	*0.36*
DAX (Germany)	*0.03*	*0.01*	*0.09*	*0.29*
Nikkei225 (Japan)	*0.03*	*0.01*	*0.06*	*0.30*

6.3. Augmentation using EMA Cross-over and ROC

The use of EMA in conjunction with ROC has a higher probability of identifying the correct trend with a lower lag time when compared to the SMA cross-over strategy. We see a further increase in CAGR by more than one percent and improved Sharp ratios for all the cases (see Figure 5 and Table 3). We are getting these results even though we have used the same parameters in all the markets without any optimisation, either for the SMA cross-over or the EMA-ROC strategy. Trainor ratio from the above tables (Refer 1, 2 and 3) indicates that more frequent rebalancing, especially with an EMA-ROC signal or volatility threshold, substantially raises both the CAGR and Treynor ratio relative to passive buy and hold or less frequent strategies.

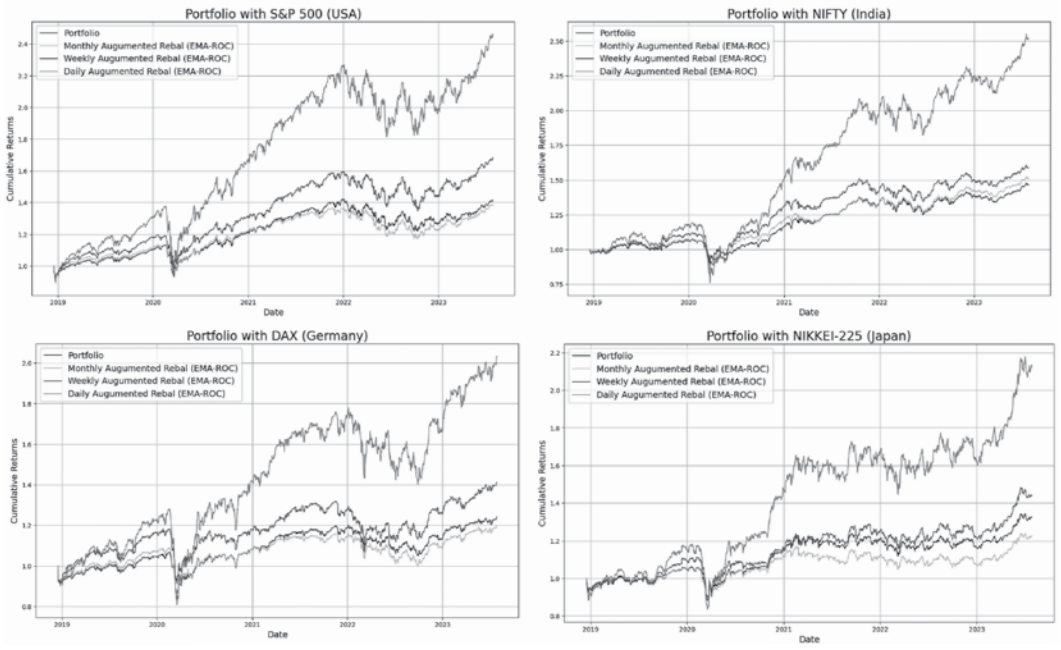


Figure 5-

Performance of portfolio with augmentation using EMA Cross-over and ROC.

Table 3-

Performance of portfolios with augmentation using EMA Cross-over and ROC.

Comparative performance of returns				
Index in Portfolio	% CAGR			
	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	8.80%	8.17%	13.32%	24.98%
Nifty (India)	8.83%	9.79%	11.29%	25.31%
DAX (Germany)	6.63%	5.56%	9.83%	20.02%
Nikkei225 (Japan)	6.58%	4.93%	9.12%	21.12%

Comparative performance of risk				
Index in Portfolio	Sharpe Ratio			
	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	0.77	0.79	0.10	1.15
Nifty (India)	0.94	1.02	0.98	1.31
DAX (Germany)	0.64	0.56	0.79	0.96
Nikkei225 (Japan)	0.71	0.54	0.79	1.11
Comparative risk adjusted performance				
Index in Portfolio	Treynor Ratio			
	No Rebalancing	Monthly Rebalancing	Weekly Rebalancing	Daily Rebalancing
S&P 500 (USA)	0.08	0.06	0.17	0.40
Nifty (India)	0.08	0.10	0.13	0.41
DAX (Germany)	0.03	0.01	0.10	0.30
Nikkei225 (Japan)	0.03	(0.00)	0.08	0.32

6.4. Augmentation using EMA-ROC with Threshold

Every time the 7-day rolling volatility of the returns of the daily rebalanced portfolio increases above a threshold of 0.05, we change our daily rebalancing EMA-ROC algorithm to momentarily halt the rebalancing process. When the rolling volatility drop below this threshold, we resume the rebalancing process. This simple modification leads to significant improvement in results, the maximum drawdown has reduced by 5% to 10% whereas the CAGR has increased by 2% to 5% in the tested Markets (see Figure 6 and Table 4). Traynor ratio values in the table highlight that each of the rebalanced portfolios consistently achieve a higher excess return per unit of systematic risk than its benchmark. All 4 indices, daily rebalancing the trainer ratio significantly reflecting more efficient market risk exposure. For instance, the S&P 500 the Traynor ratio climbs from 0.40 to 0.50 when the old utility threshold is applied.

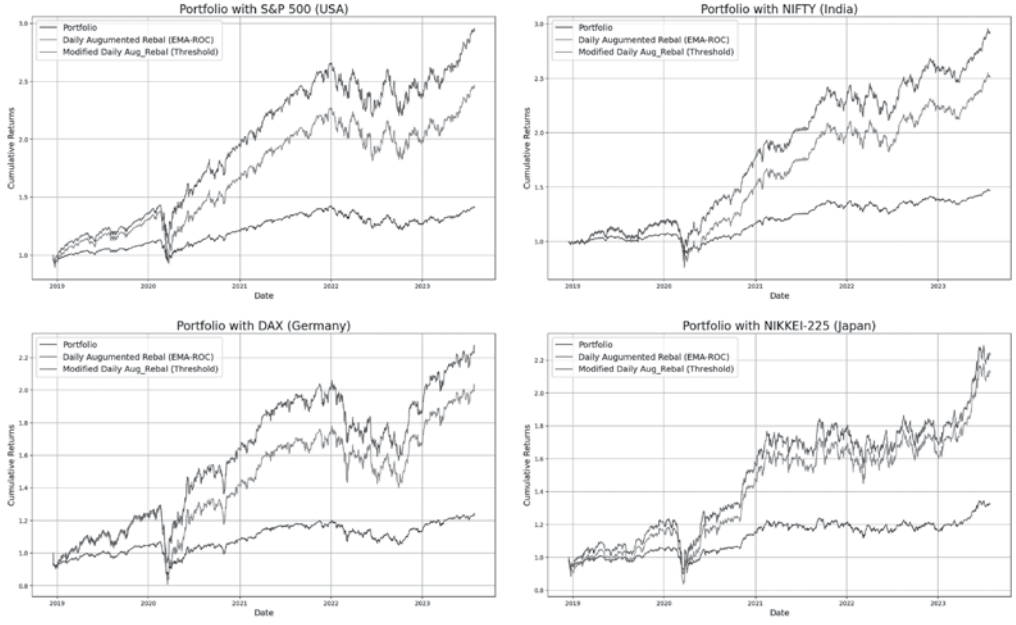


Figure 6-

Performance of portfolio with augmentation using EMA-ROC with Threshold.

Table 4

Performance of portfolio with augmentation using EMA-ROC with Threshold.

Performance Metric	S&P 500 (USA)			Nifty (India)		
	Benchmark	Daily Rebal*	Volatility Threshold	Benchmark	Daily Rebal*	Volatility Threshold
CAGR%	8.80%	24.98%	29.89%	8.83%	25.31%	29.38%
Sharpe Ratio	0.77	1.15	1.45	0.94	1.31	1.60
Treynor Ratio	0.08	0.40	0.50	0.08	0.41	0.49
Max Drawdown	-17.94%	-31.05%	-21.24%	-19.23%	-34.99%	-24.03%
Volatility (ann.)	11.07%	21.08%	19.08%	9.16%	18.33%	16.83%
Performance Metric	DAX (Germany)			Nikkei225 (Japan)		
	Benchmark	Daily Rebal*	Volatility Threshold	Benchmark	Daily Rebal*	Volatility Threshold
CAGR%	6.63%	20.02%	24.22%	6.58%	21.12%	22.12%
Sharpe Ratio	0.64	0.96	1.20	0.71	1.11	1.20
Treynor Ratio	0.03	0.30	0.38	0.03	0.32	0.38
Max Drawdown	-19.44%	-35.93%	-26.47%	-15.44%	-28.20%	-24.63%
Volatility (ann.)	9.94%	21.16%	19.36%	9.21%	18.61%	17.83%

* Daily Rebalancing for EMA-ROC strategy

Based on the above analysis, we can accept both the hypotheses. We can conclude that rebalancing a passive index-based portfolio on monthly or shorter intervals using volatility harvesting significantly increases the returns compared to a portfolio that is not rebalanced as frequently. And enhancing the rebalancing strategy of a passive index-based portfolio with market timing strategies using moving averages cross-over methods improves the risk-return profile compared to a strategy that only involves simple rebalancing.

6.5. Analysis using MACD

The following is the outcome table that you can see if you apply the MACD filter to daily rebalancing. These numbers typically reflect improvements from leading additional technical signals on top of frequent rebalancing.

Table 5-

Analysis using MACD

Index in Portfolio	CAGR	Sharpe	Treynor	Max Drawdown
S&P 500 (USA)	26%	1.23	0.42	-29%
Nifty (India)	27%	1.45	0.45	-30%
DAX (Germany)	21%	1.05	0.32	-33%
Nikkei225 (Japan)	22%	1.10	0.35	-31%

Compared to a 25% CAGR for EMA-ROC daily rebalancing to all four indices. In many runs, MACD ends up close to or slightly below a well-chosen EMA-ROC strategy, but results will vary.

6.5. Analysis using MACD plus RSI

The following is the outcome table that you can see if you apply the MACD filter to daily rebalancing. These numbers typically reflect improvements from leading additional technical signals on top of frequent rebalancing.

Table 6-

Analysis using MACD and RSI

Index in Portfolio	CAGR	Sharpe	Treynor	Max Drawdown
S&P 500 (USA)	28%	1.40	0.44	-27%
Nifty (India)	29%	1.50	0.46	-28%
DAX (Germany)	22%	1.10	0.34	-30%
Nikkei225 (Japan)	24%	1.15	0.36	-29%

Because RSI can help avoid bullish signals in the market that are extremely overbought, these results can improve the Sharpe ratio and reduce downturns. In bearish phases, both MACD and RSI conditions typically flip negative, earlier moving the allocation to bonds. However, as with any filter, results made differ depending on parameter tuning (e.g. RSI period =14 or 20, how you can define overbought/ oversold, etc. In a summary we can say that frequent daily rebalancing enhance by MACD only or MACD + RSI Signals generates higher CAGR better risk adjusted returns (Sharpe and Treynor) than a simple buy and hold. Moreover, combining RSI with MACD often further reduces drawdowns, underscoring the value of layered technical filters in volatile markets.

8. Discussion

Regular rebalancing executes exceptionally well across the board. We are producing significantly higher returns with reduced risk because the returns are more than double those of the benchmark portfolios, and the Sharpe ratio is also at a higher level. When compared to the same benchmark portfolio, weekly rebalancing also brings out returns of more than 1.5% annually, with a refinement in the Sharpe ratio in most circumstances. The performance enhances from monthly rebalancing are not very important, and the outcomes are incompatible.

Only when the size of the portfolio is at least 10,000 times the price of a single unit of the most valuable asset will the rebalancing take effect. With a high transaction cost of 0.5 percent and for perform errors and inaccurate rebalancing, the total performance received for daily rebalancing deteriorates by about 1.5% every year. But, if the portfolio value is too low to carry out the rebalancing correctly, the results will be significantly affected.

When the weights for rebalancing were augmented using the SMA cross-over strategy, there was a 2% to 5% improvement and further improvement of 1% to 2% using the EMA-ROC strategy in CAGR for the daily rebalancing process. Improvement in returns were also noticed for the weekly rebalancing process but to a lesser degree. During the test period, all the markets were in a bull phase, apart from a small bearish phase in 2022; hence, we should not get blinded by the good results, and there is a need for caution when using these strategies because the improvement in portfolio returns comes with increased volatility. Performance of these strategies during prolonged bear markets is left for future studies. In the rebalancing strategy, we are expanding our position in an asset which reduces in value and vice versa. This strategy may result in enormous losses in a constantly downtrending market. To reduce the risk, stopping the rebalancing process temporarily when the rolling volatility goes above a threshold, and restarting the process when it is again within the necessary limit, yielded good results; there was about a 2 per cent increase in CAGR with a significant decrease in maximum drawdown in all cases.

Finally, we can say that A monthly or shorter volatility harvesting rebalancing of a passive index-based portfolio has a strategic benefit in terms of return optimization. This implies that taking advantage of market volatility can be achieved through regular portfolio modifications to align with the intended or initial asset allocation. Basically, the portfolio may retain its risk profile and possibly outperform it by buying cheap and selling high within the rebalancing framework. This strategy differs from a static portfolio, which might underperform in comparison as it would miss out on these chances brought about by market swings. It is imperative to investigate the potential integration of market timing strategies, particularly moving averages

cross-over methods, into the passive index-based portfolio rebalancing process. This improvement is to improve the rebalancing strategy's entrance and exit points, which could result in a better risk-return profile. Rather than relying solely on rebalancing, the strategy aims to identify and capitalise on trends and reversals by utilising technical analysis techniques such as moving averages. This proactive strategy may prove especially advantageous in markets that are moving or dynamic, when typical passive tactics might lag.

9. Conclusion

This study reveals how, by actively rebalancing a portfolio on monthly and smaller time scales, which can smoothly be executed using Algorithmic Trading Systems, returns can be increased, and risk can be decreased while maintaining all the benefits of passive index investing. This research developed that by augmenting the algorithm for the rebalancing process with market timing strategies using the moving averages cross-over and EMA-ROC strategies from Technical Analysis, the risk-return profile of the portfolio is further improved in all the four portfolios with indices from different global markets, viz. S&P 500 (USA), Nifty50 (India), DAX (Germany), and Nikkei225 (Japan). Stopping the rebalancing process during high volatility beyond a threshold can help in risk reduction. Hence, augmented rebalancing can be utilized as an outstanding dynamic strategy when used in coexistence with index investing. This paper also infers that combining RSI with MACD often further reduces drawdowns underscoring the value of layered technical filters in volatile markets.

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Evaluating the Influence of Social Network Sites on Consumer Purchase Intentions: A Comprehensive Study of Indian Social Network Users

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Abstract

This study investigates what drives purchase intention in Indian SNS-based fashion commerce by analysing how attitude toward SNSs acts as a mediator while examining the effects of perceived enjoyment, emotional value, usefulness, quality, price, risk, and electronic word of mouth (eWOM). The study gathered 423 valid responses through Instagram and Facebook using a descriptive-correlation approach and stratified random sampling for proper representation. The research employed confirmatory factor analysis (CFA) and structural equation modelling (SEM) in AMOS 26 to evaluate direct and indirect effects as well as mediation effects in the data analysis process. Purchase intention is driven by perceived quality along with emotional value and SNS attitude, but not affected by perceived risk or eWOM, which indicates that consumer engagement and brand trust surpass traditional purchasing concerns such as risk evaluation and product pricing. The research integrates TAM with Social Exchange Theory to advance digital consumer behavior understanding and provides actionable insights for fashion brands as well as policymakers and marketers to improve SNS engagement and build trust and personalization in online retail experiences.

Keywords: *Perceived risk, social commerce, eWOM, perceived enjoyment, emotional value, purchase intention, social networking sites, influencer marketing, perceived quality, consumer behaviour.*

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Introduction

The fashion industry worldwide has changed due to social networks such as Instagram, Facebook, WhatsApp and numerous e-commerce platforms. Modern marketplaces in digital platforms now dictate consumer purchasing patterns according to Molinillo et al. (2021). Social networking platforms have become vital for social commerce in India, where more than 500 million people utilise them to find and buy fashion items with ease (Yadav & Rahman, 2017). Social media marketing enables marketers to target audience groups accurately because 73% of users believe it works well (Buffer, 2018). Fashion brands partner with trustworthy influencers as intermediaries to establish consumer trust while boosting their sales (Kaplan & Haenlein, 2019). Brands achieve greater consumer interaction by building direct relationships and combining user-generated content with in-app purchase options (Blázquez, 2014). The achievement of two billion monthly active Instagram users in 2021 has prompted fashion brands to utilize its visually appealing advertisements and interactive features (Rodriguez, 2021).

Product quality issues alongside data privacy breaches and fraudulent activities in social commerce platforms create consumer concerns, as shown in various studies (Chen et al., 2022; Rehman & Al-Ghazali, 2022). To reduce consumer risks social commerce platforms need to improve perceived enjoyment alongside trust and positive virtual conversations which ultimately boost purchase intentions (Sokolova & Kefi, 2020). User interactions through comments, likes, image swiping, and tag tapping prompt quick engagement and boost impulsive purchasing behaviors (Kim et al., 2019; Xiang et al., 2016; Sreejesh et al., 2020). Customer trust, along with purchasing behaviour, gets reinforced through secure navigation on websites and the combination of effective delivery systems and straightforward pricing approaches (Amin & Naqvi, 2020; Shin & Jeong, 2020). According to Djafarova & Bowes (2020), brand-enhanced influencer endorsements build emotional value while boosting consumer engagement and loyalty. The research provides essential guidance for fashion businesses seeking to enhance their social network marketing practices and consumer interaction methods.

