ISSN: 0973-9335 • April - June, 2025 • Volume 30 • Issue 2

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The Journal of Indian Management & Strategy

"J-Gate, EBSCO Discovery, Summon (Proquest), Google Scholar, Indian Science Abstracts, Indian Citation Index (RII - 0.016), InfoBase Index (IB Factor 2016 - 2.6), SJIF Impact Factor 2016 - 4.756, Cosmos Impact Factor, Emerging Sources Citation Index (Thomson Reuters), Web of Science."

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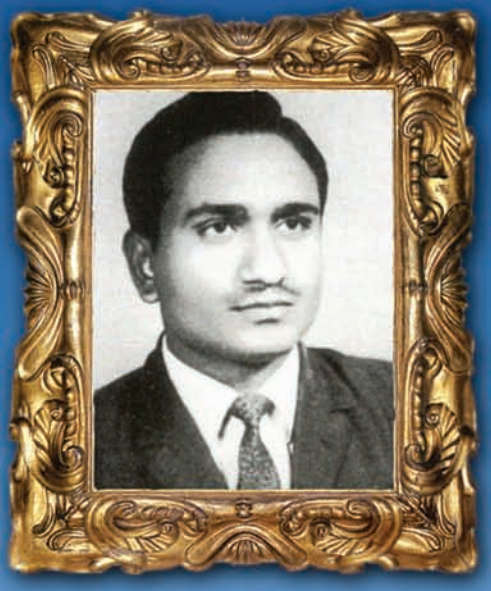
A TRUE VISIONARY

"You see things and you say **Why***? But I dream of things that never were and say* **Why** *not?"*

- George Bernard Shaw



Shri Jagannath Gupta
(1950 - 1980)

Also a true visionary...who dared to dream!
He lives no more but his dreams live on....and on!

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And more dreams to come!

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Available Online at www.indianjournals.com
RNI No. 64562/96
Online ISSN No: 0973-9343
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Editor's Desk

The Escalating Trade War – A Global Economic Standoff

As the world braces for another wave of economic uncertainty, the ongoing trade tensions between the United States and key global players—most notably China and India—have intensified. What began as tariff skirmishes has evolved into a full-blown trade war, disrupting global supply chains and reshaping international alliances.

At the heart of the U.S.-China trade dispute lies strategic rivalry. The U.S. accuses China of unfair trade practices, intellectual property theft, and state-sponsored industrial overreach. In response, Washington has imposed a slew of tariffs and export restrictions, particularly targeting China's tech sector. Beijing has retaliated with tariffs of its own, aiming at American agriculture and manufacturing. As both nations dig in, the global tech and semiconductor industries find themselves caught in the crossfire, with long-term consequences for innovation and investment.

India, traditionally seen as a strategic partner for the U.S., is now facing friction on multiple fronts. Recent tariff hikes and tighter visa norms have strained bilateral ties. Washington's insistence on reducing trade deficits and protecting domestic industries has led to a more protectionist stance, even toward allies. Meanwhile, India is pushing back with its own tariffs and by strengthening trade ties with alternative partners in Asia and Europe.

This shift toward economic nationalism—be it America's "America First," China's self-reliance drive, or India's "Atmanirbhar Bharat"—signals a retreat from the cooperative globalism that defined the post-WTO era. While national interests are important, the danger lies in decoupling without a clear strategy for mutual growth.

In an interconnected world, no country operates in isolation. The current trade war may serve short-term political ends, but it risks long-term economic fragmentation. Global leaders must prioritize dialogue over discord, or risk turning trade disputes into lasting geopolitical rifts.

The world watches—not for who wins, but to see whether reason will eventually prevail over rivalry.

Madhu Vij

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THE ROLE OF EMPLOYEE EXPERIENCE AND ITS IMPACT ON JOB SATISFACTION – AN EMPIRICAL STUDY OF THE INDIAN IT INDUSTRY

Arushi Grover* Dr. Ginni Chawla**

Significance: *A 2021 survey by Willis Tower Watson suggested that organisations are witnessing a great employee experience awakening suggesting that 92% organizations are currently planning EX enhancements. This percentage has increased from 52% prior to the pandemic indicating the importance of this topic and the need to study the same.*

Purpose*: While multiple studies have been conducted on this topic, studies have shown limited region bias and have not been tested in the Indian IT Industry. This research paper intends to propose a model of employee experience, using perceived HR Practices, person-organisation fit and job satisfaction as the variables and empirically test it for Indian IT industry.*

Methodology*: The research paper uses the existing literature and proposes a conceptual model, which is then tested empirically surveying 386 employees from the Indian IT Industry. The questionnaire comprises of 48 items. The relationship between these variables were tested using reliability analysis, factor analysis, regression analysis and goodness of fit tests using SPSS and AMOS.*

Findings: *The results of the quantitative tests suggest that a significant positive relationship exists between perceived HR practices and person organisation fit, perceived HR practices and employee experience, perceived HR practices and job satisfaction, person organisation fit and employee experience, person organisation fit and job satisfaction, employee experience and job satisfaction. It also proves that the relationship between person organisation fit, and job satisfaction is partially mediated by employee experience. It further proves that the relationship between perceived HR Practices and job satisfaction is serially mediated by person organisation fit and employee experience. The research also proves that the suggested is model is a good fit for Indian IT Industry.*

Keywords : Employee Experience, Perceived Human Resource Practices, Job Satisfaction, Mediators, Person Organization Fit , IT Industry, Information Technology Industry
JEL Code: *J53, M12, J28, C50, J24, L86*

I. Introduction

Six! Yes, six is the number of generations that are currently working in organizations together. From the octogenarians, some of whom are still working and working into key global leadership roles, to the emerging Gen Alpha, who are pursuing their summer internships. In between are Generation X, Baby Boomers, Generation Y, and Generation Z (Pearce, 2024). The question that arises is how are we going to keep them all satisfied with their jobs, will one size fit all approach work, or is there a need for contextualization?

Human resource practices contextualized as per the needs of employees are imperative in today's world to enhance employee experience. A 2021 survey by Willis Tower Watson suggested that organizations are witnessing a great employee experience awakening, where 92% of organizations intend to prioritize EX enhancements in the next three years. This percentage had increased to 54% before the pandemic. Employers recognize the need to enhance their experience as they adapt to the new normal and are battling turnover and engagement challenges (Employee Experience Survey, 2021).

Building upon the existing literature, researchers in one of the previous papers have defined Employee Experience as 'the sum of interactions that are influenced by employees' perceptions of the individual and the organizational factors within the workplace' (Grover & Chawla, 2022). After studying the existing literature on Employee Experience, it was understood that even though many studies have already been conducted and still others are being conducted on the topic, major research gaps exist in the literature as a) a lot of inconsistencies, overlaps in the existing studies have been identified with regard to the conceptualization, antecedents,

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consequences and measures of employee experience; b) minimal studies have identified the interaction of an individual with their environment and have only considered environment as a factor while trying to understand employee experience; and c) limited studies have proposed and statistically tested a conceptual model in the context of the Indian IT industry leading limited region bias exists (Buys et al., 2019; Hellman et al., 2019; Ngwane, 2019; Richards, 2019; Santos & Garibaldi de Hilal, 2020).

Considering the above-mentioned research gaps, this study aims to a) understand the interlinkages between employee experience, perceived HR practices as its antecedents, job satisfaction as its consequence and person organisation fit, b) propose a theoretical model for employee experience using its antecedents, measures, and consequences, and c) empirically test and statistically validate the theoretical model elucidating the role of employee experience and establishing a relationship between perceived HR practices, person-organization fit, employee experience, and job satisfaction in the context of the Indian IT Industry. For this research, the researchers have referred to person organization fit theory from the domain of interaction psychology to understand the impact on an individual from his or her organization, establishing the need for contextualization of HR Practices according to individuals to create a pleasant experience. Malik et al. (2020) used Person Organization Fit Theory to showcase the personalization of HRM Practices to enhance employee experience (Malik et al., 2020). To meet this objective, the researchers conducted a literature review of employee experience and person organization fit, to propose and test an empirical model that suggests that experience is an interaction of the person and his/her environment, which in this case is the organization; HR Practices available in the organization lead to a better person organization fit, leading to a pleasant experience, which in turn leads to job satisfaction.

Quantitative research methodology and convenience sampling techniques were used to collect data from five IT organizations covering various geographies within India. Reliability tests, factor analysis, regression analysis, and goodness-of-fit tests were performed using SPSS and AMOS to empirically test the proposed model. The research paper is broadly divided into the following sections: introduction, literature review, present study and research hypotheses, materials and methods, results and discussions, implications, limitations, and conclusions.

II. Literature Review

2.1 Employee Experience

Experience, as explained by Dewey, is a double-barrelled fact that includes both experience and experience (Dewey, 1958). The authors found 16 varying definitions from 13 different articles and curated three themes of employee experience. These themes are i) Experience as a 'Sum of Employee Perception about Workplace Interactions' ii) Employee Experience as a 'Connection, Meaning and Impact of Work in the Workplace', and iii) Employee Experience as 'Passion & Purpose, Two Way Contract & Impact via Technology (Grover & Chawla, 2022). The researchers in one of the previous papers has defined Employee Experience as 'the sum of interactions that are influenced by employees' perceptions of the individual and the organizational factors within the workplace' (Grover & Chawla, 2022). This definition tries to explain that employee experience is a phenomenon specific to everyone. This experience is shaped by what an employee perceives of its interactions with the organization. Therefore, while organizational policies and practices are the same for all employees, the impact and perception of each of these policies and practices on individual employees is the fundamental factor in creating an experience (Grover & Chawla, 2022).

While considering the predictors or antecedents of employee experience, we came across a 1999 research study that tested the impact of family and medical leave policies on the experience of an employee (Grosswald & Scharlach, 1999). Another study in 2015 explored the impact of the relocation policy on the experience of an employee in a work scenario (Rothe et al., 2015). A Gartner study indicated that various human resource practices such as the introduction of remote work policies, flexi work options, extensive onboarding programs, upskilling and development programs, organization redesign, technology upgrades for employees, and performance management policies and processes impact employee experience (Gartner, 2020).

In another study by Soni et al. (2017) it was stated that a significantly positive relationship between employee experience and job satisfaction (Soni et al., 2017). Lee and Kim (2023) in their research affirmed that employee experience significantly impacts job satisfaction and stated that the positive experience of employees is a significant contributor to increasing job satisfaction, in turn reducing stress. It also promotes well-being leading to enhanced levels

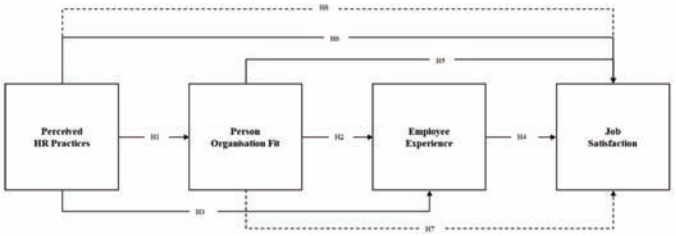
of engagement (Lee & Kim, 2023). Porkodi and Ahmad (2024) empirically tested whether employee experience greatly affects satisfaction (Porkodi & Ahmad, 2024). Another study showed that employee experience has a positive and significant influence on job satisfaction (Dwidienawati et al., 2024). Meybodi et al. (2024) identified organization commitment as one the key contributing factors towards employee experience. This commitment transcends the mere performance of KRAs and KPIs and creates a feeling of pleasure and job satisfaction (Meybodi et al., 2024).

III. Present Study & Research Hypothesis

The relationship between an individual and its organization can be explained through Interactional Psychology (Magnusson, 1990). Person organization fit or PO fit, which is a subset of the Person Environment Fit, is the match between organizations and persons that occurs either due to the needs of one entity being provided by the other, that is, a needs-supply fit, or both entities share similar fundamental characteristics, or both conditions exist (Bretz & Judge, 1994; Cable & Judge, 1997; Kristof, 1996; Kristof-brown & Guay, 2005). This implies that, in any organization, everyone has a unique experience of fit. This experience of fit results in individual-level outcomes (Kristof-brown & Guay, 2005). Malik et al. (2020) used Person Organization Fit Theory to showcase the personalization of HRM Practices to enhance employee experience (Malik et al., 2020). Kristof-brown and Guay (2005) suggested that positive experience is due to the fit or match between the person and his/her environment, which in this case is the organization. According to a research study by Vancouver and Schmitt person organisation fit has a significantly positive relationship with job satisfaction (Edwards & Cable, 2009; Vancouver & Schmitt, 1991). Many studies have examined the relationship between the combination of several perceived HRM practices, Person Organisation Fit, and job satisfaction. They discovered that human resource practices influence job satisfaction and person-organization fit (Boon et al., 2011; Gould-Williams & Mohamed, 2010; Mostafa & Gould-Williams, 2014). Boon et al. (2011) shared that HR practices such as recruitment, onboarding, and performance appraisal are mechanisms that communicate the organizations' values and philosophies to employees and enable the match between employees and their organizations (Boon, Hartog, & Boselie, 2011). Therefore, employees who perceive the presence of HR practices tend to understand the organization's values, expectations, demands, and desired behaviours. This fit between the employee and the organization leads to the emergence of pleasant feelings of belongingness, happiness, and purpose (de Sousa & Porto, 2015; Ucar et al., 2021; Xu et al., 2023). According to the IBM Employee Experience Index and King et al., these pleasant feelings can be grouped under the term Employee Experience (IBM & Workhuman, 2019; King et al., 2018). This group of positive feelings or pleasant experience enables employees to voluntarily take up more responsibility, making them content with their job, which in turn increases job satisfaction (Chen & Fulmer, 2018; Itam & Ghosh, 2020b; Soni et al., 2017). Kristof-brown and Guay (2005) suggested that a positive experience is due to the fit or match between the individual (employee) and his/her environment (organization).

This model contributes uniquely by suggesting that experience is not a one-way concept but a two-way interaction between the experiencer (employee) and the environment (organization). It is the perception of the environment by the experiencer, which establishes the level of fit that the experiencer feels with their environment, leading to the emergence of pleasant feelings of happiness, belongness, and purpose. Therefore, how an experiencer perceives his or her environment is specific to the individual and not generic to the environment. The emergence of these pleasant feelings in the context of an employment scenario enables the experiencer to feel more content with their job, which, in turn, increases job satisfaction. Refer to Figure 1 to understand the proposed model.

Figure 1: Proposed model tested empirically



Source: Author

In our model, **Perceived HR Practices** are defined as a collection of Human Resource Practices carved around recruitment and onboarding, skill and career development, compensation and benefits and rewards, and recognition practices of an organization. **Person Organisation Fit** also known as P-O fit, is the match between an organization and an employee that occurs due to the congruence of an employee's values with the organization's values. **Employee Experience** is defined as the 'sum of interactions that are

influenced by employees' perceptions of the individual and the organizational factors within the workplace' (Grover & Chawla, 2022). **Job Satisfaction** is defined as a phenomenon that determines how satisfied an individual is with their job. To test this model, researchers coined the following hypothesis:

3.1 Perceived HR Practices and Person Organisation Fit

Various researchers have suggested that human resource practices are positively associated with employees' P–O fit (Boon, Hartog, & Boselie, 2011; Mostafa & Gould-Williams, 2014). These studies provide insights into the impact of employees' perceptions of human resource practices on their sense of P–O fit. According to Rousseau and Greller (1994), HR practices are employees' way of obtaining information about the organization (Rousseau & Greller, 1994). Hence, we can propose the hypothesis **H1: Perceived HR Practices have a significant relationship with Person Organisation Fit**.

3.2 Person Organisation Fit and Employee Experience

According to a thought leadership article by IBM and Workhuman (2019), Employee Experience can be measured by taking into consideration a 5 dimension framework consisting of facets such as 'Belonging – feeling part of a team, group or organization, Purpose – understanding why one's work matters, Achievement – a sense of accomplishment in the work that is done, Happiness – the pleasant feeling arising in and around work and Vigor – the presence of energy, enthusiasm and excitement at work'(IBM & Workhuman, 2019, n.d.,p.3). This measure of Employee Experience was also used by King, Durai and Madhangopal in their research (King et al., 2018)

Han et al. (2015) argue that PO fit contributes to creating a sense of belonging in employees by making them feel insiders to the organization and the organization as a comfortable home. An empirical study by Rahmayanti and Ellya Kurniawan (2020) suggests that P–O fit is positively associated with feelings of belongingness to an organization (Rahmayanti & Ellya Kurniawan, 2020).

In another research study, Sousa 2015 suggested that PO fit affects happiness at work. This indicates that organizations with employees with values similar to organizational values tend to be happier at work (de Sousa & Porto, 2015).

A study by Xu et al. (2024) stated that the compatibility between an individual and the organization lays the foundation for the emergence of a sense of calling or purpose. Only when employees feel a match of their values with the organizational values is they more focused and engaged in their work, which in turn translates into love for their work, over a period of time emerging into a sense of calling and purpose (Xu et al., 2023). Hence, we coined the following hypothesis: **H2: Person Organisation Fit has a significant relationship with employee experience**.

3.3 Perceived HR Practices and Employee Experience

Multiple studies have shown that HR Practices are key variables that lead to employee experience. Mccallaghan (2023) examined the impact of diversity and inclusion practices on belongingness and acceptance in the workplace (Mccallaghan, 2023). Mishra and Bhattacharya (2021) suggested that human resource strategies used by a company are linked to the concepts of staffing, employee experience, and employer branding (Mishra & Bhattacharya, 2021). Joshi (2023) suggests that perceived skill development, salary, and growth are important employee experience factors (Joshi, 2023). Rothe et al., (2015) studied the impact of relocation practices on employee experience (Rothe et al., 2015). Various researchers have studied the impact of job crafting and skill development on employee experience (Kumar & Kumar, 2023; Masood et al., 2023; Rozkwitalska, 2019). Researchers have also studied how flexible working arrangements affect employee experience (Cañibano, 2019; Mcdonald & Shakespeare-finch, 2013; Shah & Gregar, 2014). Hence, we propose hypothesis **H3: Perceived HR practices have a significant relationship with Employee Experience**.

3.4 Employee Experience and Job Satisfaction

Itam and Ghosh stated in their research paper that HR strategies such as benefits, career development and planning, rewards and reinforcements, and other engagement strategies facilitate enduring employee experiences, resulting in an emotional bond formed between them. This leads to higher job satisfaction, motivation, performance, and retention (Itam & Ghosh, 2020b). Chen and Fulmer (their research tested the impact of employees' experience on flexible work arrangements and job satisfaction (Chen & Fulmer, 2018). Hence, we propose hypothesis **H4: Employee Experience has a significant relationship with Job Satisfaction**.

3.5 Person Organisation Fit and Job Satisfaction

Vancouver and Schmitt (1991) by surveying 356 principals and 14,721 teachers, found that goal congruence was positively associated with job satisfaction (Vancouver &

Schmitt, 1991). Verquer et al. (2003) reviewed 21 studies to understand the relationship between P-O fit and job satisfaction (Verquer et al., 2003). Silverthorne (2004) empirically tested this relationship using a sample of 120 subjects in Taiwan, and suggested that a significant relationship exists between the level of fit and the level of job satisfaction that an employee experiences within the organization (Silverthorne, 2004). Hence, we can coin the hypothesis, **H5: Person Organisation Fit has a significant relationship with Job Satisfaction**

3.6 Perceived HR Practices and Job Satisfaction

In 2008, when Gurbuz 2009, tested the relationship between HR Practices and job satisfaction and found a significant relationship between the two variables (Gurbuz, 2009). In 2012, Jyothi and Ravindran conducted a study of 264 individuals from the ITeS industry in Bangalore and found that a significant relationship exists between HR Practices and Job Satisfaction (Jyothi & Ravindran, 2012). Bhatt and Rana (2023) and Klerk et al. (2020) suggest that flexible work practices enhance employee experience (Bhatt & Rana, 2023; Klerk et al., 2020). This allowed us to formulate hypothesis **H6: Perceived HR Practices have a significant relationship with job satisfaction.**

3.7 Person Organisation Fit to Job Satisfaction via Employee Experience

According to the existing literature, Employee Experience results in Job Satisfaction (Chen & Fulmer, 2018; Yohn, 2016) also and the Person Organisation fit leads to Job Satisfaction (Edwards & Cable, 2009; Vancouver & Schmitt, 1991). Fit theories also suggest that both the person and the organization can significantly affect an individual's behaviours and organizational outcomes. As stated in the paragraphs above, Person Organisation Fit is positively associated with creating a feeling of belonging, happiness, and purpose (de Sousa & Porto, 2015; Ucar et al., 2021; Xu et al., 2023), all of which are components of employee experience (Lesser et al., 2016), therefore it can be interpreted that Person Organization Fit positively relates to experience. Lewin's field theory (Burnes & Cooke, 2013) explains that when an individual experiences a positive environment, they tend to display positive outcomes in return; hence, it is correct to coin hypothesis **H7: Person Organisation Fit has a significant relationship with job satisfaction via mediation from employee experience.**

3.8 Perceived HR Practices to Job Satisfaction via Person Organisation Fit and Employee Experience

Kristof (1996) defined person organization fit as the 'match between employees and organizations that occurs either when at least one entity provides what the other needs, or they share similar characteristics or both' (Kristof-brown & Guay, 2005). According to psychological contract research, human resource practices are ways in which employees understand their employment terms (Rousseau & Greller, 1994). The fit of demands and supplies and the level of similarity are likely to be affected by the underlying characteristics of the organization (Kristof, 1996) , which are communicated through these human resource practices (Bretz & Judge, 1994). It is suggested that it is preferable to consider integrated sets of HR practices instead of separate HR practices (Arthur, 1994). These practices include areas such as skill development, incentive policies, and participation opportunities (Bailey et al., 2014). The reactions to these HR systems are different for different individuals, as they are dependent on the values, preferences, and experiences of everyone. Wright and Nishii (2014) in their research proposed that it is not the conceptualization of HR practices, but rather how employees experience HR practices that will affect employee outcomes (Wright & Nishii, 2014). This value and goal congruence with the organization creates a pleasant feeling for employees and generates a feeling of happiness, belongingness, and calling or purpose (de Sousa & Porto, 2015; Ucar et al., 2021; Xu et al., 2023), all of which are measures of employee experience (IBM & Workhuman, 2019; King et al., 2018). This pleasant feeling also makes employees respond to the organization by taking ownership initiatives and showing enthusiasm for their employer, leading to job satisfaction (Chen & Fulmer, 2018; Itam & Ghosh, 2020b; Soni et al., 2017). Hence, we can coin hypothesis H8: Perceived HR Practices have a significant relationship with job satisfaction via person organisation fit and employee experience.

Table 1: Summary of Research Hypothesis

S. No.	Hypothesis Created
H1	Perceived HR Practices have a significant relationship with Person Organisation Fit (PO Fit)
H2	Person Organisation Fit (PO Fit) has a significant relationship with employee experience
H3	Perceived HR practices have a significant relationship with Employee Experience
H4	Employee Experience has a significant relationship with Job Satisfaction
H5	Person Organisation Fit (PO Fit) has a significant relationship with Job Satisfaction
H6	Perceived HR Practices have a significant relationship with Job Satisfaction
H7	Person Organisation Fit (PO Fit) has a significant relationship with Job Satisfaction via mediation from employee experience.
H8	Perceived HR Practices have a significant relationship with Job Satisfaction via Person Organisation Fit and Employee Experience

Source: Author

IV. Materials and Method

4.1 Measures

The inventory for this study was conducted by referring to existing inventories in the literature. Table 2 presents the inventory structure.

Table 2: Structure of the Inventory

Sections	Coding of the items	Type of items
I	DM01 - DM 9	Demographic profile of the respondents
II	HR_01 - HR_24	Perceived HR Practices
III	PO_01 - PO_05	Person Organisation Fit
IV	EX_01 - EX_09	Employee Experience
V	JS_01	Job Satisfaction

Source: Author

Section I captured the respondent's demographic profile comprising of 9 items.

Section II comprised of 24 items associating with types of perceived HR Practices i.e. 4 items for recruitment & selection (Alajmi & Alenezi, 2016), 3 items for Onboarding (Boon, Hartog, & Boselie, 2011), 2 items for Career Growth, 3 items for Compensation (Boon, Hartog, & Boselie, 2011), 1 item for Manpower Planning, 1 item for Job Security, 2 items for Learning & Development (Boon, Hartog, & Boselie, 2011), 2 items for Performance Management & Development (Alajmi & Alenezi, 2016; Gould-Williams & Mohamed, 2010), 2 items for Work–Life Balance (Boon, Hartog, & Boselie, 2011), 2 items for Rewards & Recognition (Saks, 2006) and 2 items for Inclusion & Diversity (Lima et al., 2016).

Section III comprises the types of fit an individual experiences with the organization, that is, complementary and supplementary fits. Supplementary fit is one in which the values of an individual match the values of the organization. A complementary fit is one in which the needs of the organization are complemented by what the employee has to offer. This section has five items, inclusive of 3 items for supplementary fit and two items for complementary fit (Grobler, 2016).

Section IV comprised nine items, wherein two items responded to belongingness (Jena & Pradhan, 2018; Malone et al., 2012), two items responded to happiness (Hills et al., 2002; Singh & Aggarwal, 2018), two items for purpose (Steger, 2017), one item for achievement (Hayday, 2014) and two items for vigour (Schaufeli et al., 2006).

Section V comprises one item that corresponds to job satisfaction (Gould-Williams & Mohamed, 2010).

The inventory consisted of 48 items. All the items for perceived HR practices, person organization fit, employee experience, and job satisfaction were rated on a 5-point Likert Scale. The labels used for the items were strongly agree, agree, neutral, disagree, and strongly disagree.

4.2 Sampling and Data Collection

A finite sample of employees in the Indian IT Industry was chosen for this study. This study used purposive convenience sampling. The overall employment in the IT industry worldwide is about 28 lakhs, and in India, there are about 17 lakhs. The Sample Size considering a 99% confidence level, with an error of +_.075, was $n=\frac{1Z^2}{4e^2} = 296$ individuals. The bias caused by missing data was reduced by deleting responses with incomplete or missing data.

Data were collected through an online Google survey form administered via web mail to full-time employees of five privately owned IT Organizations spread across India. Along with the questionnaire, a covering letter explicitly stating the objectives of the study was added as a pre-curser for the concerned respondents, who were informed that the ratings were for academic purposes only and that the complete confidentiality of the responses was maintained. A total of 400 responses were gathered from five IT Organizations in India. Of the 400 responses, 14 were removed because of missing values, leaving us with 386 valid responses. The responses were then coded, and raw data were entered into SPSS version 25 (statistical software) for further analysis.

V. Results and Discussions

5.1 Respondent's Profile

An overview of the sampling population is provided in Table 3 using the frequency and corresponding percentage distribution.