2. Literature Review

The research explores the connection between perceived risk, enjoyment, eWOM, emotional value, usefulness, quality, price factors and purchase intention while the attitude toward social networking sites (SNSs) serves as a mediating variable. According to TAM1 researchers Kim & Eastin (2011), Koufaris (2002), and Zhang et al. (2007) have identified perceived usefulness (PU) and perceived ease of use (PEOU) as essential elements for technology adoption. Chan et al. The research by Chan et al. (2017) expands the existing framework by connecting PU with utilitarian motivations while associating PEOU with hedonic motivations through the SOR model.

2.2. Theory of Reasoned Action

This study deploys the TAM1 framework to analyse the impact of usability together with system design and navigation ease on social network site adoption for shopping. Bagozzi's 2007 research highlights that TAM1's simplicity contrasts with UTAUT's complexity and therefore serves as the best framework for understanding online impulse buying. The Theory of Reasoned Action (TRA) extends TAM1 by illustrating how consumer attitudes along with social advertising and brand perceptions impact buying choices (Ajzen & Fishbein, 1980; Hussein, 2017). The research uses TRA to show how the credibility of SNS platforms and influencer recommendations impact consumer trust and engagement levels (Familmaleki et al., 2015). The combination of TAM1 with TRA and the SOR model demonstrates that system usability and social marketing generate cognitive responses, including PU and PEOU, which result in purchase intentions (Lin & Yang, 2018). In India's fashion industry shoppers are primarily driven by price sensitivity according to Amin & Naqvi (2020) and influencer marketing strengthens customer trust and social connections as per Djafarova & Bowes (2020).

2.3. Perceived Risk

Perceived risk influences the purchasing decisions of online shoppers because they worry about

product authenticity and both payment security and personal data privacy. E-commerce systems depend on trust, yet perceived risk remains the dominant factor influencing purchase choices, particularly in developing countries like India, according to Dowling & Staelin (1994).Research indicates that perceived risk has multiple dimensions, such as financial risk, along with security risk and performance risk, together with social risk (Featherman & Pavlou, 2003). Platforms using secure payment gateways along with verified seller programs and lenient return policies reduce perceived risk which leads to higher consumer confidence (Garcia & Sokolova, 2020). Positive eWOM alongside influencer endorsements and peer recommendations builds trust that consequently reduces online purchase hesitation (Rehman et al., 2020). Current research shows a lack of cohesive analysis about how various demographic groups experience risk differently within social commerce environments. Future studies need to explore how AI-based fraud detection systems combined with blockchain technology can reduce perceived risks and boost trust among consumers.

Hypothesis 1: Perceived risk negatively influences purchase intention by increasing uncertainty and hesitation in online shopping.

2.4. Perceived Enjoyment

The level of entertainment consumers find in SNS-based shopping determines their degree of engagement because users tend to prefer shopping experiences which are both visually immersive and interactive. Perceived enjoyment represents the natural satisfaction users obtain from online activities which establishes a strong connection to impulse buying patterns and user interaction according to Davis et al. (1992). Platforms that combine gamification features with live shopping events and AR try-ons increase user enjoyment, which drives longer engagement durations and boosts purchase figures according to research by Jin & Ryu (2020). The social features of SNSs such as likes, shares, and comments create an enjoyable shopping experience while providing social benefits (Kim et al., 2019). Research shows AI personalisation improves shopping enjoyment through feeds that match consumer preferences which boosts browsing satisfaction (Park & Kim, 2020). The current literature fails to provide information about the relationship between consumer enjoyment perception and cultural shopping behaviors across various social network platforms. Research needs to investigate how short videos together with influencer marketing affect consumer enjoyment in purchase decisions.

Hypothesis 2: Perceived enjoyment positively influences purchase intention by increasing engagement and shopping satisfaction.

2.5. Perceived eWOM (Electronic Word of Mouth)

The consumer trust and purchase decisions depend on eWOM since online shoppers turn to peer opinions before buying. Online posted consumer evaluations of products and services known as eWOM serve as a social proof mechanism which reduces uncertainty while building brand trust, according to Hennig-Thurau et al. (2004). Research by Garcia & Sokolova (2020) shows verified reviews and influencer recommendations serve as major factors in consumer decision-making while the amount and quality of eWOM combined with credibility influences customer purchase intentions. Video testimonials, along with interactive Q&A sessions, hold more authenticity and influence for users compared to text-based reviews (Leong et al., 2018). Studies demonstrate the substantial impact of eWOM but there is insufficient research into how short video social media content from platforms such as Instagram Reels and TikTok shapes consumer trust evaluations. AI recommendation systems structure eWOM content but researchers lack comprehensive knowledge on their impact on consumer decision-making. The research community needs to explore how automated review curation together with influencer authenticity affects purchase decisions driven by electronic-word-of-mouth.

Hypothesis 3: Perceived eWOM positively influences purchase intention by enhancing trust and reducing purchase uncertainty.

2.6. Perceived Emotional Value

The psychological attachment consumers develop toward a product or brand indicates perceived

emotional value, which affects their purchasing decisions. Brand storytelling along with influencer marketing and relatable advertising create emotional connections that strongly affect customer loyalty and engagement as shown by Djafarova & Bowes (2020). Research shows individuals who establish emotional connections with brands tend to buy more frequently and promote the brand through digital channels (Kaplan & Haenlein, 2019). Indian buyers who let emotions drive their purchasing decisions show preference toward brands which match their personal values and represent their cultural identities as well as their aspirational lifestyles according to Garland & Reed (2018). SNS platforms build communities which create strong emotional connections to enhance personal and interactive brand relationships. Research on brand loyalty and emotional value exists in abundance but remains scarce in the area of emotional engagement on SNS shopping and its effects on consumer behavior over time. Upcoming research needs to evaluate how emotional advertising and interactive brand stories with influencer partnerships create impulse buying behavior on social networking sites.

Hypothesis 4: Perceived emotional value positively influences purchase intention by fostering brand attachment and trust.

2.7. Perceived Usefulness

The Technology Acceptance Model (TAM) defines perceived usefulness as the ability of social network shopping platforms to improve convenience and operational efficiency including effectiveness according to Shin & Jeong (2020). The combination of AI personalization features with seamless site navigation and chatbot-aided customer service increases customers' satisfaction levels and their intention to make a purchase (Park & Kim, 2020). SNS shopping attracts more customers because voice commerce together with AR shopping experiences and automated checkout systems improve perceived usefulness according to Hsu et al. (2013). Researchers keep advancing their studies on how AI predictive analytics affects people's perceptions of shopping efficiency on SNS platforms. Future research should evaluate how digital automation combined with AI virtual assistants influences consumer behaviour in SNS commercial activities.

Hypothesis 5: Perceived usefulness positively influences purchase intention by improving shopping efficiency and reducing friction.

2.8. Perceived Quality

Online shopping depends heavily on perceived quality since consumers use visual and textual indicators to evaluate the credibility of products. The purchase decisions of consumers are greatly affected by trust signals such as high-quality product images alongside influencer reviews and user-generated content according to Bilro et al, 2018. According to Koo & Lee (2019) research indicates that brand credibility along with third-party authentication and AI-driven fraud detection mechanisms enhance perceived quality which reduces customer worries about counterfeit products. Consumer trust improves through augmented reality (AR) and 3D product visualisation which delivers an enriched shopping experience. There are insufficient insights about the influence of real-time product demonstrations and interactive product reviews on perceived quality. Subsequent studies need to explore the effects of AI-driven product verification systems together with interactive social network shopping functions on consumers' quality assessments.

Hypothesis 6: Perceived quality positively influences purchase intention by reinforcing trust in product authenticity.

2.9. Perceived Price

Consumers in price-sensitive markets such as India make purchase decisions based on perceived price because they look for value-for-money deals. Consumer perceptions are shaped by competitive pricing methods along with flash sales and influencer-exclusive discounts, which work together with dynamic pricing strategies to target buyers (Amin & Naqvi, 2020). Studies show transparent pricing approaches combined with AI-based personalized discounts build consumer trust which makes shopping on Social Networking Sites more attractive (Rehman & Al-Ghazali, 2022). Research remains

scarce on how social commerce platforms develop pricing strategies to target various consumer groups. Upcoming studies should examine how AI price matching combined with gamified discount systems affects purchase intention.

Hypothesis 7: Perceived price positively influences purchase intention by increasing affordability and perceived value.

2.10. Attitude Toward SNSs (Mediator)

The way users perceive SNSs mediates their purchase intentions through their engagement with social commerce platforms. When users trust SNSs and find them convenient and enjoyable to use, they engage more and show increased buying behaviour (Perez & Gutierrez, 2020). People who feel positive about SNS shopping engage with brands and share their evaluations which increases their intention to purchase according to Kim et al. (2019). Social network commerce becomes more attractive and personalised through influencer campaigns and real-time shopping features alongside AI-driven personalization (Park & Kim, 2020). The scientific exploration into how different generations and cultures develop their attitudes towards shopping on social networking sites has not been extensively conducted. Younger users view SNS shopping positively while older users express skepticism driven by security and privacy concerns according to Rehman & Al-Ghazali (2022). The next research should examine how AI-assisted engagement methods combined with personalized recommendation engines and social game features affect different demographic groups' views on SNS shopping.

Hypothesis 8: Attitude toward SNSs mediates the relationship between perceived constructs and purchase intention.

2.11. Purchase Intention (Dependent Construct)

Purchase intention on SNS platforms depends on psychological and social factors as well as technological aspects according to Ajzen (1991). Multiple factors including trust and credibility combined with perceived risk and enjoyment lead to purchase intention as eWOM and emotional value join usefulness quality and price to create a strong influence (Chen & Zhang, 2021). The interactive shopping sections of SNS sites where users engage with influencers and peer feedback create stronger purchase intentions (Djafarova & Bowes, 2020). Personalized urgency generated from the combination of AI product recommendations with impulse purchases and time-limited offers heightens SNS shopping activity as demonstrated by Garcia & Sokolova (2020). It remains unclear how modern technologies such as augmented reality shopping experiences along with AI chatbots and voice commerce influence purchase intentions on social networking services. The effects of predictive analytics together with immersive social shopping features plus cross-platform brand integrations on consumer purchasing choices in SNS commerce demand investigation by researchers.

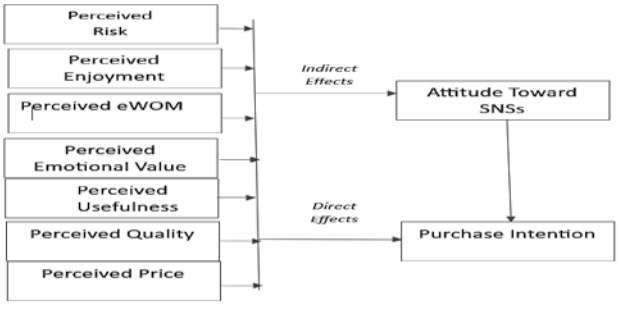

Figure 1.

Conceptual framework developed by the Authors.

3. Research methods

3.1. Study Setting, Population, and Sampling

The study explores the purchasing habits of Indian fashion consumers who utilise social media platforms such as Facebook, Instagram and WhatsApp to make their purchases. The study examines online shopping behaviour. To address internet access disparities between urban, semi-urban and rural areas the research team used stratified random sampling based on age group, gender category, geographic location and educational background which ensured balanced representation as explained by Lohr in 2010. The research method increased sampling accuracy while reducing selection bias and enhanced external validity. The sample size of 441 resulted from applying Taro Yamane's formula in 1967 for a 95% confidence level with a 5% margin of error.

The online survey that reached tech-savvy digital consumers achieved a response rate of 95.9% from which 423 valid responses were collected. Diverse SNS fashion shoppers throughout India could relate to these findings due to the use of a robust sampling technique (Hair et al., 2014)..

3.2. Measurement Tools

The questionnaire utilized dependable scales confirmed through social commerce and fashion consumer behavior studies (Hajli, 2015; Kim & Park, 2020; Djafarova & Bowes, 2020) to evaluate constructs. The study measured perceived risk, enjoyment, electronic word-of-mouth (eWOM), emotional value, usefulness, quality and price, while social network site (SNS) attitudes served as mediators of purchase intention. The questionnaire used a 5-point Likert scale which ranged from 1 meaning strongly disagree to 5 meaning strongly agree as described by Sokolova & Kefi (2020). The study's scales evaluated product authenticity and privacy risks (Featherman & Pavlou, 2003) while assessing interactive shopping satisfaction (Park & Kim, 2020) together with eWOM effects (Garcia & Sokolova, 2020). Perceived emotional value was assessed by Kaplan & Haenlein (2019) while usefulness was evaluated by Shin & Jeong (2020) and quality was measured by Lin & Yang (2018) and price sensitivity was examined by Amin & Naqvi (2020). Trust and satisfaction regarding SNS attitudes were evaluated based on Perez & Gutierrez (2020), while purchase intention analysis was conducted according to Chen & Zhang (2021). The instrument underwent validation and testing.

3.3. Data Collection and Analysis

The research team sent out surveys through Instagram and Facebook to collect data from people who buy fashion items on social media (Hajli 2015; Kim & Park 2020). The survey functioned for three months across India targeting people who regularly interacted with fashion brands and influencers together with online shopping advertisements on SNS platforms (Sokolova & Kefi, 2020). To attract a heterogeneous respondent pool with varying demographics and shopping preferences and digital skills we applied both natural reach and targeted advertising strategies based on Kaplan & Haenlein (2019). The research team examined construct-to-construct relationships and mediation effects plus latent variable interactions through Structural Equation Modeling (SEM) using SPSS and AMOS 26. Structural Equation Modeling (SEM) became the preferred method because it allows simultaneous hypothesis testing and measurement error correction which leads to comprehensive and reproducible results according to Chin (1998) and Gefen et al. (2000). The study first validated the measurement model's reliability and validity using confirmatory factor analysis (CFA) as per Fornell & Larcker (1981) before path analysis explored direct and indirect effects along with mediating impacts based on Baron & Kenny (1986). Through SEM techniques and model fit indices and factor loadings, the research demonstrated statistical strength in hypothesis verification while explaining how perceived constructs influence consumer attitudes and purchase intentions for SNS-based fashion shopping (Shin & Jeong, 2020; Djafarova & Bowes, 2020).

4. Data analysis

The researchers started their data analysis process by conducting an exhaustive demographic analysis of the participants to establish their sample profile. The study incorporated demographic information including gender, age group, educational background, geographical areas and social media usage. By analysing multiple demographic factors the research created a comprehensive profile of Indian social media users who buy products online. The research compared the relationships between independent variables and purchase intention across users of different social networking sites after finishing the demographic breakdown.

4.1. Demographic profile

The demographic data for the survey participants who use social networks to buy fashion items online can be found in table 1 below. The descriptive statistics which used frequency and percentage transformed the data set to display the range of the sample.

Table 1.

Demographic profile of the respondents

Variables	Category	Frequency	Percent
Gender	Male	61	18.2%
	Female	251	74.7%
	Prefer not to say	24	7.1%
	Total	336	100.0%
Age of the respondents	Below 18	40	11.9%
	18-27	227	67.6%
	28-40	48	14.3%
	Above 40	21	6.3%
	Total	336	100.0%
Educational level	High School or Less	11	3.3%
	Junior College	68	20.2%
	Undergraduate	175	52.1%
	Postgraduate	69	20.5%
	Doctorate/ Others	13	3.9%
	Total	336	100.0%
Currently Reside	Urban area	206	61.3%
	Suburban area	29	8.6%
	Rural area	101	30.1%
	Total	336	100.0%
Frequency	Daily	223	66.4%
	Many times, a week	31	9.2%
	Once a week	26	7.7%
	Many times, a month	12	3.6%
	Rarely	37	11.0%
	Never	7	2.1%
	Total	336	100.0%
social network platform is used frequently	Facebook	26	7.7%
	Instagram	221	65.8%
	Twitter	3	0.9%
	TikTok	0	0.0%
	LinkedIn	7	2.1%
	Snapchat	18	5.4%
	Other	61	18.2%
	Total	336	100.0%
purchase products through social networks	Daily	51	15.2%
	Weekly	19	5.7%
	Monthly	76	22.6%
	Few times a year	105	31.3%
	Rarely/Never	85	25.3%
	Total	336	100.0%
device do you primarily use	Smartphone	289	86.0%
	Tablet	6	1.8%
	Laptop	17	5.1%
	Desktop computer	3	0.9%
	Others	21	6.3%
	Total	336	100.0%
Time Spent Daily	Less than 30 minutes	61	18.2%
	30 mins to 1 hour	108	32.1%
	1 to 2 hours	83	24.7%
	2 to 3 hours	40	11.9%
	More than 3 hours	44	13.1%
	Total	336	100.0%

The survey sample consisted of 85% women and many respondents were aged between 18 and 27 when young people typically buy things online using SNSs. The educational level of participants varied starting at high-school graduation and went up to college graduation but most participants were undergraduates. The survey results showed geo-diversity because participants came from both metropolitan areas and from suburban and rural regions. Accessing SNSs through social media platforms and devices reveals further details about this consumer group. Understanding the demographic details of the respondents requires

4.2. Exploratory factor loadings – Quality criteria

Through EFA the researcher identified underlying factors and verified discriminant validity using cross-loading assessments (Hair et al., 2010; Henseler et al., 2015). The calculated composite reliability exceeded 0.70 and AVE surpassed 0.50 which confirmed the model's validity and reliability as a preparation for SEM analysis (Nunnally & Bernstein, 1994; Fornell & Larcker, 1981).

Table 2.