Table 3: Respondent's Profile

Managerial Level		
	Frequency	Percent
Junior Management	127	32.9
Mid Management	133	34.5
Senior Management	126	32.6
Total	386	100.0
Salary Bracket		
	Frequency	Percent
Less than 40000	119	30.8
40000 to 80000	8	2.1
80000 to 120000	42	10.9
120000 to 160000	49	12.7
160000 to 200000	118	30.6
More than 200000	50	13.0
Total	386	100.0

Educational Level		
	Frequency	Percent
Undergraduate	56	14.5
Graduate	297	76.9
Postgraduate	33	8.5
Total	386	100.0
Age Group		
	Frequency	Percent
less than 25 years	103	26.7
25 to 35 years	192	49.7
35 to 45 years	91	23.6
Total	386	100.0
Gender		
	Frequency	Percent
Female	262	67.9
Male	124	32.1
Total	386	100.0
Married/Unmarried		
	Frequency	Percent
Married	241	62.4
Single	145	37.6
Total	386	100.0
Work Model		
	Frequency	Percent
Complete Work from Home	28	7.00
Complete Work from Office	239	62.00
Hybrid Model (Partial Work from Home & Partial Work from Office)	119	31.00
Total	386	100.0
Overall Experience		
	Frequency	Percent
less than 5 years	175	45.00
5 to 10 years	83	22.00
10 to 15 years	86	22.00
20 to 25 years	41	11.00
more than 25 years	1	0.00
Total	386	100.0
Tenure in the Organisation		
	Frequency	Percent
Less than 2 years	155	40.2
2 to 4 years	63	16.3
4 to 6 years	43	11.1
8 to 10 years	85	22.0
more than 12 years	40	10.4
Total	386	100.0

Source: Created by the author using SPSS Output Sheet

5.2 Reliability Analysis

Table 4: Reliability analysis for all variables

Variable Name	Number of items	Cronbach's Alpha Value
Perceived HR Practices	24	0.952
Person Organisation Fit	5	0.885
Employee Experience	9	0.918
Job Satisfaction	1	NA
All the items together	39	0.967

Source: Created by the author using SPSS

As can be seen in the table 4, the Cronbach's alpha value for each variable is greater than 0.8, implying that the data are reliable (Nunnally & Bernstein, 1994).

5.3 Factor Analysis

Exploratory Factor Analysis (EFA) was used in the current study to create a precise scale for measuring HR practices, employee experience, person-organization fit, and employee outcomes. Principal component analysis with varimax rotation was used to identify contributing variables from a larger set of variables. To identify factors that should be extracted, Kaiser's criterion (eigenvalue >1) and the percentage of variance criterion were used (Hair et al., 2011). Therefore, if the factor has an eigenvalue greater than 1, it has been treated as significant, and if the extracted combination of factors accounts for at least 50% of the total variance, that is, retaining variables with strong factor loadings (greater than 0.5) has been followed.

Exploratory Factor Analysis for perceived HR Practices

Table 5a. KMO and Barlett's Test for Perceived HR Practices

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.940
Bartlett's Test of Sphericity	Approx. Chi-Square	7008.325
	df	276
	Sig.	.000

Source: SPSS Output Sheet

Table 5b. Variance Matrix for Perceived HR Practices

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.085	50.354	50.354	12.085	50.354	50.354	5.174	21.557	21.557
2	1.505	6.270	56.624	1.505	6.270	56.624	4.069	16.952	38.510
3	1.321	5.505	62.128	1.321	5.505	62.128	3.603	15.013	53.523
4	1.288	5.366	67.495	1.288	5.366	67.495	3.353	13.972	67.495

Extraction Method: Principal Component Analysis.

Source: SPSS Output Sheet

Table 5c. Rotated Component Matrix for Perceived HR Practices

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
The recruitment team was available and promptly answered my questions during the hiring process_HR_02	0.766	0.110	0.165	0.136
The recruitment team was in constant touch with me during the overall hiring process_HR_03	0.742	0.074	0.221	0.185
Post Joining, the buddy assignment process was effective and helped me navigate through the organisation_HR_04	0.728	0.145	0.162	0.279
The Selection and Hiring Process was extremely transparent_HR_01	0.647	0.325	0.111	0.183
The Induction Session was comprehensive and explained the policies and process of the organisation_HR_05	0.602	0.380	0.247	0.160
My manager was assigned to me within the first 2 weeks and was extremely responsive_HR_06	0.590	0.312	0.066	0.249
The selection process and employment in this organisation are based on clear and objective criteria_HR_018	0.560	0.491	0.306	0.178
Employees are given meaningful feedback regarding their individual performance on a regular basis in this organisation_HR_017	0.558	0.495	0.293	0.172
This organisation has proper policy for planning the number of employees required in the present or future in the workforce_HR_012	0.475	0.427	0.452	0.305
This organisation offers me career advancement/promotion opportunities_HR_08	0.428	0.349	0.405	0.382
This organisation offers me job security_HR_013	0.367	0.322	0.356	0.323
This organization gives equal career opportunity to employees regardless of gender, ethnicity, and so on_HR_023	0.153	0.764	0.043	0.326
The organization implements diversity and inclusion policy_HR_024	0.113	0.725	0.033	0.431
This organisation offers me the opportunity to develop new skills and knowledge for possible jobs in the future_HR_014	0.357	0.692	0.425	0.039
This organisation offers me the opportunity to develop new skills and knowledge for my current job_HR_015	0.390	0.687	0.338	0.039
There is a clear system for fair performance evaluation in this organization_HR_016	0.495	0.580	0.416	0.101
This organisation provides me a competitive compensation package_HR_010	0.210	0.120	0.859	0.239
This organisation provides me a fair compensation package_HR_09	0.208	0.118	0.847	0.243

This organization has a transparent compensation and incentive disbursement policy_HR_011	0.198	0.342	0.701	0.257
This organisation offers me opportunity to avail part-time working hours_HR_020	0.263	0.076	0.157	0.789
This organisation provides a reward or token of appreciation (eg a lunch, a cash amount, an amazon voucher) _HR_022	0.051	0.335	0.202	0.740
This organisation provides some form of public recognition (eg Felicitation During Celebratory Event, Organisation wide award announcement) _HR_021	0.326	0.286	0.254	0.681
This organization provides me opportunity to change my job profile/department during my organisational tenure_HR_07	0.375	0.067	0.326	0.576
This organisation offers me opportunity to avail flexible working hours_HR_019	0.451	0.204	0.307	0.495
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 9 iterations.				

Source: SPSS Output Sheet

Table 5a shows that the KMO test value was .940 (greater than .5) and the Bartlett's test of sphericity significance level was 0.000 (less than .05), indicating the appropriateness of the factor analysis. Table 5b reveals that four factors emerged from the factor analysis with eigenvalues greater than 1, explaining 67.49% of the total variance. Table 5c reveals four factors with significant factor loadings (greater than .3), adequately representing Perceived HR practices.

a) Exploratory Factor Analysis for Person Organisation Fit

Table 6a. KMO and Barlett's Test for Person Organisation Fit

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.839
Bartlett's Test of Sphericity	Approx. Chi-Square	1070.175
	df	10
	Sig.	.000

Source: SPSS Output Sheet

Table 6b. Total Variance Explained for Person Organisation Fit

Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.439	68.771	68.771	3.439	68.771	68.771
2	.557	11.143	79.913			
3	.476	9.519	89.432			
4	.319	6.373	95.804			
5	.210	4.196	100.000			
Extraction Method: Principal Component Analysis.						

Source: SPSS Output Sheet

Table 6c. Component Matrix for Person Organisation Fit

Component Matrix[a]	
	Component 1
My personal abilities, skills and education provide a good match with the demands that my job places on me_PEF3	.873
The things that I value in life are very similar to the things that my supervisor values_PEF5	.850
The match is very good between the demands of my job and my personal skills_PEF2	.847
My personal values match my organisation's values and culture_PEF1	.820
I get along well with the people I work with on a day-to-day basis_PEF4	.751
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Source: SPSS Output Sheet

Table 6a suggests that the KMO test value was .839 (greater than .5) and the Bartlett's test of sphericity significance level was 0.000 (less than .05), indicating the appropriateness of the factor analysis. Further, Table 6b shows that one factor emerged from the factor analysis with eigenvalues greater than 1, explaining 68.71% of the total variance. Table 6c reveals one factor with significant factor loading (greater than .3), adequately representing the Person Organisation. As only one component was extracted, the rotated component matrix table was not generated because the solution could not be rotated further.

b) Exploratory Factor Analysis for Employee Experience

Table 7a. KMO and Barlett's Test for Employee Experience

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.913
Bartlett's Test of Sphericity	Approx. Chi-Square	2288.003
	df	36
	Sig.	.000

Source: SPSS Output Sheet

Table 7b. Total Variance Explained for Employee Experience

Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.562	61.805	61.805	5.562	61.805	61.805
2	.850	9.443	71.248			
3	.630	7.003	78.252			
4	.474	5.261	83.513			
5	.408	4.536	88.050			
6	.387	4.300	92.350			
7	.310	3.442	95.792			
8	.197	2.191	97.983			
9	.182	2.017	100.000			
Extraction Method: Principal Component Analysis.						

Source: SPSS Output Sheet

Table 7c. Component Matrix for Employee Experience

Component Matrix[a]	
	Component 1
I am very happy at my organisation_EX3	.864
I have discovered work that has a satisfying purpose_EX6	.862
My work helps me make sense of the world around me_EX4	.853
I enjoy what I am doing at work_EX3	.843
I get a feeling of accomplishment from my job_EX5	.808
When I get up in the morning, I feel like going to work_EX9	.781
I feel connected with others at my organisation_EX2	.742
I use 'we/us' rather than 'they/them' when I refer my organisation to outsiders_EX1	.647
At my work, I feel bursting with energy_EX6	.633
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Source: SPSS Output Sheet

Table 7a suggests that the KMO test value was .913 (greater than .5) and the Bartlett's test of sphericity significance level was 0.000 (less than .05), indicating the appropriateness of the factor analysis. Table 7b reveals that only one factor emerged from the factor analysis with eigenvalues greater than 1, explaining 61.80% of the total variance. Table 7c reveals one factor with significant factor loadings (greater than .3) representing Employee Experience. Because only one component was extracted, the solution could not be rotated further; hence, a rotated component matrix table was not generated.

5.4 Hypothesis Testing

5.4.1 Testing Hypothesis amongst all variables

Table 8. Summary Table for the first six hypothesis tested

S. No.	Hypothesis Created	Durbin - Watson	R	R Square	p-value	Equation
H1	Perceived HR Practices have a significant relationship with Person Organisation Fit (PO Fit)	2.109	0.711	0.506	0.0000	PO Fit = 7.539E-17 + 1.422HR Practices
H2	Person Organisation Fit (PO Fit) has a significant relationship with employee experience	1.899	0.791	0.626	0.0000	Employee Experience = -7.568E-17 + .791Person Organisation Fit
H3	Perceived HR practices have a significant relationship with Employee Experience	1.843	0.696	0.485	0.0000	Employee Experience = -7.258E-18 + 1.393 HR_Practices
H4	Employee Experience has a significant relationship with Job Satisfaction	1.954	0.629	0.395	0.0000	Job Satisfaction = 3.764 + .644 Employee Experience
H5	Person Organisation Fit (PO Fit) has a significant relationship with Job Satisfaction	1.988	0.534	0.285	0.0000	Job Satisfaction = 3.764 + .547 Person Organisation Fit
H6	Perceived HR Practices have a significant relationship with Job Satisfaction	2.010	0.545	0.297	0.0000	Job Satisfaction = 3.764 + 1.115 HR_Practices

Source: Author

As observed in table 8, the Durbin Watson statistic value for all the tested hypothesis is lying between 1 and 3, implying the data is free from auto correlation effect. The value of R in the above table shows the strength of association between variables. The R2 value denotes the level of variability in the dependent variable due to the independent variable. The adjusted R2 value is very close to the R2 value and can be inferred that if the model were derived from a population rather than the sample, it would account for .2% less variance in the outcome. The regression analysis (critical p-value = 0.000) suggests a positive and statistically significant relationship between the dependent and the independent variable

5.4.2 H7: PO Fit has a significant positive relationship with job Satisfaction via employee experience and employee experience mediates this relationship.

Following the Barron and Kenny method, we conducted stepwise regression to understand the mediating influence of Employee Experience.

i) In step one, linear regression analysis was performed to identify whether the independent variable (X) was a predictor of the dependent variable (Y). In Hypothesis 5, we saw that Person Organization Fit is a predictor of Job Satisfaction and has a significant positive relationship, as mentioned in the equation below:

Job Satisfaction = 3.764 + .547 Person Organisation Fit

Hence the overall direct effect 'c' = .547

ii) Similarly, in step two, a linear regression analysis is performed to verify whether the independent variable (X) is a predictor of the mediating variable (M), that is, the person–organization fit, has a significant relationship with Employee Experience. In Hypothesis 2, we see that the Person Organization Fit has a significant positive relationship with employee experience with the equation below.

Employee Experience = -7.568E-17 + .791Person Organisation Fit

Hence the value of effect from Person Organisation Fit to Employee Experience 'a' = .791

iii) In step three, a regression analysis is conducted to predict the dependent variable (Y) from both the mediating variable (M) and independent variable (X). This implies that a regression analysis must be performed to predict job satisfaction from both the person-organization fit and employee experience. As mentioned in figure 2, the equation can be formulated as follows:

Job Satisfaction = 3.764 + .564 Employee Experience +.100 Person Organisation Fit

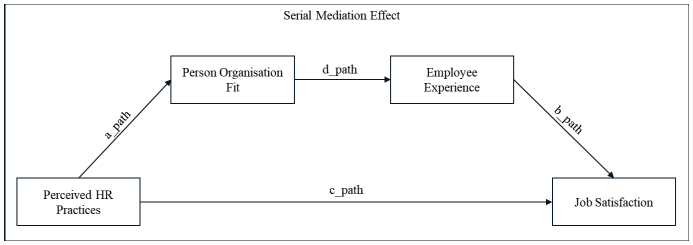
Hence, the value of the effect from Employee Experience to Job Satisfaction, that is, the value of variable 'b' = .564 and indirect effect from Person Organisation Effect 'c' = .100

c = c' + ab; .547 = .100 + .791*.564; .547 = .100+.447

Hence, Hypothesis 7 holds true, suggesting that Employee Experience partially mediates the relationship between job satisfaction and person-organization fit.

5.4.3. H8: Perceived HR Practices have a significant positive relationship with Job Satisfaction via Person Organisation Fit and Employee Experience

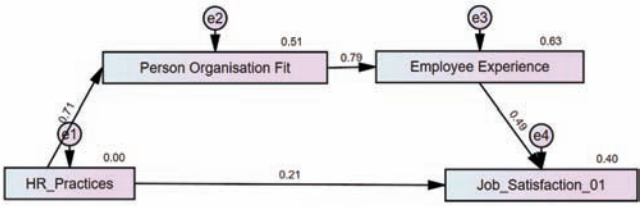
Figure 2: Serial Mediation influence of Person Organisation Fit and Employee Experience



Source: Author

To test the mediation effect of person-organization fit and Employee Experience between Perceived HR Practices and Job Satisfaction, serial mediation was carried out using AMOS.

Figure 3: Serial mediation effect of Person Organisation Fit and Employee Experience using AMOS



Source: Created using AMOS

Table 9: Serial Mediation Output using AMOS

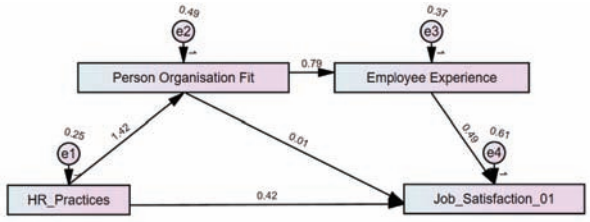
Relationship	Total Effect	Direct Effect	Indirect Effect	Confidence Interval		p-Value	Conclusion
				Lower Bound	Upper Bound		
Perceived HR Practices on Job Satisfaction	.983	.425	0.558	0.392	0.731	.000	Partial Mediation

Source: Created by the author using AMOS

The study evaluated the serial mediation of Person Organisation fit and Employee experience on the relationship between Perceived HR Practices and Job Satisfaction. The results in table 9 revealed a significant indirect effect of perceived HR practices on job satisfaction through person-organization fit and employee experience (regression weight = .558, p = .000). Furthermore, the direct effect of Perceived HR practices on Job Satisfaction in the presence of person-organization fit and employee experience (c_path) was also found to be significant (regression weight = .425, p = 0.000). In addition, the total effect of Perceived HR practices on Job Satisfaction (regression weight = .983, p = 0.000) was reduced significantly in the presence of mediators; hence, we can say that Person Organization Fit and Employee Experience partially mediate the relationship between perceived HR practices and job satisfaction.

5.5 Evaluating model fit for employee experience using person organisation fit theory

Figure 4: Evaluation of model fit in AMOS



Source: Created by the author using AMOS

According to existing literature, multiple indices can be considered to evaluate the overall model fit. Hu and Bentler (1999) proposed a 2-index strategy, that is, reporting one of the fit indices (e.g., RNI, CFI, or RMSEA) with SRMR. The criteria for an indication of good model data fit were RNI (or CFI) ≥ .95, and SRMR ≤ .08 (Lei & Wu, 2007).

Table 10: Model Fit estimates

X2	p value <.05	0
CFI	>=.95	0.957
SRMR	<.08	0.027

SRMR<.080.027Source: Created by the author using AMOS

Table 10 shows the fitness indices computed using AMOS, implying that the model suggested in Figure 4 is a good fit.

VI. Discussion

The hypothesis tested between perceived HR practices and person organization fit suggests that the presence of HR practices appropriately communicates the values of the organization to the employees leading them to have better complimentary and supplementary fit (Boon, Hartog, Boselie, et al., 2011; Mostafa & Gould-Williams, 2014). The hypothesis between person organization fit and employee experience suggests that that if the mutual needs of the organization and the employee is met, there is congruence between the values of employee and the organization, personality similarity between employees and other members of the organization, and shared employee and organizational goals, leading to an employee feeling a sense of belongingness, vigour, achievement, happiness and purpose in turn having an enhanced experience of the organization (de Sousa & Porto, 2015; Rahmayanti & Ellya Kurniawan, 2020; Xu et al., 2023).The hypothesis tested between perceived HR practices and employee experience means that what an employee perceives about the organization through the HR practices, influences their thoughts about care, values, similarity in shared goals and interests with the organization making them feel enhanced experience at work (Kumar & Kumar, 2023; Masood et al., 2023; Rozkwitalska, 2019). The positive results of the hypothesis tested between employee experience and job satisfaction implies that if an individual feels a sense of happiness, belongness, purpose, achievement and vigour to come to work each day, he or she will be more satisfied with his/her job (Chen & Fulmer, 2018; Itam & Ghosh, 2020a). The positive association of person organization fit, and job satisfaction implies that if the mutual needs of the organization and the employee is met, there is congruence between the values of the employee and the organization, personality similarity between employee and other members of the organization, and shared employee and organizational goals, an employee will tend to be more

satisfied with his/her job (Vancouver & Schmitt, 1991). The positive association between perceived HR practices and job satisfaction suggests that how an employee perceives HR practices will influence the level of satisfaction employees experience with their job (Gurbuz, 2009; Jyothi & Ravindran, 2012). The hypothesis tested between PO Fit and job Satisfaction via employee experience suggests that Person Organization fit is a strong predictor of both employee experience and job satisfaction. Furthermore, the test suggests that employee experience partially mediates the relationship between person organization fit and job satisfaction. This also implies that the level of value and goal congruence and shared interests an employee feels with the organization tends to increase the level of satisfaction one experiences about their job. This occurs because value and goal congruence lead to an employee experiencing happiness, belonging, a sense of achievement, vigor and purpose which leads to a feeling of satisfaction with their job. The eighth hypothesis suggests that Person Organization fit, and Employee experience serially mediate the relationship between perceived HR Practices and job satisfaction. The result revealed a significant indirect effect of perceived HR practices on job satisfaction through person organization fit and employee experience (regression weight (a*d*b) = .558, p = .000). This implies that the level of satisfaction an employee feels with regards to their job is influenced by their perception about the HR practices of an organization and is significantly controlled by the mutual fit that an individual has with the organization as well as the kind of experience (a sense of happiness, belongingness, purpose, achievement and vigour) with the organization. This hypothesis test also implies that the HR practices of an organization communicate the values and culture of the organization to the employee, creating a sense of value and goal congruence with the organization. This value and goal congruence results in a feeling of happiness, belongness, achievement, vigour and purpose, in other words employee experience. This enhanced feeling of pleasant experience urges an employee to transcend beyond the call of duty and showcase loyalty and commitment towards their work resulting in increased job satisfaction.

VII. Implications

7.1 Theoretical Implications

It can be seen from the results of the empirical tests conducted that there is a significant positive relationship between each of the variables, and the model is a good fit, suggesting that HR practices communicate the values of the organisation to the employees, enabling them feel a fit with the organisation, this person – organisation fit, leads to a sense of happiness, belongness, achievement and vigour, all of which can be grouped into a term employee experience, which in turn leads to job satisfaction. The empirical tests conducted in the previous section also suggest that the relationship between perceived HR practices and job satisfaction is serially mediated by person organisation fit and employee experience, which implies that the strength or effect of impact that the perception of HR practices have on job satisfaction can be enhanced if an individual feels a better fit with the organisation and also have a pleasant experience because of the same. This also implies that there is a need of contextualisation of HR practices as per the need of the employees to enhance the fit that they feel with the organisation. Let's understand this by taking the example of recruitment and onboarding practices of the organisation. In a scenario where the recruitment and onboarding process is extremely transparent and responsive, the candidate feels that his or her values of being responsive and transparent are a match with that of the organisation leading to a supplementary fit. This supplementary fit results into a feeling of belongingness towards the organisation, in turn making the candidate feel satisfied with the job. Considering the skill and career development practices, in cases where the employee feels that he or she has been given plethora of opportunities to upskill themselves according to their aspirational roles within the organisations, and envision their career growth as per their wish, provides the employee a feeling of a complimentary fit, where they feel their efforts are being returned with possible options of career growth in the organisation, allowing an employee to feel happy and motivated to work each day in turn leading to feel satisfied with the current job.

7.2 Practical Implications

The relationships established using the empirically tested models, suggest that the role that perceived HR practices in job satisfaction can be enhanced when an employee feels a better fit with the organisation and when an employee feels enhanced experience. This implies that it is important to contextualise HR practices as per the employee needs, to improve the perception that the employees have about the practices and the organisation.

This contextualisation is possible when a shift in mindset happens for HR professionals. The shift in the mindset of HR professionals to keep the employees at the centre while

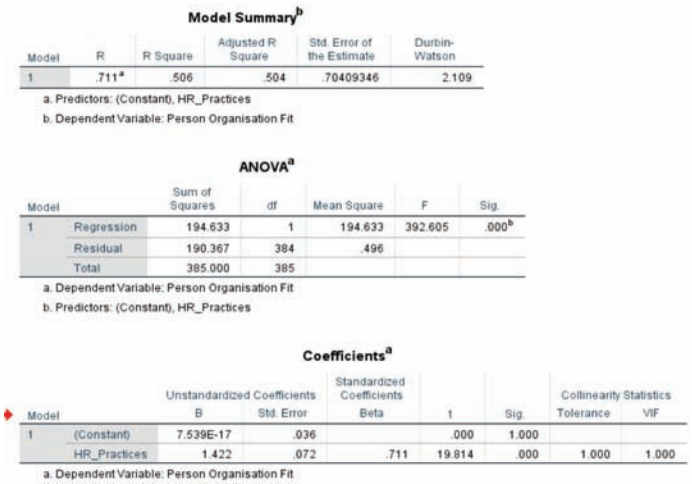
creating organizational policies, practices and platforms, is a cultural shift, that will only happen if this thought percolates down and is practised in the form of three managerial layers i.e. HR Leadership; HR Managers and Employees. HR needs to adopt practices like 'Design Thinking', Employee Journey Mapping, Hackathons with Employees and HR, to design Policies and Platforms, which cater to the needs of the employees and nurture employee experience. The solutions and platforms provided to employees have to be very specific to employee needs and must be enabled using technology. Hence the change in HR needs to occur on 3 fronts; People or the HR mindset front; The Techniques with which HR creates solutions, and the tools and platforms provided to the employees.

VIII. Limitations and scope for future research

The current research proposes and empirically tests a model for employee experience. However, this research is restricted to the Indian Information Technology Industry and has not been tested in other regions or industries and has not been tested in various working conditions such as work from home or work from office or hybrid; the research has not tested its impact and varying effects at various managerial levels. As a scope for future research, the research model should be tested in industries other than Information Technology and regions other than the Indian Subcontinent. The research model should be tested under various working conditions, such as work from home and hybrids, and should also be tested at various managerial levels.