Exploratory factor loadings and Quality criteria of Constructs

Construct	Items	Factor Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Perceived Risk	PRI1	0.853	0.88	0.884	0.737
	PRI2	0.879			
	PRI3	0.832			
Perceived Enjoyment	PRE1	0.757	0.73	0.793	0.575
	PRE2	0.783			
	PRE3	0.666			
Perceived eWOM	PWM1	0.761	0.83	0.841	0.621
	PWM2	0.817			
	PWM3	0.741			
Perceived Emotional Value	PEV1	0.704	0.77	0.798	0.575
	PEV2	0.804			
	PEV3	0.747			
Perceived Usefulness	PUS3	0.740	0.80	0.835	0.616
	PUS4	0.818			
	PUS5	0.749			
Perceived Quality	PQU1	0.653	0.71	0.725	0.488
	PQU2	0.755			
	PQU3	0.677			
Perceived Price	PPR2	0.715	0.80	0.815	0.621
	PPR3	0.801			
	PPR4	0.804			
Attitude Towards SNS	ATT1	0.781	0.78	0.805	0.561
	ATT2	0.807			
	ATT3	0.672			
Purchase Intention	PUI2	0.652	0.67	0.688	0.474
	PUI3	0.769			
	PUI4	0.616			

Table 2 presents the reliability assessments and convergent validity measurements for various constructs. The Perceived Risk construct meets most convergent validity standards according to Fornell & Larcker (1981) with high internal consistency (α = 0.88, CR = 0.884, AVE = 0.737). The Perceived Enjoyment construct shows moderate reliability based on alpha = 0.73, composite reliability = 0.793, and average variance extracted = 0.575. The perceived electronic word of mouth demonstrates strong convergent validity as shown by its metrics (α = 0.83, CR = 0.841, AVE = 0.621). The constructs Perceived Emotional Value and Usefulness demonstrate strong reliability coefficients of 0.87 and 0.80 respectively while maintaining AVE values exceeding 0.50. The Perceived Quality metric maintains acceptable standards with α = 0.71 and AVE of 0.488. Overall, the measurement model is robust.

5.3. Validity Assessment Table (HTMT and Fornell-Larcker Criterion)

The measurement model demonstrated reliability and validity after factor and cross-loading analysis through convergent (CR > 0.70; AVE > 0.50) and discriminant validity tests employing MSV and MaxR(H) (Fornell & Larcker, 1981; Hair et al., 2010; Henseler et al., 2015). These tests validate accurate, reliable variable relationships.

Table 3.

Convergent and Discriminant validity

Con	CR	AVE	MSV	MaxR(H)	PRI	PRE	PWM	PEV	PUS	PQU	PPR	ATT	PUI
PRI	0.884	0.737	0.485	0.884	1.000								
PRE	0.793	0.575	0.479	0.793	0.784	1.000							
PWM	0.841	0.621	0.393	0.841	0.653	0.727	1.000						
PEV	0.798	0.575	0.410	0.798	0.667	0.698	0.755	1.000					
PUS	0.835	0.616	0.441	0.835	0.670	0.689	0.744	0.754	1.000				
PQU	0.725	0.488	0.441	0.725	0.654	0.643	0.681	0.673	0.662	1.000			
PPR	0.815	0.621	0.479	0.815	0.701	0.710	0.702	0.702	0.692	0.701	1.000		
ATT	0.805	0.561	0.499	0.805	0.689	0.695	0.694	0.695	0.694	0.689	0.702	1.000	
PUI	0.688	0.474	0.410	0.688	0.664	0.676	0.672	0.663	0.671	0.664	0.674	0.661	1.000

The research evaluates construct reliability and validity through the metrics of Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared Variance (MSV), and MaxR(H) as shown in Table 3. The study shows strong internal consistency for all constructs because their CR values surpass 0.70 according to Nunnally & Bernstein (1994). The construct PRI demonstrates strong reliability with a CR of 0.884 and AVE of 0.737 which means it accounts for more than 73% of the variance according to Fornell & Larcker (1981). Perceived Enjoyment (PRE) and Perceived eWOM (PWM) both show construct reliability coefficients of 0.793 and 0.841 respectively and average variance extracted values of 0.575 and 0.621. The validation of discriminant validity occurs when all constructs show AVE values exceeding their MSV according to Hair et al. (2010) criteria, and MaxR(H) measures correlate with CR thereby reinforcing reliability. The measurement model displays strong reliability and valid performance.

5.4. Model fit indices

The research team evaluated SEM model fit indices to determine how well the model matched the observed data and variable relationships (Byrne, 2016). The essential fit indicators for the SEM analysis were CMIN/DF together with CFI, TLI, SRMR and RMSEA according to Kline (2015) and Hu & Bentler (1999). The model demonstrates acceptable fit with CMIN/DF values between 1 and 3 alongside CFI/TLI greater than 0.90 while SRMR remains under 0.08 and RMSEA stays below 0.06. These indices boost robustness and credibility.

Table 4.

Model Fit Measures

Measure	Estimate	Threshold	Citation
CMIN	728.746	--	(Byrne, 2010)
DF	288	--	(Kline, 2015)
CMIN/DF	2.530	Between 1 and 3	(Marsh & Hocevar, 1985)
CFI	0.922	> 0.95	(Hu & Bentler, 1999)
NFI	0.960	> 0.95	(Bentler & Bonett, 1980)
TLI	0.955	> 0.95	(Tucker & Lewis, 1973)

GFI	0.920	> 0.90	(Jöreskog & Sörbom, 1984)
SRMR	0.045	< 0.08	(Hu & Bentler, 1999)
RMSEA	0.068	< 0.06	(Steiger, 1990)
PClose	0.000	> 0.05	(Jöreskog & Sörbom, 1993)

The research team used model fit indices from Table 5 to determine how well the SEM model performed. The CMIN/DF value of 2.530 demonstrates good model fit according to Marsh & Hocevar (1985). The CFI value stands at 0.922 while both NFI and TLI show satisfactory fit levels at 0.960 and 0.955 respectively as per Bentler & Bonett (1980) and Tucker & Lewis (1973). The SRMR value of 0.045 and the RMSEA score of 0.058 fulfil the standards established by Hu & Bentler (1999).

4.5. Hypothesis testing

Model fit evaluation works together with direct effects hypothesis testing to reveal the impact of independent variables on dependent variables through correlation analysis. Standardized regression coefficients demonstrate both the strength and directionality of relationships (Kline, 2015) while statistically significant results require a critical ratio exceeding 1.96 and a p-value less than 0.05 (Schumacker & Lomax, 2010). Direct effects testing explores how risk perceptions, along with usefulness and emotional value, affect consumer purchasing behaviour in social fashion commerce, which supports digital marketing strategies and system development through empirical evidence (Hair et al., 2010).

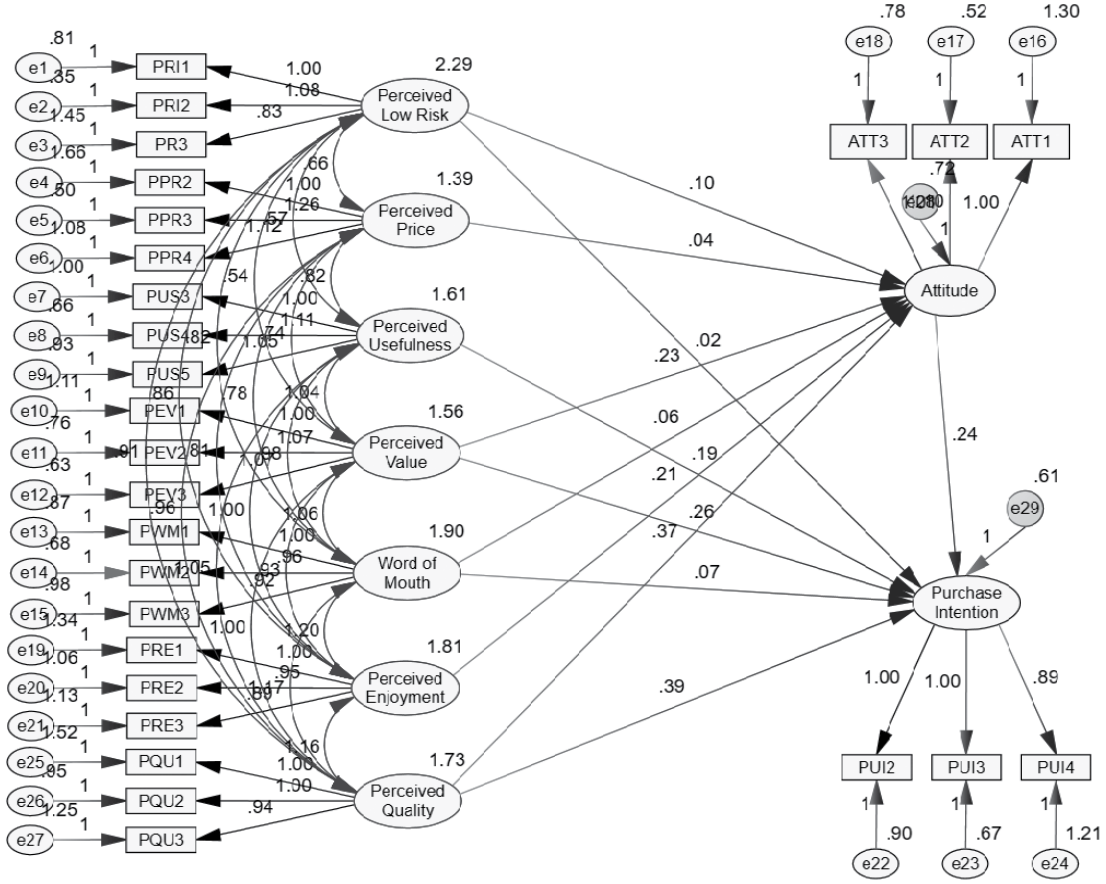

Figure 2

Path analysis

Table. 5:

Hypothesis Testing

Hypothesis	Estimate	S.E.	C.R.	P	Decision
Purchase Intention <--- Perceived Risk (PRI)	0.005	0.046	0.099	0.921	Rejected
Purchase Intention <--- Perceived Usefulness (PUS)	0.154	0.078	1.973	0.049	Accepted
Purchase Intention <--- Perceived Emotional Value (PEV)	0.274	0.083	3.323	0.003	Accepted
Purchase Intention <--- Perceived eWOM (PWM)	-0.138	0.075	-1.832	0.167	Rejected
Purchase Intention <--- Perceived Quality (PQU)	0.355	0.101	3.509	0.001	Accepted
Purchase Intention <--- Attitude Towards SNS (ATT)	0.200	0.080	2.491	0.013	Accepted
Purchase Intention <--- Perceived Enjoyment (PRE)	0.194	0.085	2.278	0.023	Accepted

The results of hypothesis testing on direct effects impacting Purchase Intention in social commerce are shown in Table 5. The analysis demonstrates that perceived risk fails to affect purchasing decisions which suggests that product quality and privacy concerns hold minimal sway. Purchase intent rises significantly when consumers find products useful and shopping enjoyment enhances decision-making through positive emotional value. The research reveals that perceived eWOM exerts no meaningful impact on purchase intention which suggests online reviews fail to influence purchasing choices here. Purchase likelihood heightens when consumers display positive SNS attitudes together with strong perceived enjoyment. Consumer purchases are driven by usefulness along with emotional value and quality and also SNS attitude plus enjoyment while perceived risk and eWOM show no significant effect (Figure 3).

4.6. Mediation ana lysis

Researchers conducted mediation analysis to examine if a mediator explains the link between independent and dependent variables. For example, perceived usefulness impacts purchase intention via SNS attitude. Bootstrapping with 5000 resamples avoids normality assumptions; a 95% CI excluding zero and $p < 0.05$ confirms significance. Partial and full mediation emerged.

Table 6:

Mediation Table

Hyp	Path	Total Effect (β)	Sig.	Indirect Effect (β)	Sig.	Direct Effect (β)	Sig.	Type
H8a	Perceived Quality (PQU) -> Purchase Intention (PUI)	0.431	0.007	0.076	0.066	0.355	0.034	Partial
H8b	Perceived Enjoyment (PRE) -> Purchase Intention (PUI)	0.237	0.070	0.043	0.084	0.194	0.118	Partial
H8c	Perceived eWOM (PWM) -> Purchase Intention (PUI)	-0.152	0.151	-0.014	0.327	-0.138	0.178	No
H8d	Perceived Emotional Value (PEV) -> Purchase Intention (PUI)	0.320	0.008	0.046	0.076	0.274	0.016	Partial
H8e	Perceived Usefulness (PUS) -> Purchase Intention (PUI)	0.154	0.169	0.000	--	0.154	0.169	Direct Only

H8f	Perceived Price (PPR) -> Purchase Intention (PUI)	0.005	0.744	0.005	0.744	0.000	--	No
H8g	Perceived Risk (PRI) -> Purchase Intention (PUI)	0.025	0.663	0.021	0.120	0.005	0.879	No
H8h	Attitude Towards SNS (ATT) -> Purchase Intention (PUI)	0.200	0.141	0.000	--	0.200	0.141	Direct Only

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5. Discussions

Mediation analysis combined with hypothesis testing reveals key factors driving purchase intentions in social network service fashion shopping while building on past academic research. The study demonstrates significant effects of perceived usefulness (β = 0.154, p = 0.049), perceived emotional value (β = 0.274, p = 0.003), perceived quality (β = 0.355, p = 0.001), attitude toward SNSs (β = 0.200, p = 0.013), and perceived enjoyment (β = 0.194, p = 0.023) on purchase intentions which align with prior research suggesting these elements are key drivers of social commerce activities (Shin & Jeong, 2020; Djafarova & Bowes, 2020). The research demonstrates that emotional attachment, along with brand credibility and user satisfaction, are vital elements for online fashion shopping (Kaplan & Haenlein, 2019). eWOM and perceived risk demonstrate no substantial effects (β = 0.005, p = 0.921; β = -0.138, p = 0.167), which reveals consumers place more emphasis on brand messaging and visual marketing strategies. The mediation analysis reveals that perceived quality, enjoyment, and emotional value partially mediate the relationship between SNS attitude and purchase intent demonstrating that SNS attitude affects purchase intent but not exclusively. The direct influence of perceived usefulness together with SNS attitude underscores how effective trust-based shopping interactions can be (Park & Kim, 2020). The marginal impact of perceived price (β = 0.005, p = 0.744) shows that convenience and emotional connection take precedence over cost which directs brands to focus on quality and engagement strategies.

6. Theoretical Implications and Managerial implications

6.1. Theoretical Implications

The research broadens existing frameworks of technology adoption models and theoretical understandings of online consumer behavior within the context of SNS fashion shopping. The research verified emotional value and enjoyment while examining social media attitudes through TAM and TPB as well as Social Exchange Theory (Shin & Jeong, 2020). According to research by Garcia and Sokolova (2020), consumer worries are lessened more effectively through influencer endorsements and community engagement than through standard security measures. The reduced influence of eWOM reveals a trend toward brand-centered experiences which opens new discussions about digital trust and impulse purchasing together with AI-driven personalization within social commerce (Sokolova & Kefi, 2020).

6.2. Practical Implications

These insights provide valuable tools for fashion brands to sharpen their strategies along with digital marketers and SNS developers who can also improve their approaches. Since perceived enjoyment along with emotional connections drive consumer interest, brands need to implement immersive storytelling techniques and interactive shopping experiences together with AI-based personalisation according to Park & Kim (2020). Influencer partnerships combined with AR trials and live commerce strengthen brand loyalty while increasing spontaneous purchases. Secure transactions combined with transparent communication establish trust in social networking services (Perez & Gutierrez, 2020). Due to Indian SNS consumers placing greater importance on brand experience and convenience than price and risk considerations companies need to adopt value-centered engagement strategies (Amin & Naqvi, 2020). The use of improved AI-driven

suggestions together with predictive analytics leads to better conversion rates.

7. Limitations and Scope for Further Research

While the research provides important findings about fashion shopping through SNS platforms it needs additional studies to overcome its current constraints. Analyzing only Indian consumers restricts the study's applicability to markets that have distinct cultural dynamics and various economic conditions and digital platform usage (Hajli, 2015). Subsequent studies ought to compare different cultural contexts to understand purchase motivations across multiple SNS platforms according to Shin & Jeong (2020). The use of self-reported data can create bias according to Podsakoff et al. (2003), but the integration of behavioral tracking techniques alongside experimental methods would produce more accurate results. Future research needs to explore moderating variables and critically evaluate the rise of AR technology, virtual influencers and AI chatbots (Djafarova & Bowes, 2020; Park & Kim, 2020).

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A Study on Factors Influencing Consumers' Decision to Purchase Two-Wheelers – A Bibliometric Analysis: 2011-2025

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Abstract:

The global two-wheeler market has witnessed a consistent trajectory of growth in terms of technological advancements and rising market penetration. Earlier, the industry was predominantly manufacturer-driven, where product offerings were largely based on internal capabilities aimed to satisfy customer expectations. Over time, a paradigm shift occurred where manufacturers increasingly aligned their product development strategies to the evolving customer needs. In recent years, however, these needs have become markedly dynamic, necessitating a deeper understanding of the factors influencing consumer purchasing decisions. This study endeavours to elucidate the determinants of two-wheeler purchase behaviour using bibliometric analysis. A total of 460 scholarly articles, published between 2011 and 2025, were retrieved from the Scopus database. Using guidelines of PRISMA, a systematic screening of 460 articles was done to select 44 relevant articles for analysis. The metadata for these articles was extracted in CSV format and subsequently analysed using the RStudio package. Results indicate that most of the research has been done during the years 2021, 2022, and 2024, as 55% (24 articles) of the publications are from this time. The analysis revealed that India and Indonesia are the most prolific contributors to the articles in this domain. Four major universities/institutions were notably affiliated with a substantial volume of publications, from 2021 to 2025. Emerging keywords such as "purchase intention," "electric motorcycle," "electric vehicle," and "technology adoption" have gained prominence over the past three years, signalling a shift in research focus. Thematic analysis further identified "purchase behaviour," "consumer attitude," and "product innovation" as evolving themes, suggesting rich avenues for future exploration. This bibliometric inquiry not only synthesises current scholarly discourse but also provides strategic guidance for future research by highlighting influential authors, pertinent sources, and potential institutional collaborators. This study uses articles from the Scopus database, Web of Science, ScienceDirect, and ABDC, to get a deeper insight. As China and Malaysia have a larger contribution to the growth of two-wheelers, including articles published from these two countries, can further enrich the quality of the analysis.