IX. Appendix

Figure 5: Regression Analysis between HR Practices and Person Organisation Fit



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.711[a]	.506	.504	.70409346	2.109

a. Predictors: (Constant), HR_Practices
b. Dependent Variable: Person Organisation Fit

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	194.633	1	194.633	392.605	.000[b]
	Residual	190.367	384	.496		
	Total	385.000	385			

a. Dependent Variable: Person Organisation Fit
b. Predictors: (Constant), HR_Practices

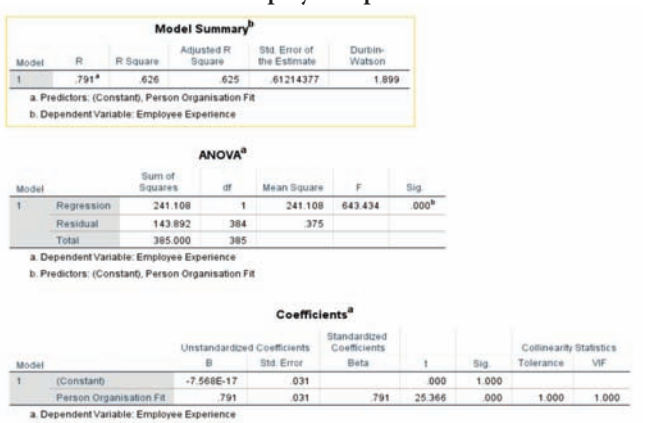
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	7.539E-17	.036		.000	1.000		
	HR_Practices	1.422	.072	.711	19.814	.000	1.000	1.000

a. Dependent Variable: Person Organisation Fit

Source: SPSS Output

Figure 6: Regression Analysis between Person Organisation Fit and employee Experience



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.791[a]	.626	.625	.61214377	1.899

a. Predictors: (Constant), Person Organisation Fit
b. Dependent Variable: Employee Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	241.108	1	241.108	643.434	.000[b]
	Residual	143.892	384	.375		
	Total	385.000	385			

a. Dependent Variable: Employee Experience
b. Predictors: (Constant), Person Organisation Fit

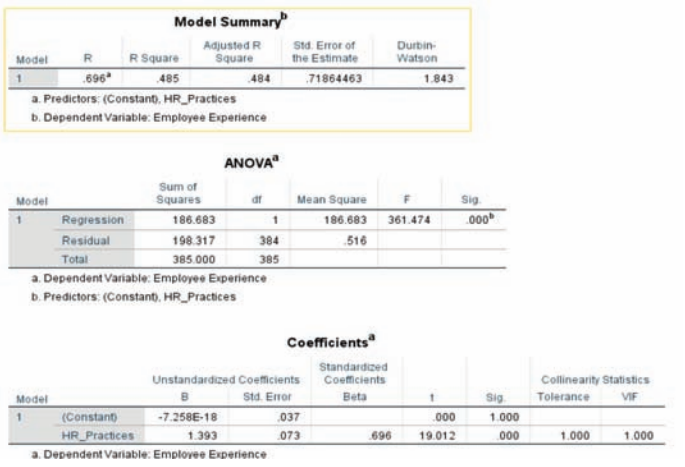
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	-7.568E-17	.031		.000	1.000		
	Person Organisation Fit	.791	.031	.791	25.366	.000	1.000	1.000

a. Dependent Variable: Employee Experience

Source: SPSS Output

Figure 7: Regression Analysis of Perceived HR Practices and Employee Experience



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.696[a]	.485	.484	.71864463	1.843

a. Predictors: (Constant), HR_Practices
b. Dependent Variable: Employee Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	186.683	1	186.683	361.474	.000[b]
	Residual	198.317	384	.516		
	Total	385.000	385			

a. Dependent Variable: Employee Experience
b. Predictors: (Constant), HR_Practices

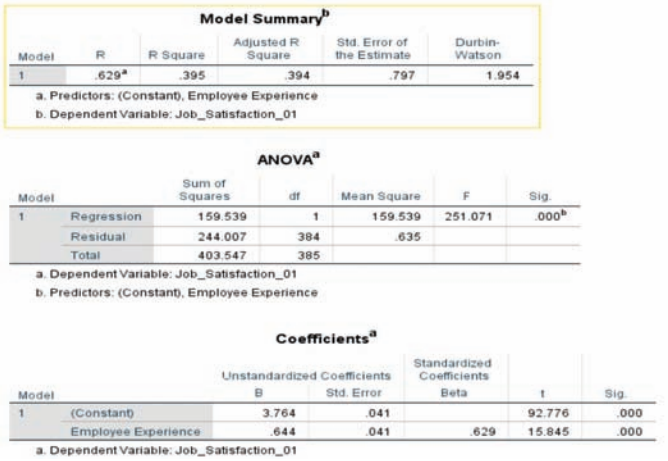
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	-7.258E-18	.037		.000	1.000		
	HR_Practices	1.393	.073	.696	19.012	.000	1.000	1.000

a. Dependent Variable: Employee Experience

Source: SPSS Output

Figure 8: Regression Analysis of Employee Experience and Job Satisfaction



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.629[a]	.395	.394	.797	1.954

a. Predictors: (Constant), Employee Experience
b. Dependent Variable: Job_Satisfaction_01

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	159.539	1	159.539	251.071	.000[b]
	Residual	244.007	384	.635		
	Total	403.547	385			

a. Dependent Variable: Job_Satisfaction_01
b. Predictors: (Constant), Employee Experience

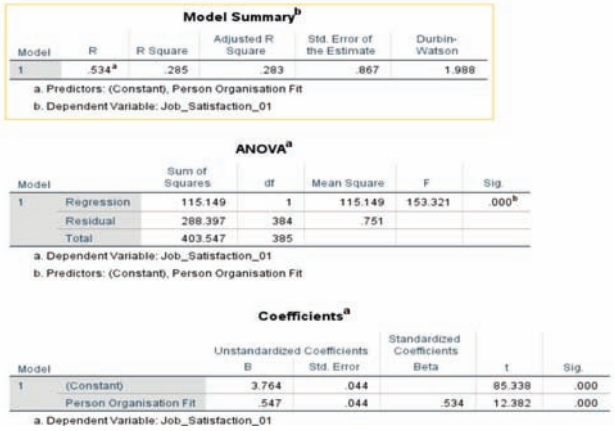
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.764	.041		92.776	.000
	Employee Experience	.644	.041	.629	15.845	.000

a. Dependent Variable: Job_Satisfaction_01

Source: SPSS Output

Figure 9: Regression Analysis of Person Organisation Fit and Job Satisfaction



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.534[a]	.285	.283	.867	1.988

a. Predictors: (Constant), Person Organisation Fit
b. Dependent Variable: Job_Satisfaction_01

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	115.149	1	115.149	153.321	.000[b]
	Residual	288.397	384	.751		
	Total	403.547	385			

a. Dependent Variable: Job_Satisfaction_01
b. Predictors: (Constant), Person Organisation Fit

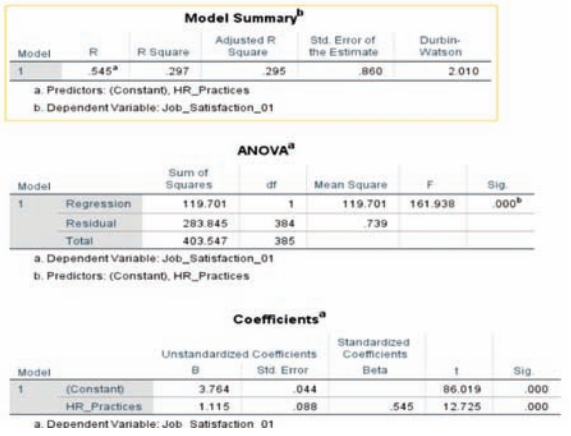
Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.764	.044		85.338	.000
	Person Organisation Fit	.547	.044	.534	12.382	.000

a. Dependent Variable: Job_Satisfaction_01

Source: SPSS Output

Figure 10: Regression Analysis of Perceived HR Practices and Job Satisfaction



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.545[a]	.297	.295	.860	2.010

a. Predictors: (Constant), HR_Practices
b. Dependent Variable: Job_Satisfaction_01

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	119.701	1	119.701	161.938	.000[b]
	Residual	283.845	384	.739		
	Total	403.547	385			

a. Dependent Variable: Job_Satisfaction_01
b. Predictors: (Constant), HR_Practices

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.764	.044		86.019	.000
	HR_Practices	1.115	.088	.545	12.725	.000

a. Dependent Variable: Job_Satisfaction_01

Source: SPSS Output

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AI-DRIVEN HR PRACTICES: ENHANCING MILLENNIAL ENGAGEMENT THROUGH DIGITAL ORIENTATION, TRAINING AND FLEXIBILITY

Taruna Tokas* Dr. Harminder Kaur Gujral Dr. Prachi Bhatt*****

Purpose: *This study examines the influence of HR policies on millennial employee engagement, with a specific focus on AI and digital orientation. Given that millennials constitute a significant portion of the workforce, understanding their engagement drivers is crucial for organizational success. The research explores the role of employee training, flexible work practices, and digital orientation in shaping engagement levels.*

Methodology: *A structured questionnaire was distributed among millennial employees working in private organizations in Delhi NCR, using purposive sampling. Exploratory Factor Analysis (EFA) and regression analysis were conducted to determine the relationships between HR practices and employee engagement. The study analyzed key factors such as AI-driven training, flexible work arrangements, and digital orientation in influencing employee engagement levels.*

Findings: *The results indicate that AI and digital orientation significantly enhance employee engagement ($\beta = .276$, $p < .001$), emphasizing the growing role of technology in modern workplaces. Flexible work practices also contribute positively ($\beta = .142$, $p = .004$), supporting millennials' preference for work-life balance. Employee training ($\beta = 0.268$, $p < .001$) demonstrated a positive relationship, suggesting that technology-driven training methods align with millennial learning preferences. Reliability analysis confirmed strong internal consistency, with Cronbach's alpha values exceeding .80 for all constructs.*

Originality/Value: *This study highlights the need for organizations to adopt AI-driven training programs and flexible work arrangements to optimize millennial engagement. The findings provide valuable insights for HR professionals, organizational leaders, and researchers interested in enhancing employee engagement through digital transformation and modern HR practices.*

Keywords : Millennials, Employee Engagement, HR Practices, Artificial Intelligence
JEL Code: *M12, M15, O15*

I. Introduction

Human Resource professionals in today's multigenerational organizations face significant challenges. In recent years, workplaces have experienced a notable shift, with millennials and even Gen Z gradually replacing employees from previous generations and technology knowing no bounds. The acceptance of AI in workplaces from recruitment, training, retention to day-to-day work only highlights the indispensability of the technology in the workplaces of today . This transition was already expected to be complex, but it became even more challenging as many in these younger generations were either entering the workforce or already employed when the Covid-19 pandemic disrupted traditional work structures. The pandemic forced organizations to undergo a complete transformation, as existing work models proved unsustainable. As a result, HR professionals and management had to embrace new and adaptive approaches, including hybrid work models, remote work (WFH), employee training and development, recognizing the importance of mental health, flexible working arrangements, and the adoption of advanced technology. In recent years, AI has also become an integral part of modern workplaces, enhancing productivity, improving decision-making, and streamlining HR processes such as recruitment, employee engagement, and performance management. Millennials are defined, by the Cambridge dictionary as "people born in the 1980s, 1990s or the early 2000s." To make the demarcation clear for the sake of understanding the generational cohort, millennials are considered to be born between the years 1980 and 2000 ' . Millennials are increasingly becoming a part of the workforce and according to a survey by Deloitte in 2014, Millennials will make more than 75% of the total workforce by the year 2025. They are also known by other names such as Gen Y, Netizens, Eco boomers . Gen Y is different and diverse and comes into workplaces with different expectations' . This term was coined by Howe and Strauss in the year 2009 . Millennials

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began entering the workforce after 2004 and are expected to continue doing so until around 2025 (Hershatter& Epstein, 2010). They are recognized for frequently changing jobs to pursue better career prospects and growth opportunities (Culiberg & Mihelič, 2016). Over the past decade, extensive research has highlighted how millennials have driven substantial transformations within organizational environments, resulting in profound implications for organizations, employers, and society. Their trust in institutions is based on the belief that a fair system should reward hard work and achievement with recognition, support, and acknowledgment (Hershatter& Epstein, 2010; Kenney et al., 2011; Alima Aktar, 2017). In recent years, the integration of Artificial Intelligence (AI) has also reshaped how organizations engage and manage millennial employees. As digital natives, millennials are more adaptable to AI-driven technologies, which streamline HR processes like recruitment, performance management, and employee engagement. AI enables personalized learning experiences, enhances workplace efficiency, and supports remote collaboration—elements that align with millennials' expectations for flexibility and continuous growth. This study acknowledges the growing influence of AI in modern workplaces and considers how its application within HR practices may impact millennial work engagement and organizational commitment. To deepen the understanding of how organizations can effectively engage millennials, this study examines three core HR practices and their influence on millennial work engagement. While previous research has extensively explored the relationship between employee engagement and job performance, there remains limited insight into how specific HRM practices including AI shape employee engagement (Katou, 2017; Alima Aktar, 2017). Furthermore, the ambiguity in existing findings regarding how diverse organizational practices enhance engagement underscores the need for further investigation (Reissner & Pagan, 2013; Alima Aktar, 2017). Effective HRM practices play a crucial role in fostering positive attitudes and motivation, which subsequently influence employee behaviour (Huang et al., 2018; Katou, 2017). Indian organizations, in particular, face challenges in integrating millennial workers into their traditional frameworks. Millennials bring fresh perspectives and advanced technological expertise due to their digital upbringing. However, aligning their expectations and work styles with conventional organizational structures presents significant hurdles. In response, Indian businesses are adopting flexible work arrangements, AI-driven training programs, and career development opportunities to bridge this gap. By understanding and leveraging the strengths of millennial employees, Indian organizations aim to create a cohesive and productive work environment that meets the needs of this dynamic generation. Thus, the objective of this study is to explore the relationship between HRM practices, AI integration, and millennial employee engagement, with a focus on understanding how these factors collectively influence organizational commitment and long-term engagement.

II. Literature Review and Hypothesis Development

Millennials as employees

The persons born between 1980 and 2000 are referred to as millennials ' (also known as Gen Y). For any 21st-century organisation to succeed, it is essential to fully employ their skills and potential. In addition, millennials are described as probably "the best generation yet" and as the group that has been "watched over" the most throughout history. They work well together and have high levels of optimism and ambition (Howe and Strauss, 2000). 'Generation Y' will produce the highest-performing workforce in human history, according to , an expert on generations and the workplace. Gen Y members tend to be extremely ambitious, diversified in terms of colour and ethnicity, more open to different options, and less concerned with societal issues than previous generations. They enter with more knowledge in their minds and at their fingertips, along with great expectations. Themes relevant to Generation Y's working needs include adaptability, flexibility, career development possibilities, and upscaling via training. The greatest number of economic crises and environmental disturbances have been experienced by millennials"–""–". They have become risk-averse, very concerned with their own personal growth, and unwilling to devote their entire attention to a single work. As a result, individuals search for employment opportunities that enable them to hold multiple positions, demonstrating a demand for flexibility. Millennials place considerably greater emphasis on juggling work with their personal objectives and passions than earlier generations did.. Rather than being seen as a challenge, it can be seen as a chance that presents itself to developing nations like India, whose working population (15-59 years) will expand from 749 million to 924 million by the year 2030, making it the most sought-after location for talent acquisition fostering national advancement and growth .

Optimizing Engagement Through HR

A growing amount of academic literature has examined how various predictors affect employee performance over the years, and the idea that HRM practises have a significant impact on employee behavioural outcomes has emerged as the dominant theme. HRM practises are the philosophy, policy, system, and practises that have an impact on employees' behaviour, attitudes, and performance . HRM practises are the means through which an organisation can manage its people capital to achieve its goals. Particularly, HRM practises are the primary duties carried out by the company. may foster and mould employees' abilities, skills, and behaviours to help them perform their jobs well and stay focused on reaching organisational goals '.A recent report reveals that 70% of employees are actively seeking to enhance their AI skills to remain competitive in the job market. Additionally, 37% of employees state that their organizations are adopting AI due to a fear of missing out on future innovations and competitive advantages. This reflects a balance between AI-related anxieties and the recognition of its strategic importance in modern workplaces.HRM practises are specifically the essential actions that an organisation can use to develop and mould an employee's abilities, skills, and behaviour in order for them to perform their duties successfully and remain focused on achieving organisational goals .According to SET, people have connections in which resources are exchanged, and this exchange has an impact on people's attitudes and behaviours. It is imperative to comprehend the application of SET to millennial engagement, given their unique tastes and expectations with regard to work relationships and rewards. A study by offers a basic explanation of SET, implying that people aim to maximize benefits and minimize costs in social interactions. When this idea is applied to the workplace, it implies that when millennials believe their efforts are being adequately rewarded, they are more inclined to engage and commit to their business. The application of SET to organizational settings is examined by , who highlight the significance of perceived organizational support (POS) in the exchange relationship between employees and employers.

Leveraging Artificial Intelligence in Workplaces

Artificial Intelligence (AI) is transforming employee training by enabling personalized learning experiences, real-time feedback, and adaptive training modules (Kaplan & Haenlein, 2020). AI-driven training systems utilize machine learning algorithms to assess employee skill levels and tailor content accordingly, improving engagement and retention (Nguyen et al., 2021). Research highlights that AI-powered chatbots, virtual simulations, and gamified learning platforms enhance interactive learning, making training more effective and accessible (Bhardwaj & Sharma, 2022). Furthermore, AI-driven analytics provide HR managers with insights into employee progress, identifying skill gaps and optimizing training strategies (Garg & Singh, 2023). As workplaces integrate AI into training, it is crucial to understand its impact on digital-native employees, particularly millennials, who prefer technology-driven learning environments (Smith & Brown, 2021). Studies suggest that AI enhances self-paced learning and fosters continuous skill development, making it particularly relevant for industries undergoing rapid technological advancements (Chen et al., 2023). Additionally, AI-based training reduces costs and administrative burdens, allowing organizations to scale employee development programs efficiently (Jones & Patel, 2022). However, while AI improves training outcomes, concerns around data privacy, algorithmic biases, and human-AI interaction challenges remain key areas of exploration (Johnson & Lee, 2022). Researchers also emphasize the need for a hybrid approach, combining AI with human mentorship, to maximize learning outcomes and ensure ethical AI implementation in workforce training (Kumar & Das, 2023). The growing adoption of AI in employee training necessitates further empirical research to assess its effectiveness in fostering skill development and long-term employee engagement.

Employee Training

It is suggested by that there is a substantial gap between what millennial workers desire and expect from their careers and workplace experiences that they get–. hypothesised that when given training chances, employees are able to support their own resilience and optimism. This is accomplished via raising psychological capital and involvement. According to the Freshwork report published in 2024, more than 45% of jobs today require new hires to have some level of AI experience. The prospects for job progression, personalised experiences, and ongoing learning are important to millennials. Millennials respond positively to training programs that align with their personal goals and provide tangible benefits for both their personal and professional growth. They are eager to continue learning in the workplace and are willing to invest considerable time in acquiring new knowledge and experiences. According to a PWC survey, 35% of millennials identified excellent training and

development programs as a crucial factor in choosing an employer (PWC, 2011). Many HR leaders recognize the need to train millennials in basic workplace culture and behavior. Having developed digital skills independently during their youth, millennials prefer to integrate continuous learning and technological advancements into their work processes. They view ongoing skill development as essential for long-term career sustainability (Cloutier et al., 2015). In the modern workplace, AI-related skills have become a critical component of employee training. As organizations increasingly adopt AI-driven technologies, providing comprehensive AI training not only enhances productivity but also empowers millennials to stay competitive and innovative. Employers who invest in AI literacy and upskilling programs are more likely to engage and retain millennial talent while preparing their workforce for future technological advancements.

Hypothesis 1 – Employee Training is positively related to millennial employee engagement.

AI & Digital Orientation

Millennials, having grown up immersed in technology, are recognized as digital natives with distinct expectations regarding digital tools, AI integration, and communication in the workplace. To effectively attract, retain, and engage millennial employees, organizations must understand how digital, and AI orientation influences their work experiences. Cennamo and Santoro (2019) explored the relationship between millennial employee engagement and digital orientation, revealing that millennials are more engaged in workplaces that leverage digital and AI technologies for learning, communication, and collaboration. This underscores the importance of aligning digital and AI initiatives with millennials' preferences to enhance their engagement. Shah et al. (2020) examined the impact of digital leadership on millennial engagement, highlighting that managers skilled in using advanced digital and AI tools are better equipped to motivate and involve millennial workers. This finding emphasizes the need for digitally and AI-literate leaders to foster a more engaged workforce. Similarly, Karanges et al. (2015) discuss how digitalization shapes millennials' work experiences, noting that millennials feel a stronger sense of connection and belonging in organizations that embrace digital advancements. Nguyen et al. further stress the value of digital communication tools, which facilitate collaboration and engagement among millennial employees. In the evolving workplace, the integration of AI technologies—such as automated workflows and AI-driven learning platforms—further enhances engagement by providing personalized experiences and enabling millennials to work more efficiently and innovatively.

Hypothesis 2 – AI & Digital Orientation is positively related to millennial employee engagement.

Flexible Work Practices

Millennials are increasingly opting for flexible work arrangements over higher pay, as they value control over their work environment and hours. This preference aligns with findings from a PWC Survey (2014), which revealed that many millennials feel the sacrifices made to their personal lives for work are not worth it. They are willing to leave organizations that do not align with their desired work-life balance. AI is now playing a critical role in fostering workplace flexibility, as it enables remote work, optimizes workflows, and offers personalized solutions for better time management. This technological advancement allows employees to better balance their professional and personal commitments, addressing the growing need for flexible work practices. AI-powered systems enhance agility within organizations, supporting the evolution of workplace structures to meet millennial expectations and improve knowledge transfer (Jooss et al., 2021). As AI becomes more integrated into work environments, it increasingly facilitates flexible, efficient, and employee-centred practices, aligning with the values of modern workers (Stella, 2020; Smith, 2010). This shift significantly impacts both businesses and employees, contributing to the broader social change toward more adaptable working conditions (Tinuke, 2014)

Hypothesis 3 – Flexible Work Practices is positively related to millennial employee engagement.

Employee Engagement

Employee engagement is a motivational construct defined by the active investment of an individual's cognitive, emotional, and physical self into their work role (Kahn & Kahn, 2013). This concept reflects employees' desire to express their preferred self—their chosen attributes and qualities—within the organization. Engagement is often viewed as the opposite of burnout, encompassing positive job attitudes and emotional well-being (Schaufeli et al., 2009). According to Schaufeli et al. (2002), work engagement is a persistent, affective-cognitive state characterized by enthusiasm, commitment, and absorption rather than a temporary or specific experience. Engaged employees feel connected to

their work and are more confident in meeting job demands. Work engagement is positively linked to job resources provided by the organization, which can be categorized into various levels: organizational (e.g., pay, career opportunities), interpersonal (e.g., support from supervisors and peers), job position-specific (e.g., role clarity, decision-making participation), and task-level (e.g., skill variety, task significance, autonomy, and performance feedback) (Aybas, 2013). HR practices play a critical role in fostering engagement by enhancing ability, motivation, and opportunity while providing supportive working conditions. When employees perceive that the organization applies HR practices fairly and consistently, they are more likely to engage in work willingly rather than out of obligation (Aybas, 2013). Conversely, inconsistent or inadequate HR practices may lead to higher levels of disengagement (Ang et al., 2013). Drawing from Social Exchange Theory, employees reciprocate positive treatment with higher engagement when they perceive equitable HR practices . Engagement manifests through three key dimensions: vigour, dedication, and absorption. Vigour refers to maintaining high energy levels and mental resilience while working, including the willingness to invest effort and persist through challenges. Dedication reflects a deep sense of involvement, characterized by pride, inspiration, and purpose '. Absorption is the state of being fully immersed in one's work, where time appears to pass quickly, and detachment from tasks becomes difficult (Schaufeli et al., 2002). In contemporary organizations, AI-driven HR practices further enhance engagement by offering personalized learning opportunities, automated feedback systems, and real-time performance analytics, which align with millennials' preference for continuous development and technological integration. The use of AI-based tools helps organizations deliver adaptive work environments, improving both job satisfaction and overall engagement.

For this study, the Utrecht Work Engagement Scale (UWES), a 15-item self-report questionnaire, is employed to measure these three engagement dimensions. The scale includes six items for vigour, five items for dedication, and six items for absorption, providing a comprehensive assessment of work engagement (Aybas, 2013). This multidimensional approach to engagement is critical for fostering employee loyalty, enhancing service quality, and ensuring organizational success in today's dynamic business environment–" .

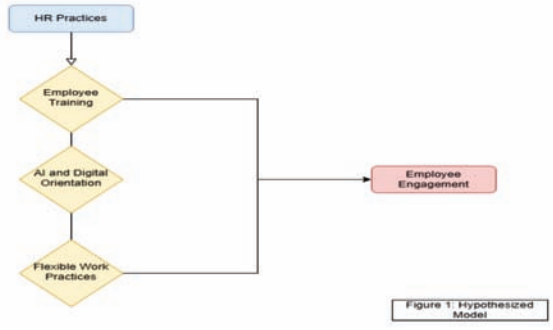

Figure 1: Hypothesized Model

III. Research Methodology

1. Instrumentation

The study was conducted with the help of a questionnaire to collect data from millennials to test the hypothesis and validate the model. The Questionnaire contains questions about the sociodemographic background of the participants and items measuring the seven constructs. The first section includes gender, age, education, work experience and income. The second part contains 3 constructs namely, Employee Training, Flexible Work Practices, AI & Digital Orientation, and Employee Engagement that have been adapted from relevant studies in the area and is measured on a 5-point scale where 1= strongly disagree and 5= strongly agree. The questionnaire was pre-tested by four subject experts to enhance the content validity of the items in questionnaire. Figure 1 illustrates the hypothesized model linking HR practices with millennial employee engagement. Rooted in Social Exchange theories, the model suggests that practices like employee training, flexible work practices and AI &digital orientation impact engagement. This framework aims to guide the study's investigation into these relationships.

2. Sample

The study focused on millennial employees working in private organizations in Delhi NCR. Millennials were chosen as the target group for this study because they form a significant and growing portion of the global workforce, particularly in India. As digital natives, they are more likely to be influenced by AI-driven HR practices, digital orientation, and flexible work arrangements. Understanding their engagement drivers is crucial for organizations aiming to attract, retain, and maximize the potential of millennial employees.The study focuses on the private sector instead of the public sector because private organizations tend to adopt AI-driven HR practices, digital transformation strategies, and flexible work models more rapidly than public

institutions. The private sector's dynamic work environment provides a more suitable setting to assess the impact of digital orientation and AI in HR policies on employee engagement. Additionally, millennial employees in private organizations often experience different workplace expectations, technological exposure, and career progression models compared to their counterparts in the public sector, making them a relevant sample for this research. Prior approval was obtained from HR and managers before distributing the questionnaires, and the purpose of the study was communicated to the participants. Email IDs and contact numbers were collected, and the electronic questionnaires were shared through emails and social media platforms. Purposive sampling was used to target millennial employees familiar with mobile phones and the internet. A total of 280 questionnaires were distributed, and 192 were completed, resulting in a 67% response rate. The demographic details of the respondents are outlined in the table below:

Table 1: Demographic Profile

Characteristics		Frequency	Percentage
Gender	Male Female Other	102 90 0	53.5 46.5 0
Age	20-30 30-40 40-50	84 61 47	43.7 31.7 24.4
Education	Graduate Postgraduate	117 75	61.6 38.4

3. Results

The statistical analysis for this study was conducted using SPSS software. Linear Regression was utilized to predict the dependent variable based on independent variables. Descriptive statistics were employed to produce frequency tables for demographic data, while correlation analysis was used to measure the strength of the relationships between variables.