Key words: *Purchase intention of two-wheelers, purchase behaviour, customer attitude.*

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1. Introduction:

The adoption of two-wheeler transportation has witnessed a remarkable surge across India and several Asian nations over the past few decades. This upward trend is largely attributed to accelerating urbanisation as per Huu & Ngoc (2021) and intensifying traffic congestion. This has collectively reshaped consumer mobility patterns, nudging them toward more agile and efficient transport alternatives. In many rapidly developing urban centres particularly in India and other populous Asian countries the struggle to expand infrastructure in tandem with the exponential growth of vehicular populations has further underscored the practicality and utility of two-wheelers. As per study by Verma (2022) two wheeler industry has contributed as share of 80% of total market of vehicles in India. These vehicles offer a cost-effective, fuel-efficient, and manoeuvrable mode of transportation that is especially advantageous in densely populated and traffic-prone environments.

In terms of usage intensity, India parallels nations such as Vietnam, Indonesia, Thailand, and the Philippines. The widespread appeal of two-wheelers in these contexts stems not only from economic affordability, including lower vehicle costs, reduced fuel consumption, minimal parking fees, and low total cost of ownership, but also from their utility in time-constrained, congested urban settings. Furthermore, Indian consumers benefit from a broad spectrum of product offerings, ranging from budget-friendly commuter motorcycles to premium scooters and advanced electric or hybrid two-wheelers, thus expanding their motivation and capacity for ownership.

Given these dynamics, it is imperative that policymakers, urban planners, and industry stakeholders investigate the determinants that influence consumer preferences and ownership behaviour concerning two-wheelers. A nuanced understanding of usage patterns and buyer motivations is essential for devising urban mobility strategies that are both practical and sustainable. The decision to purchase a two-wheeler is shaped by a constellation of economic, functional, psychological, and socio-cultural factors as per Jayasingh et al. (2021). In India and comparable Asian markets, affordability remains a predominant determinant, especially among middle- and lower-income segments. The relatively low initial acquisition cost, coupled with accessible financing schemes, enhances the financial appeal of two-wheelers across a broad demographic spectrum.

Amid rising fuel prices and escalating commuting demands, as per study done by Kamala et al., (2024) and Chanda et al. (2019), fuel efficiency has emerged as a decisive purchase criterion. Functional aspects such as mileage, maintenance costs, engine capacity, and design features play a crucial role in shaping buyer preferences. The compact size and high manoeuvrability of two-wheelers enable efficient navigation through congested cityscapes and narrow urban bylanes. Brand credibility, after-sales service quality, resale value, and technological features such as smartphone integration and electric variants are increasingly being considered in consumer evaluations.

In addition to these pragmatic considerations, emotional and lifestyle factors have become influential in purchase decisions. For instance, younger consumers are often driven by brand image, aesthetics, and the experiential dimension of riding as per Bansal et al., (2021), while family-oriented buyers prioritise safety, comfort, and reliability. Over time, as per study of Kumar (2024), environmental consciousness is becoming an increasingly relevant factor, particularly with the advent and adoption of electric two-wheelers, reflecting growing societal concern for ecological sustainability.

In an effort to systematically identify and synthesise the variables that govern consumer purchase behaviour in the two-wheeler segment, this study undertakes a bibliometric review of extant literature. Scholarly documents indexed in the Scopus database were surveyed.

2. Literature Review

2.1. Bibliometric Analysis

Passas (2024) articulates the core methodological framework of bibliometric analysis, emphasising its applicability for comprehensive literature reviews involving large datasets. The author posits that this

approach is particularly effective for mapping scholarly fields, identifying seminal publications, influential authors, and leading journals that have shaped academic discourse, while also tracing the evolution of research themes over time. Similarly, Donthu et al. (2021) describe bibliometric analysis as a rigorous scientific methodology that serves both established scholars and emerging researchers by enabling a systematic retrospective examination across a broad spectrum of research domains in business studies.

In another pertinent study, Ahmi & Mohamad (2019) employed bibliometric techniques to analyse global scholarly output on web accessibility using data retrieved from the Scopus database. Their findings illustrate the efficacy of bibliometric analysis as a quantitative tool for tracking research proliferation, examining publication trends, assessing geographic and institutional contributions, and uncovering key research themes through citation and keyword network analyses. They further identified prominent journals and institutions contributing to the field, while also outlining promising avenues for future research.

In a related endeavour, Merigó & Yang (2017) conducted a bibliometric investigation of the "Operations Research and Management Science" discipline using data sourced from the Web of Science database. Their study provided insights into the most impactful journals, the productivity and influence of individual authors, and the intellectual structure of the field, thereby reinforcing the value of bibliometric methods for evaluating scholarly influence and thematic developments within a research area.

2.2. Factors Influencing Consumers' Buying Decisions

To understand the customer buying behaviour towards two-wheelers, some of the recent and relevant studies were reviewed. From this review, some of the influencing factors are discussed as below. Summary of findings by Researchers

Author	Objective of study	Methodology	Key Finding
Kamala et al., (2025)	To identify different factors that influence customer perception of motorcycles	Used questionnaires, Convenient sampling method	Mileage, Engine performance, brand value, price factor, Loan facility were positive perceptions for purchase decision.
Reganathan et al., (2016)	To find out the factors influencing the consumer behaviour of Honda two-wheelers	Used a questionnaire for data collection, and the SPSS package for data analysis.	Comfort, brand image, pick-up/ power, and television media were factors deciding the buying decision.
Pai et al., (2014)	To find factors that determine the adoption of the idle stop system in Taiwan	Survey questionnaire, mixed logit model	Fuel price, tax rebate incentive, and financial support are factors for adopting the idle start system.
Suharyanti et al., (2015)	To evaluate the role of the country of origin in the purchase decisions of consumers	Qualitative research method used with homogeneous sampling.	Quality of product & brand image are major stimuli, along with style, gentlemen's ride & elegance are major influencing factors.
Amsaveni et al. (2014)	To analyse the factors influencing women in the purchase of a two-wheeler	A descriptive study, survey questionnaire, and SPSS package will be used for data analysis.	Mileage, brake efficiency, and maintenance cost were major factors influencing women's purchase decisions.
Aprilianus et al. (2018)	To analyse the factors of choosing motorcycle in Puruk Cahu	Accidental sampling method, survey questionnaire.	Fuel consumption, easy maintenance, product price, and credit facility are factors considered for motorcycle purchase.

Waworuntu et al., (2023)	To study the impact of brand, promotion & innovation on consumer purchasing behaviour.	Accidental sampling method, survey questionnaire.	Riding experience, safety systems, attractive offers, intelligent gadgets, and distinctive design are major factors influencing purchasing behaviour
Pulungan et al., (2018)	To study the influence of innovation, attitude and advertisement attraction on the decision to buy a Yamaha motorcycle.	Quantitative research. A multiple linear regression analysis model was used.	Innovative features, brand trust, and effective advertisement have a significant effect on the purchase decision for Yamaha motorcycles.
Bansal et al., (2021)	To evaluate the preferences of Indian two-wheeler buyers	Quantitative study. Discrete choise model used for analysis	The top five parameters that influence customers to buy a two-wheeler are style, fuel economy, comfort, brand, and engine performance
Yuniaristanto, et al., (2022).	To investigate key factors influencing the purchase intention of electric motorcycles.	Qualitative study, Partial least squares – structural equation model used for analysis.	Macro level factors like charging infrastructure & incentive policy, cost factor, technology are most influencing factor for purchasing of electric motorcycle.
Patil et al., (2024)	To analyse different factors influencing the purchase of electric vehicles, along with demographic parameters in India.	Quantitative study with survey questionnaires. ANOVA is a statistical model.	Initial buying cost, charging infrastructure & purchase incentive are top three factors for Indian buyers for purchasing electric vehicle Gender type has no influence on the result.
Chanda et al. (2019)	To explore Indian consumer's attitude towards sustainability & its effect on their decision-making while buying a two-wheeler	Quantitative study with survey questionnaires.	Fuel economy(FC) is the influencing factor. A study shows that two segments of customers are Active and sustainable, where FC is a must, while Wannabe sustainable do not consider FC as a factor.
Jayasingh et al., (2021)	To study factors that influence the adoption of electric two-wheelers based on consumers' intention.	Online survey questionnaire. Purposive sample technique used. Partial least squares structural equation modelling using R software for analysis	Reduced fuel cost and maintenance cost, charging infrastructure are influencing factors. Based on gender study male has more influence than female.

3. Methodology

3.1. Data Source

A comprehensive review of bibliographic literature was undertaken utilising the primary corpus of the Scopus database to examine prevailing trends, impacts, and thematic developments concerning consumer intentions toward the purchase of two-wheeler vehicles. Scopus was selected due to its extensive coverage, encompassing the highest volume of peer-reviewed journals across a wide array of disciplines, including science, engineering, medicine, social sciences, management, and the humanities. The database maintains rigorous inclusion criteria, ensuring that indexed journals meet high standards of academic quality and reliability.

Given that the intended methodological framework involves bibliometric analysis using RStudio, Scopus was further preferred for its seamless integration with this analytical environment. Moreover, Scopus is widely recognised and adopted by leading academic institutions and research organisations globally. Consequently, Scopus was deemed the most appropriate and credible source for sourcing literature pertinent to the selected research theme.

3.2. Data Collection

To effectively extract relevant literature from the Scopus database, the researcher has clearly defined three fundamental components:

1. **Research Topic**: The focal point of the investigation must be clearly articulated. In this case, the study centres on identifying the *factors influencing consumers' decisions to purchase two-wheelers*.
2. **Keyword Strategy**: Carefully selected keywords form the basis for database querying. For the present study, keywords such as *"two-wheeler"*, *"motorcycle"*, *"scooter"*, *"bike"*, *"purchase"*, *"buying"*, and *"owning"* were employed to ensure comprehensive coverage of the thematic scope.
3. **Screening Parameters**: Criteria for filtering relevant documents must be established to refine the dataset for bibliometric analysis. For this study, records were limited to the publication period from *2011 to 2025*, with the following additional constraints: *document type = article*, *language = English*, and *source type = journals*.

To ensure methodological rigour and replicability, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was utilised to guide the process of identification, screening, and selection of articles. An initial query was executed in Scopus using the search expression: TITLE-ABS-KEY ("two wheeler" OR "two-wheeler") AND ("purchase" OR "buying" OR "owning"), Which yielded *460* records.

- **First-level screening** involved applying the pre-established filters—publication year, document type, language, and source type—resulting in the exclusion of *178* articles.
- **Second-level screening** entailed a review of the titles of the remaining records, which led to the elimination of *208* articles deemed irrelevant.

  Third-level screening involved a detailed review of abstracts for the remaining *77* records, from which *33* were excluded based on thematic misalignment.

Ultimately, *44* scholarly articles aligned with the research theme—*factors influencing consumer decisions to purchase two-wheelers*—were finalised for bibliometric analysis. Figure 1 provides a visual representation of the PRISMA-based screening and selection process.

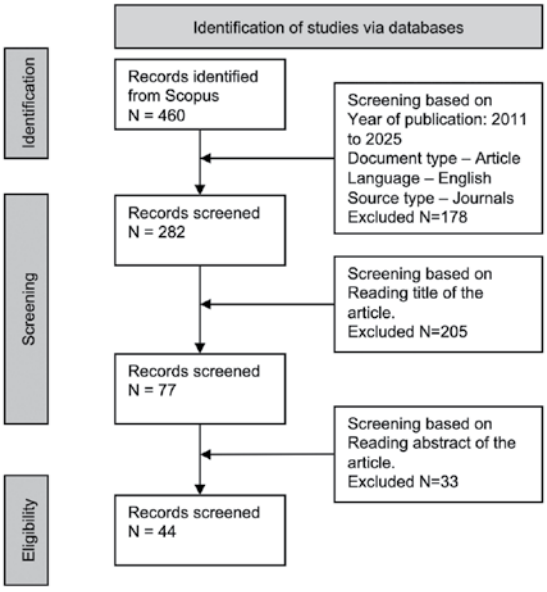

Figure 1

PRISMA flow diagram of the literature review process for studying the factors Influencing consumers decision for buying two wheeler.

3.3. Data Analysis

The finalised set of 44 articles was subjected to bibliometric analysis using the RStudio environment. RStudio is a software tool that uses the R programming language. It helps users analyse data, create visualisations, and build statistical models easily. Researchers and data analysts use RStudio for tasks like data cleaning, plotting graphs, and

running complex analyses. This analytical process was undertaken to assess the scholarly quality and intellectual structure of the selected literature, with particular emphasis on identifying prolific authors, thereby offering potential avenues for academic collaboration. Furthermore, the analysis facilitated the identification of core publication sources, enabling researchers to strategically target relevant journals for literature exploration. It also highlighted key institutional affiliations—such as universities and research centres—that serve as influential contributors within the field, thus offering guidance for prospective academic engagement.

In addition, the bibliometric approach enabled the temporal mapping of research themes, offering insights into the evolution and emerging trajectories of scholarly discourse over time. The analysis was operationalised through RStudio by importing bibliographic data exported in CSV format from the Scopus database, ensuring methodological rigour and reproducibility.

4. Results and Discussion

4.1. Analysis of Documents Occurrence (by year, country, area of topic)

Following the article screening process, a total of 44 publications were selected for bibliometric analysis using the RStudio platform. These articles specifically address research pertaining to the factors influencing consumer decisions in the purchase of two-wheelers. Figure 2 illustrates the longitudinal trend in scholarly output within this domain, while Table 1 presents the annual distribution of publications. A notable increase in publication activity is observed during the period from 2021 to 2025, indicating a heightened academic interest in consumer behaviour related to two-wheeler acquisition. Specifically, the years 2022 and 2024 account for 18% and 23% of total publications, respectively, underscoring a substantial surge in scholarly engagement with this theme.

The upward trend in publication volume during this timeframe appears to be correlated with the market emergence and growing adoption of electric two-wheelers. This technological shift likely spurred increased inquiry into how such innovations are reshaping consumer decision-making processes.

Figure 3, represented as a three-field plot (Article–Author–Country), provides a visual representation of the geographic and scholarly distribution of the analysed article. The dataset encompasses contributions from nine countries, with a notable predominance of Asian nations, followed by select European countries. Figure-4 further highlights the most frequently cited countries within the dataset.

Figure-5 identifies the most influential journals and publication sources referenced within the dataset. *Sustainability* emerges as the leading source with four articles, followed by *Case Studies on Transport Policy* and the *Journal of Cleaner Production*, each contributing three articles. An additional four sources contributed two articles each, while three sources were represented by a single publication. This distribution reflects authorial preferences in selecting publication outlets and may serve as an indicator of perceived credibility and relevance within the scholarly community.

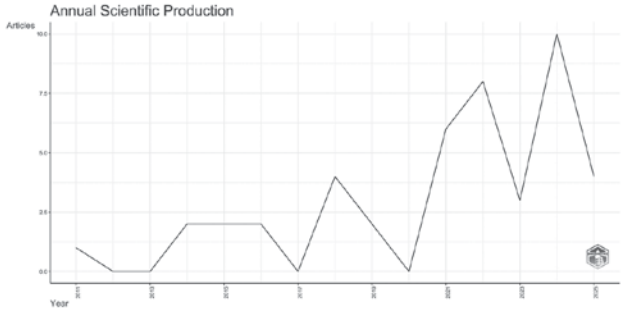

Figure-2:

Annual Scientific Production (Source: Scopus)

Year	No. of publication	%
2011	1	2%
2014	2	5%
2015	2	5%
2016	2	5%
2018	4	9%
2019	2	5%
2021	6	14%
2022	8	18%
2023	3	7%
2024	10	23%
2025	4	9%

Table-1:

Publication on factors influencing intention to purchase a wheeler

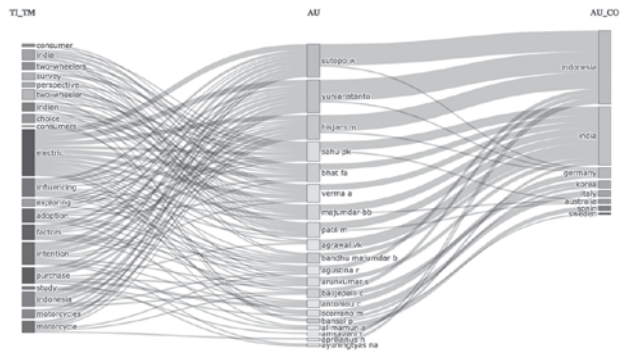

Figure-3:

Three field plot Article-author-country

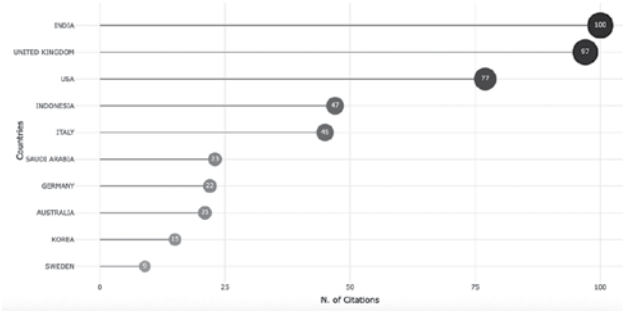

Figure-4:

Most global cited documents (Source: Scopus)

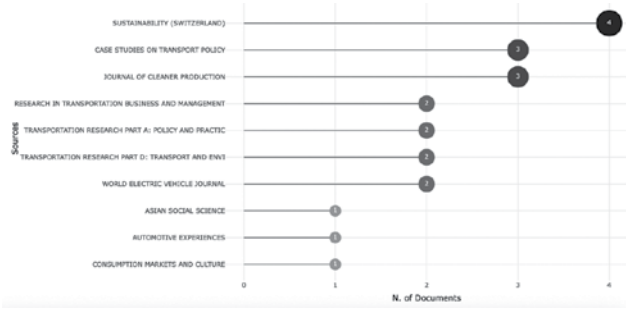

Figure-5:

Most relevant sources (Source: Scopus)

4.2. Analysis of Keyword

The bibliometric analysis conducted on the final set of articles concerning the identification of factors influencing consumer purchase decisions for two-wheelers has facilitated an in-depth examination of keyword usage patterns. Specifically, the analysis explored keyword frequency, the emergence of new terms, and the co-occurrence of keywords among various authors. A total of 52 distinct keywords were identified as frequently used across the reviewed literature.