Exploratory Factor Analysis (EFA)

KMO and Barlett test of Sphericity were applied to make sure that data is fit for factor analysis. The value of KMO test and the significance level of Bartlett test provide sufficient proof to confirm the suitability of data as shown in table 2. An EFA was performed using Principal component method with varimax rotation to extract the fixed number of factors . Three items that cross loaded were excluded from the final scale. Hence table 3 contains 30items, Flexible Work Practices (five), Employee Training (five), AI &Digital Orientation (five).Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO): The KMO value of 0.722 indicates that the sample is adequate for conducting a factor analysis. Typically, a KMO value above 0.5 is considered acceptable, suggesting that the variables in analysis are sufficiently correlated for factor analysis to be useful . Bartlett's Test of Sphericity: The Bartlett's Test of Sphericity results show an approximate chi-square value of 10923.233 with 1081 degrees of freedom and a significance level (Sig.) of .000. The significance level of less than .05 indicates that the correlation matrix is not an identity matrix (i.e., not a diagonal matrix), suggesting that there are relationships among the variables suitable for factor analysis.The results of Exploratory Factor Analysis are reported in Table 3. It shows the factor loadings of all constructs used for the study.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.722
Bartlett's Test of Sphericity	Approx. Chi-Square	10923.233
	Df	1081
	Sig.	.000

Reliability Test

Reliability is the measure of internal consistency of the constructs in the study. A construct is reliable when the alpha value is greater than .70 . The results are reflected in Table 3. Reliability analysis was conducted to assess the internal consistency of the measurement scales for all variables. For the Employee Training construct, which consisted of 5 items, Cronbach's alpha was found to be .846, indicating a high level of internal consistency among the items. Similarly, for the Flexible Work Practices construct, which comprised 5 items, AI & Digital Orientation consisting of 5 items, Cronbach's alpha was calculated to be .902, .897, respectively suggesting a high degree of reliability among the items in measuring the construct. For Employee Engagement, the Cronbach's alpha was found to be .837.

Table 3: EFA Results

Exploratory Factor Analysis (EFA) was conducted to identify the underlying structure of the constructs and ensure the validity of the measurement model. The Kaiser-Meyer-Olkin (KMO) test confirmed sampling adequacy, and Bartlett's test of sphericity indicated significant correlations among items, supporting factorability. Items with factor loadings above 0.5 were retained, as loadings above this threshold are widely considered acceptable in social science research. Hair et al. (2019) suggest that loadings of 0.5 or higher are practically significant, while Field (2018) and Tabachnick & Fidell (2013) also support this criterion for factor retention.

Furthermore, Comrey and Lee (1992) classify loadings above 0.5 as "fair to good," reinforcing their inclusion in factor structures. Given these established guidelines, the retained items demonstrate acceptable factor loadings, ensuring the robustness of the construct measurement.

Measures	Factor Loadings	Cronbach's
Employee Training(Raina, Bhavna, Kalse, 2016)		
My company has provided me with ongoing training, which enables me to do my job better.	.551	
I believe I am satisfied with my training opportunities.	.716	
I have been able to acquire some additional job training when I have needed it.	.622	.846
My company has made a substantial investment in me by providing me with formal training and development opportunities.	.773	
I have received adequate training to leverage AI technologies effectively in my role.	.566	
AI & Digital Orientation(Aggarwal, 2020)		
My organization is committed to using updated digital technology to carry out the jobs.	.795	
New technology including AI is readily accepted in my organization.	.864	
My company actively encourages employees to incorporate AI tools in their workflow.	.751	.897
The use of AI has enhanced my job satisfaction.	.616	
Our present AI use supports our goals in ways that add value to our organisation.	.722	
Flexible Work Practices(Aggarwal, 2020)		
Flexible working arrangements help me balance life commitments.	.705	
Having Flexible working hours allows me to attend to family responsibilities.	.800	
Flexible working arrangements are essential for me to participate in family and social events.	.836	.902
Flexible working arrangements enable me to focus more on the job when I am at the workplace.	.782	
If a job didn't offer me flexible work arrangements, I wouldn't be able to do any paid work.	.757	
EMPLOYEE ENGAGEMENT(Harter et al., 1998)		
VIGOR		
When I get up in the morning, I feel like going to work.	.744	
At my work, I feel bursting with energy.	.712	
At my work I always persevere, even when things do not go well.	.863	
I can continue working for very long periods at a time.	.655	
At my job, I am very resilient, mentally.	.761	
At my job I feel strong and Vigorous.	.609	
DEDICATION		.837
I find my job challenging.	.658	
I find my job inspiring for me.	.762	
I am enthusiastic about my job.	.703	
I am proud on the work that I do.	.753	
I find the work I do is full of meaning and purpose.	.567	
ABSORPTION		
When I am working, I forget everything else around me.	.664	
Time flies when i am working.	.711	
I feel engrossed in my job while working.	.864	
I feel happy when I am working intensely.	.795	

IV. Findings and Discussion

This study aimed to identify key HR practices that attract millennials and examine the relationship between these practices and their impact on millennial employee engagement. Through a comprehensive literature review, three HR practice factors were selected for analysis: employee training, flexible work practices, AI &digital orientation.

To measure employee engagement, the study utilized the Gallup Employee Engagement 15-item questionnaire, a well-established tool known for its reliability and validity. This questionnaire includes 15 statements that employees rate on a scale from strongly agree to strongly disagree, covering critical aspects of engagement such as clarity of job expectations, opportunities for professional growth, and recognition satisfaction (Killham, 2003). Its extensive use in both academic and organizational contexts highlight its effectiveness in capturing and enhancing employee engagement (Gallup, n.d.; Harter et al., 2002).

The study's findings revealed that employee training, with a beta coefficient of 0.268, plays a crucial role in engaging millennial employees. Consistent with prior research (Ilhami et al., 2020), the study suggests that millennials are more likely to remain with organizations that prioritize continuous professional development, especially the ones that recognise and incorporate AI tools in training, enabling millennials to be more effective employees. This preference stems from their emphasis on lifelong learning and career advancement. Furthermore, training initiatives reflect the organization's commitment to employee growth, staying up to date with the changing trends of technology and the future of work fostering a sense of value and increasing loyalty among millennial workers.

Table 4:

Hypothesis	Beta Coefficient	SE	T value	P value	Hypothesis supported
H1: ET →EE	.268	.053	5.077	.000	Accepted
H2: AI & DO →EE	.276	.042	6.611	.000	Accepted
H3: FWP →EE	.142	.048	2.947	.004	Accepted

Flexible work practices were found to be the next important factor to influence employee engagement of millennials with standardised β coefficient of .142. Flexibility has been linked to higher job satisfaction and lower turnover intentions among millennials. It also aligns with their digital native characteristics, allowing them to work efficiently from various locations and outside traditional office hours"' . Millennials will have higher levels of engagement when they see the organisation's policies as an assurance that they can maintain a healthy balance between work and other aspects of life.AI &Digital orientation was also found to have appositive relationship with employee engagement of millennials (β = .276). A positive relationship exists between Digital Orientation and millennial employee engagement in the contemporary job market. AI and Digital tools and platforms are integral to millennials, facilitating communication, collaboration, and task management, which enhances their engagement. Organizations that embrace digital technologies create a work environment that aligns with millennials' preferences, leading to increased engagement and job satisfaction.

V. Conclusion

The findings of this study emphasize the growing need for organizations to rethink their HR strategies to align with the expectations of a tech-savvy millennial workforce. Rather than relying on conventional policies, companies must adopt AI-driven solutions and flexible work structures that cater to evolving professional aspirations. This research highlights the necessity for organizations to move beyond standardized HR models and develop engagement-driven frameworks that reflect the digital proficiency and career-oriented mindset of millennials. By integrating AI into training programs and offering adaptable work arrangements, businesses can foster a more dynamic and future-ready workplace. Additionally, the study reinforces the importance of continuous policy evaluation, ensuring that HR initiatives remain relevant in an era of rapid technological advancement and shifting workforce demographics.

Implication

This study identified three key factors that influence millennial employee engagement: employee training, flexible work practices, and AI-driven digital orientation, all of which positively impact their engagement levels. Organizations should allocate resources to develop human resource models tailored to millennial needs to enhance their engagement. Given that millennials constitute a significant portion of today's workforce, it is crucial to revise HR policies to align with their expectations.

This research contributes to the existing body of knowledge by addressing a gap related to HR practices that effectively motivate millennials to stay engaged in modern organizations. It also extends the Gallup Employee Engagement (EE) questionnaire by examining its connection to various HR practices implemented by companies. With the increasing integration of artificial intelligence in workplace processes, organizations must recognize that a one-size-fits-all HR policy is insufficient to meet the diverse needs of a multigenerational workforce. Millennials, having grown up with advanced technology, require specialized policies that align with their career aspirations. The study highlights the significant impact of modern HR practices—including employee training, flexible work arrangements, AI-driven digital orientation, and employee benefits—on enhancing millennial employee engagement.

Limitations and Future Research

This study has certain limitations. Firstly, the data was collected exclusively from millennial employees. Future research could expand on these findings by including a diverse sample of inter-generational respondents. Although the study provides valuable insights through the derived model, it also paves the way for further exploration. A comparative analysis of HR practices preferred by different generational cohorts could reveal unique preferences for customized HR policies tailored to their specific needs and expectations.

Additionally, the study focused solely on the millennial population. Future research could extend the analysis to other generations present in the workplace, such as Gen Z and Gen X, to provide a broader perspective. With the increasing use of artificial intelligence in shaping HR practices, future studies could explore how AI-driven strategies cater to the distinct needs of various generations. Since the results are limited to the millennial cohort, they cannot be generalized to all employees. To improve the applicability of the findings, further research should conduct cross-generational studies. Moreover, incorporating AI-powered analytics could enhance the accuracy and adaptability of future research outcomes across diverse workforce groups.

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"HAVOC" IS CREATED BY TEENS' ANXIETY OF HEARING THAT A CERTAIN DISH OR DISCOUNT WON'T BE AVAILABLE IN THE FUTURE ON ONLINE FOOD APPLICATIONS

Dr. Purvi Mathur* Dr. Vidhu K Mathur**

Purpose: *The anxiety among consumers is caused by a mind full with lava in the form of different products, brands, availability, and marketing initiatives. The anxiety converts into mental stress in the consumer mind and results into impulse purchasing. Consumer choices and purchase behaviour have an impact on a company's earnings and profitability. The study targeted towards teens who are perceived as a group that is increasingly adopting technology and is familiar with mobile applications.*

Research Methodology: *The study used the survey based technique. The study focused on the teen population. The Teenagers were given a questionnaire as part of the study's analytical research methodology based on where they were studying either in school or college. The technique termed as cluster sampling.*

Findings: *The results showed that among Indian teens, emotions and purchasing behavior are positively correlated. Teenagers' purchase decisions will thus be influenced by marketing (the absence of a special offer, discount, or menu item in the future) and emotions (happiness or sadness).*

Originality/Value: *This study identifies a new relationship between teen use of online food applications, consumer anxiety, and food waste sustainability. Teenagers are important decision makers who often place food orders for their families, according to the report. Their purchase decisions are influenced by the psychological reaction that produces stress and uncertainty when they are presented with promotional offers. Through an analysis of this complex connection, the study offers new perspectives on how digital marketing tactics affect food sustainability and customer well-being.*

Keywords : Scarcity Promotion, Consumer Anxiety, Teenagers, Online Food Application, and Havoc (Food Waste)
JEL Code: *M3, M37, M370*

I. Introduction

"Whether or not the ship is sinking, you're going to run for the lifeboats if everyone else on the Titanic is." — Steven Taylor

Market participants incite worry and tension to boost demand for products and services. This ensures the long-term health of the organization by assisting with customer attrition and retention throughout a difficult business cycle. The psyche of the customer becomes anxious due to the plethora of options, brands, goods, availability, and advertising efforts. Consumer anxiety is fueled by a mind full of lava in the shape of various items, brands, availability, and promotional efforts (Derval, D. 2022). Other anxiety-inducing factors include shortages in the future availability of goods, seizing a bargain on time, and uncertainty in supply chain management. The emotional and affective system of the left brain plays a major role in consumer anxiety (LeDoux, J. 2015).

The decisions made by customers affect a business's revenue and profitability. Therefore, their actions and intentions influence the firm's economic viability. Food is a part of the physiological category that provides the highest degree of satisfaction, and group membership in this category shapes human behavior (Őnday, Ő. 2016). These days, this group is connected to service providers, thus it is not just focused on people's feelings but also on technology. It operates on drive, cue, reaction, and reinforcement with technology shared by the application group of the service provider. The concern that one's personally identifiable and publicly visible consumer behaviors will highlight the market trend is the root cause of consumption anxiety. The food supply system has gone digitized, and ordering food using a mobile application has grown popular (Kittipanya-Ngam, P., & Tan, K. H. 2020). Teens are seen to be a demographic that is using technology more and more, and they are knowledgeable about mobile applications (Wartella, E. et al. 2016)

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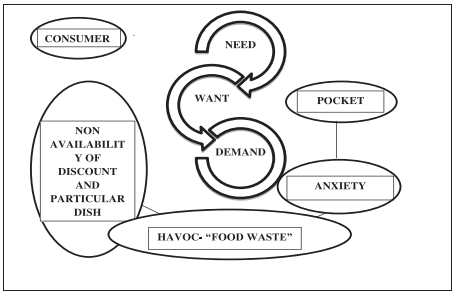
Teenagers have a highly diverse range of behavioral traits, and this age group presents opportunity to examine their psychological traits (Gerbino, M. et al.2018). Digital literacy is a hallmark of the adolescent demographic, which has 253 million individuals in India and represents one in five of the population (UNICEF India Report on "Adolescent development and participation"). These children are not only buying technology for themselves, but they are also providing their parents with access to it (Botkin, J. R. et al. 2015).

Figure 1: Consumer Anxiety Erectors



Source: Author Composition

1.1 "Purchase more" Consumer reactions to the Emotional Promos

When it comes to buying products of different categories, customers' anxiety levels are influenced by fear, sorrow, happiness, disappointments, and disgust. This leads to a temporary decrease in mood, anxiety, and contentment. The most harmful feeling that a human mind may encounter is fear (Cooper, A., & Lousada, J. 2018). The precise domains of anxiety related to risks to the environment, nuclear, chemical, and health. Customers usually act in routine ways. Intention is not as powerful as habit. Even yet, a buyer may be limited by their routine choice. But these actions also include helping them become better consumers and even postponing certain unnecessary purchases when they see deals and know that there could be a future supply disruption. The current study examines how existing purchasing patterns are impacted by the absence of a discount and a specific dish, and how this leads to food waste—a sustainable issue.

1.2 Food Waste: Havoc created by the Teens Anxiety

As consumption grows, food waste will inevitably increase (Girotto, F.et al. 2015). Household purchases of both amount and kind of food have increased as a result of disruptions in the food supply chain. Conversely, increased food spending can lead to food waste, which has a big impact on the environment since it pollutes groundwater and produces greenhouse gas emissions. The observed changes in behavior may be attributed to dread, stemming from a generalized anxiety and feeling of unease as conventional beliefs on job security, anticipated income, and the significance of savings have been questioned. Date labeling, container dimensions and design elements, price strategies that incentivize overspending, and information that reorients consumer priorities away from the avoidance of food waste are some of the ways that food marketing and retailing contribute to consumer-related food waste (Lapourré, T. et al. 2020) Advertising and other promotional materials influence the purchase decisions of consumers (Martins, J. et al. 2019). One of the main objectives of advertising, which is a component of interaction, is to attract consumers' attention and persuade them to purchase a product by altering or enhancing their attitudes in behavioral, emotional, or cognitive domains. Experts in persuasion need to know how the facts they offer connect to the receiver's objectives, needs, and reasons. Without their really needing the goods, a well-planned and performed advertising may stimulate someone's interest in or desire for it (Shaddiq, S. et al. 2021). This is the point at which "neuromarketing" becomes relevant. It alludes to the psychological control of cognition.

The current study examines how existing purchasing patterns are impacted by the absence of a discount and a specific dish, and how this leads to food waste—a sustainable issue.

1.3 Hypothesis

H0: The teenagers' anxiety towards non availability of discount and a particular dish in future has no influence on the Food Waste.

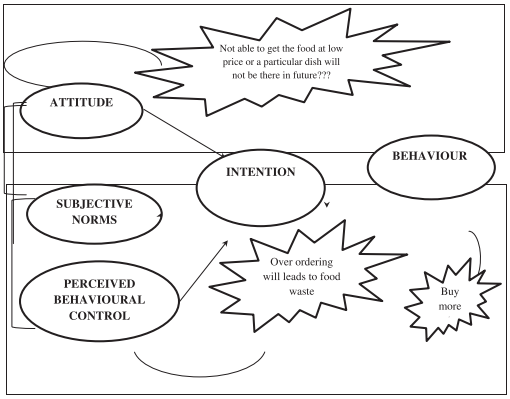
HA: The teenagers' anxiety towards non availability of discount and a particular dish in future has an influence on the Food Waste.

1.4 Theoretical Contribution

The perceived behavioral control component of Ajzen's 1991 Theory of Planned Behavior states that behavior is not entirely voluntary and cannot be controlled. Three issues are identified by the idea of planned behavior. The first is the behavioral belief, which is also known as trained conduct accounting for likely outcomes. The second factor influencing other people's expectations is normative views. The third factor, known as control belief, facilitates or hinders the performance of the rehearsed behavior. This hypothesis explains how teenagers' behavior in relation to the promotional methods (such a discount or a dish that won't be available in the future) of online food applications affects

their present purchasing behaviour and its impact on food waste.

Figure 2: Theoretical Framework of the study incorporating Theory of Planned Behaviour, Ajzen, 1991



Source: Author Composition

1.5 Review of the Existing Work and Study

Since they make ordering simple and provide a wide selection of food from surrounding restaurants, mobile applications are growing in popularity (Kapoor, A. P., & Vij, M. 2018). It has been a boon for many who detest cooking, lead hectic lives, or reside in undesirable areas for work or school. It's more convenient and offers more options. Online meal ordering and electronic commerce have become more and more popular due to factors such as shifting consumer lifestyles, rapid economic growth, customer purchasing attitudes, and an increase in online customers (Rosário, A., & Raimundo, R. 2021). People have developed a serious preoccupation with online purchasing, especially younger shoppers (Kamal, Б. M. & Shnarbekova, M. K. 2021). Exposure of Indian teenagers to food marketing, including peer pressure, online advertisements, and commercial, emotional, and cognitive communication Moreover, they are sometimes studied as a subset of the larger category of children rather than as an independent group (Mehta, R., & Bharadwaj, A. 2021). At this point in time, this clientele has the most spending power (Nielson survey report, 2016). The majority of teenagers prefer to use internet shopping apps to make purchases.

Consumers' thoughts are influenced by promotions on the website for online food apps. Promotion of websites is indirectly related to impulsive purchasing behavior that causes worry (Chen, J. et al. 2022). The consumer is making a purchase out of fear and a likely expectation of danger (Kemp, E. et al. 2021). Risk perceptions are automatic responses to the possibility of not receiving an offer down the road. Purchase decisions made by consumers are influenced by anxiety (Park, J. et al. 2019). A generalized sense of risk gives rise to the sensation of dread, tension, and fear that is known as anxiety. There was a disproportional association established between consumer worry, purchasing, and consumption. Food waste results from overordering as a result of customer fear. According to estimates, one-third of all edible food produced for human consumption is wasted annually, making food waste a significant worldwide problem (Rohini, C. et al 2020). The environmental burden and resources needed to produce the food, as well as the emissions associated with any food that is thrown out, demonstrate the significant environmental consequences of this waste (Read, Q. D. et al. 2020).

1.6 Research Gap

It was discovered that the majority of study publications dealt with consumer behavior in general and impulsive buying, which causes over ordering, after a review of the literature and studies that have been done thus far between 2015- 2023. Food waste resulting from over ordering is not well explained or analyzed.

Food loss and waste pose the biggest threat to sustainability, despite the fact that this problem has not received enough attention. Food loss occurred in the supply chain, whereas food waste occurred at the consumer level (de Gorter et al. 2021). Studies in the medical sciences have been done on teens. The study's main topics were personality, stress, and nutrition. The current study is on teenagers as consumers and customers who are affected by advertisements that draw attention to the absence of a certain dish and a discount in the future and have an effect on their current purchasing behavior.

1.7 Objectives of the study

1. The study aims towards identifying the factors that result into consumer anxiety.

2. Builds the relationship between consumer anxiety and buying behavior.

3. It also identifies that the consumer anxiety results into food wastage.

II. Method

Consumer purchase behavior, expired promotional offers, and future food shortage are dependent factors, whereas consumer anxiety is an independent variable. Since the phenomena have been demonstrated by data collection and

testing to establish the previously described links, the technique is deductive in nature.

2.1 Design

In order to gather information and analyze the influence of causes causing consumer concern on current purchasing behavior and draw conclusions about the hypothesis, the study employed analytical research through the distribution of a questionnaire among the teens.

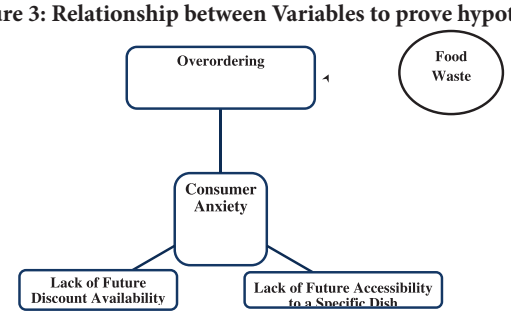
The hypothesis is created but for analysis it is further divided-

H1: Non- Availability of Discount and Particular Dish in future affect their current purchase decision

H2: Consumer Anxiety results into overordering

H3: Overordering results into Food Waste

Figure 3: Relationship between Variables to prove hypothesis



Source: Author Composition

2.2 Sampling Technique

The teenagers are categorized together based on demographic parameters. The teenagers were divided into school-age and college-aged groups based on the location of their studies. Cluster sampling is the method applied.

2.3 Sample Size

The sample size used for data collection and analysis consists of 401 teens, including those in school and college. The Cochran Sampling Formula is used to determine the sample size.

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where,

n = Sample Size

z = z statistic for a level of confidence

p = expected prevalence or proportion

d = Precision

A 95% confidence interval was used to determine the sample size, and the result was 295. Teenagers in India number 243 million, accounting for around 21.4% of the country's total population (Radha, N., & Iyer, S. R. 2018). The population size of teenagers was 384 based on Table I's 95% confidence interval, given that there are over a million teenagers worldwide.

Table 1: Sampling Table

	Confidence level = 95%			Confidence level = 99%		
	Margin of error			Margin of error		
Population size	5%	2,5%	1%	5%	2,5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1.000	278	606	906	399	727	943
10.000	370	1.332	4.899	622	2.098	6.239
100.000	383	1.513	8.762	659	2.585	14.227
500.000	384	1.532	9.423	663	2.640	16.055
1.000.000	384	1.534	9.512	663	2.647	16.317

Source: Check Mart Website

2.4 Data Collection Instrument

A survey-based technique was used in this study; therefore 500 teenagers each received a questionnaire with an error margin. Out of 205 colleges and 196 schools, the completed and well-organized questionnaire totaled 401.

2.5 Statistical Tools and Software

For data analysis, SPSS 22.0 is used, along with pie charts, probability plots, cluster analysis, correlation matrices, and descriptive statistics.

III. Result

3.1 Demographic Profile of the Respondents

Table 2: Demographic profile of the Teenagers on the basis of Age, Gender, and Place of Study

Factors	Classifications	No. of Respondents
Age	13-14	51
	14-15	33
	15-16	44
	16-17	32
	17-18	34
	18-19	207
Gender	Female	170
	Male	231
Study in (Place of Study)	School	196
	College	205

Source: Authors Composition

3.2 Impact of Discount or an offer on the purchase behaviour

Table 3: Discount and offer impact on purchase behaviour from the online food applications among the Indian teenagers' studying in the school and college

Discount and offer impact on purchase behaviour from the online food applications	N	Mean	St Dev	SE Mean
1	276	1.547	0.499	0.030
2	125	1.584	0.495	0.044

Source: Author Composition

The two sample T test was used to determine the effect of a discount or offer on the purchasing behavior of teens using online food applications since the population means of the two groups were equal.

Estimation for Difference

Table 4: Estimation for Difference between the population of school and college teenagers of India

Difference	95% CI for Difference
-0.0369	(-0.1422, 0.0685)

Source: Author Composition

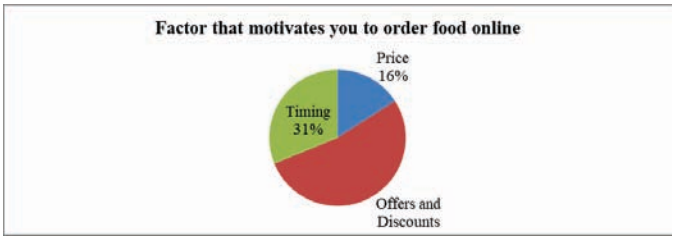
The groups shared similarities in the context of the effect evaluation of a discount or an offer on the purchase behavior from the online food apps since there was a negative difference between the school population and the teenager's population. Teenagers' purchasing behavior was either not affected at all by a discount or offer, or the answers were fairly equal.

3.3 Factor that motivates you to order food online

Table 5: Factor that motivates you to order food online

S. No.	Factors	Respondents (Total- 401)	
		Number	Percentage (%)
1.	Price	64	15.98
2.	Offers and Discounts	212	52.87
3.	Timing	125	31.15

Figure 4: Factor that motivates you to order food online



Source: Author Composition

"Promotion based on product and price" is a key tactic that the online apps employ. As indicated by 52.87% of the teens, deals and discounts were the driving force behind their online meal orders. The second significant aspect that inspired youngsters, accounting for 31.15% of the replies, was timing.

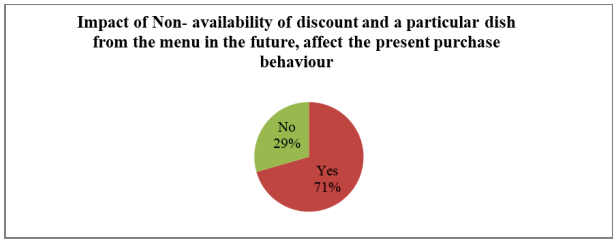
3.4 Non- Availability of Discount and Particular Dish in future affects their current purchase decision

Table 6: Impact of Non- availability of discount and a particular dish from the menu in the future, affect the present purchase behaviour

S.No.	Impact of Non- availability of discount and a particular dish from the menu in the future, affect the present purchase behaviour	No. of Respondents
1.	Yes	283
2.	No	118
Total		**401**

Source: Author Composition

Figure 5: Impact of Non- availability of discount and a particular dish from the menu in the future, affect the present purchase behaviour



The price of the goods or its potential future unavailability caused a rise in anxiety. The aforementioned graph illustrates how the absence of a specific dish, promotion, or discount influences consumers' present purchasing habits. 71 percent of teens had a favorable view on the way in which the absence of a discount, offer, or specific dish influences their current purchasing habits.

H1: Non- Availability of Discount and Particular Dish in future affect their current purchase decision= Alternative Hypothesis accepted

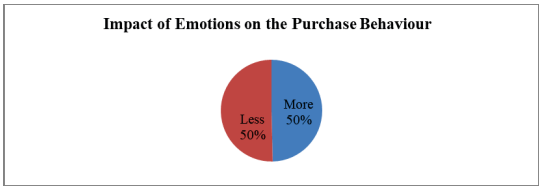
3.5 Impact of Emotions (state of mind- happy or sad) on the current purchase behaviour

Table 7: Impact of Emotions on purchase from the online food applications

S.No.	When angry or happy, order more or less food from the online food applications	No. of Respondents
1.	More	199
2.	Less	202
Total		**401**

Source: Author Composition

Figure 6: Impact of Emotions on purchase from the online food applications



Source: Author Composition

Our whole purchase behavior is influenced by an emotion. Happy and angry emotions were separated, and their impact on buying food from online food applications was quantified. Teenagers in India had roughly identical responses to the two options: more (49.64%) and less (50.36%). This study demonstrated how emotions affect consumers' purchasing decisions when they purchase food through online food applications.

H2: Consumer Anxiety results into over ordering= Alternative Hypothesis is accepted as the results are like impact of emotions affecting their buying behaviour (More=49.64%)

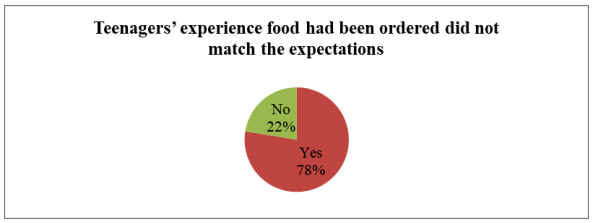
3.6 Teenagers' experience food had been ordered did not match the expectations as described on applications

Table 8: Teenagers' experience food had been ordered did not match the expectations as described on applications

S.No.	Teenagers' experience food had been ordered did not match the expectations	Respondents (Total- 401)	
		Number	Percentage (%)
1.	Yes	311	77.57
2.	No	90	22.43
Total		401	

Source: Author Composition

Figure 7: Teenagers' experience food had been ordered did not match the expectations as described on applications



Source: Author Composition

The graph above shows that 77.57% of teens experienced disappointment when their meal did not live up to their application's expectations. In order to achieve maximum satisfaction and eliminate the possibility of switching, online food applications needed to improve their user experience and engagement. Loyalty to specific applications will result from this.

78% Teens experience that the ordered food didn't matched their expectations as promoted ˅ FOOD WASTE

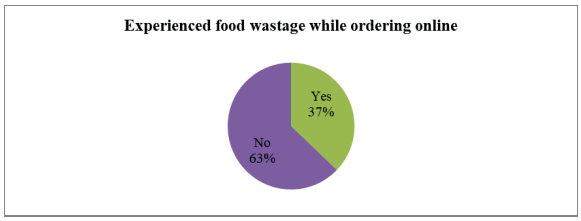
3.7 Experience food wastage while ordering online

Table 9: Experienced food wastage while ordering online

S.No.	Experienced food wastage while ordering online	Respondents (Total- 401)	
		Number	Percentage (%)
1.	Yes	149	37.05
2.	No	252	62.95

Source: Author Composition

Figure 8: Experienced food wastage while ordering online



Source: Author Composition

The graph presented a positive image for the online food application, as Indian youths expressed that 62.95% of them had never wasted food when placing an online order. Technology was used to make the process visible and to engage customers at every stage of the supply chain network, which led to a very happy customer experience. However, 37% of the adolescents reported wasting food while placing an online purchase. It is impossible to avoid this proportion, hence the operation must be effective.

H3: Over ordering results into Food Waste= Null Hypothesis accepted

3.8 Relationship between believe in saving environment and reducing wastage

Table 10: Relationship between believe in saving environment and reducing wastage

Correlations			
Variables		Believe in Saving Environment	Reduce wastage
Believe in Saving Environment	Pearson Correlation	1	.151**
	Sig. (2-tailed)		.002
	N	401	401
Reduce wastage	Pearson Correlation	.151**	1
	Sig. (2-tailed)	.002	
	N	401	401

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Author Composition

The correlation between the factors was found to determine the attitudes of the teenagers about minimizing waste and protecting the environment. The factors showed a significant and positive association. The correlation coefficient was 0.151. the typical range of -1 and +1. Since the partnership

was beneficial, India will continue to prosper sustainably in the future.

Indian teenagers are taking the initiative and going green to reduce the likelihood of causing "HAVOC" damage to the environment and to become informed consumers.

IV. Discussion

The study found that while the discounts provided by online food applications may draw users and impact their present purchasing decisions because of peer pressure, these effects are short-lived and do not translate into long-term behavioral changes. Perceived behavioral control would exist, as per the notion of Theory of planned behavior.

The research findings indicate a favorable correlation between emotions and buying behavior among Indian teenagers. Therefore, the marketing (the lack of a discount, offer, or specific dish from the menu in the future) and emotions (happy or sad) will influence the purchasing behavior of teens.

Since the meal that is ordered online is what the customer wants to eat at that specific time and location. Teenagers in India therefore said that placing an order using an online meal application did not result in waste. Food is not wasted when orders are placed online using the online food application. The majority of Indian teenagers had similar opinions. Hence, while ordering meals online via the food application, food waste is either nonexistent or very little.

The correlation between the factors was found to determine the attitudes of the youths about minimizing waste and protecting the environment. The factors' positive, robust association predicted India's future as a green, sustainable nation.

V. Conclusion

The study's goal is to determine how worry affects consumers' purchasing decisions. Data on the shift from dining out to utilizing online food applications was collected by the study from the digitally savvy teenager population. Promotions about discounts and the future availability of certain dishes were also taken into consideration. The study's goal is to examine how concern among consumers is influencing their present purchasing habits. The study is based on Ajzen's (1991) theory of planned behavior, which examined how intention, which develops behavior, is influenced by attitude, subjective standards, and perceived behavioral control.

In order to conduct the research, non-hierarchical groupings based on the place of learning—such as college and high school students—are created. The part of the marketing that highlights the product's future scarcity invariably causes customers' minds to race, leading them to purchase more of the product than is necessary. Due to the influence of their peers' and other younger generations' opinions, teens' attitudes about a specific meal and the lack of a discount on it have been the focus of this particular study's analysis. The study looked at the idea that discounts and future absences from a certain dish have a transient impact but do not change behavior that is governed by the behavior of food waste. However, a crucial component revealed that kids were having trouble finding meals that met their expectations, which were shaped by food applications promoted online. This factor contributes to waste as well, thus online food players should prioritize working toward consistency.

The study will assist both established players and upcoming ones in the online food market by highlighting the transient nature of scarcity-based marketing and the need for players to focus on standardization in order to instill sustainable behaviors in teens. The youth have positioned themselves as guardians of the environment and demand sustainability from all industries, including internet food vendors. Therefore, internet food companies need to develop a suitable procedure to establish an ecosystem that would support a "Win-Win" approach.

Limitations

Teenagers in India were the study's primary focus since they are viewed as influencers who affect the shopping decisions of other demographic groups. In comparison to the other categories excluded from the investigation, it also exhibits a stronger inclination towards digital technology. The only variables that affected the information collected from the teenagers enrolled in school were the teachers who gave the kids the online questionnaire and the schools' accessibility. The study examined how one variable affected customer anxiety, which leads to overordering and food waste, as well as how that variable affected buying behavior.

Scope

The age range that the study focused on was 13 to 19 years old. Future studies may encompass a broader spectrum of demographic generations and age groups, including millennia's. Several antecedents for the study were found by a literature analysis done between 2015 and 2023; they may be elaborated upon by adding other variables. The single

hypothesis, which was subsequently split into three sub-hypotheses based on the notion of planned behavior, serves as the foundation for the whole inquiry. Other theories of consumer behavior can be used to produce a framework with a unique design.

Conflict of Interest

There are no known conflicts of interest associated with this publication

Funding Statement

There was no financial support for the work that could have influenced the outcomes.

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HOW DO FINANCIAL MARKETS INTERACT? A VECTOR ERROR CORRECTION MODEL(VECM) ANALYSIS OF COMMODITY, BOND, CURRENCY, AND STOCK MARKETS

Dr. Silky Vigg Kushwah*

Purpose: *This paper investigates the interlinkages among major financial markets in India, aiming to analyze the dynamic relationships between different financial asset classes and evaluate their implications for portfolio construction and risk management.*

Design/Methodology: *The study employs a quantitative research design using daily time-series data spanning from 2018 to 2023 to analyze the interlinkages among four major financial markets in India: the stock market, bond market, commodity market, and currency market. The stock market is represented by the Nifty and Sensex indices, while the bond market includes indices for corporate bonds and green bonds. The commodity market is captured through the prices of Gold, Silver, Aluminium, Copper, and Cotton, and the currency market is represented by the INR/USD exchange rate. To examine the dynamic relationships among these diverse asset classes, the Vector Error Correction Model (VECM) is employed. This model is well-suited for analyzing co-integrated time series data, allowing for the identification of both short-term adjustments and long-term equilibrium relationships among variables. The VECM framework helps uncover how shocks in one market transmit to others, thereby providing a comprehensive view of market interdependencies over time.*

Findings: *The analysis reveals significant interactions across the selected asset classes, highlighting both immediate and persistent influences. The study identifies how shocks in one market can transmit to others, influencing asset prices and volatility, which is crucial for multi-asset investment strategies.*

Practical Implications: *Insights from the study can guide individual and institutional investors in portfolio diversification, enhancing return potential while managing exposure to risk. The findings support the development of more balanced and efficient portfolios by leveraging cross-market dynamics.*

Originality/Value: *By integrating a wide array of asset classes and applying a robust econometric framework (VECM), this research contributes to a deeper understanding of market interdependencies in India. It offers practical tools for investors to refine their strategic asset allocation.*

Keywords : *Bitcoin mining; carbon emissions; climate changes; green financial assets; portfolio optimization; wavelet coherence*
JEL Code: *C32, G11, G15, E44*

I. Introduction

The interlinkages among various financial markets hold paramount importance in understanding the broader economic landscape and guiding investment decisions (Dungey et al., 2006; Claeys and Vašíček, 2014; Gómez-Puig and Sosvilla-Rivero, 2014; Bekiros et al., 2018). Financial markets are interconnected in complex ways, with movements in one market often influencing or being influenced by another. Analyzing these interconnections can provide valuable insights into market dynamics, enhance portfolio diversification strategies, and improve risk management. Research indicates that financial market interdependencies are crucial for understanding systemic risks and improving financial stability (Claeys & Vašíček, 2014)

This paper investigates the interlinkages among significant financial markets in India, focusing on the commodity market, bond market, currency market, and stock exchange market. The study aims to provide an in-depth analysis of the relationships between different types of financial assets, exploring the potential for constructing an efficient investment portfolio that maximizes returns while managing risk. Studies have shown that understanding these relationships is essential for effective portfolio diversification and risk management (Dungey et al., 2006; Gómez-Puig & Sosvilla-Rivero, 2014). By analyzing these interconnections, investors can identify opportunities to diversify their portfolios, thereby reducing exposure to specific market risks and enhancing overall returns (Bekiros et al., 2018).

Understanding the interconnections between financial markets is crucial for several reasons. Portfolio diversification is one key aspect. By analyzing the relationships between different financial assets, investors can identify opportunities for diversification, which helps in spreading risk and reducing the impact of adverse

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movements in any single asset class (Markowitz, 1952). An optimized portfolio that includes a mix of commodities, bonds, currencies, and stocks can potentially achieve better risk-adjusted returns (Sharpe, 1964). Additionally, interconnected markets can transmit risks from one asset class to another. For instance, a decline in stock prices may affect bond yields, currency exchange rates, and commodity prices (Allen & Gale, 2000). Understanding these linkages allows investors and policymakers to anticipate and mitigate potential risks, thereby enhancing financial stability (Longin & Solnik, 2001).

Knowledge of market interdependencies can inform investment strategies by highlighting how different assets respond to economic events and market trends. This understanding helps investors make informed decisions about asset allocation, timing, and hedging strategies. For instance, optimal portfolio allocation can range from simple rule-based methods like equalweighting to sophisticated models like risk parity and minimum variance, which consider correlations between assets to manage risk effectively (Anderson, et al., 2012). For policymakers, understanding the interconnections between financial markets is essential for designing effective monetary and fiscal policies. It enables them to anticipate the broader impact of their decisions and implement measures to stabilize markets and foster economic growth. Research has shown that perfect market timing is nearly impossible and that strategies like dollar-cost averaging can help mitigate the risks associated with market volatility and timing errors.

This study focuses on the interlinkages among four key financial markets in India: the commodity market, bond market, currency market, and stock exchange market. By examining these diverse asset classes, the research aims to explore the potential for constructing an efficient investment portfolio that maximizes returns while managing risk. The period of analysis extends from 2018 to 2023, utilizing daily data of stock market indices (Nifty and Sensex), bond market indices (Corporate bond and Green bond), commodity market (Gold, Silver, Aluminium, Copper, and Cotton), and currency market (INR/USD rate). This timeframe captures recent market trends and events, providing relevant insights for current and future investment strategies. The current paper makes crucial contribution to the existing literature. firstly, this research examine interdependence across asset returns within a large range of asset classes like stock indices, corporate bonds, gold, silver, currency, commodities and green bonds. The findings of this study hold practical significance for a wide range of investors, including individual investors, portfolio managers, and institutional investors. By understanding the interplay between different markets, investors can make more informed decisions about portfolio diversification. This can help them optimize their investment strategies, enhance returns, and mitigate risks. Whether they are individual investors seeking to balance their portfolios or institutional investors managing large-scale assets, the insights gained from this research can assist them in achieving more balanced and efficient portfolios.

II. Literature Review

Recent research has highlighted the complex dynamics and interdependencies among various financial markets, offering valuable insights into how these markets interact and influence one another. The literature presents a range of methodologies and findings that contribute to our understanding of these interconnections.

Lee, Lee, and Li (2021) explore the dependencies of the stock market, renewable energy, and green bonds on their tails rather than their static averages. Their study reveals that the relationships among these markets are dynamic and driven by extreme events or tail dependencies. This finding is crucial as it suggests that average measures may not fully capture the risk and return characteristics of these assets, emphasizing the importance of considering tail risks in portfolio management and risk assessment. Another study by Reboredo (2018) utilizes bivariate copula models to examine the interrelationships among stock and energy commodity markets, and markets for corporate and treasury bonds. The study also considers markets for green bonds and various other fixed-income securities. The results indicate that green bonds have marginal connections with energy, stocks, and commodity markets. This implies that green bonds may offer diversification benefits, as their performance is relatively independent of the more traditional asset classes. Choi and Hammoudeh (2010) argue that price fluctuations in commodity assets should be routinely monitored by portfolio investors to enhance portfolio selection. This perspective highlights the volatility and sensitivity of commodity prices to various economic factors and the need for continuous monitoring to make informed investment decisions. By keeping a close watch on commodity price movements, investors can better anticipate market shifts and adjust their portfolios accordingly.

Ferrer, Shahzad, and Soriano (2021) examine multi-scale spillovers between green bonds and financial markets using

the frequency spillover index. Their study provides a detailed analysis of how shocks and volatility in one market can influence others across different time scales. This approach allows for a more nuanced understanding of market interactions, particularly how short-term fluctuations and long-term trends can have varying impacts on market behavior. Baruník and Křehlík (2018) investigate the interrelations in energy markets, financial markets, and green bond markets, revealing robust short-term links. Their findings suggest that there are significant immediate interactions among these markets, which can have implications for traders and short-term investors. Understanding these short-term dynamics is essential for exploiting arbitrage opportunities and for managing short-term risks effectively. Interesting research by Taghizadeh, Yoshino, and Phoumin (2021) argues that a decline in oil prices might reduce the incentive for renewable energy development, thereby negatively impacting the growth of green bonds. This relationship highlights the interconnected nature of energy markets and financial instruments tied to sustainability initiatives. The dependency suggests that fluctuations in oil prices can indirectly affect investor sentiment and funding for green projects.

Huang, Cao, and Zhong (2022) find that green bonds display a negative correlation with crude oil. This negative correlation indicates that as crude oil prices decrease, green bonds tend to perform better, and vice versa. Such a relationship can be attributed to the increasing attractiveness of green investments when traditional energy sources become less profitable. Li, Zhou, Hu, and Guo (2022) suggest that fluctuations in the price of crude oil adversely impact the index of green bonds. Their study implies that significant changes in oil prices can lead to volatility in the green bond market, affecting the stability and returns of green investments. This insight is crucial for investors who need to account for energy market trends when managing green bond portfolios. Deus, Crocco, and Silva (2022) emphasize that the green bond market in China benefits from robust green policies, which help mitigate the impact of external shocks, including volatility in oil prices. These policies foster a shift towards sustainability by providing a stable and supportive environment for green investments. The study underscores the importance of policy frameworks in shielding green markets from external economic fluctuations.

In a study by Umar, Ji, Kirikkaleli, and Alola (2021) identified strong co-movements between green bonds and traditional bonds, while noting limited correlation with conventional stocks and commodities. This finding indicates that green bonds tend to move in tandem with other fixed-income securities, suggesting similar risk and return profiles. However, their limited correlation with stocks and commodities makes them a valuable diversification tool in mixedasset portfolios. Le et al. (2021) reveal that volatility is largely transmitted across many markets in the short term, with green bonds subjected to net volatility shocks. This study highlights the vulnerability of green bonds to sudden market changes, emphasizing the need for investors to monitor broader market conditions and prepare for potential short-term volatility in their green bond holdings. Huynh et al. (2020) explore the behavior of portfolios composed of various financial assets and discover a notable reliance on heavy tails. This suggests a heightened probability of extensive joint losses during periods of economic instability. Such tail dependencies indicate that during extreme market conditions, these assets tend to experience significant losses simultaneously, underscoring the importance of tail risk management in portfolio construction. Azhgaliyeva et al. (2021) examine the impact of oil supply shocks on green bond issuance and find that these shocks positively influence the issuance of green bonds, contrary to the overall market trend. This counterintuitive finding suggests that disruptions in oil supply may drive investors towards greener investments, possibly due to increased awareness and demand for sustainable financial instruments during periods of energy market uncertainty. This highlights the role of green bonds as a viable alternative investment during times of traditional energy market disruptions.

In a study by Henriques and Sadorsky (2008), significant impact of oil price shocks on alternative energy stock prices is investigated. Their study reveals that oil price shocks can lead to substantial changes in the stock prices of alternative energy companies. This relationship underscores the sensitivity of alternative energy markets to changes in the traditional energy sector. However, it is also uncovered that shocks to technology stock prices have a noteworthy positive effect on alternative energy stock prices (Sadorsky, 2012). This finding indicates that advancements in technology can bolster the performance of alternative energy stocks, suggesting a symbiotic relationship between technological innovation and the growth of the alternative energy sector. Mensi et al. (2021) conduct a comprehensive analysis of the green bond market and reveal evidence of asymmetric spillovers within this market. The concept of asymmetric spillovers refers to

the phenomenon where shocks or changes in one market have unequal effects on another market, depending on the direction and magnitude of the initial change. In the context of green bonds, Mensi et al. find that these financial instruments exhibit characteristics that set them apart as a distinct asset class.

Overall, these studies contribute to a more comprehensive understanding of the dynamics between various financial assets. The identification of bitcoin and gold as crucial hedging assets, along with the positive influence of oil supply shocks on green bond issuance, provides valuable insights for developing robust investment strategies that account for both short-term volatility and long-term market trends. The uniqueness of this study lies in its comprehensive analysis of the interlinkages among multiple key financial markets in India, using a detailed dataset spanning from 2018 to 2023. By employing the Vector Error Correction Model (VECM), this research provides a nuanced understanding of both long-term equilibrium relationships and short-term dynamics among diverse financial assets. This approach not only sheds light on current market trends but also equips investors with the insights needed to develop strategies that leverage these connections to enhance investment outcomes and manage risks effectively.

III. Research Methodology

In this study, daily closing price data of stock market indices (Nifty and Sensex), bond market indices (Corporate bond and Green bond), commodity market (Gold, Silver, Aluminium, Copper and Cotton) and currency market (INR/$ rate) has been meticulously assembled. This data compilation process involved extracting requisite information from diverse sources, encompassing the Bloombergwebsite and RBI. The analytical journey in this study traverses the period from from 2018 to 2023, a chronicle defined by the disruptive emergence of the COVID-19 pandemic. The closing prices have been transformed into log returns to remove the problem of heteroscedasticity while exploring both short-run and long-run interdependence among these market indices.

The conventional methodology employed in similar studies in the past is based on estimating the time series model for the different financial assets under investigation. In our case, there are ten time series models employed to investigate the dynamic linkages among the different financial assets considered in the current study and are structured as follows:

When analyzing the connections between financial assets using an econometric model, the choice between the VAR model and the VECM model depends on the characteristics of the time series data (Atenya, 2019; Hung, 2019; Wu, 2020; Nathani & Kushwah, 2022). If the time series are stationary, meaning their statistical properties remain constant over time, the VAR model is appropriate. VAR captures short-term relationships between the assets, showing how changes in one asset affect others over time. In cases where the time series are non-stationary but not co-integrated, differencing the data to achieve stationarity may allow the use of VAR; Mills and Mills (2015), though this can introduce some uncertainty into the model's theoretical robustness. On the other hand, the VECM model is used when the time series are non-stationary but co-integrated, meaning they share a long-term equilibrium relationship; Kusuma & Kumar (2022); Papana et al. (2023) and Bhatia & Kushwah (2023). VECM is particularly useful because it accounts for both short-term dynamics and long-term relationships between the assets, making it a more comprehensive model in such cases. Before applying VECM, the Johansen co-integration test is commonly used to check for co-integration among the series; Dicky et al. (1991). If co-integration is found, VECM is the preferred method to analyze both the short-term adjustments and long-term equilibrium of the financial assets.

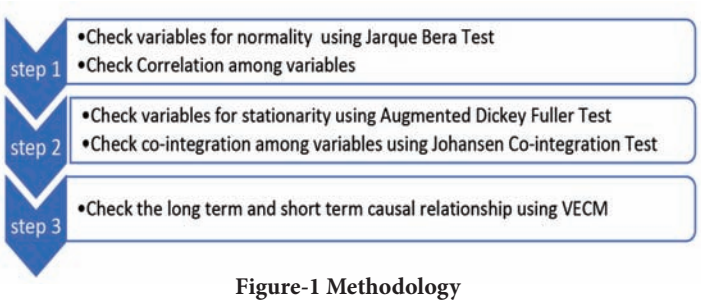

Figure-1 Methodology
Source: Authors' presentation

Descriptive Statistics

The financial assets time series employed in the current study is examined for normality using descriptive and Jarque Bera Normality Test, Jarque and Bera (1980, 1987) and are depicted in Table-1.

Table 1: Descriptive and Normality Test

Variables	Mean	Maximum	Minimum	Std. Dev.	Jarque-Bera	Probability
Lraluminium	-2.37E-05	0.029034	-0.087259	0.006561	39721.65	0.0000
Lrcopper	0.000103	0.052944	-0.03009	0.006657	1053.661	0.0000
Lrcorporatebonds	0.000157	0.014849	-0.00241	0.000633	3115007	0.00000
Lrcotton	2.48E-05	0.048773	-0.11853	0.008806	42723.3	0.00000
Lrgold	0.00024	0.068723	-0.04742	0.004612	270794.8	0.00000
Lrgreenbonds	-4.66E-05	0.027543	-0.01047	0.002095	42691.44	0.00000
Lrnifty	0.000254	0.050601	-0.03764	0.004883	13672.69	0.00000
Lrsensex	0.000254	0.046587	-0.03705	0.00487	10301.92	0.00000
Lrsilver	0.000235	0.119774	-0.06408	0.007889	125832.7	0.00000
Lrusa_Inr	4.60E-05	0.011463	-0.00813	0.001695	614.6457	0.00000

Source: Authors' presentation

Note 1: Lraluminium is log returns of aluminium prices, Lrcopper is log returns of copper prices, Lrcorporatebonds is log returns of corporate bonds. Lrcotton is log returns of cotton, Lrgold is log return of gold prices, Lrgreenbonds is log returns of greenbonds prices, Lrnifty is the log return of Nifty 50 prices, Lrsensex is log return of sensex 30 prices, Lrsilver is log return of silver prices and Lrusa_Inr is log return of USA/INR exchange rate.

*Note 2: * Significant at 10%, **Significant at 5 %, ***Significant at 1 % level of significance*

The descriptive statistics of the financial variables in this study, covering daily data from 2018 to 2023, provide a comprehensive overview of returns, volatility, and distribution normality across commodities, stock indices, bond indices, and currency markets. Nifty and Sensex exhibited the highest mean daily returns (0.000254), reflecting positive performance in Indian stock markets, while aluminium and green bonds had the lowest returns, with aluminium showing a slight negative trend (-0.0000237). Volatility, as measured by the standard deviation, varied widely. Silver demonstrated the highest volatility (0.007889), suggesting substantial fluctuations in its daily returns, while corporate bonds were the least volatile (0.000633), indicating stability. Stock indices (Nifty and Sensex) displayed moderate volatility, providing a balanced risk-return profile. The Jarque-Bera test results confirmed that none of the variables followed a normal distribution, with all p-values indicating significant deviations from normality. This is consistent with the fat tails and volatility clustering typically observed in financial markets. Overall, the data highlight the diverse performance of asset classes, with commodities being more volatile, bonds more stable, and stock indices offering a moderate level of risk and return. These findings form a basis for further exploration of the risk-return dynamics of these assets in varying market conditions.

Correlation Dynamics

To understand the existence of a relationship between the study variables, a correlation matrix is also formed. Table 2 show the cross-correlation matrices among the selected financial assets over the mentioned time periods. The correlation matrix provides valuable insights into the relationships between daily returns of stock indices, bonds, commodities, and the INR/USD exchange rate from 2018 to 2023. Nifty and Sensex are highly correlated (0.995), reflecting their similar movement as major Indian stock indices, while both have weak negative correlations with the INR/USD exchange rate, indicating minimal influence from currency fluctuations. Commodities such as copper and aluminium show moderate positive correlations with stock indices, suggesting some degree of co-movement with market performance. Silver and gold display the strongest correlation (0.694), reflecting their similar behavior as safehaven assets. Corporate and green bonds exhibit a moderate positive correlation (0.414), showing alignment within the bond market. Both bond indices have weaker correlations with other assets, while the INR/USD exchange rate shows generally low correlations across the board, suggesting its relatively independent movement. These correlation patterns highlight the interconnectedness of certain asset classes, such as stocks and commodities, while bonds and the exchange rate demonstrate more independent behavior. This information is crucial for understanding diversification and risk management in the Indian financial markets.