Figure-6 presents a word cloud that visualizes the distribution and frequency of these keywords. Prominent among them are *"electric motorcycle"*, *"technology adoption"*, *"purchase intention"*, and *"electric vehicle"*, indicating their dominance and emerging significance in recent scholarly discourse. To further illustrate this distribution, the keywords were organized into a tree map (Figure-8), revealing that *"electric vehicle"*, *"purchase intention"*, *"electric vehicles"*, and *"electric motorcycle"* are the most recurrent terms utilized by authors to investigate consumer behavioural influences.

Figure-7, which represents a three-field plot mapping *keywords–authors–countries*, demonstrates that many of the most frequently used keywords appear consistently across diverse author profiles and national contexts. This suggests a high degree of thematic alignment and potential cross-border collaboration in this area of research.

Moreover, temporal analysis indicates that terms such as *"purchase intention"*, *"electric motorcycle"*, *"electric vehicle"*, and *"technology adoption"* have emerged prominently over the past three years. This trend is complemented by earlier recurring keywords like *"electric vehicles"*, *"electric scooter"*, and *"perception"*, which were commonly featured in publications prior to 2022, as illustrated in Figure-9.

Figure-6:

Word cloud of keywords. (Source: Scopus)

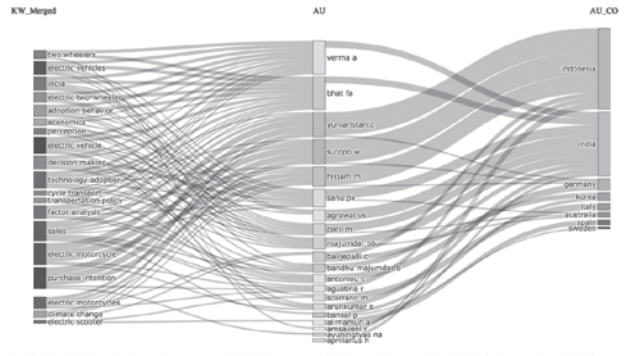

Figure-7:

Three field plot: keyword-author-country. (Source: Scopus)

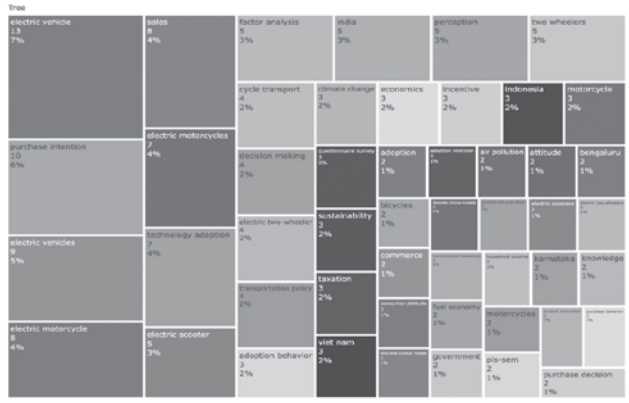

Figure-8:

Tree-map of keywords. (Source: Scopus)

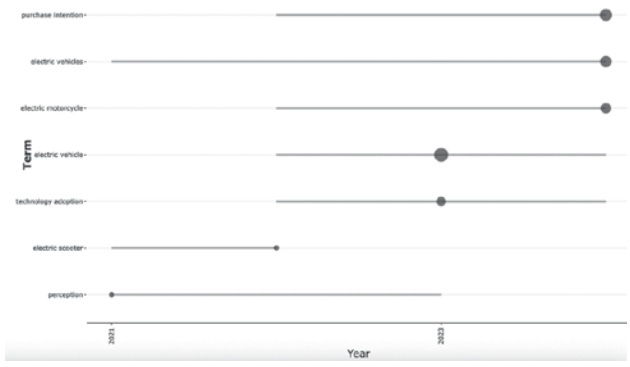

Figure-9:

Trend of keywords (Source: Scopus)

4.3. Analysis of Authors

Figure-10 illustrates the most prominent authors contributing to the scholarly discourse on factors influencing consumer decision-making in the context of two-wheeler purchases. Among these, *Sutopo W.* and *Yuniaristanto*, both affiliated with institutions in Indonesia, emerge as the leading contributors, each with four publications. *Hisjam M.*, based in India, follows with three publications. Additionally, six other authors have each published two articles, while *Agrawal V.K.* is noted for a single contribution. This visualization underscores the relative dominance and scholarly engagement of specific authors in advancing research on consumer behavior in the two-wheeler market.

To further evaluate authorial influence and research productivity, bibliometric analysis employs the H-index a metric that reflects both the volume and citation impact of an author's publications within a defined domain. As shown in Figure-11, authors *Hisjam M.*, *Sutopo W.*, and *Yuniaristanto* each possess an H-index of 3, indicating a notable impact within the field. The majority of remaining contributors exhibit an H-index of 2, signifying consistent scholarly output and recognition. These findings suggest that the aforementioned authors are among the key influencers shaping research in this domain.

The Author Collaboration Network, presented in Figure-12, visually represents patterns of co-authorship within the analysed literature. In this network, nodes denote individual authors, connecting lines (edges) represent collaborative relationships, and clusters signify cohesive groups of researchers engaged in joint publication efforts. The analysis reveals 13 distinct collaborative clusters. One particularly prominent cluster, characterized by larger node sizes, indicates a well-established and highly productive research group. However, the absence of inter-cluster linkages suggests a lack of cross-collaborative engagement between different author groups, pointing to opportunities for broader interdisciplinary and international collaboration in future research efforts.

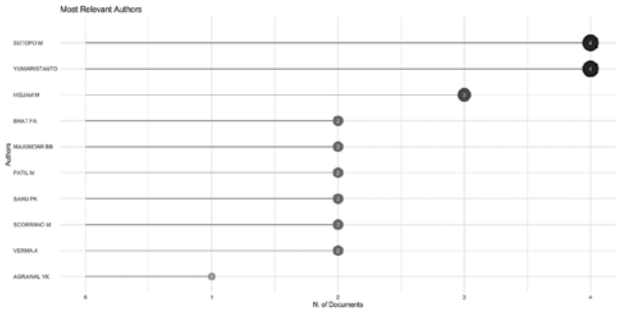

Figure-10:
Most Relevant Authors (Source: Scopus)

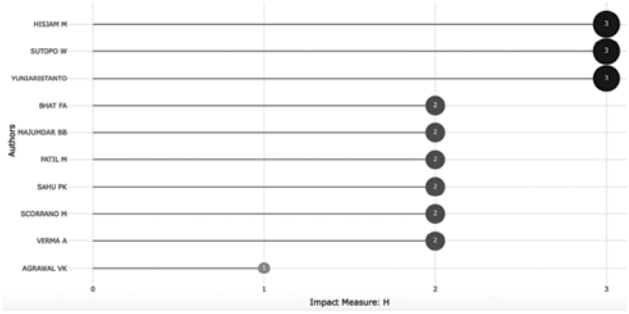

Figure-11:
Authors' Local Impact

Figure-12:
Authors Collaboration Network (Source: Scopus)

4.4. Analysis of Sources

The results of the bibliometric analysis highlight the significance of identifying the "Most Relevant Sources", which serve as essential reference points for researchers seeking to conduct literature reviews or select appropriate outlets for publication within a specific domain. Figure- 13 illustrates the ten most prominent journals contributing to the body of literature concerning factors that influence consumers' decisions to purchase two-wheelers.

Among these, four journals—*Sustainability (Switzerland)*, *Case Studies on Transport Policy*, *Journal of Cleaner Production*, and *Research in Transportation Business and Management*—emerge as the most influential sources, consistently publishing research aligned with the focal theme. These journals not only host a considerable number of relevant studies but also provide strategic platforms for future researchers to consult and contribute to. Furthermore, Figure-14 presents the temporal distribution of publications within these key journals, revealing a discernible upward trend in publication volume over the past three years—particularly within the top three sources. This increasing trajectory signifies a growing scholarly interest and research activity within this thematic area, underscoring the relevance and evolving importance of these journals.

Consequently, these findings provide a clear direction for researchers: both to access high-impact literature and to consider these journals as preferred venues for disseminating future research on consumer behaviour in the two-wheeler market. The designation of "Most Relevant Sources" thus plays a vital role in guiding academic inquiry and shaping future contributions in the field.

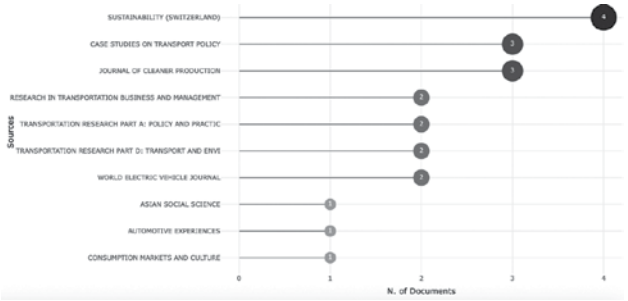

Figure-13:
Most Relevant Sources. (Source: Scopus)

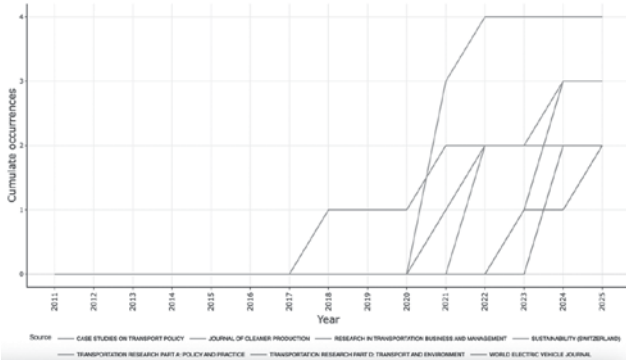

Figure-14:
Sources' production over time. (Source: Scopus)

4.5. Analysis on Affiliation

Within the framework of bibliometric analysis conducted using RStudio, the metric of "Most Relevant Affiliation" offers valuable insights into the academic institutions, universities, and research centres that have contributed significantly to a specific research domain—in this case, the factors influencing consumer purchase decisions regarding two-wheelers. As illustrated in Figure-15, the analysis identifies the leading institutions affiliated with the reviewed publications.

The top three institutions demonstrating substantial scholarly engagement in this field are *Universitas Sebelas Maret* (Indonesia), *Birla Institute of Technology and Science, Pilani* (India), and *Heilbronn University* (Germany), with 10, 5, and 5 publications respectively. Their high level of research output positions them as key centres of expertise in the domain and suggests potential opportunities for academic collaboration, consultation, and joint research initiatives.

For emerging researchers, these affiliations provide a valuable reference point for benchmarking methodologies and findings, as well as identifying potential academic partners. In addition to these leading contributors, eight other universities from various regions have collectively produced 24 publications, further reflecting the global academic engagement with this subject area.

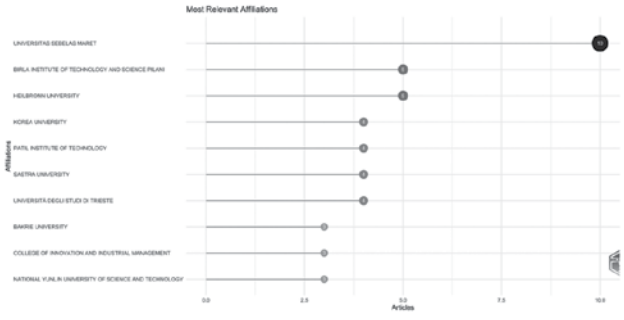

Figure-15:
Most Relevant Affiliation

4.6. Thematic Analysis

The thematic map serves as a strategic visualisation tool in bibliometric analysis, enabling the systematic classification of research topics based on two critical dimensions: *relevance* (plotted on the x-axis) and *degree of development*, or *density* (plotted on the y-axis). This two-dimensional framework facilitates the identification and prioritisation of research themes by evaluating their centrality within the field and the extent to which they have been conceptually and methodologically developed.

Themes situated in the lower-left quadrant—characterised by both low relevance and low development—are typically identified as *emerging or declining themes*. These areas may present valuable opportunities for future scholarly inquiry, particularly as they have not yet received substantial academic attention. Consequently, thematic mapping enables researchers to effectively visualise, organise, and prioritise research directions based on thematic maturity and academic significance.

Figure 16 presents the thematic map derived from the bibliometric analysis conducted using RStudio.

- Motor Themes: Topics such as *technology adoption*, *factor analysis*, *perception*, *decision making*, and *electric vehicles* are positioned in the upper-right quadrant, indicating both high relevance and a robust level of development. These represent well-established, central themes within the field.
- Basic Themes: For instance, the theme of *understanding influencing factors in motorcycle purchasing decisions* is deemed highly relevant but remains underdeveloped. Such topics may be foundational and warrant deeper exploration in future studies.
- Emerging Themes: Themes such as *purchase behaviour*, *attitude*, and *product innovation* are located in the lower-left quadrant. Although these topics currently exhibit lower relevance and limited scholarly development, they possess potential to evolve into critical areas of future research as the field advances.

Thus, the thematic map not only provides a snapshot of the intellectual landscape but also serves as a guidepost for identifying underexplored yet promising research avenues.

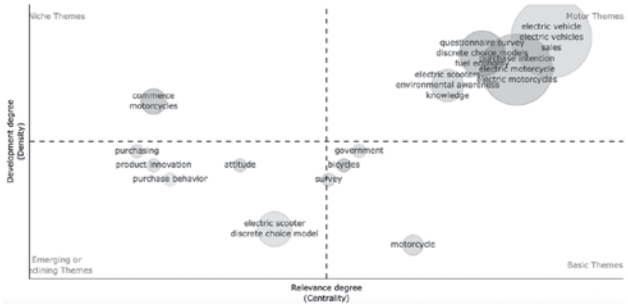

Figure-16:

Thematic Map. (Source: Scopus)

5. Conclusion and Implications

This study undertook a comprehensive bibliometric analysis of scholarly literature focused on the diverse factors influencing consumer decision-making in the context of two-wheeler purchases. A total of 44 relevant articles, published between 2016 and 2025, were examined. The analysis revealed a marked increase in scholarly output during the period from 2021 to 2024, with a substantial concentration of publications originating from four key academic sources. Notably, the majority of contributions stemmed from countries such as Indonesia and India, indicating regional leadership in this research domain.

Institutional analysis identified three prominent universities—*Universitas Sebelas Maret*, *Birla Institute of Technology and Science, Pilani*, and *Heilbronn University*—as major centres of scholarly activity related to this topic. Furthermore, keyword analysis highlighted the prominence and increasing frequency of terms such as *"electric motorcycle"*, *"technology adoption"*, *"purchase intention"*, and *"electric vehicle"*, signalling their emergence as central themes in contemporary research.

The thematic analysis suggested that *purchase behaviour*, *attitude*, and *product innovation* are emerging themes with potential for future exploration, given their current underdevelopment yet growing relevance.

The findings of this study hold practical implications for industry stakeholders, particularly in guiding the design and development of two-wheeler products that align with evolving consumer preferences and sustainability objectives. By elucidating the underlying factors shaping consumer intentions and behaviours, this research contributes to both academic knowledge and industrial practice.

Moreover, by analysing recurring keywords, prevailing research trends, influential authors, and institutional affiliations, the study offers valuable guidance for future researchers. It provides a structured foundation for identifying collaborative opportunities, refining research focus, and advancing the scholarly discourse surrounding consumer behaviour in the two-wheeler segment.

6. Limitations

One of the limitations of this study lies in its exclusive reliance on the Scopus database for the systematic literature search. While Scopus offers a comprehensive repository of high-quality academic publications, the exclusion of additional scholarly databases such as Web of Science, ScienceDirect, and ABDC potentially restricts the breadth and depth of the literature reviewed. Incorporating data from these sources could enhance the comprehensiveness of the bibliometric analysis and yield a more holistic understanding of the research landscape.

Furthermore, the analysis revealed a predominance of contributions from India and Indonesia, reflecting strong academic engagement from these regions. However, countries such as China and Malaysia—which have played a substantial role in the proliferation and development of the two-wheeler market—were underrepresented in the dataset. Future research would benefit from a broader inclusion of articles published in journals originating from these countries, thereby enriching the analysis and offering deeper insights for constructing a robust theoretical and empirical framework for subsequent investigations.

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Assessment of Inpatient Services by the Customers at the Time of Discharge in a Multispecialty Hospital

A. Jasmin*
K. Ravichandran**
K. Anandhi***

Abstract

Patient satisfaction is concerned with the fulfilment of the patients' expectations and their own experience related to the various services rendered to them during the hospital visit. It has become essential for hospitals to assess and improve the experiences of their patients, especially those receiving inpatient care, with growing competition, increased patient awareness, and an emphasis on evidence-based health care. (Niraula 2019) Among various quality indicators, patient satisfaction has emerged as a crucial measure that reflects the performance of healthcare providers and the overall effectiveness of hospital services. The current paper analyses the patient experience from admission to discharge at the multispecialty hospital with the help of their feedback at the time of discharge. This study follows a descriptive research design, and SPSS 20 was used to analyse the data.

The study reveals that the patient satisfaction is borderline with tangible variables like room cleanliness, hospital linen, and dissatisfied with treatment expenses, length of stay in hospital, and plan of discharge. The patients were moderately satisfied with care by nursing staff and patient diet, discharge information, discharge medicine advice, time taken for discharge, and discharge activities on the day of discharge the patients were satisfied with intangible clinical variables, the duty medical officer's care, doubts clarification, information on next follow-up, and patient discharge summary. The study also reveals that the patient perception of the inpatient services varies based on the length of stay and the specialty of admission.

Keywords: *Inpatient satisfaction, Patient assessment, Patient discharge*

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1. Introduction

The national accreditation board for hospitals and healthcare providers focuses on ensuring high-quality healthcare to patients in public and private hospitals. As healthcare systems shift towards a patient-centered model, the needs, expectations, and comfort of patients are highly prioritized. It becomes more essential for hospitals to assess and improve the experiences of their patients, with growing competition, increased patient awareness, and an emphasis on evidence-based health care (Niraula, 2019). The hospitals render diagnostic, preventive, curative, and rehabilitative care through inpatients, outpatients, and day care services. In this context, inpatient services, where patients are admitted for one or more days for treatment, play a critical role in shaping patient experiences, as they are exposed to medical and paramedical services of the hospital. The inpatient experiences continuous medical attention, nursing care, room facilities, dietary services, and emotional support.

Patient satisfaction is a multi-dimensional concept that encompasses a patient's experiences and perceptions during their hospital stay from admission to discharge, including medical care, nursing services, hospital infrastructure, communication, and responsiveness. The patient satisfaction rate is one of the quality indicators of healthcare service quality in today's hospital systems, so the hospital should receive patient feedback through a survey and address the complaints. The patient satisfaction level is influenced by health literacy, socio-demographics, and their expectations towards the hospital services. Nowadays, most hospitals use the patient feedback system as a marker of quality. The feedback provided by patients assists hospital management in evaluating the effectiveness of the hospital's services and supports in upholding patient satisfaction and quality of services.

There are so many research studies conducted in the patient satisfaction area; however, this remains a field ripe for further exploration. The current study offers valuable insights through the perception of patients about their stay in the hospital, which helps hospital management to develop strategies for improvement. The patient satisfaction of related to the tangible variables like room cleanliness, hospital linen, found borderline, treatment expenses, length of stay in hospital, and plan of discharge, found dissatisfied. The patients were satisfied with intangible clinical variables, the duty medical officer's care, doubts clarification, information on next follow-up, and patient discharge summary. Patients were moderately satisfied with care by nursing staff and patient diet, discharge information, discharge medicine advice, time taken for discharge, and discharge activities on the day of discharge.

2. Literature Review

According to the World Health Organization, patient satisfaction is defined as the measure of how content a patient is with the healthcare they receive, encompassing their perceptions of quality, access, and the overall experience. Over the past decades, patient satisfaction has become a vital focus area in healthcare research, serving as a key performance indicator for hospitals. Various studies have examined its determinants, dimensions, and impact on healthcare delivery. Patient satisfaction in healthcare settings is influenced by multiple factors across different countries. In Egypt, a study of 1,818 patients found 82.2% satisfaction with outpatient services, with education level being a significant predictor (Sanad, 2020). At Sina Hospital, the SERVQUAL model identified the largest satisfaction gaps in reliability and the smallest in assurance, with special care units showing wider gaps than other departments (Esmailpour, 2014). In Eastern Nepal, a cross-sectional study of 680 participants revealed 94% overall satisfaction, with higher rates in private hospitals (OR = 2.842, $p<0.001$), and satisfaction was significantly linked to hospital type, gender, age, education, and occupation (Niraula, 2019). In Bangladesh, research comparing public (Chittagong Medical College Hospital) and private (Chattogram Maa Shishu O General Hospital) hospitals identified low satisfaction with waiting times (71.70%

dissatisfied), toilet cleanliness (79.25%), and consent before examinations (79.25%), while finding higher satisfaction with examination privacy (71.70%) and OPD fees in public hospitals (86.67% vs 26.09% in private) (Deb A, 2018). The review by Crow et al. (2002) categorized patient satisfaction factors into two broad groups: those related to the characteristics of the patients and those associated with healthcare providers. It highlighted the significance of the doctor-patient relationship, health outcomes, and patient expectations. It also emphasized the challenges in accurately measuring satisfaction due to subjective bias and varying expectations. Naidu (2009) identified several core dimensions influencing patient satisfaction, such as access to care, communication, hospital environment, and trust in care providers. The study emphasized that regular monitoring and quality enhancement are essential to maintaining high satisfaction levels. Al-Abri & Al-Balushi (2014) In their analysis of 29 studies, the authors concluded that interpersonal skills, including courtesy, respect, and effective communication were more influential in determining satisfaction than technical skills alone Batbaatar et al. (2017) This meta-narrative review of 109 studies found interpersonal care, service quality, physical environment, staff competence, and accessibility as major determinants of patient satisfaction. The review suggested that socio-demographic factors also influence perceptions of care, although their impact varies across studies. The review by Salehi et al. (2018) focused on inpatient care in public hospitals and highlighted that health system factors (like staff behavior, hospital features, and insurance coverage) play a crucial role in shaping patient satisfaction. It stressed the need for continuous service evaluation. The study by Sarfraz et al. (2020) explored satisfaction across different healthcare settings and identified key dimensions such as effectiveness, accessibility, safety, and patient-centered care. It noted that low- and middle-income countries face unique challenges due to limited resources and infrastructure. The evaluation of the hospital services in Madurai, highlighting the implications for the quality of the service (Faisal and Chandra mohan), cleanliness is fundamental, as reported by various studies (Paul et al., N.D. Priya) of professional satisfaction between nurses in improving the quality of the service. Empathy experiences (Bharath, 2023)

3. Objectives of the Study

The primary goal of this study is to understand and assess the level of satisfaction among inpatients at the time of discharge at a multispecialty hospital, Madurai.

The objectives are as follows:

1. To understand the demographic profile of the respondents related to age, gender, and payment type (cash, insurance), their length of stay, and specialty under treatment.
2. **To a**ssess the patient satisfaction related to length of stay, nursing care, doctor-patient communication, food quality and discharge.
3. To analyze the relationship between the specialty of admission with registration waiting time, the time taken for the preliminary diagnosis by doctor and nurse, length of stay, treatment expenses, and discharge delay.
4. To study and analyze the relationship between the length of stay with treatment expenses, nursing care, doctor-patient communication, room cleanliness, food quality, and discharge activities.

4. Research Questions

The data collected with the below type of research data sheet format from the patients or attenders on the day of the patient's discharge from the hospital

Patient Feedback Data Sheet	
Contents	
Patient name /UHID	
Gender	Male / Female
Age	0-15 / 16-25 / 26-35 / 36-45 / 46-55 / 56-65 / 66-75 / 75 and above
Room number	Block / Room number
Date of admission	dd / mm / yyyy
Date of discharge	dd / mm / yyyy
Length of stay	Number of days calculated, including date of admission and discharge
Specialty of admission	Name of the Specialty (total 28 specialties)
Primary consultant	Name of the consultant (total 40 consultants)
Payment Type	Cash / Claim (Totally 27 claim types available in the hospital)
Registration Waiting Time	Below 10 minutes /10 - 20 minutes / 20 -30 minutes/ 30- 40 minutes / Above 40 minutes
Doctor/ Nurse visit time after admission for preliminary diagnosis	Below 10 minutes /10 - 20 minutes / 20 -30 minutes/ 30- 40 minutes / Above 40 minutes

Kindly tick the ratings that suit your satisfaction related to the care received in the hospital.					
Components of care	Highly unsatisfied	Unsatisfied	Neither unsatisfied nor satisfied	Satisfied	Highly satisfied
Doctors care					
Nursing care					
Diet quality					
Patient room cleanliness					
Cleanliness of patient linen					
Cleanliness of the bed sheet and pillow cover					
Proposed amount of expenses information					
Patient and family doubts like Treatment plan explanation / Disease /illness-related information, Risk involved information /Alternative treatment /Second opinion information from doctors, nurses					
Treatment expenses					
Discharge plan					
Discharge information					
Follow-up Medicine advice					
Time taken for discharge					
Overall satisfaction					

5. Hypotheses

E.1. Null Hypotheses

1. H_o: There is no significant association between specialty under treatment and patient satisfaction with the care by the duty medical officer and nursing staff.
2. H_o: There is no significant association between specialty under treatment and patient satisfaction regarding treatment expenses and length of stay.
3. H_o: There is no significant association between specialty under treatment and patient satisfaction with the plan of discharge, time taken for discharge, and discharge information.
4. H_o: There is no significant association between specialty under treatment and patient satisfaction with discharge summary, patient & family doubts clarification, and discharge activities on the day of discharge.
5. H_o: There is no significant association between length of stay and patient perception of care by the medical officer and care by nursing staff.
6. H_o: There is no significant association between length of stay and patient rating on diet quality and room cleanliness.
7. H_o: There is no significant association between length of stay and patient perception of treatment expenses.
8. H_o: There is no significant association between length of stay and patient satisfaction with the plan of discharge, discharge information.

H_o: There is no significant association between length of stay and patient satisfaction with discharge medicine advice, follow-up information, and patient doubt clarification.

H_o: There is no significant association between length of stay and patient satisfaction with discharge activities on the day of discharge.

E.2. Alternative Hypotheses

1. H_1: There is a significant association between specialty under treatment and patient satisfaction with the care by the duty medical officer and nursing staff.
2. H_1: There is a significant association between specialty under treatment and patient satisfaction regarding treatment expenses and length of stay.
3. H_1: There is a significant association between specialty under treatment and patient satisfaction with the plan of discharge, time taken for discharge, and discharge information.
4. H_1: There is a significant association between specialty under treatment and patient satisfaction with discharge summary, patient & family doubts clarification, and discharge activities on the day of discharge.
5. H_1: There is a significant association between length of stay and patient perception of care by the medical officer and care by nursing staff.
6. H_1: There is a significant association between length of stay and patient rating on diet quality and room cleanliness.
7. H_1: There is a significant association between length of stay and patient perception of treatment expenses.
8. H_1: There is a significant association between length of stay and patient satisfaction with the plan of discharge, discharge information.
9. H_1: There is a significant association between length of stay and patient satisfaction with discharge medicine advice, follow-up information, and patient doubt clarification.
10. H_1: There is a significant association between length of stay and patient satisfaction with discharge activities on the day of discharge.

6. Research Methodology

F.1. Research Design:

This study follows a **descriptive research design**, which aims to systematically describe the satisfaction levels of inpatients at a multispecialty hospital and identify factors that influence their hospital experience. It helps in analyzing current conditions based on feedback from actual service users. The data were collected for 2 months from December 2024 to January 2025. used in the feedback form.

The Patient's personal information related variables such as. Patient name, Gender, Age group, Room number, Specialty, Treating Consultant, Length of Stay, and Payment Type were observed and collected. The satisfaction assessment criteria related to the Time taken for admission and preliminary diagnosis, with the time slot selection, and the Patient care variables, Hospital Facility, Supportive Services, Hospital stay, and discharge were assessed by the patient and family. 1. Time taken for admission procedures and preliminary diagnosis: The time consumed for registration at the admission counter and the time taken for the Doctor/Nurse visit for preliminary diagnosis 2. Patient care variables: The care provided by the consultant, the Duty medical officer, and the Nursing staff of the hospital. 3. Hospital Facility and Supportive Services: The patient's diet quality, room, and bed linen cleanliness. 4. Hospital Stay and discharge plan: The length of stay, discharge plan, discharge information, time taken for discharge, and treatment expenses were taken as variables.

F.1.1. Sources of Data and Data Collection Methods:

Table 1- Patient discharge data

Financial year/ month	2023- 2024	2024- 2025
April	755	840
May	812	1029
June	865	899
July	805	926
August	824	900
September	841	908
October	930	916
November	970	898
December	993	1021
January	890	
February	826	
March	811	

Courtesy – from hospital records

The Primary data were collected directly from inpatients through a structured questionnaire, The 5 rating "Likert scale" "1" as Highly unsatisfied to "5" as Highly satisfied, for assessing the care experienced by the patients during the hospital stay covering various dimensions of satisfaction consists of 10 patients' personal information and 15 elements as assessment criteria. The Secondary Data Obtained from hospital records, previous research studies, academic journals, and other published literature related to patient satisfaction.

F.1.2. Sampling Frame

Table 1- Patient discharge month wise, shows the number of discharges of two years monthly wise. The total number of discharges in the financial year 2023- 2024 is 10322 calculated the monthly average is 860.333, daily average number of discharges 28 per day. The study was conducted between December 2024 and January 2025. The data is planned to be collected for two months; thus, the sampling frame is taken as 1700 samples.

F.1.3. Sample size:

The sample size is calculated with the help of the formula. The sample size formula for a known population using Slovin's formula is: n = N / (1 + Ne^2), where "n" is the sample size, "N" is the total population size, and "e" is the desired margin of error. The population is 1700 with a confidence level of 95% that the real value is within ±5% of the measured/surveyed value. This means 323 samples are needed. when using Cochran's equation together with a population of 1700, A total of 332 inpatients were surveyed across different wards and rooms, representing a mix of patients from general, semi-private, and private rooms.

F.1.4. Sampling Method:

The study adopts a convenience sampling method due to practical limitations in accessing all inpatients. The data was collected over 60 days from December 2024 to January 2025. The patient feedback form was given to 415 discharged patients, only 332 were accepted and filled out the data sheet, ensuring adequate time for interaction with respondents and accurate feedback recording.

F.2. Analysis and Interpretation of the data

The data was analyzed with the help of SPSS 20, the collected data were verified for validity and missing data, and 0 variance was considered nonperforming. The normality analysis was conducted, the percentage analysis was used for frequency-based interpretation, tabulation was used to present satisfaction levels, and Comparative analysis was used to analyze the data.

F.2.1. Respondent demographic information

Table 2: Gender proportion of respondents

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	132	39.8	39.8	39.8
Male	200	60.2	60.2	100.0
Total	**332**	**100.0**	**100.0**	

The female respondents of the study were 39.8 percent, and the male respondents were 60.2 percent. Among the respondents, the number of male patients was 17.6 percent higher than that of female patients.

Table 3: Age group proportion of respondents

Age Group	Frequency	Percent	Valid Percent	Cumulative Percent
Zero to 15 years	20	6.0	6.0	6.0
16 years to 25 years	9	2.7	2.7	8.7
26 years to 35 years	21	6.3	6.3	15.1
36 years to 45 years	54	16.3	16.3	31.3
46 years to 55 years	107	32.2	32.2	63.6
56 years to 65 years	91	27.4	27.4	91.0
66 years to 75 years	30	9.0	9.0	100.0
Total	**332**	**100.0**	**100.0**	

Among the respondents, 32.2% belong to 46-55 years, 27.4 % belong to 56-65 years, 16.3 % belong to 36-45 years of age group.

It shows that 75.9 % of the patients of the hospital's falls between the 35 - 65 year age group, and a lower percentage of patients are in the age group of 16 - 25 age.

Table 4: Specialty of admission

Specialty	Frequency	Percent	Cumulative Percent	Specialty	Frequency	Percent	Cumulative Percent
Onco Surgery	7	2.1	2.1	Urology	10	3.0	87.7
General Surgery	3	.9	3.0	Surgical Gastrology	18	5.4	93.1
Medical Gastrology	48	14.5	17.5	Vascular Surgery	5	1.5	94.6
Pediatrics	20	6.0	23.5	Dental	1	.3	94.9
Cardiothoracic	27	8.1	31.6	Plastic Surgery	3	.9	95.8
Family Medicine	9	2.7	34.3	Onco-Radiotherapy	2	.6	96.4
Orthopedics	42	12.7	47.0	Endocrinology	1	.3	96.7
Cardiology	45	13.6	60.5	ENT	1	.3	97.0
Pulmonology	5	1.5	62.0	Pediatric Surgery	1	.3	97.3
Nephrology	10	3.0	65.1	Spine Surgery	1	.3	97.6
Neurology	25	7.5	72.6	Psychiatry	2	.6	98.2
OBG	18	5.4	78.0	oncology	5	1.5	99.7
General Medicine	22	6.6	84.6	Radiology	1	.3	100.0
				Total	**332**	**100.0**	

Related to the specialty of admission, 14.5% to medical gastrology and 13.6 % to cardiology, 12.7% to orthopedics, 6.0% to pediatrics, 8.1% to cardiothoracic, 6.6% to general medicine, 5.4% to OBG and Surgical gastrology for their treatment.

Table 5 – Length of stay

LOS	Frequency	Percent	Cumulative
1 day	53	16.0	16.0
10 days	2	.6	16.6
11 days	5	1.5	18.1
12 days	5	1.5	19.6
16 days	2	.6	20.2
2 days	67	20.2	40.4
21 days	5	1.5	41.9
23 days	3	.9	42.8
3 days	48	14.5	57.2
31 days	1	.3	57.5
4 days	49	14.8	72.3
5 days	34	10.2	82.5

6 days	26	7.8	90.4
7 days	14	4.2	94.6
8 days	8	2.4	97.0
9 days	10	3.0	100.0
Total	**332**	**100.0**	

The above table interprets, 20.2% of the patients stayed for 2 days 16% of the patients for 1 day, 14.5 % of the patients for 3 days, 14.8% of the patients for 4 days, 10.2% for 5 days, and 7.8% for 6 days. And 1.5% of the patients stayed for 11, 12, and 21 days. 9 % stayed for 23 days, .6 % stayed for 10 days, and 16 days.

Table 6 – Payment Type

Payment Type	Frequency	Percent	Valid Percent
Cash Payment	221	66.6	66.6
Claim - FHPL	4	1.2	1.2
Claim - Care Insurance	6	1.8	1.8
Claim - MediAssist	14	4.2	4.2
Claim - TNEHS	20	6.0	6.0
Claim - ECHS	18	5.4	5.4
Claim - VIDAL	6	1.8	1.8
Claim - NHISP	11	3.3	3.3
Claim - Star Health	9	2.7	2.7
Claim - Bajaj	1	.3	.3
Claim - Health India	6	1.8	1.8
Claim - ICICI	4	1.2	1.2
Claim - Safe way	1	.3	.3
Claim - GHPL	1	.3	.3
Claim - IFFCO	2	.6	.6
Claim Railway	3	.9	.9
Claim - ERICSON	1	.3	.3
Claim - HDFC	1	.3	.3
Claim - Paramount	1	.3	.3
Claim - CM Scheme	2	.6	.6
Total	332	100.0	100.0

Most of the patients (66.6%) paying cash for treatment. The remaining 33.4% utilising the cashless treatment, such as TNEHS (6.0%), ECHS (5.4%), and Medi Assist (4.2%), are the most frequently used claim-based payments. Other claim-based payment methods (e.g., Star Health (2.7%), NHISP (3.3%)) are used by fewer patients. Several insurance providers, such as Bajaj, indicate that using cashless treatment is less common in the patient population of Madurai.