Table 2: Correlation Test Results

	Date	LRNifty	LRSensex	LRUSA/INR	LRCotton	LRCopper	LRAluminium	LRSilver	LRGold	LRGreenBonds	LRCorporatebonds
Date	1										
LRNifty	-0.00296	1									
LRSensex	-0.00491	0.995336	1								
LRUSA/INR	0.030475	-0.08558	-0.08311	1							
LRCotton	0.000247	0.160013	0.158079	0.025721	1						
LRCopper	-0.01629	0.254183	0.246675	-0.03318	0.306997	1					
LRAluminium	0.003953	0.088455	0.084123	-0.06113	0.164398	0.412737	1				
LRSilver	-0.01013	0.273351	0.263992	-0.00284	0.13908	0.25611	0.107379	1			
LRGold	-0.00383	0.061067	0.05199	0.006646	0.073132	0.146983	0.025008	0.694181	1		
LRGreenBonds	-0.05887	0.305237	0.298525	-0.09426	0.076518	0.317511	0.112751	0.393582	0.310531	1	
LRCorporatebonds	-0.06542	0.235099	0.218157	-0.06017	0.133363	0.193778	-0.00048	0.351486	0.307439	0.413851	1

Source: Authors' presentation

Note 1: Lraluminium is log returns of aluminium prices, Lrcopper is log returns of copper prices, Lrcorporatebonds is log returns of corporate bonds. Lrcotton is log returns of cotton, Lrgold is log return of gold prices, Lrgreenbonds is log returns of greenbonds prices, Lrnifty is the log return of Nifty 50 prices, Lrsensex is log return of sensex 30 prices, Lrsilver is log return of silver prices and Lrusa_Inr is log return of USA/INR exchange rate.

Stationarity

Additionally, further methodological precision involves examining the stochastic trends within the data, as described by Nelson & Plosser (1982). This is done through unit root tests, such as the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test, based on the work of Eliot et al. (1996) and Dritsaki & Dritsaki-Bargioti (2005). These tests are key in conducting empirical analysis to reveal the complex dynamics in the financial assets. The Augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller (1979), is conducted on each time series to assess their robustness. The outcomes of this test are discussed in detail in the results and discussion section. The ADF model is expressed as follows:

$$\Delta V_t = \alpha_1 + \alpha_2 + \alpha_3 V_{t-1} + \sum_{i=1}^{p} \beta_i \Delta V_{t-1} + \varepsilon_t$$

Where, ADF tests for the existence of unit root of V_t , the logarithmic values of all model variables at time t.

Cointegration model

In econometrics, when time series data are non-stationary, they are typically transformed into stationary series through differencing to allow for further empirical investigation (Box & Jenkins, 1976). However, this method raises concerns about the economic model's validity after such modifications, as differencing can remove valuable long-run information (Perron, 1989). Engle and Granger (1987) demonstrated that even if time series are non-stationary, they can be analyzed at their levels if they are integrated at the same order and exhibit cointegration. This implies that despite non-stationarity, cointegrated series may still show a long-run equilibrium relationship (Dickey, Jansen, & Fuller, 1991; Phillips & Ouliaris, 1990). Granger (1986) also highlighted the necessity of performing cointegration tests to avoid spurious regression results (Stock & Watson, 1988; Engle & Yoo, 1987). In this study, the Johansen Fisher test, based on Johansen and Juselius's (1990) methodology, is applied to examine cointegration. The results are summarized in the section on results and discussion. The null hypothesis tested is the absence of cointegration, while the alternative suggests cointegration.

This approach employs the maximum likelihood technique to determine the presence of cointegrating vectors in non-stationary time series within a Vector Autoregressive (VAR) framework of order l.

$$S_t = A_1 St_{\,1} + A_2 St_{\,2} + \ldots\ldots\ldots + A_k St_{\,1} + BU_t + ft \text{ - - - } (3)$$

Where, S_t = a l-vector of non-stationary I (1) variables, U_t = the vector of deterministic variables,

In this scenario, (St) denotes a vector of non-stationary variables. The coefficient matrix (Pi), which reflects the interrelationships between the levels of the series, can be factorized as (Pi = alphabeta). Here, (alpha) is a matrix containing the adjustment coefficients, and (beta) consists of the cointegrating vectors. To determine the number of cointegrating vectors, Johansen and Juselius (1990) recommend two likelihood ratio test statistics. The first is the Maximum Eigenvalue statistic, which tests the null hypothesis of exactly (r) cointegrating vectors against the alternative of (r + 1) vectors. The second is the Trace statistic, which examines the null hypothesis of at most (r) cointegrating vectors versus the alternative of more than (r) vectors. In these tests, the null hypothesis posits the absence of a cointegrating relationship, meaning (r = 0) or (r leq 1).

The outcomes of the stationarity and cointegration tests play a crucial role in determining whether to apply a VAR or VECM model for the study, allowing for the examination of both short-term and long-term dynamics between the selected financial assets. According to Johansen and Juselius (1990), cointegration tests are essential in deciding whether a VECM is needed, as this model accounts for nonstationary time series data while still capturing long-run equilibrium relationships (Engle & Granger, 1987). The analysis indicates

that the time series are nonstationary (explained in the following section) but show evidence of cointegration (also discussed in the next section). Therefore, the study employs the Vector Error Correction Model (VECM), which is appropriate for uncovering the Granger causal relationships between the variables (Granger, 1986). The VECM model is presented as follows:

$$\Delta y_{1,t} = \alpha_1(y_{2,t-1} - \beta y_{1,t-1}) + \epsilon_{1,t}$$
$$\Delta y_{2,t} = \alpha_2(y_{2,t-1} - \beta y_{1,t-1}) + \epsilon_{2,t}$$

In this model, the only variable on the right-hand side is the error correction term. In a longrun equilibrium scenario, this term equals zero. However, when (y_1) and (y_2) deviate from the long-run equilibrium, the error correction term becomes non-zero, prompting each variable to adjust in order to partially restore the equilibrium relationship. The coefficient (alpha) represents the rate at which the i^{th} endogenous variable returns to equilibrium. A critical consideration when estimating any VAR model is ensuring the correct model specification. To address this issue, we have employed the Akaike Information Criterion (Akaike, 1974) and the Schwarz Bayesian Criterion (Schwarz, 1978), following the guidance of Maddala (1992) and Mills & Prasad (1992).

Findings and Discussion

This section presents the findings of the study, which investigates the interlinkages among various financial markets in India. The analysis focuses on key asset classes from the commodity, bond, currency, and stock markets, covering the period from 2018 to 2023. Using daily data from indices such as Nifty, Sensex, corporate bonds, green bonds, and commodities like gold, silver, aluminium, copper, and cotton, the study provides a comprehensive exploration of the relationships between these markets. The Vector Error Correction Model (VECM) is employed to analyze the short- and long-term dynamics of these financial assets, shedding light on how they influence each other.

Stationarity Test

The table 3 presents the results of the Augmented Dickey-Fuller (ADF) test conducted on the log returns of various financial time series over the period from 2018 to 2023, including stock market indices (Nifty and Sensex), bond market indices (Corporate bonds and Green bonds), commodity markets (Gold, Silver, Aluminium, Copper, and Cotton), and the currency market (INR/USD exchange rate). The ADF test is commonly used to assess the stationarity of a time series by testing the null hypothesis of a unit root (Dickey & Fuller, 1979). A p-value below 0.05 indicates that the null hypothesis can be rejected, suggesting stationarity. In this case, the p-values for all variables are 0.0000, indicating that the log returns of each series are stationary at the 1% significance level. This finding suggests that the statistical properties of the returns, such as the mean and variance, remain constant over time, making them appropriate for econometric modeling (Brooks, 2019). Stationarity is critical for financial time series as it ensures the reliability of further analyses, such as volatility modeling and correlation assessments (Gujarati, 2009). Consequently, the stationarity of these variables supports their use in the broader econometric models developed in this study.

Table 3: Unit Root Test Results

Variables	Prob.value
Lraluminium	0.0000
Lrcopper	0.0000
Lrcorporatebonds	0.0000
Lrcotton	0.0000
Lrgold	0.0000
Lrgreenbonds	0.0000
Lrnifty	0.0000
Lrsensex	0.0000
Lrsilver	0.0000
Lrusa_Inr	0.0000

Source: Authors' presentation

Note 1: Lraluminium is log returns of aluminium prices, Lrcopper is log returns of copper prices, Lrcorporatebonds is log returns of corporate bonds. Lrcotton is log returns of cotton, Lrgold is log return of gold prices, Lrgreenbonds is log returns of greenbonds prices, Lrnifty is the log return of Nifty 50 prices, Lrsensex is log return of sensex 30 prices, Lrsilver is log return of silver prices and Lrusa_Inr is log return of USA/INR exchange rate.
Note 2: Significant at 10%, **Significant at 5 %, ***Significant at 1 % level of significance*

Lag selection

The lag selection table is used to determine the appropriate lag length for the VAR model, which is essential for analyzing the relationships between stock indices (Nifty, Sensex), bond indices (Corporate and Green bonds), commodities (Gold, Silver, Aluminium, Copper, Cotton), and the currency market (INR/USD)(Refer table 4). The table evaluates different lag lengths (0 to 8) using several criteria: Log Likelihood (LogL), Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Criterion (HQ). Each criterion aims to balance model fit with the complexity of the parameters. In this case, Lag 1 is selected by SC and HQ as optimal, while Lag 2 is preferred by AIC and

FPE, indicating that Lag 2 would likely be the best choice for the model.

Table 4: Lag selection

VAR Lag Order Selection Criteria
Endogenous variables: ALUMIUM CD__COTTON CD__USD_INR_ COPPER C...
Exogenous variables: C
Date: 12/11/23 Time: 10:56
Sample: 10/23/2018 10/19/2023
Included observations: 1125

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-76993.71	NA	4.62e+44	136.8990	136.9526	136.9193
1	-51011.95	51363.04	5.20e+24	90.96525	91.66213*	91.22859*
2	-50782.05	449.5968	4.46e+24*	90.81253*	92.15267	91.31895
3	-50689.12	179.7416	4.89e+24	90.90332	92.88674	91.65284
4	-50588.79	191.9178	5.29e+24	90.98096	93.60764	91.97356
5	-50498.28	171.2014	5.82e+24	91.07606	94.34601	92.31174
6	-50377.20	226.4490	6.06e+24	91.11680	95.03002	92.59557
7	-50281.75	176.4851*	6.62e+24	91.20310	95.75959	92.92496
8	-50189.24	169.0676	7.27e+24	91.29464	96.49440	93.25958

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Authors' presentation

Note 1: Lraluminium is log returns of aluminium prices, Lrcopper is log returns of copper prices, Lrcorporatebonds is log returns of corporate bonds. Lrcotton is log returns of cotton, Lrgold is log return of gold prices, Lrgreenbonds is log returns of greenbonds prices, Lrnifty is the log return of Nifty 50 prices, Lrsensex is log return of sensex 30 prices, Lrsilver is log return of silver prices and Lrusa_Inr is log return of USA/INR exchange rate.

*Note 2: * Significant at 10%, **Significant at 5 %, ***Significant at 1 % level of significance*

Given that the Johansen Cointegration test indicates the presence of 6 cointegrating relationships among the stock market indices, bond market indices, commodity market, and currency market, the most appropriate model to apply is the Vector Error Correction Model (VECM). The VECM is designed for systems where the variables are non-stationary but cointegrated, allowing it to account for both the short-term dynamics and long-term equilibrium relationships. In this case, since the variables are cointegrated, using a VECM will ensure that the long-term relationships between the markets are appropriately modelled, while also capturing the short-term fluctuations in the system. Therefore, a VECM is the most suitable choice to analyze these interrelationships.

Table-5: Johansen Co-integration Test

Hypothesized No. of CE(s)	Trace Statistic	Prob.**
None *	386.2414	0.0001
At most 1 *	296.2796	0.0158
At most 2	233.7214	0.0862
At most 3	182.6008	0.2107
At most 4	134.2201	0.501
At most 5	99.31971	0.6232
At most 6	69.38073	0.7428
At most 7	45.1214	0.827
At most 8	27.9613	0.8154
At most 9	12.75992	0.9022
At most 10	4.139193	0.892
At most 11	4.98E-05	0.9968

Source:Authors Calculations

Note 1: Significant at 10%, **Significant at 5 %, ***Significant at 1 % level of significance*

Cointegration model

Analysis of Significant Short-Term Interactions Between Financial Assets Using VECM The Vector Error Correction Model (VECM) results provide a clear framework to assess the short-term relationships between various financial assets such as stock market indices (Nifty and Sensex), bond indices (Corporate Bond and Green Bond), commodity markets (Gold, Silver, Aluminum, Copper, Cotton), and the currency market (USD/INR rate). The model identifies statistically significant relationships by estimating the influence of lagged values of one asset on the current values of other assets. These relationships offer insights into how shocks in one market propagate to others in the short term.

Table 6: Cointegration model

Variable	Coefficient	t-Statistic	Prob.
C(1)	-0.000904	-0.310564	0.7561
C(2)	0.073753	2.20043	0.0278
C(3)	-0.436149	-0.734935	0.4624
C(4)	-4.117552	-1.054118	0.2919
C(5)	25.43793	1.07143	0.284
C(6)	-1.236027	-0.257416	0.7969
C(7)	-0.004198	-1.77389	0.0761
C(8)	7.426161	3.51641	0.0004
C(9)	-0.001173	-0.15729	0.8751
C(10)	0.00989	0.107966	0.914
C(11)	-0.004813	-0.190564	0.8489
C(12)	0.267692	0.229089	0.8188
C(13)	-0.000424	-2.79291	0.0051
C(14)	1.27E-05	0.007199	0.9943
C(15)	0.078957	2.55576	0.0106
C(16)	-0.037933	-1.186544	0.852
C(17)	1.095866	0.886671	0.3753
C(18)	0.423141	1.692807	0.0905
C(19)	-3.50E-05	-0.284422	0.7761
C(20)	-1.196272	-1.785289	0.0742
C(21)	0.000245	0.631436	0.5278
C(22)	0.004724	0.990686	0.3219
C(23)	-0.001508	-1.147007	0.2514
C(24)	-0.02715	-0.446321	0.6554
C(25)	7.65E-05	3.679836	0.0002
C(26)	0.000466	1.948574	0.0514
C(27)	-0.008103	-1.912391	0.0559
C(28)	-0.177318	-6.35738	0
C(29)	-0.811936	-4.78871	0
C(30)	0.031927	0.93119	0.3518
C(31)	0.000104	6.137434	0
C(32)	-0.000149	-5.526515	0
C(33)	2.88E-05	0.540957	0.5885
C(34)	-0.000148	-0.228339	0.8194
C(35)	-2.62E-05	-0.145246	0.8845
C(36)	0.006643	0.796119	0.426
C(37)	-2.58E-06	-0.588671	0.5561
C(38)	4.20E-05	0.831743	0.4058
C(39)	0.000223	0.24951	0.8033
C(40)	-0.002419	-0.365127	0.715
C(41)	-0.054417	-1.520922	0.1283
C(42)	-0.010248	-1.416189	0.1567
C(43)	-5.41E-07	-0.151686	0.8794

Source: Authors' presentation

*Note 1: * Significant at 10%, **Significant at 5 %, ***Significant at 1 % level of significance*

Commodities Influencing Financial Markets

From the VECM results, we observe that commodities, particularly Aluminum and Copper, exhibit significant short-term impacts on other financial assets. The coefficient C(8), which represents Aluminum, has a significant t-statistic (3.516410) and a very low p-value (0.0004), suggesting that past changes in Aluminum prices have a strong and direct short-term impact on one or more dependent variables in the model, possibly stock indices or bond indices. This indicates that fluctuations in Aluminum prices could lead to immediate adjustments in broader financial markets. Similarly, Copper also has a notable influence, with coefficients indicating short-term significance. For instance, C(28), which represent Copper's lagged value, has a significant coefficient with a t-statistic of -3.357233 and a p-value of 0.0011, suggesting that Copper prices negatively impact the dependent variable, potentially stock or bond indices. This negative relationship implies that an increase in Copper prices could lead to a short-term decrease in these financial markets.

Stock Market Indices Influencing Commodities and Other Markets

The stock market indices, particularly Nifty and Sensex, also exhibit significant short-term impacts on the other financial assets in the system. The coefficient C(29), which may represent a stock index like Sensex, has a statistically significant value with a negative t-statistic (4.789372) and a very low p-value (0.0000). This result implies that past movements in the Sensex exert a substantial short-term negative impact on other financial assets, such as commodity prices or exchange rates. For example, a short-term increase in the Sensex may lead to a corresponding decrease in commodity prices or bond yields. Additionally, the Nifty index could also be influential in the short term, affecting various asset classes. The relationships captured in the VECM model suggest that stock market indices serve as critical channels through which information flows to other markets, particularly in times of volatility.

Bond Markets and Their Short-Term Influence

The Corporate Bond and Green Bond indices are also important components in the financial system. The coefficient C(13), which could represent a bond index, is statistically significant with a p-value of 0.0051, indicating that changes in bond prices have a significant short-term impact on other variables, potentially stock indices or commodity markets. This finding suggests that bond yields and prices could be a critical driver of short-term market movements, particularly during periods of heightened interest rate changes or monetary policy adjustments. The significant short-term relationships involving bond indices reflect the sensitivity of the broader market to fluctuations in interest rates and credit spreads. Changes in bond markets can ripple through to other financial markets, such as equity and commodity markets, affecting prices and returns.

Currency Market (USD/INR) Influence

The USD/INR exchange rate also plays a key role in driving short-term interactions among financial markets. The coefficient C(37), which may represent the USD/INR rate, has a significant t-statistic (2.979166) and p-value (0.0030), indicating that past fluctuations in the exchange rate significantly influence other financial assets, such as stock indices or commodities. The positive coefficient suggests that an appreciation of the USD/INR exchange rate could result in an increase in other asset prices in the short run, potentially due to the interconnected nature of global trade and capital flows. As currency markets are deeply integrated with commodities and equities, fluctuations in the exchange rate can lead to immediate adjustments in these markets, particularly for assets like Gold and Oil, which are priced in USD.

In a nut shell, the VECM results indicate that certain financial assets, including Aluminum, Copper, stock indices (Nifty, Sensex), bond indices (Corporate and Green Bonds), and the USD/INR exchange rate, have significant short-term impacts on other financial assets. Commodities like Aluminum and Copper exhibit strong short-term effects on broader financial markets, while stock indices and bond markets also drive short-term movements across various asset classes. Furthermore, the currency market plays a pivotal role, with fluctuations in the USD/INR exchange rate having an immediate influence on other markets. These interdependencies highlight the interconnected nature of global financial markets, where shocks in one asset class can quickly propagate to others.

Analysis of Significant Long-Term Interactions Between Financial Assets Using VECM

The VECM results reveal significant long-term relationships between various financial assets, such as stock market indices (Nifty and Sensex), bond indices (Corporate Bond and Green Bond), commodity markets (Gold, Silver, Aluminum, Copper), and the currency market (USD/INR rate). The presence of statistically significant error correction terms

(ECTs) suggests that these markets are cointegrated, meaning they share a long-run equilibrium despite shortterm deviations. For example, the negative and significant ECT for C(29) (stock market index) indicates that stock indices actively adjust towards the long-term equilibrium when deviations occur, playing a key role in stabilizing the broader system. Similarly, the significant and negative ECT for C(28) (Copper) highlights how commodities help restore equilibrium over time. These findings suggest that, despite short-term volatility, stock indices, bond yields, and commodity prices converge to a long-term relationship, making these assets important drivers in the financial ecosystem.

The currency market, represented by C(37) (USD/INR), also plays a pivotal role in the longterm adjustment process, albeit with a different dynamic. A positive and significant ECT for C(37) suggests that while the exchange rate initially reacts to short-term market fluctuations, it ultimately contributes to the system's return to equilibrium over time. This interdependency between financial markets is crucial for investors and policymakers. It demonstrates how markets adjust not only in the short term but also over extended periods, helping participants make informed decisions about hedging, diversification, and long-term strategy. These longterm relationships indicate that while markets may experience short-term shocks, they tend to realign over time, ensuring stability across various financial asset classes.

The findings of this research align with, and expand upon, existing literature that explores the interdependencies between various financial markets. In particular, this study's focus on the Indian market, using a comprehensive dataset from 2018 to 2023, confirms and contextualizes some of the earlier results in other markets while offering new insights specific to the Indian financial landscape.

The identification of strong short-term relationships between commodity markets, such as Aluminum and Copper, and other financial assets, reflects the findings of Choi and Hammoudeh (2010), who emphasize the need for continuous monitoring of commodity prices. This study, like theirs, highlights the significant influence that fluctuations in key commodities have on the broader market, supporting the idea that commodity price volatility is a crucial factor for portfolio management and risk diversification. However, this research extends the argument by showing that Aluminum and Copper, specifically, have a pronounced influence on stock indices and bond markets in India, indicating that commodity shocks in these sectors can propagate more broadly across asset classes in the short term.

In comparison with Ferrer, Shahzad, and Soriano (2021), who discuss multi-scale spillovers between financial markets, this study also confirms the presence of significant short-term volatility transmission. However, while Ferrer et al. focused on green bonds and financial markets in general, this research highlights the short-term spillover effects from more traditional commodities such as Aluminum and Copper. Additionally, the impact of stock market indices (Nifty and Sensex) on commodities and bonds adds nuance to the understanding of market interlinkages in India, reinforcing the importance of stock indices as key conduits for information transmission, as mentioned in previous studies.

The significant role of bond markets, particularly Corporate and Green Bonds, in influencing stock and commodity markets mirrors the findings of Reboredo (2018) and Umar et al. (2021), who noted the unique characteristics of green bonds and their interactions with other asset classes. However, while Reboredo found that green bonds have marginal connections with traditional markets, this research shows that both Corporate Bonds and Green Bonds in India have more pronounced short-term effects, particularly in response to interest rate changes. This suggests that green bonds in India, which have gained prominence due to sustainable investing initiatives, may have more significant interactions with other financial assets than previously thought. This finding is crucial for investors seeking to hedge interest rate risks and capitalize on the growing green bond market.

The USD/INR exchange rate's significant impact on commodities and stock indices, identified in this study, is consistent with earlier research by Huang, Cao, and Zhong (2022), who found a negative correlation between green bonds and crude oil prices. In this research, the exchange rate's effect on commodities like Gold and Copper provides further insight into how currency fluctuations can impact market dynamics, especially in a globalized financial environment where commodities are often priced in U.S. dollars. This underscores the importance of managing foreign exchange risks, as highlighted by Deus, Crocco, and Silva (2022), who emphasized the role of policy frameworks in mitigating external shocks in green bond markets.

The long-term equilibrium relationships identified in this study align with the concept of market cointegration explored by studies such as Baruník and Křehlík (2018) and

Li, Zhou, Hu, and Guo (2022). The significant error correction terms (ECTs) in this study suggest that despite short-term volatility, the Indian financial markets maintain long-run stability, a finding that echoes previous research on long-term dynamics in global markets. This long-term cointegration, particularly the stabilizing role of commodities like Copper and bond markets, highlights the potential for investors to leverage these relationships in their portfolio strategies. The findings confirm that, over time, commodities and bonds contribute to restoring market equilibrium, supporting long-term investment strategies that aim to hedge against short-term volatility.

IV. Conclusion

The research offers an in-depth investigation of the interlinkages among significant financial markets in India, focusing on four key asset classes: stock market indices (Nifty and Sensex), bond market indices (Corporate Bonds and Green Bonds), commodity markets (Gold, Silver, Aluminium, Copper, Cotton), and the currency market (USD/INR rate). The study utilizes daily data from 2018 to 2023 and employs the Vector Error Correction Model (VECM) to explore both short-term and long-term dynamics among these financial markets. The results of this research contribute significantly to the literature on financial market analysis by providing valuable insights into how these markets interact, influencing portfolio diversification, risk management, and investment strategies.

A key contribution of this study is the identification of significant short-term relationships between various financial assets. The results reveal that certain commodities, such as Aluminium and Copper, exert substantial influence on other financial markets in the short term. Aluminium, in particular, demonstrates a strong spillover effect on stock indices and bond markets, highlighting the importance of commodity price movements for investors. Similarly, Copper shows a negative short-term relationship with other asset classes, indicating that rising Copper prices may lead to declines in stock or bond indices. These findings underline the interconnectedness of financial markets, where shocks in one asset class, especially commodities, can propagate to other sectors, necessitating immediate adjustments in investment portfolios.

The study also emphasizes the central role of stock indices, such as Nifty and Sensex, in driving short-term fluctuations in bond and commodity markets. The negative correlation between Sensex and commodity markets suggests that rising stock prices may coincide with falling commodity prices, which is particularly relevant during periods of market volatility. Understanding these relationships enables investors and portfolio managers to navigate the complexities of cross-market dependencies and adjust their investment strategies accordingly. In essence, stock indices act as key transmission mechanisms through which economic events impact various financial markets.

In addition to the short-term dynamics, this study highlights the importance of the bond market, particularly Corporate Bonds and Green Bonds, in influencing other financial assets. Bond yields and their movements have significant implications for stock and commodity markets, especially during periods of interest rate adjustments. The growing prominence of Green Bonds due to the focus on sustainable investing further accentuates their role in modern financial markets. The study's findings underscore the need for investors to monitor bond market trends and adjust their portfolios to manage interest rate risks effectively.

The currency market, particularly the USD/INR exchange rate, also plays a crucial role in shaping short-term market dynamics. Fluctuations in the exchange rate, as demonstrated by the VECM results, significantly affect commodities and stock indices. This relationship is especially important for foreign investors and multinational corporations, as currency movements can impact both the profitability of investments and the cost of raw materials. By understanding how currency fluctuations influence other asset classes, investors can better manage foreign exchange risks and optimize their global investment strategies.

Beyond short-term interactions, the long-term equilibrium relationships identified by the VECM are of equal importance. The study reveals that despite short-term volatility, India's financial markets maintain a long-run equilibrium relationship. This finding is particularly evident through the significant error correction terms (ECTs) observed for various asset classes, which demonstrate how markets adjust to restore equilibrium after deviations. For example, the negative ECT for Sensex suggests that stock indices play a stabilizing role in the broader financial system by correcting themselves following short-term shocks. This long-term stability offers reassurance to investors, as it suggests that while markets may experience short-term turbulence, they eventually return to a balanced state.

Similarly, the significant long-term relationships observed for commodities, such as Copper, and bond markets indicate that these asset classes also contribute to restoring equilibrium in the financial system. These long-term relationships can be particularly valuable for portfolio diversification strategies, as they suggest that while individual asset classes may experience short-term volatility, they tend to move in tandem over the long run. This interconnectedness can be leveraged by investors to hedge against short-term market fluctuations, providing a buffer during periods of heightened volatility.

The study's findings on the long-term stabilizing role of the bond market, particularly Corporate and Green Bonds, are crucial for long-term investors such as pension funds and insurance companies. The significant ECTs for bond markets indicate that bonds adjust over time to bring the financial system back to equilibrium, offering stable returns during periods of uncertainty. Additionally, the positive ECT for the USD/INR exchange rate highlights the currency market's role in long-term market stability, providing foreign investors with a tool to manage currency risks in both the short and long term.

In conclusion, this research provides a comprehensive analysis of the interdependencies between India's financial markets, offering valuable insights into both the short-term dynamics and long-term equilibrium relationships between stock indices, bonds, commodities, and currencies. The findings have important implications for investors, portfolio managers, and policymakers, as they emphasize the need to manage cross-market dependencies and consider both short-term and long-term dynamics when making investment decisions. By understanding the intricate relationships between different asset classes, investors can optimize portfolio diversification, enhance returns, and mitigate risks, ultimately improving their investment strategies. This study, therefore, makes a significant contribution to the understanding of financial market interdependencies, providing a robust framework for navigating the complexities of the Indian financial landscape.

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EVALUATING THE ECONOMIC CONSEQUENCES OF EDUCATIONAL RESTRICTIONS ON AFGHAN GIRLS

Tarun Sagar* Pratheeksha Vijayalakshmi Ganeshan**

Purpose: *The objective of the study is to determine the impact of the misogynistic policies adopted by the Taliban 2.0 administration on the GDP of Afghanistan. Of specific interest are examining key determinants such as the Labor Force Participation Rate of females, Enrolment in Upper Secondary Education of females, and Maternal Mortality Ratio between 1996 and 2019.*

Design/Methodology/Approach: *Secondary data collected from various sources have been utilized in the research. The VIF test was conducted to verify multicollinearity among the independent variables. A multiple linear regression model has been employed to verify the correlation between the independent and dependent variables. A Durbin-Wu-Hausman test was used to check for endogeneity. VIF and Durbin-Wu-Hausman tests were performed using Python, while regression and correlation tests were performed using MS Excel.*

Findings: *The analysis reveals that women's Labor Force Participation Rate negatively impacts GDP, while women's enrolment in upper secondary education has a positive effect. Maternal mortality showed a negative but insignificant relationship with GDP. The study also estimates a $9.94 billion annual GDP loss due to the ban on women's education, emphasizing the economic cost of such policies.*

Originality/Value: *The research emphasizes the importance of women's participation in education and the labor force in pursuing economic development. It suggests that the Taliban administration needs to reexamine its policies and provide access to education for women at no cost, on an equal basis, and make them comfortable to work freely in the labor market.*

Keywords : *Taliban 2.0, GDP, Women's education, Labor Force Participation Rate of females, Maternal Mortality Ratio*
JEL Code: *J16, I25, J21, I15*

Introduction

Following the withdrawal of the US-led military coalition in Afghanistan and the Afghan National Security Forces collapsed leading to the fall of the Islamic Republic Government of Afghanistan, the Taliban seized control of all the legal and institutional infrastructure of the entire country in September 2021 — a feat they were unable to accomplish during their previous administration from 1996 to 2001. They promised to respect every individual's rights, including those of women permissible under Islamic law**[2]**. Still, soon after coming into power the Taliban administration imposed restrictions on women by segregating them from their male counterparts in classrooms, mandating hijab and separate entrances for female students in the Afghanistan Universities, and that the female students can only be taught by the female teachers. **[3]**

Further, in March 2022, the Taliban regime refused to reverse its decision to put an end to the restrictions upon girls attending secondary school for an indefinite period. **[4]** To aggravate the matter, they denied women access to education by barring them from all universities, and International NGOs such as UNICEF-led community-based education were banned.**[5]** They were requested to transfer to local organizations, undoing decades of progress gained since 2003 when women began reclaiming their fundamental rights. As per the data from the Special Inspector General for Afghanistan Reconstruction (SIGAR), at the beginning of 2001, only 29% of boys and 1% of girls were in school. However, statistics for 2016 indicate a significant increase in student enrollment, rising from 900,000 in 2002 to 8 million in 2013, highlighting the sector's overall growth.**[6]**

The plight of the Afghan women worsened with time, and an array of restrictions were imposed to curb further the rights of the Afghan women such as the decision of the Taliban's supreme leader Hibatullah Akhundzada in May 2022 to prevent women from travelling without a male companion more than 72 kilometers or forcing women to wear the all-covering burqa. **[7]** In April 2023, the Taliban further escalated these restrictions on women from participating in sports activities, visiting public parks, or working outside the home including the public sector such as the UN, and beauty salons, except for healthcare, primary education, and specific security facilities such as airports or women's prisons. Those who disobeyed these stringent laws faced harsh and public punishments, including verbal abuse, physical beatings, and even executions.**[8]** This situation may amount to "gender

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apartheid" as per the UN experts report.**[9]**

The women in Afghanistan are, hence, in a constant battle with the current regime to reclaim the most fundamental rights that one must have to create and be a part of a healthy society. Thus, this paper contains three main sections: Literature review, Methodology, and Results, and attempts to understand and evaluate the economic implications of the draconian policies adopted by the Taliban regime.

I. Literature Review

Mariel, E. (2022) provided a sound basis for understanding a strong positive correlation between "Enrollment in Upper Secondary Education," "Labor Force Participation Rate," and GDP. While this study provides valuable insight, Afghanistan's socio-political environment is so unique that, considering the policies of the Taliban, more is needed. According to research evidence, restrictions by the Taliban government on the attainment of education by females and seeking employment would have a substantial economic cost. The literature has also identified an interaction of cultural norms, issues regarding security, and access to healthcare as crucial elements in women's economic empowerment in Afghanistan. Thus, a more profound analysis is required to comprehend the economic consequences of the country's hindering female education and labour force participation, both in terms of the progress made before 2021 and the challenges presented by the current regime.

Muhammadi, S., Dariz, K., & Ahmadzai, M. Y. (2023) suggested that, between the years 2020-2022, economic growth and a labor force contributed by Afghan women who are either at the intermediary or higher educational level do not have a positive relationship. Authors have postulated that other sectors like trade, export, and import were more influential in ensuring economic growth within this period. Therefore, this issue has been complex and might be influenced by other factors such as political instability, security concerns, and structural inequalities.

Duflo, Esther, (Dec 2011) gives a wider theoretical framework for understanding the connection between women's empowerment and economic development. Educating women, providing them with healthcare, and opening up economic opportunities tend to bring better outcomes for families, communities, and national economies. The results presented in this paper also bring out the importance of gender equality for sustainably attaining development.

Hamidi, A. B. (2024) has surveyed 50 female students across five provinces with key impacts, such as emotional distress, forced marriages, migration, and loss of future opportunities. 96.4% of the respondents have reported suffering from severe emotional distress, whereas many are also suffering from depression and anxiety. Forced and child marriages have increased because families feel that there is no future for their daughters. Migration has increased, and many are leaving for neighbouring countries. The long-term effects are increased illiteracy, reduced employment opportunities, and organized exclusion from society. The study highlights the immediate need for international intervention to regain educational rights for Afghan girls.

II. Methodology

2.1 Premise

Afghanistan has experienced interminable political instability since the 1970s **[10]**, affecting millions of lives and leading to mass displacement and migration. This severely took a toll on the educational progression of the country, ranking it as one of the countries with the highest illiteracy rates in the world.**[11]** In war-torn countries, higher education and job opportunities often become the only beacon of hope. Afghanistan being the slowest performing economy even within the conflict-affected countries, completely excluding women from contributing to the economy can lead to a negative impact in the future considering a significant portion of the Afghan's working population is female. The female primary enrollment has increased, from

4.802% in 1999 to 88.334% in 2019. Female attendance at secondary schools remained low, with only 41.132% of the total enrollment in 2018. Youth illiteracy among girls (ages 15-24) was considerably greater than among males, indicating a significant gender disparity in schooling. Afghan women face challenges not only from the lack of educational opportunities but also from the cultural norms and societal expectations to marry young and have children, resulting in a high adolescent fertility ratio. **[12]** The legal and social environment further complicates women's economic engagement. The Women, Business, and the Law Index Score for Afghanistan was 38.125 out of 100 in 2021, indicating significant legal barriers to women's economic participation. Moreover, restrictions on women's mobility have increased, with the Mobility

Indicator Score decreasing from 50 in 2020 to 25 in 2023. The

percentage of female employers has declined from 1.061% in 2018 to a mere 0.362% in 2022. Women's representation in senior and middle management positions is minimal, at only 5.889% in 2020.

This complex environment offers an essential framework for examining the economic consequences of educational constraints on Afghan girls.

2.2 Data

Our study bases its numerical data from 1996 up to 2019; Thus, we chose the quantitative research approach to carry out our analysis. We have used data from the World Bank's website to conduct our study. As per the foundation led by Mariel, E. (2022), we have used "Enrolment In Upper Secondary Education, Female" and "Labor force participation rate, female" as two of our Independent variables. To measure the extent to which females have access to healthcare and the economic impact of preventing them from healthcare, we have used the "Maternal mortality ratio" as a proxy to measure its effects, which acted as our third Independent variable. Since we could not access the actual GDP figures, we collected the per capita GDP for each year and multiplied it by the respective population figures. We could not access the "Maternal Mortality" ratio data from 1996 to 1999; hence, we used the mean value to impute the null values. Since the data we collected was panel data, it helped us to comprehensively capture the trends and patterns that occurred during the 24 years, some of which have been visualized below.

2.3 Econometric Model

We have deployed a multiple regression model for our analysis where our dependent variable Y is GDP. Our independent variables, as we discussed before, are namely "Enrolment In Upper Secondary Education, Female", "Labor force participation rate, female", and "Maternal mortality ratio". The regression equation is represented as follows:

=80+ 1 1+ 2 12+ 3 3+

Y=GDP

0 = The constant term

1 = Beta Coefficient for Labor Force Participation Rate, female

2 = Beta Coefficient for Enrolment In Upper Secondary Education, Female

3 = Beta Coefficient for Maternal Mortality Ratio

1 = Labor Force Participation Rate, female (LFP)

2 = Enrolment In Upper Secondary Education, Female (EUSE)

3 = Maternal Mortality Ratio (MMR)

= Error term

III. Results

Regression Statistics	
Multiple R	0.96793236
R Square	0.93689306
Adjusted R Square	0.92742702
Standard Error	*1876567192*
Observations	24

	Coefficients	*Standard Error*	*T - Stat*	*P - value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	23325000000	7418204380	3.14431328	0.00510445	7851055338	38799000000	7851055338	38799000000
LFP	-822243384	358002436	-2.2967536	0.03256575	-1569000000	-75463388	-1569000000	-75463388
EUSE	50595.1929	5579.09318	9.06871264	1.5944E-08	38957.4084	62232.9773	38957.4084	62232.9773
MMR	*-5345847.5*	*3401601.5*	*-1.5715678*	*0.13173748*	*-12441464*	*1749768.85*	*-12441464*	*1749768.85*

Table I Regression Analysis

ANOVA					
	df	SS	MS	F	Significance F
Regression	3	1.0456E+21	3.4854E+20	98.9741191	3.5988E-12
Residual	20	7.043E+19	3.5215E+18		
Total	*23*	*1.116E+21*			

Table II ANOVA Analysis

The multiple regression model is a good fit since the Adjusted R-square is 0.92742702, so 92.74% of the variance in GDP comes from independent variables. ANOVA test where the F-statistic is obtained as 98.97, indicating that all the independent variables contribute to GDP. The

1 coefficient shows that the female labour force participation rate negatively correlates with the dependent variable by 822,243,384 units. The 2 coefficient female enrolment in upper secondary education has a significant positive relationship with the dependent variable. For every additional female enrolled in upper secondary education, the dependent variable will increase by 50,595.1929 units, keeping other variables constant. The 3 coefficient maternal mortality ratio has a value of -5345847.5 and is negatively related to the dependent variable. The conclusion is that female labour force participation rate and enrollment in upper secondary education are significant predictors, while the maternal mortality ratio is not statistically significant in this model.

Thus, we now test for multicollinearity to ensure that our independent variables are not highly correlated and would provide more accurate interpretations of the relationships among variables.

3.1 Variance Inflation Factor (VIF) Analysis

Table III VIF Analysis

Variable	
Constant	375.042591
LFP	3.089855
EUSE	4.025369
MMR	*2.883316*

The VIF analysis was conducted to assess multicollinearity for each independent variable and to undermine the reliability of coefficients. The test was conducted using Python by importing the pandas library.

The test results are as follows:

1. Labour Force Participation is 3.089, which is below the common threshold of 5, indicating a moderate level of correlation with other variables.

2.Upper Secondary Enrollment values boil down to 4.02, suggesting some correlation with other variables but not at a level of concern.

3.Maternal Mortality Ratio is the lowest among all of the variables at 2.883, showcasing the least correlation with other predictors.

4.The above results suggest that none of the variables show severe multicollinearity, which is greater than 5, indicating a reasonable stability of the econometric model.

3.2 Durbin-Wu-Hausman Test For Endogeneity

Table IV Durbin-Wu-Hausman Test

Test	*P-Value*
Durbin-Wu-Hausman Test	0.241133

The Durbin-Wu-Hausman test with a P-value of 0.24 gives further insight into endogeneity in the model. A principal assumption for carrying out a random effects model means that individual-specific effects are, by construction, uncorrelated to the other variables. The P-value of 0.24 suggests that we do not have enough evidence to reject the null hypothesis of no endogeneity, implying that this assumption is likely valid. Unobserved factors varying across the individual units of the panel data, specifically cultural or regional differences across Afghanistan, would not be correlated with the model's explanatory variables, such as female education enrollment or labour force participation. When this endogeneity assumption is met, the random effects estimator will be credible, consistent, and efficient. This also allows for a more reliable interpretation of the coefficients and their standard errors, besides improving the model's overall performance. It further supports endogeneity, claiming that results can be generalized from this sample since it applies well to broader contexts or another period in Afghanistan.

3.3 Correlation Analysis

Table V Correlation Analysis

Independent Variables	*LFP*	*EUSE*	*MMR*
LFP	1		
EUSE	0.81243433	1	
MMR	-0.7248438	-0.7973067	1

Female Labor Force Participation & Female Enrollment Upper Secondary Education

There is a strong positive correlation of 0.812. This means that higher female enrollment in upper secondary education tends to have more women participating in the workforce. It makes sense because education often leads to better job opportunities and higher employability for women.

Female Labor Force Participation & Maternal Mortality Ratio

There is a strong negative correlation of -0.725 which means that if more women are participating in the workforce then the maternal mortality rate tends to go down. This possibly could be because working women generally have access to better health care, are more financially independent, and keep abreast of more health-related issues, all of which contribute to safe pregnancies and deliveries.Female enrollment in upper secondary education & Maternal mortality ratio

There is a high negative correlation of -0.797 which suggests that well-educated women tend to make proper health decisions; they seek healthcare when necessary, and limit the risks encountered during childbirth.

Estimating the Loss in GDP due to the education ban on women:

Table VI Average Yearly Loss in GDP Calculation

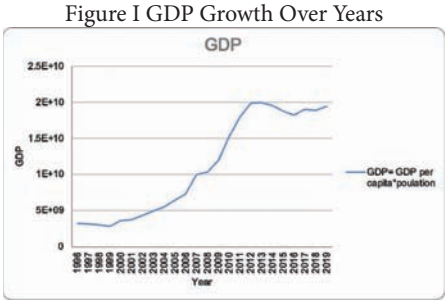
Year	Current Enrollment	Loss in opportunity
2003	31400	1588689057
2004	33100	1674700885
2005	39100	1978272042
2006	53900	2727080897
2007	68200	3450592156

2008	88300	4467555533
2009	122000	6172613534
2010	159000	8044635671
2011	248000	12547607839
2012	296000	14976177098
2013	321000	16241056921
2014	317000	16038676149
2015	323000	16342247307
2016	335000	16949389622
2017	348000	17607127129
2018	368000	18619030987
2019	185353	9377970790
	Average Yearly Loss:	9929613154

To estimate the average annual GDP loss from the ban on women's education, we took the beta coefficient of Enrolment In Upper Secondary Education, Female which came out to be 50595.1929 and then we multiplied it with the enrollment figures from 2003 to 2019 because the enrollment numbers prior to 2003 were 0 for women. We took its average after multiplying the beta coefficient with the respective year's enrollment numbers. We found that the annual average loss in Afghanistan's GDP because of its policies against women is about $9.94 billion.

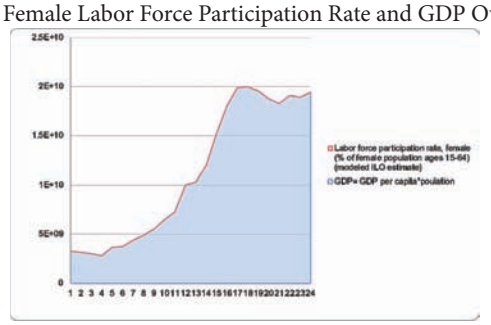
3.4 General Observations

Figure I GDP Growth Over Years



The graph reveals a long upward GDP trend from the late 1990s to 2008. Then, the rate accelerated sharply between 2005 and 2010, when GDP had approximately doubled, indicating a robust expansion of the economy. Beyond 2010, GDP growth turned slow, stabilizing the figure of about 20 trillion with minor fluctuations between 2012 and 2016, consistent with economic adjustments or external shocks. The sharp rise during the mid-2000s may be associated with favourable economic policies or global growth, and the post-2010 plateau may reflect the aftermath of the 2008 financial crisis, market saturation, or shifts in global economic conditions.

Figure II Female Labor Force Participation Rate and GDP Over Time



The graph shows the female labour force participation rate in red and the trend for the GDP figures as the blue-shaded region. The latter begins as stable and upward at the end of the 1990s; it then follows a sharp increase between the early 2000s and 2010 and stabilizes slightly afterward. Female labour force participation also rises over time but with more pronounced ups and downs than GDP. Both rising simultaneously might indicate that higher female workforce participation is somehow associated with higher economic growth. However, even when GDP peaks in 2010 and then stabilizes, the participation rate remains relatively steady, implying that while women's participation contributes to economic performance, other factors are likely influencing GDP growth.

IV. Conclusion

This study reveals how deeply the Taliban's misogynistic policies are economically devastating for Afghanistan's GDP. By multiple regression analysis, this study shows that female labour force participation and upper secondary education enrollment are the major factors influencing economic growth. This would suggest a possible negative relationship between female labour force participation and the GDP because of structural inefficiencies, underemployment, or the nature of jobs women may be limited to in the rather restrictive socio-political environment in Afghanistan. Upper secondary female enrollments have, however, revealed a very high positive relationship with the GDP; education, once again, as an instrument, is found transforming human capital and productivity, contributing to economic growth.

While the maternal mortality ratio presented a negative

association with GDP, its statistical insignificance implies that maternal health outcomes, though very important for social welfare, are not directly correlated with economic growth within the boundaries of this model. However, better maternal health may indirectly contribute to higher GDP levels due to increased participation of women in the labour market and better educational achievements.

Importantly, the estimated annual GDP loss due to banning education from women works out at a $9.94 billion estimate. It says something about devastating economic cost and gender-based restrictions and degrades their human capital, innovation potential, and social progress over the long term.

Therefore, the denial of education and work opportunities to women is a direct infringement on human rights and also the main hindrance to Afghanistan's economic growth. The Taliban administration should take these factors into account and ensure free and equitable access to education and a conducive environment for women to take part in the labour market.

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A STUDY OF FINTECH ADOPTION: PAST TRENDS, PRESENT INSIGHTS, AND FUTURE HORIZONS

Kajal Mittal* Prof. Sunil Kumar Gupta**

***Purpose**: This study examines the evolving research trends in FinTech adoption through a bibliometric analysis of Scopus-indexed publications from 2000 to 2024. It aims to identify key thematic areas, research gaps, and potential directions for future studies in the domain.*

***Methodology**: A total of 428 research publications were extracted from Scopus database based on predefined inclusion criteria, focusing on the business, management, and accounting domains. Bibliometric analysis was conducted using VOSviewer and Biblioshiny to assess citation structures, keyword trends, influential authors, and journal contributions.*

***Key Findings**: The bibliometric analysis highlights a growing research interest in FinTech adoption, with a significant surge in publications since 2019, peaking in 2024. The study identifies Technological Forecasting and Social Change, Journal of Risk and Financial Management, and International Journal of Electronic Finance as the most influential sources in the domain. Country-wise, India, the United States, and Malaysia lead in research contributions. Co-citation analysis reveals key research clusters, including technology adoption models (TAM, UTAUT), financial inclusion, risk and trust in FinTech, and blockchain innovations. The study also identifies underexplored areas, such as sustainability in FinTech, social responsibility, and leadership's role in adoption.*

***Implications**: This study provides a structured foundation for future FinTech adoption research by identifying key themes and gaps. It offers valuable insights for researchers, policymakers, and industry stakeholders, guiding informed decision-making and fostering innovation in the sector. The findings highlight the need for interdisciplinary approaches and global collaborations to drive sustained advancements.*

Keywords : Bibliometric analysis, FinTech, Adoption, VOSviewer, Financial Technology, Biblioshiny
JEL Code: *D85, G21, L86, O33*

I. Introduction

Financial technology (FinTech) is widely regarded as one of the most significant recent innovations in the financial sector. Its potential to revolutionize the industry by offering enhanced convenience and security in financial transactions has garnered substantial recognition. According to Gai et al., (2018), FinTech represents a novel technological application in the financial services industry, while Bajwa et al., (2022) describe it as the integration of finance and information technology.

This groundbreaking technology is reshaping the global financial ecosystem by enabling more efficient transactions and heightened security. Innovative FinTech solutions provide seamless transaction experiences anytime and anywhere, whether it involves riding a cab, shopping at a small retail outlet, or engaging in online transactions. The rapid growth of FinTech can be attributed to several factors, with the increased role of information technology in daily life being the most prominent. Technologies such as cloud computing, the internet, and big data have empowered the financial sector to optimize processes, enhance services, and innovate business models. Although FinTech has emerged as a distinct research area, its development remains fragmented (Bajwa, Ur Rehman, et al., 2018), primarily due to its dependence on various technology-related domains (e.g., blockchain, artificial intelligence). This expanding scope, driven by rapid technological advancements (Li & Xu, 2021), has led to diverging perspectives among researchers—resulting in fragmented developments of the field.

Many researchers have utilized bibliometric as a cross-disciplinary analytical approach, such as in management (Podsakoff et al., 2008). According to (Bjork et al., 2014), these studies provided comprehensive overviews of the relevant research area, including analyses of leading scholars,

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countries, and universities.

To achieve the study's objectives, a bibliometric analysis of data on FinTech adoption in business, management, and accounting, sourced from the Scopus database is conducted. The structure of the study is as follows: Section 2 provides an overview of the relevant literature on FinTech adoption, Section 3 outlines the methodological approaches used in the analysis, Section 4 presents the findings of the bibliometric study, and Section 5 offers conclusions, including recommendations for future research, while addressing the study's limitations.

II. Literature Review and Justification for Study

The historical development of FinTech can be traced back to as early as 1986. According to the Consumer International (2020) report, the evolution of FinTech can be categorized into three distinct phases. The first phase, spanning from 1866 to 1967, marked the foundational period with significant milestones such as the invention of the telegraph and the establishment of the transatlantic cable. The second phase, from 1967 to 2008, witnessed major advancements, including the introduction of ATMs and online banking services. The third phase, commencing in 2008, ushered in a new paradigm characterized by the era of digitalization and the integration of advanced technologies in financial services (Sahabuddin et al., 2019). Despite being a relatively new field of research, FinTech has experienced significant growth, reflecting its widespread acceptance and implementation. Moreover, there is limited clarity regarding the current state of FinTech research, its present contexts, and future directions, as previous studies often focused on a narrow set of keywords and research dimensions. Further gaps include a lack of analysis on country-level contributions, publication trends, and international collaboration tendencies, which could provide valuable insights into the progress of the financial services sector in different regions. Understanding these aspects could help foster cross-border collaborations and accelerate advancements in FinTech research.

FinTech has become a focal point of financial research due to its secure, efficient, and transparent processes. Its evolution is closely tied to the industry 4.0 revolution, encompassing technologies such as blockchain, big data, robo-advisors, the Internet of Things (IoT), cybersecurity, cloud computing, and crowdsourcing. The number of annual publications on FinTech grew steadily until 2018. However, the COVID-19 pandemic introduced critical implications for international finance, reshaping the trajectory of financial research (Le et al., 2021).

Using bibliographic sources, these techniques assist researchers in identifying the most significant findings. They can also be applied to various tasks, such as providing a comprehensive summary of a research topic and conducting analyses of leading scholars, organizations, and countries (Bjork et al., 2014). Specifically, the expected outcomes could serve as a brief overview of the literature available for analyzing and categorizing bibliographic data (Sindhu & Bharti, 2021). Many researchers have used this method to analyze keywords (Gurzki & Woisetschläger, 2017), institutions (Merigó et al., 2019), countries (Mas-Tur et al., 2019), and journals (Valenzuela-Fernandez et al., 2019). These techniques are effective in uncovering the intellectual convergence of prominent sources and trends (Kessler, 1963). Other common methods employed in bibliometric studies include reference co-occurrence and co-authorship analysis (Koseoglu, 2016).

These findings guided the authors in identifying key areas for bibliometric analysis of FinTech adoption research. The study aims to explore current trends in the field and highlight areas for further investigation. Therefore, this article is expected to enhance academic understanding of existing research on FinTech adoption and open new opportunities for future research in this domain. The methodology employed to carry out the analysis is detailed in the next section of the manuscript.

III. Research Questions

The study aims to address the following research questions:

RQ1: What are the primary areas of research on FinTech adoption?

RQ2: Which countries, journals, and authors are leading in this domain?

RQ3: Which articles are the most influential and highly cited in the field?

RQ4: What are the key research streams within the FinTech adoption literature?

RQ5: What are the potential avenues for future research in this domain?