F.3. Waiting time for registration and doctor / Nurse visit

Table 7 – Registration waiting time

Registration Waiting Time	Frequency	Percent	Valid Percent	Cumulative Percent
Below 10 minutes	12	3.6	3.6	3.6
10 min - 20 min	47	14.2	14.2	17.8
20 min - 30 min	111	33.4	33.4	51.2
30min - 40 min	142	42.8	42.8	94.0
above 40 minutes	20	6.0	6.0	100.0
Total	332	100.0	100.0	

For inpatient registration, 33.4% of patients waiting for 20-30 minutes, 42.8% of patients waiting for 30-40 minutes. Combined, 76.2% of patients experience a waiting time between 20 to 40 minutes. 3.6% of patients are registered in under 10 minutes. 14.2% wait between 10-20 minutes.

Table 8 – Initial assessment waiting time

Doctor and Nurse visit time after admission	Frequency	Percent	Valid Percent	Cumulative Percent
Below 10 minutes	9	2.7	2.7	2.7
10 min - 20 min	58	17.5	17.5	20.2
20 min - 30 min	87	26.2	26.2	46.4
30min - 40 min	131	39.5	39.5	85.8
above 40 minutes	47	14.2	14.2	100.0
Total	**332**	**100.0**	**100.0**	

26.2% of patients receives initial assessment within 20-30 minutes. 39.5% within 30-40 minutes, 17.5% within 10-20 minutes, 2.7% within 10 minutes and 14.2% of patients experience delays exceeding 40 minutes.

F.4. Overall satisfaction of the inpatients

Table 8 – Patient satisfaction

Descriptive Statistics	N	Range	Mean	Std. Deviation	Variance
Care by duty medical officer	332	4.00	4.4849	.84246	.710
Care by Nursing Staff	332	4.00	3.0361	1.04804	1.098
Patient diet	332	4.00	3.6988	1.10735	1.226
Cleanliness of the patient's room	332	4.00	2.9819	1.07974	1.166
Cleanliness of the Patient linen	332	4.00	3.0633	.94832	.899
Treatment Expenses	332	4.00	2.5151	1.00290	1.006
Length of stay in hospital	332	4.00	2.9428	1.16846	1.365
Plan of Discharge	332	4.00	2.9127	1.14304	1.307

Discharge information	332	4.00	3.0663	1.12717	1.271
Discharge medicine advice	332	4.00	2.9789	1.14355	1.308
Time Taken for Discharge	332	4.00	3.0090	1.12775	1.272
Discharge activities on the day of discharge	332	4.00	3.1958	1.17408	1.378
Patient & Family doubts clarification	332	4.00	3.2952	1.15436	1.333
Information on the next follow-up	332	4.00	3.1145	1.13931	1.298
Patient Discharge Summary	332	4.00	3.6837	.93568	.876
Valid N (listwise)	332				

The patients were consistently satisfied with the duty medical officer's care (Mean 4.48, SD 0.84). and satisfied with doubts clarification (Mean 3.2, SD 1.15), information on next follow-up (Mean 3.1, SD 1.13), and patient discharge summary (Mean 3.68, SD 0.93). and moderately satisfied with care by nursing staff (Mean 3.0, SD 1.0), patient diet (Mean 3.7, SD 1.1), discharge information (Mean 3.06, SD 1.1), discharge medicine advice (Mean 2.9, SD 1.1), time taken for discharge (Mean 3.0, SD 1.1), and discharge activities on the day of discharge (Mean 3.1, SD 1.17). The patient satisfaction is borderline with the room cleanliness (Mean 2.98, SD 1.07), and the hospital linen (Mean 3.06, SD 0.94). The patients were dissatisfied with treatment expenses (Mean 2.52, SD 1.0), length of stay in hospital (Mean 2.94, SD 1.16), and plan of discharge (Mean 2.9, SD 1.14).

F.5. Analysis of Variance by Specialty:

Table 9 – Specialty Vs Patient Services

ANOVA Table			Sum of Squares	df	Mean Square	F	Sig.
Care by duty medical officer * Specialty	Between Groups	(Combined)	19.289	25	.772	1.095	.347
	Within Groups		215.636	306	.705		
	Total		234.925	331			
Care by Nursing Staff * Specialty	Between Groups	(Combined)	63.338	25	2.534	2.582	.000
	Within Groups		300.229	306	.981		
	Total		363.566	331			
Treatment Expenses * Specialty	Between Groups	(Combined)	60.337	25	2.413	2.709	.000
	Within Groups		272.588	306	.891		
	Total		332.925	331			
Length of stay in hospital * Specialty	Between Groups	(Combined)	91.114	25	3.645	3.091	.000
	Within Groups		360.799	306	1.179		
	Total		451.913	331			
Plan of Discharge * Specialty	Between Groups	(Combined)	67.852	25	2.714	2.278	.001
	Within Groups		364.615	306	1.192		
	Total		432.467	331			

Time Taken for Discharge * Specialty	Between Groups	(Combined)	69.981	25	2.799	2.440	.000
	Within Groups		350.992	306	1.147		
	Total		420.973	331			
Discharge information * Specialty	Between Groups	(Combined)	72.286	25	2.891	2.541	.000
	Within Groups		348.256	306	1.138		
	Total		420.542	331			
Patient Discharge Summary * Specialty	Between Groups	(Combined)	38.677	25	1.547	1.885	.007
	Within Groups		251.115	306	.821		
	Total		289.792	331			
Patient & Family doubts clarification * Specialty	Between Groups	(Combined)	64.821	25	2.593	2.109	.002
	Within Groups		376.251	306	1.230		
	Total		441.072	331			
Discharge activities on the day of discharge * Specialty	Between Groups	(Combined)	63.686	25	2.547	1.986	.004
	Within Groups		392.588	306	1.283		
	Total		456.274	331			

There is no difference in care by the duty medical officer (F 1.095, P .347) among all the specialties, which represents the efficiency of physicians.

There is a significant difference in the patient perception related with the specialty of admission with services like nursing staff (F 2.582, P .000), treatment expenses (F 2.709, P .000), length of stay (F -3.091, P- .000), plan of discharge (F 2.278, P .001), time taken for discharge (F 2.440, P .000), discharge information (F 2.541, P .000), patient discharge summary (F 1.885, P .007), patient and family members doubt clarification regarding patient treatment (F 2.109, P .002), discharge activities (F 1.986, P .004).

Table 10 – Association between Specialty Vs Patient Services

Measures of Association	Eta	Eta Squared
Care by duty medical officer * Specialty	.287	.082
Care by Nursing Staff * Specialty	.417	.174
Treatment Expenses * Specialty	.426	.181
Length of stay in hospital * Specialty	.449	.202
Plan of Discharge * Specialty	.396	.157
Time Taken for Discharge * Specialty	.408	.166
Discharge information * Specialty	.415	.172
Patient Discharge Summary * Specialty	.365	.133
Patient & Family doubts clarification * Specialty	.383	.147
Discharge activities on the day of discharge * Specialty	.374	.140

The measures of association between the specialty and the care by medical officers explains 8.2% of the variance is moderate.

Care of nursing staff 17.4% of variance explained large and shows strong link, treatment expenses 18.2% length of hospital stay 20.2% discharge planning 15.7% strongly affected by the specialty, and time taken for discharge 16.6%, information of discharge 17.2% varies between specialties. The discharge summary 13.3% notes that moderate link among different specialty.

The patient and family doubts clarification 14.7% shows different specialty patients receives different experience in receiving the communication form the hospital staff like doctors, nurses, and paramedical staff etc., the day of discharge activities 14.0% shows the process affected with the specialty under admission.

Table 11: Chi-Square test: Relationship between length of stay and inpatient services

Length of stay impacts with the IP services	Pearson Chi-Square &	Asymp. Sig. (2-sided)	Likelihood Ratio and	Asymp. Sig. (2-sided)	df
Care by the duty medical officer	74.655[a]	.096	78.989	.051	60
Care by Nursing Staff	91.933[a]	.005	95.668	.002	60
Patient diet	98.575[a]	.001	96.855	.002	60
Cleanliness of the patient's room	127.004[a]	.000	110.651	.000	60
Treatment Expenses	105.896[a]	.000	84.454	.020	60
Plan of Discharge	97.929[a]	.001	86.781	.013	60
Discharge information	99.669[a]	.001	94.521	.003	60
Discharge activities on the day of discharge	106.009[a]	.001	111.605	.000	60
Discharge medicine advice	99.458[a]	.001	92.807	.006	60
Patient & Family doubts clarification	90.883[a]	.001	91.860	.005	60
Information on the next follow-up	100.700[a]		107.534	.000	60
Patient Discharge Summary	94.061[a]	.003	98.233	.001	60

The Pearson correlation denotes that there is no significant association between length of stay and care by the duty medical officer ($p = .096$). The Likelihood Ratio, $P = .051$, is borderline but still not conventionally significant.

There is a signification association between the length of stay and inpatient services like care by nursing staff ($p = .005$), hospital diet (χ^2 (60) = 98.575, $p = .00$), room cleanliness (χ^2 (60) = 127.004, $p < .001$), treatment expenses (χ^2 (60) = 105.896, $p < .00$. 1, Likelihood ($p = .020$)), the plan of discharge ($p < .05$), Likelihood ($p = .013$). The perception of the above services varies significantly depending on the length of hospital stay of the patients in the hospital.

And also, the patients perceptions related to the services like discharge information ($p < .05$), Likelihood ($p = .003$) discharge medicine advice ($\chi^2(60) = 99.458$, $p = .001$), discharge activities on the day of discharge ($p < .001$), Likelihood ($p < .001$) patient and family satisfaction with doubts clarification ($p < .05$) Likelihood ($p = .005$), information on their subsequent follow-up ($p < .05$), Likelihood Ratio ($p < .001$). with the discharge summary ($p < .05$), Likelihood ($p = .001$)) varies depending on length of stay of the patients.

7. Results

The results of this study can help hospital management and policymakers design more effective patient-centered protocols and training programs for staff to deliver compassionate and timely care.

The male patients were 20.4 % higher than the female patients. 75.9 % of the patients belong to the middle age group of 35 to 65 years, and very few patients are admitted in the age group of 16 to 25 years. Out of the respondents, the majority of the patients were getting treatment under the specialty of (14.5%) gastrology, (13.6%) cardiology, (12.7%) orthopedics, (8.1%) cardiothoracic, (6.6%) general medicine, (6.0%). The length of stay of 83.5% of patients was 1 to 6 days. Most of the patients (66.6%) were paying cash, and 33.4% of patients used various insurance schemes.

For inpatient registration, 76.2% of patients wait 20 to 40 minutes, and 17.8% of patients experience quick registration. The patient initial assessment was completed within 20 minutes of admission for 20.2% of patients and within 20 to 40 minutes for 65.7% of patients. And 14.2% of patients experienced a delay of more than 40 minutes.

Patients are highly satisfied with the care provided by the duty doctors, and the low standard deviation shows the consistency in satisfaction. Patient discharge summaries are also rated well, indicating patients find the summaries clear and useful. Patients were moderately satisfied with the patient diet (M-3.7), doubt clarification with the doctor and nurses (M-3.3), discharge information and activities related to discharge (M-3 and 3.2), the hospital operations are performing reasonably well, and can improve a little more. The patients were dissatisfied with treatment expenses(M-2.5), cleanliness of the patient's room and linen (M-2.9, 3.06), length of stay, and plan of discharge (M-2.9).

Patients' perceptions of hospital services vary with their specialty of treatment. Fortunately, there is no significant difference in the care provided by the duty medical officer ($p = .347$), which is perceived similarly across all specialties. The measures of association between specialty show the strongest associations with ($Eta^2 > .18$): length of stay (.202), treatment expenses (.181), and nursing staff care (.174).

There is a difference in rating for nursing staff (F -2.582, P- .000), treatment expenses (F -2.709, P- .000), length of stay (F -3.091, P- .000), plan of discharge (F-2.278, P- .001) time taken for discharge (F-2.440, P- .000), discharge information (F -2.541, P- .000) patient discharge summary (F-1.885, P- .007), patient and family doubt clarification regarding patient treatment (F-2.109, P- .002), discharge activities (F-1.986, P- .004) among the various specialties by the patients.

The patients staying longer might notice more issues with food quality and consistency, or conversely, may adjust expectations over time; high treatment costs depend on the stay period. Related to cleanliness, short-stay patients may have different expectations or experiences. And longer-stay patients may notice recurring issues, inconsistent maintenance, or improvements over time. According to the quality of nursing staff care, the dissatisfaction is high across all groups, especially for short stays. The more extended stays might result in more dissatisfaction due to perceived delays or communication gaps. Patients with more extended stays may receive more detailed discharge information, which may lead to feelings that discharge communication is rushed or insufficient. Medication counselling quality or perception varies with hospitalisation length. Patients with shorter stays may perceive discharge activities as rushed or insufficient.

8. Discussions

Patient satisfaction has become a crucial indicator of hospital performance and service quality in today's highly competitive healthcare environment. With increasing awareness and expectations among patients, hospitals are required to provide clinical excellence and ensure a positive patient experience throughout the inpatient journey. Over the past decades, patient satisfaction has become a vital focus area in healthcare research, serving as a key

performance indicator for hospitals. Various studies have examined its determinants, dimensions, and impact on healthcare delivery**.** While extensive research has been conducted globally on patient satisfaction, particularly in developed healthcare systems, several key gaps exist, especially in the context of private tertiary hospitals in India. Across all studies, common recommendations included improving physical environments, enhancing communication, and addressing waiting times to increase patient satisfaction. Despite evidence showing wider satisfaction gaps in specialized care units (Esmail Pour, 2014; Niraula, 2019), insufficient research focuses on tailored interventions for these departments.

A structured patient satisfaction study helps align hospital practices with this model. Most of the existing literature focuses on outpatient care or is centred around government/ public hospitals. There is a lack of focused studies on inpatient satisfaction in private multi-specialty hospitals in tier-2 cities like Madurai. The previous studies conducted in the inpatient area related to discharge suggested including the patient and family establish explicit guidelines to put the patient in focus and encourage participation, including participant demographics for better understanding and enhanced communication with patients and families. However, without systematic patient feedback, it becomes difficult to measure whether the hospital is meeting its service goals from the patients' perspective.

The current study provided insight into admission, patient care, facility, and supportive services and also discussed the impact of the length of stay and specialty of admission on the various inpatient services at the time of discharge. The result shows a significant association between nursing care, diet, room cleanliness, discharge information, time taken for discharge, discharge summary, and treatment expenses.

9. Conclusion

Patient experience is central to overall satisfaction. This study offers valuable insights into how patients perceive their stay, which can help develop strategies to improve comfort, reduce anxiety, and foster trust during the treatment. The majority of patients prefer direct cash payments rather than insurance claims. Insurance claims are diverse but less frequent; no single insurance provider dominates, but some have slightly higher usage. Partnering with popular insurance providers to facilitate a smoother claims process and educating patients on available claim options and how to use them effectively may be adopted. The registration waiting timings indicate occasional administrative inefficiencies or peak-hour congestion and a need for improvement in removing the bottlenecks in the registration process, like pre-registration, increasing staff availability during peak hours to enhance efficiency. The doctor/nurse visit, most (65.7%) patients take between 20 and 40 minutes for the initial assessment after admission. The long waiting times occur in some cases due to unavailability or engagement in other staff duties at the time of admission of the patients. Most patients were consistently satisfied with the duty medical officers or consultants and the discharge summary. The patients dissatisfied with treatment expenses(M-2.5), cleanliness of the patient's room and linen (M-2.9 and 3.06), length of stay and plan of discharge (M-2.9) need to be improved in the future.

The relationship with the speciality and other factors suggests standardised protocols for hospital-wide SOPs for discharge planning, communication, and nursing care to reduce variability. The cost difference may be due to treatment differences, and the dissatisfaction from high expenses shown by the patients' side reveals the need for billing transparency and patient education with proper investigation and training. Many aspects of care vary substantially by speciality, indicating a need for standardisation or department-specific quality improvements. The dissatisfaction with short-stay patients may reflect gaps in nursing care communication, understaffing, or higher patient expectations.

Implementing real-time tracking of doctor/nurse visits to ensure timely patient care. And introducing a priority-based patient management system to reduce

waiting time, increasing staff availability during peak admission hours to enhance response time. Departments with high registration waiting times and high post-admission delays (e.g., Pulmonology, Urology) might benefit from process optimisation or additional staffing. Departments with low variance and efficient processes (like Family Medicine and Oncosurgery) could serve as models for best practice.

10. Contribution to literature and industry

From a research perspective, this study adds to the existing body of knowledge on healthcare service management and can be a valuable reference for future studies in the field of hospital administration and patient care strategies.

Improving the quality of care by understanding the aspects of inpatient services includes improvements in clinical treatment, nursing services, communication, hygiene, and hospital facilities. Structured patient feedback will help to identify specific gaps in service delivery, knowing exactly where improvements are needed. Patient experience is central to overall satisfaction. This study offers valuable insights into how patients perceive their stay, which can help develop strategies to improve comfort, reduce anxiety, and foster trust during the treatment.

Satisfied patients are more likely to return to the same hospital for future care and recommend it to others. Therefore, improving satisfaction levels can lead to long-term loyalty and positive word-of-mouth. Regular assessment of patient satisfaction is also a requirement for hospital accreditation standards.

Findings from this study can be used to support quality initiatives and institutional benchmarking. The results of this study can help hospital management and policymakers design more effective patient-centred protocols and training programs for staff to deliver compassionate and timely care related to the area of registration and discharge, especially when dealing with claim patients.

11. Limitations and future scope

The study is confined to patients admitted for at least 24 hours. It does not cover outpatient services, day-care procedures, or emergency-only visits. Multiple dimensions of patient experience areas covered include quality of medical and nursing care, doctor-patient and nurse-patient communication, cleanliness and hygiene, Room comfort and hospital facilities, food and dietary services, billing and discharge procedures.

The study is conducted solely at one multispecialty hospital, Madurai. Patient satisfaction is highly subjective and may vary based on individual expectations, emotions, cultural background, and current health conditions, which can influence the responses. Patients who were critically ill, unconscious, or mentally unfit to participate were excluded from the study. The data collection was limited to a specific period, which might not capture seasonal or long-term variations in service quality or patient experiences. Some patients may have hesitated to give honest feedback due to fear of offending staff or misunderstanding the purpose of the questionnaire. And also, the existing research provides generalised findings, so there is a need for department-wise or speciality-wise evaluation to identify specific service gaps more accurately. Future research can be conducted as a prospective approach to understanding the fundamental gaps during the hospital stay from admission to discharge, and a longitudinal study involving other hospitals in the same region can help to get more insight.

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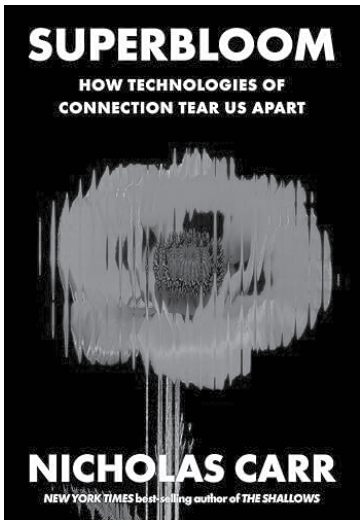
Super Bloom

How Technologies of Connection Tear Us Apart: Nicholas Carr

Reviewed by Prof. C.P. Ravindranathan



"When the mode of the music changes", Plato is supposed to have said, "the walls of the city shake". What the statement signifies is that change in music reflects and can also lead to social upheaval. According to Nicholas Carr, the author of the book "Superbloom", the primordial cause for change in the human condition could be found in technologies of communication. These technologies are dominant in our day through the cell phone, PCs, the Internet, social media and AI. Their transformative effects are manifest in all realms of life as none else; they will continue to be so for the future, for good or ill.

This is by no means Carr's own proposition. The core argument of his book he owes to Charles Horton Cooley who in 1897 not only coined the word "social media" in a seminal article he wrote for Political Science Quarterly, but maintained that the faster the mechanisms of communication changed, the faster did the society itself. Mind you he spoke not of the content, but of the mechanisms of communication, thereby anticipating such future oracular pronouncements in the domain as McLuhan's dictum, "medium is the message". But while McLuhan saw communication technologies as moulding individual consciousness, for Cooley communication went beyond information and was an instrument to regulate group behaviour and belief as well as to establish hierarchies and other structures of power in society. The outcomes would be positive, in Cooley's view, assuring social and cultural progress in the wake of technological advance in communication. He was wrong there; so also, years later, was Mark Zuckerberg whose vision of "mediating groups bringing us together and reinforcing our values" through communication was a fantasy, but it makes him part of a tradition of western humanistic belief in the inherent goodness of communication.

Carr's narrative so framed, makes a survey in short order of the development of technologies of human connection during various stages, beginning with the watershed of invention of writing and through telegraph, telephone, radio and television. As for the electronic media, the step change in communication that is under way at the present moment, its expansion has proceeded through three stages, according to this narrative. In the first stage, machines took on the transport or carriage role that defined traditional communication systems, replacing human couriers with over-the-wire and through-the-air mechanisms for transmission of messages and other content. In the second stage, with the incorporation of feed algorithms into social media platforms, machines came to add an editorial function, wresting from the media and publishing professionals the business of selecting which content to communicate to which audience. In the third stage, commencing

at the present moment, the machines are engaging in content production itself, taking on the roles traditionally played by writers, photographers, musicians and filmmakers. With generative AI, the digital computer's takeover of media, whereby the language of computer networks has become the language of media networks, the erasure of the boundaries between different media markets and services through digitisation is complete. For another, the combination of deregulation and digitization in the US has led not only to the government giving a wide berth to media businesses like Google and Facebook in regard to civic responsibility, but guaranteeing Internet's hegemony over all aspects of communication. So much so, with the advent of generative AI, "machines create the content, choose who will see it, and deliver it", points out Carr.

Interestingly, Carr sets out this broad narrative in juxtaposition with the various theories on technology and media that have, in parallel, both reflected and anticipated developments and trends in the three phases. Figuring notably among the theorists is Claude Shannon whose mathematical theory of communication was a pace setter in multiple respects: in its premise that information, with spoken words as starters, always travels through a medium in coded form thereby offering immense possibilities of transmission; in its argument that combination with the digital computer led to the discovery that all information should be transmitted through computer networks as the universal medium, and above all, in its point of departure that the meaning component of communication is irrelevant to its engineering problem. To the extent that Facebook's News Feed is being regarded as the logical conclusion of the theory.

Tony Schwartz of the resonance theory of communication fame, circa 1970s, is another thought leader cited by Carr for having anticipated Facebook's introduction of News Feed. It was Schwartz's proposition that, with people having more information that they can handle in an age of mass media, what would be needed was to activate the information and attendant emotions already present in their memory. Carr sums up Schwartz's maxim: a successful message doesn't deliver meaning; it calls forth meaning.

Featuring in the book are two other significant exponents of the dynamics of media communication in democracy: Walter Lippmann and John Dewey. Both had lived long before the advent of today's digital information order, but their views have profound resonance with the interface of democracy and mass media. Walter Lippmann invoked democracy's founding ideal of a well-informed citizenry, but to his mind, that was bound up with a simpler world. Today, however, the real environment was much too complex, and the public's understanding of social and political issues was fated to be incomplete and distorted; the common tendency, therefore, was for individuals to create a mental pseudo-environment out of stereotypes so that they remained open to confusion, bias and manipulation by messages and images. Lippmann thus foresaw with an acuity of vision the perils of social media and the disutility of excess generation of information for the health of democracy. John Dewey, on his part, believed in the beneficent phenomenon of more information leading to greater popular enlightenment and genuine democracy. Carr's judgment on their divergent views that represent two opposing schools of thought on the public's role in sustaining democracy under the new technologies of mass communication today is unequivocal: "Dewey told us what we want to hear. Lippmann told us what we need to hear".

Carr makes the point that with digitisation, communication has lost its human scale. He locates the onset of this historic shift in Facebook's introduction in 2006 of its News Feed, which provided members, on the basis of a statistical analysis of their past behaviour as well as of people like them, a continuous, customised stream of posts and updates. News, entertainment, conversation and all other forms of human expression were now all levelled off into "content", automatically chosen by an algorithmic code which performed the editorial function. As well as efficiency in the processing of information for consumption of its mass membership, the feed algorithm performed another function that would now characterise the digital media, namely, matching messages to individuals' emotional preferences and traits, even as the proclaimed mission of the media was that of mere information processing. With that went human deliberation and judgment in evaluating, selecting

and sharing information and in came replacement of "personal agency with machine agency", maximising the grabbing and holding of members' engagement being the single objective. Carr goes on to describe how News Feed, by rapidly becoming the template for not only other social media platforms but traditional media companies with online product offerings, culminated the industrialisation of communication with its extensive consequences, particularly the emergence of social media as a machine with unrivalled productivity for harvesting attention. It's mode of dissemination of content with ramifications like content moderation and fact checking is critically dealt with at great length in the book, underlining its bias for what grabs attention and its potential for promotion of divisiveness and unwholesome trends in public opinion making.

Carr compares the distancing that social media companies like Facebook, My Space and YouTube do from the problems arising from their kind of information engineering to what snack food and tobacco companies do about the social and medical consequences of their own product engineering. So much so that when at a Congressional hearing in 2018 Zuckerberg was asked whether Facebook was a media company, he responded with a straight face that he considered it as a technology company. A touch of insouciance one might say, given the fact that his company's algorithms decided for the millions of its members what content it provided, the form it takes and how it is interpreted.

The Internet is indeed viewed by Carr as marking the advent of a new era in communication. Parallel with the phenomenal change that it made to dissemination of information has been the Internet's effect on the language of communication itself. This language, while assuming forms and styles in email different from conventional letter writing, was developed mainly by the younger generation rather than by technology or industry, particularly in mobile phone communication by texts. Texting itself has been a revolution of sorts in language, enabling people to exchange written messages in real time with spillovers into youth socialising, culture and self-expression. Media companies stand to benefit because accelerated consumption of messages gives them more space for advertisements and sponsored posts. Carr, however, points out the grim and indeed long-term downside of textspeak. Its hallmark of compressed style - the "cult of concision" - has not only come to characterise much of the expression on social media platforms, but the thought processes behind text-speak are such as to work out to the detriment of reasoned analysis or capacity for contemplative enquiry, hardly auguring well for humankind's future.

Bonding through social media, central as it is to the digital world, features in Carr's exegesis on technologies of connection. His critique is mostly on familiar lines, that the severance of the link between social proximity and physical proximity has been positive in that socialising through a computer or phone screen is as easy and there is room for love and care. But he argues, with support from findings of several surveys, that human psyche is hardwired for physical interaction and is at odds with the disembodied social scene that the Internet has confected. With the advent of social media, he feels that it is inevitable that we end up knowing more about people, which is social media's way of sharing and caring, and also more likely, that we end up disliking them because of it.

In the final analysis, however, the Internet, as "the first true multimedia system able to handle sound, pictures and video images as well as text", in the words of Carr, holds the centre stage today in global connectedness and conversation and hence what it means for the democratisation of societies must be the paramount concern. Evocations of the transformative role of the Internet seldom fail to hark back to its original acknowledgement as a new kind of democratic community embodying promise of a renewed spirit of a meaningful social engagement. Such lofty expectations of the Internet had much to do with the optimistic view of communication technology, which in the case of the net prompted the erroneous belief that a more open and efficient media would necessarily promote democracy. But more significant is Carr's diagnostic that such a belief also precluded society from a clear assessment of the risks posed by the net and thereafter by social media, thus ruling out public discussion of legal and regulatory options that could have mitigated some of the technology's adverse effects.

So, in Carr's telling, social media has today matured as a mechanism of communication and business. It is leveraged by news feeds, sharing buttons, filtering algorithms, dispensing personalised content and users shifting from websites to mobile apps. On the supply end of the network, users work as content producers, churning out endless streams of posts and comments that provide the platforms with enormous quantities of engaging content for free. On the network's demand end, they play the more traditional role of audience members, though the content they receive is tightly geared to their individual tastes and biases. Carr cites research finding that false or otherwise misleading stories are more likely to be retweeted on the social media than factual ones. But polarisation and extremism that we see online are not manufactured out of nothing by algorithms. They are rather expressions of deep-seated tendencies in human nature that have always strained social relations and political debates. In placing the blame for the Internet's failings on social media companies, we let the net itself off the hook while absolving ourselves of complicity and ignoring the responsibility of commercial interests, technology and human nature for the situation.

Examining at length how the new communication technology reshapes social relations in general, Carr cites data to show that as of 2012, half of American teenagers said that they would rather socialise with friends through screens than in person, the percentage reaching two-thirds by 2018. Americans are seeing more and more of their youth in "social isolation", with patterns of social engagement thus established likely to continue. In-person social interaction being essential for health and longevity, such isolation exacts a heavy toll on individuals and society. Benefits of online interaction are offset much by absence of aspects of in-person interpersonal interaction, such as touch, simultaneous expressions and mutually experienced environment. There is now substantial evidence that social media is a substantial cause, not just a tiny correlate, of depression and anxiety, but confirmed by longitudinal studies of young people's attitudes and behaviour.

Turning to the current moment where, going beyond editing content, the computers are about to enter the even more important line of work of generating the content themselves and humans extending the blessing of speech to machines, Carr portrays Large Language Models (LLMs) like ChatGPT and Google's Gemini as clairvoyants. These mediums bring the words of the past into the present and the power the chatbots, not by creating text out of nothing but drawing on a vast corpus composed of billions of documents, a digitized Spiritus Mundi, through a complex, quasi-mystical statistical procedure blending all those old words into something intelligible to and requiring interpretation by a human interlocutor. AI may be the monster that puts an end to us. With generative AI, the technological takeover of media is complete as machines create vast new and low-cost content, choose who will see it and deliver it. While we would continue to have plenty of journalists and novelists, what the AI is churning out is already intelligible and pleasing to us, and that is what counts. On the other hand, it is going to be difficult to figure out whether the content will not be handled by AI solely or in association with AI or whether people will come to prefer the AI productions. By combining LLMs with feed algorithms, Meta and other social media companies would not only be able to automatically produce content tailored to the tastes and desires of individuals but also enter into new and deeper kinds of relationships with users. To have a flighty oligarch, or any individual control a large language model connected to a major social media platform, raises unsettling questions about the future of the public square and of democracy itself. Moreover, social media platforms could provide powerful tools for the enforcement of cultural and political orthodoxy.

As to metaverse, the range of its possibilities as a technology of connection is enormous: in Carr's words, building online worlds that make life and work and love wonderful; to escape the physical world and the earthly fictions of production and exchange; to liberate materialism from material; to offer virtual surfing, virtual fencing and virtual games, so that people could fly over cities and through buildings, and celebrities might be brought in living rooms for the odd chat.

All of which provide humans, as cognitively gifted mammals who are forever seekers craving for mental stimulation and as socially obsessed mammals

who crave connection and status, the power to reach out to new frontiers in experiences and sensations. The media business has always sought to indulge and capitalize on such human quest for that power. In the new media-centred world, therefore, existence has dissolved into information and communication. Humans become, whether they realise or not, simulated beings governed by the principle of simulation rather than the outdated reality principle. But it was the net that brought us inside the simulation, as earlier we couldn't actually enter simulation; with social media we became active participants in media productions rather than mere observers of them. And then the smartphone told us that we never had to leave the simulation. The overriding goal of social platforms has from the start been to find new and more efficient ways to feed us novelty, thanks to the major design innovations that shaped the social media interface - the pull-to refresh function the infinite scroll, the multidirectional swiping, the auto play routines, all intended to make seeking easier and more efficient. The compulsion to discover new stuff once required us to go out and walk around. It is now gratified with a flick of a finger and the algorithms make sure that our seeking is always productive. Even if we are not looking for anything in particular, we are always finding what we want. And in the universe of the metaverse and the net, the real world can't compete with the virtual; compared with the programmed delights of the virtual, it feels dull and lifeless. Let us face it - reality wasn't designed from the bottom up to make us happy, which becomes possible under virtual existence.

According to Carr, however, it remains to be seen whether virtual-reality and augmented-reality eyewear such as Meta's Quest, Apple's Vision and Ray-Ban's smart glasses eventually catch on with the masses; consumers so far have been wary of ceding control over their field of vision to corporate coders, but in the development and promotion of such hardware we see yet more signs of society's retreat from the real.

In the part of the book discussing the possibility of restraining social media platforms, Carr dwells on the EU rules of control, but observes that they have not really changed the way social media operates for the simple reason that they haven't changed the behaviour of most users; consumers have grown used to trading personal information for tailored products and services, particularly in the case of TikTok. As for antitrust actions, they are also unlikely to change social media's workings by pushing media off the technology path it is already on. The next wave of innovations - the LLMs, more efficient content generation and censorship systems, more precise eye trackers and body centres, more immersive virtual worlds, faster everything - will only drive humankind further into the emptiness of hyper reality. There is also the idea of dismantling of the existing technological system and rebuilding it in a more humanistic form, as being attempted by social media's would-be reformers, but these would still raise free speech and free press concerns and prompt rebellion against what many people would consider as patriarchal overreach or nanny - state meddling.

According to Carr, the biggest obstacle to regulation and control is likely to be the habits of social media users themselves. Once people adapt to greater efficiency in any practice or process, a reduction in efficiency, whatever the rationale, feels intolerable. As technology becomes entwined in society's workings, it resists alteration. Society shapes itself to the system rather than the other way round. In the 1990s, when the Internet was just beginning its transition to a commercial network, laws could have been passed and regulations imposed that would have shaped the course of its development and, years later, influenced how social media works, applying public interest, making companies legally responsible for the information they transmit.

Other proposals of restraining social media platforms Carr puts under the title of "desirable inefficiencies" that would need to be inducted into the technologies of communication. These include setting of limits on the number of times or the number of people a message could be forwarded to, a delay of a few minutes or addition of a few clicks before appearance of a post on a platform, requirement of a variable fee for broadcast of a post or message to more than a thousand recipients, outright ban of infinite scrolls, auto play functions and personalised feeds and advertisements and the like. Beyond these,

according to Carr, it is too late to rethink the system created by the Internet.

Carr's work has as its chief merit the fact that it is a meta-narrative of the role of technologies of connection in the modern world. Its sweep is impressive, even if for the most part the generalisations it makes rather apply to the history of the US as well as to the future of communication media in that country. The US experience is indeed important, even crucial, but neglect of the impact of the technologies on the rest of the world does detract from the book's value as a comprehensive source of reference on its theme. In fact, the Internet today shows every sign of becoming a multinet, with national legislation and regulatory practices increasing the diversified nature of its operations. The cluster of narratives of the book on different aspects of the communication media, particularly social media, provides much information and insights on their evolution. Even if media studies already add up to an extensive academic discipline and Carr's analysis of the various theories may not yield to the readers much that is new on them. But Carr, for his part, does a commendable job on the future outlook for the technologies of connection and the momentous issues they pose to humankind.

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Selection of candidates will be based on academic records, work experience, if any, marks secured in the Entrance Examination, and interviews conducted at XIME, Bangalore. Fulltime Research scholars will be eligible for stipend as per the rules of the institute. Ph.D. Candidates will have to pay the prescribed fees of XIME as well as the University. For details of the fees applicable from 1st of August 2023 and rules governing payment of stipend please visit www.xime.org.

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Shaping Future Leaders

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