IV. Methodology

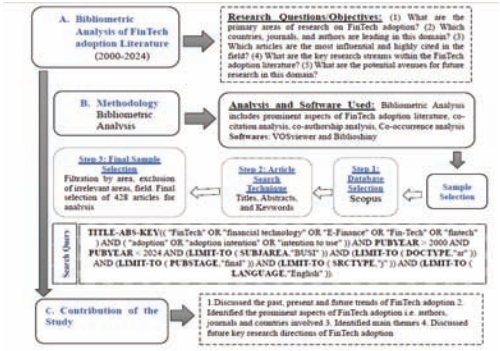

Figure 1: Methodology Flow Chart

The present study adopts the methodology proposed by (Tranfield et al., 2003) to utilize literature reviews as a systematic tool for identifying current and emerging trends. Bibliometric data focusing on FinTech adoption were collected from the Scopus database for the years 2008 to 2025. Initially, data cleaning techniques were applied to eliminate redundant, incomplete, or irrelevant data through manual screening. The study concentrated on papers with keywords and abstracts relevant to FinTech adoption and its related themes. Titles, abstracts, and keywords were manually filtered based on their relevance to the study's objective. Following (Fahimnia et al., 2015), the bibliometric analysis was conducted to assess the state of current research and propose future directions. Macro-level keyword definitions were based on the standards suggested by (Chen & Xiao, 2016). Subsequently, the retrieved results underwent micro-level filtering. The Boolean operation employed for bibliometric data collection was as follows:

TITLE-ABS-KEY(("FinTech" OR "financial technology" OR "E-Finance" OR "Fin-Tech" OR "fintech") AND ("adoption" OR "adoption intention" OR "intention to use")) AND **PUBYEAR** > 2007 AND **PUBYEAR** < 2026 AND (**LIMIT-TO** (**SUBJAREA**,"BUSI")) AND (**LIMIT-TO** (**DOCTYPE**,"ar")) AND (**LIMIT-TO** (**PUBSTAGE**,"final")) AND (**LIMIT-TO** (**SRCTYPE**,"j")) AND (**LIMIT-TO** (**LANGUAGE**,"English")).The focus was restricted to the field of business and management, with only final articles published in English selected for analysis. A total of 645 bibliometric records were initially retrieved. After reviewing the data to remove duplicates and redundant entries, and manually screening the "Titles, Abstracts, and Keywords," 428 entries remained for analysis.

Bibliometric analysis, a set of quantitative methods, was employed to assess text and data (Goyal & Kumar, 2021; Mishra et al., 2018). This method enables the extraction of new insights from literature reviews, which can then be integrated into the study (Suominen et al., 2016). Through bibliometric analysis, biographies on relevant themes are created, research patterns are identified, and key publications that map the current state of the field are evaluated (Gao et al., 2021; Hossain et al., 2022). The study utilized multiple bibliometric techniques such as authorship, citation, bibliographic coupling, and co-citation analysis, in line with the guidelines by (Donthu et al., 2021).

V. Results and Discussion

This section analyzes the results of the bibliometric analysis of the extracted literature. Researchers use bibliometric methods, including authorship analysis, citation analysis, bibliographic coupling, and co-citation analysis using software tools such as VoSviewer and Biblioshiny, to examine the biographical data published by (Donthu et al., 2021)

5.1 Performance Analysis

Table 1: Publication Trends

Year	Articles
2024	141
2023	108
2022	63
2021	36
2020	28
2019	19
2018	9
2017	1
2015	2
2014	1
2013	3
2012	1
2011	2
2010	2
2009	3
2008	3

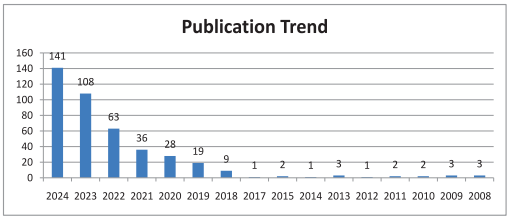

Figure 2: FinTech Adoption Research publication trends.
Source: Author's compilation.

The publication patterns in FinTech adoption research are illustrated in the bar diagram (Figure 1). While initial research in this field began in 2008 with only three publications, there has been a significant upward trend in recent years. The most productive year was 2024, with 141 articles published, and followed by 2023, which saw 108

publications. From 2019 onward, there has been a noticeable surge in research activity, with a steady increase in the number of publications each year. This rise can be attributed to growing interest in the field and its expanding relevance across industries. The trend indicates that research in FinTech is gaining momentum, with 2020 onwards marking a period of accelerated growth. Based on the current trajectory, it is expected that the field will continue to attract significant scholarly attention in the coming years.

5.2 Source Analysis

Table 2 and figure 3 list the top ten noteworthy journals that have consistently contributed to the field of FinTech adoption research. Source analysis identifies publications that regularly publish research on this topic, offering aspiring researchers' valuable guidance for organizing their submissions. With respect to the quantity of papers published on FinTech, Technological Forecasting and Social Change holds the top position with 25 articles, followed by the Journal of Risk and Financial Management with 22 articles, and the International Journal of Electronic Finance with 18 articles. Other notable contributors include the International Journal of Bank Marketing and the Journal of Financial Services Marketing, with 14 and 10 articles, respectively. These top sources collectively highlight the diversity of journals focusing on FinTech, providing a solid foundation for researchers seeking high-impact venues for publication.

Table 2: Top 10 sources in the domain

Sources	Articles
Technological Forecasting And Social Change	25
Journal Of Risk And Financial Management	22
International Journal Of Electronic Finance	18
International Journal Of Bank Marketing	14
Journal Of Financial Services Marketing	10
Research In International Business And Finance	10
Investment Management And Financial Innovations	9
Journal Of Islamic Marketing	9
Journal Of Payments Strategy And Systems	8
Cogent Business And Management	7

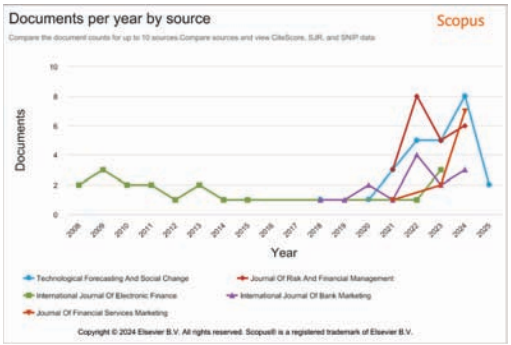

Figure 3: FinTech Adoption Research sources
Source: Scopus Database

5.3 Regional Contribution Analysis

Country-wise analysis of FinTech adoption research reveals India as the leading contributor with 75 publications, followed by the United States (48) and Malaysia (47). This highlights the prominent role of these countries in advancing FinTech adoption research, potentially influenced by their economic and technological advancements. Future studies could focus on underrepresented regions to enhance global understanding of FinTech adoption dynamics.

Table 3: Country Wise Publications

Country	Publications
India	75
United States	48
Malaysia	47
United Kingdom	39
China	35
Indonesia	34
Germany	19
Jordan	19
Spain	18
France	17

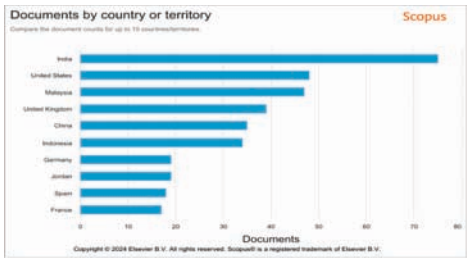

Figure 4: FinTech Adoption country-wise Publication
Source: Scopus Database

5.4 Most influential articles on FinTech Adoption research

Table 3 lists the most cited articles in FinTech research, reflecting their significant contributions to the domain. The article titled "Artificial Intelligence in FinTech: Understanding Robo-Advisors Adoption among Customers" by Belanche et al. (2019) is the most cited, with 396 citations. This study focuses on a research framework to understand the adoption of robo-advisors and highlights the role of personal and socio demographic variables, such as familiarity with robots, age, gender, and country, in moderating adoption. The study offers valuable insights for financial institutions to design robo-advisors and marketing strategies catering to diverse customer segments. The second most cited article, "How Blockchain Can Impact Financial Services – The Overview, Challenges, and Recommendations from Expert Interviewees" by Chang et al. (2020), has 367 citations. This research explores the transformative impact of Blockchain technology on the financial industry, emphasizing challenges, ethical concerns, and knowledge-sharing issues. It provides actionable recommendations to

overcome Blockchain adoption barriers using the Theory of Planned Behavior (TPB) approach. The third most influential article, "The Economics of Mobile Payments: Understanding Stakeholder Issues for an Emerging Financial Technology Application" by Au and Kauffman (2008), has received 334 citations. This study examines the economic forces influencing the adoption and implementation of mobile payment systems. By identifying relevant stakeholders and applying a robust evaluative framework, the authors provide practical insights for senior managers to navigate the economic aspects of mobile payments effectively. These highly cited works highlight critical areas of FinTech, including AI, Blockchain, and mobile payments, providing valuable directions for future research and practical applications.

Table 4: Most influential article in the FinTech adoption research.

Authors	Title	Total Citations
Belanche et al (2019)	Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers	396
Chang et al (2020)	How Block chain can impact financial services – The overview, challenges and recommendations from expert interviewees	367
Au and Kauffman (2008)	The economics of mobile payments: Understanding stakeholder issues for an emerging financial technology application	334
Milian et al (2019)	Fintechs: A literature review and research agenda	275
Albayati et al (2020)	Accepting financial transactions using block chain technology and cryptocurrency: A customer perspective approach	254
Senyo et al (2020)	Unearthing antecedents to financial inclusion through FinTech innovations	215
Akpan et al (2022)	Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic	212
Garg et al (2021)	Measuring the perceived benefits of implementing block chain technology in the banking sector	194
Singh et al (2020)	What drives FinTech adoption? A multi-method evaluation using an adapted technology acceptance model	191
Pizzi et al (2021)	Fintech and SMEs sustainable business models: Reflections and considerations for a circular economy	188

5.5. Knowledge foundations FinTech Adoption research through co-citation analysis

Co-citation analysis demonstrates the foundational knowledge of a topic through semantic connections of co-cited references (Donthu et al., 2021). The co-citation map of references cited at least seventy times in the review corpus's articles is presented in Figure 5, revealing key clusters that represent distinct thematic areas of research in FinTech adoption. The red nodes, featuring works by Rogers (Diffusion of Innovations) and Demirguc-Kunt and Klapper (on global financial systems), reflects studies exploring innovation diffusion and the role of financial inclusion in driving FinTech adoption. These works form the conceptual and global economic foundation for understanding FinTech trends. The green nodes, dominated by influential works from Venkatesh, Davis, and Morris, focuses on the behavioral and psychological dimensions of technology adoption. It includes seminal models such as TAM (Technology Acceptance Model) and UTAUT (Unified Theory of Acceptance and Use of Technology), which are widely used to study FinTech adoption and user acceptance behavior. The blue nodes, which include Haddad and Hornuf, emphasize the development and regulation of FinTech ecosystems. These works investigate the institutional and structural dynamics shaping the FinTech landscape, including the regulatory frameworks and market structures enabling FinTech innovation. The yellow nodes, represented by Junger and Mietzner, delve into banking innovation and FinTech's disruptive role in traditional financial institutions. This research examines how FinTech advancements are transforming the operational and competitive dynamics of the banking sector.

These clusters collectively illustrate the intellectual structure of FinTech adoption research, showcasing the integration of theoretical foundations, empirical insights, and practical implications across diverse domains. The analysis highlights the key scholarly contributions shaping the field and offers a roadmap for future research directions.

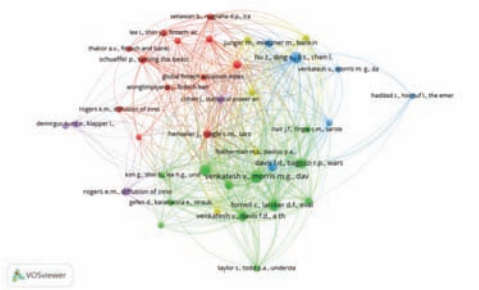

Figure 5: Co-citation of references cited by articles on FinTech Adoption research.
Source: Author's compilation.

5.6. Thematic and influence structure analysis through bibliographic coupling

Table 6 illustrates the theme clusters of FinTech adoption research. All facets of FinTech adoption are covered by five categories. Cluster 1 integrates foundational theories like the Technology Acceptance Model (TAM) (Davis, 1989) and the Theory of Planned Behavior (TPB) (Ajzen, 1991), emphasizing the significance of perceived usefulness, ease of use, and behavioral intention in FinTech adoption. Venkatesh et al. (2003) extend TAM into UTAUT, introducing variables like effort expectancy and social influence as critical factors influencing user adoption. Research in this area underscores user-centered determinants, providing a theoretical

framework for understanding consumer behavior in adopting innovative technologies.

Cluster 2 focuses on the interplay between perceived risk, trust, and psychographic traits, with studies like Featherman and Pavlou (2003) and Ali et al. (2021) identifying perceived risk as a significant barrier to FinTech adoption and trust as a mitigating factor. Gefen et al. (2003) integrate trust into TAM frameworks, highlighting its importance in online environments, while psychographic traits such as self-efficacy and perceived benefit enrich the understanding of user attitudes toward FinTech services.

Cluster 3 examines demographic traits (e.g., age, gender, income, education) and contextual factors, with the Global Findex Database (Demirguc-Kunt et al., 2017) exploring financial inclusion and the global FinTech revolution. Studies like Junger and Mietzner (2020) and Hu et al. (2019) incorporate demographic variables into adoption frameworks, offering empirical evidence on their moderating effects and highlighting the need for tailored FinTech solutions for diverse populations.

Cluster 4, grounded in the Diffusion of Innovations Theory (Rogers, 1995; 2003), examines the spread of FinTech innovations within ecosystems, with works like Gomber et al. (2018) and Lee and Shin (2018) analyzing the forces driving innovation, disruption, and transformation in financial services, providing a macro-level perspective.

Cluster 5 highlights advanced methodologies like PLS-SEM in adoption research, with Hair et al. (2011) and Henseler et al. (2015) contributing robust statistical tools for evaluating complex relationships, ensuring rigor and reliability in FinTech studies. Finally, Cluster 6 explores emerging constructs like user innovativeness, with Setiawan et al. (2021) examining its influence on adoption behavior in developing economies and Oliveira et al. (2016) focusing on determinants like perceived value in mobile payment adoption, showcasing their relevance in the evolving FinTech landscape.

Table 6: Thematic clusters of FinTech adoption research

Theme	Author(s)	Title
Behavioral Theories and Technology Acceptance	Davis F.D.	Perceived usefulness, perceived ease of use, and user acceptance of information technology
	Ajzen I.	The theory of planned behavior
	Venkatesh V., Morris M.G., Davis G.B., Davis F.D.	User acceptance of information technology: Toward a unified view
	Davis F.D., Bagozzi R.P., Warshaw P.R.	User acceptance of computer technology: A comparison of two theoretical models
	Venkatesh V., Thong J.Y.L., Xu X.	Consumer acceptance and use of information technology
Perceived Risk, Trust, and Psychographic Traits	Featherman M.S., Pavlou P.A.	Predicting e-services adoption: A perceived risk facets perspective
	Ali M., Raza S.A., Khamis B., Puah C.H., Amin H.	How perceived risk, benefit and trust determine user FinTech adoption
	Gefen D., Karahanna E., Straub D.W.	Trust and TAM in online shopping: An integrated model
Demographic and Contextual Factors	Demirguc-Kunt A., Klapper L., Singer D., Ansar S., Hess J.	The Global Findex Database 2017: Measuring financial inclusion and the FinTech revolution
	Junger M., Mietzner M.	Banking goes digital: The adoption of FinTech services by German households
	Hu Z., Ding S., Li S., Chen L., Yang S.	Adoption intention of FinTech services for bank users
Innovation Diffusion and Ecosystem Dynamics	Rogers E.M.	Diffusion of innovations
	Gomber P., Kauffman R.J., Parker C., Weber B.W.	On the FinTech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services
	Lee I., Shin Y.J.	FinTech: Ecosystem, business models, investment decisions, and challenges
Methodological Advancements in Adoption Research	Hair J.F., Ringle C.M., Sarstedt M.	PLS-SEM: Indeed a silver bullet
	Henseler J., Ringle C.M., Sarstedt M.	A new criterion for assessing discriminant validity in variance-based SEM
	Fornell C., Larcker D.F.	Evaluating structural equation models with unobservable variables and measurement error
User Innovativeness and Emerging Constructs	Setiawan B., Nugraha D.P., Irawan A., Nathan R.J., Zoltan Z.	User innovativeness and FinTech adoption in Indonesia
	Oliveira T., Thomas M., Baptista G., Campos F.	Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology

5.7 Keyword Analysis

Table 7 and fig. 6 reveals the study of keyword analysis conducted through VOSviewer software. This type of analysis helps to identify the keywords under each research stream in a research area. The red cluster centres on FinTech adoption and trust, exploring themes like perceived risk, financial literacy, behavioral intention, and models such as TAM, UTAUT, and UTAUT2, along with mobile banking and payments. The green cluster focuses on blockchain technology, highlighting sustainability, e-commerce, decision-making, and supply chain finances, showcasing blockchain's role in digital transformation. The blue cluster covers financial services, AI, e-finance, cryptocurrency, and topics like financial markets and crowdfunding, emphasizing technological advancements in finance. The yellow cluster emphasizes financial inclusion and mobile money, particularly in developing countries, alongside internet banking and behavioral intention.

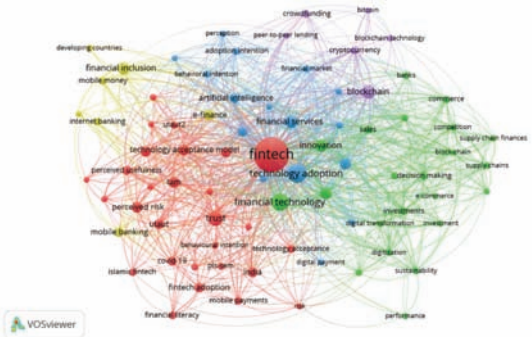

Fig 6: Keyword Analysis using VOSviewer

Keyword	Frequency
fintech	193
technology adoption	58
financial technology	48
trust	33
blockchain	32
financial services	27
financial inclusion	25
innovation	25
banking	22
finance	22

Table 7: Top 10 Keywords

VI. Future Research Directions

Although numerous studies have explored FinTech adoption, there remains significant scope for further research to address specific gaps and emerging areas in this field. Future studies could investigate how tailored policies and strategies can promote FinTech adoption across diverse demographic and psychographic segments. For instance, analyzing the implementation of targeted financial literacy programs or innovative app designs to enhance user trust and reduce perceived risks could provide actionable insights for policymakers and practitioners. Given the critical role of research and development (R&D) in driving FinTech innovation, future research can examine the integration of sustainability principles into FinTech R&D processes. This could include studies on sustainable technology development, ethical considerations in algorithm design, and long-term impacts of FinTech innovations on society and the environment.

Social responsibility is another area requiring attention in FinTech research. Studies can focus on how FinTech organizations contribute to societal well-being through financial inclusion initiatives, micro financing for underserved communities, or supporting small businesses. Future researchers could explore frameworks to align these activities with the broader sustainability goals of FinTech ecosystems.

The role of leadership in driving FinTech adoption is an emerging area of interest. Investigating the influence of leadership styles, such as transformational or adaptive leadership, on the successful implementation of FinTech strategies within organizations can provide valuable insights. Additionally, researchers can explore the role of institutional culture in fostering innovation and adoption of FinTech solutions.

The study of FinTech adoption is intrinsically linked to sustainable development goals (SDGs). Future research can explore how FinTech solutions align with specific SDGs, such as poverty alleviation (Goal 1), gender equality (Goal 5), or economic growth (Goal 8). These studies could provide a roadmap for FinTech organizations to contribute to global sustainability efforts effectively. Further, while existing studies have identified numerous factors influencing FinTech adoption, a comprehensive conceptual framework integrating these variables and explaining their interrelationships remains largely unexplored. Future researchers can focus on building such frameworks to enhance understanding of the enablers and barriers to FinTech adoption.

Finally, there is a lack of standardized scales for measuring FinTech adoption and its impact on sustainable development. Future research can develop and validate measurement scales that capture the multidimensional aspects of FinTech adoption, including technological, psychological, and socio-economic dimensions. Such advancements would significantly contribute to the theoretical and practical understanding of FinTech adoption and its role in fostering sustainability.

VII. Final Considerations

Bibliometric studies play a crucial role in understanding citation patterns, institutional research strengths, and networks of co-cited scholarly contributions. This study has mapped research trends, topic evolution, and key contributions in the field of FinTech adoption. Using bibliometric data extracted from Scopus, the study traces the development of this domain and identifies emerging areas for future exploration. By doing so, it provides actionable insights for academics, policymakers, and practitioners aiming to deepen their understanding of FinTech adoption and its associated factors.

The study is limited to bibliometric analysis based on Scopus data, which may exclude high-quality publications available only in other databases like Web of Science. Future studies could integrate data from multiple databases to provide a more comprehensive view. Additionally, while this study focuses solely on English-language publications, future research could include non-English publications to broaden the scope of insights. The analysis was confined to the business and management domain; extending the scope to include other domains could uncover interdisciplinary perspectives and enrich the understanding of FinTech adoption. These expansions would enhance the depth and breadth of future research in this rapidly evolving field.

VIII. Implications of the Study

8.1 Theoretical Implications

This study enhances the academic understanding of FinTech adoption by mapping research trends, identifying key themes, and highlighting influential contributions. The findings reveal a strong focus on technology adoption models, financial inclusion, risk and trust, and blockchain innovations, while areas such as sustainability, social responsibility, and leadership's role in FinTech adoption remain underexplored. By addressing these gaps, this study provides a structured foundation for future research and encourages interdisciplinary approaches. Co-citation and bibliographic analyses further guide scholars in aligning their work with emerging priorities and high-impact studies.

8.2 Practical Implications

For policymakers and industry professionals, this study offers insights into regional research contributions, influential studies, and key adoption factors such as trust, risk perception, and financial literacy. These findings can inform targeted policies, consumer education programs, and regulatory frameworks to enhance user confidence and FinTech adoption. Additionally, the identification of high-impact journals and research clusters provides valuable guidance for professionals seeking evidence-based insights to drive industry innovation and sustainable growth.

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DIESEL CAR BAN BY 2027 IN INDIA: A DISRUPTIVE DECISION FOR THE EXISTING BUSINESS ENVIRONMENT FACTORS

Dr. Sumit Saha* Dr. S. SaiGanesh**

Government of any country always plays an important role on existing business environments through its decision time to time. Diesel-powered vehicles were introduced in the early 1930s. The series production of the model 260D commenced at the end of 1935, and the world's first regular-production diesel car premiered in February 1936. Diesel vehicles were primarily used for commercial applications and public transportation due to their great torque and high fuel efficiency. Diesel cars have been prevalent in India for several years. They have been popular due to their fuel efficiency and torque, which makes them suitable for long-distance travel and heavy-duty applications. However, there has been a growing concern about the environmental impact of diesel vehicles, particularly in terms of air pollution and emissions of harmful pollutants like nitrogen oxides (NOx) and particulate matter (PM). As a result, the Indian government has implemented various measures to regulate and control the use of diesel cars in the country. These measures include stricter emission norms, higher taxes and surcharges on diesel vehicles, and the introduction of cleaner fuel standards. The government has also encouraged the adoption of electric vehicles (EVs) as a more sustainable alternative to diesel cars. It is worth noting that while there are ongoing discussions and debates about the future of diesel cars in India.

Hence, as a result the government has imposed a BAN ON DIESEL CAR BY 2027 IN INDIA. Because of this one of the business environment factors "legal" plays an important role in changing and transition of this Diesel vehicle to energy efficient and eco friendly alternate transport solution.

Keywords : Diesel car, EV, Business Environment factors

I. Introduction

A report commissioned by the Ministry of Petroleum and Natural Gas in India has recommended banning the use of diesel-powered four-wheeler vehicles incities with a population of over 10 lakh by 2027, in favour of electric and gas-fuelled vehicles. The panel headed by former Oil Secretary Tarun Kapoor also suggested phasing out motorcycles, scooters, and three-wheelers with internal combustion engines by 2035. To achieve its goal of cutting its emissions tonet-zero by 2070, India aims to produce

40 percent of its electricity from renewables by the same year, and reduce total projected carbon emissions by one billion tonnes. The report suggested boosting the use of natural gas, which is less polluting than liquid fuels like diesel, in industries and automobiles, and raising the share of natural gas in its energy mix to 15 percent by 2030 from 6.7 percent now.

The report also advocated for the extension of the FAME scheme beyond 31 March to accelerate EV production and adoption in the country. While the Indian government is yet to accept the report, the panel proposed that EVs may be promoted as the optimal solution in preparing for phasing out internal combustion engine two/three-wheel vehicles by 2035.

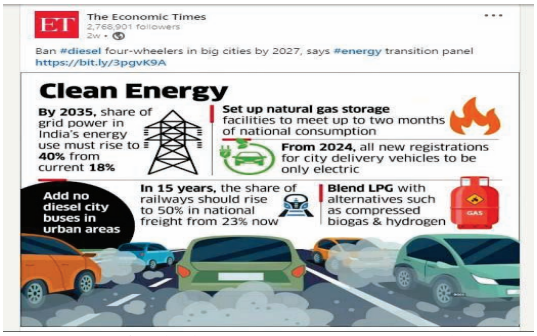

Fig-1: Twit in official 'The Economics Times' social media page

The major diesel car players in India now are Mahindra & Mahindra, Toyota Kirloskar Motor, Kia India, MG Motor and Hyundai Motor India Ltd. Going by industry numbers shared by the officials, banning of diesel vehicles by 2027 need not be a pipe dream.

"The share of diesel cars in the total industry volume is on the decline. Ten years back, diesel cars accounted for about 58.4

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per cent of the industry volume. In April 2023,the share was just 17.4 percent. Last year, it was 18.6 percent, "Shashank Srivastava, Senior Executive Officer (Marketing & Sales), Maruti Suzuki India Ltd, told IANS.


PETROLEUM MINISTRY'S ENERGY TRANSITION ADVISORY COMMITTEE SUBMITS FINAL REPORT

Ban Diesel 4-Wheelers in Big Cities by '27: Panel

KEY PROPOSALS Transition must be in favour of EVs, share of grid power in national energy basket should double to 40% by 2035

Clean Energy

Fig-2: Newspaper report on Diesel vehicle ban

WHATISTHEREASONFORTHISDECLINE?

The economic logic for a diesel car is no longer the reowing to the marginal difference in the retail price between petrol and diesel and the high upfront price of diesel cars. The SUV/MPV segment has a major presence in the diesel segment. Within that, the midsize SUVs have 54 percent volume share. Diesel cars world over are disappearing and manufacturers are not investing in them.

"With the decline in market share of diesel-powered vehicles, attention is shifting towards gasoline and alternative fuel vehicles such as CNG and electric cars. Diesel shares in the total Indian passenger vehicle market has reduced from about 36 percent in 2018 to 18 per cent now, which meansless than one of the five cars sold in India is diesel-powered. The share of petrol engine-powered cars has grown from 54 per cent in 2018 to 60 per cent now," Venkatram Mamillapalle, Country CEO & Managing Director, Renault India Operations, told IANS. By the end of 2019, Renault India had ceased the use of K9K diesel engines and subsequently halted production of all diesel vehicles.

"The decision was made to align with the transition to the BS VI emission norms mandated by the government. These regulations establish strict standards for exhaust emissions, requiring vehicles to implement advanced technology to curb pollutants," Mamillapalle said.

The panel has advised the government to provide incentives to boost the adoption of electric and other alternative fuel cars.The suggestion comes as India's air pollution situation worsens, with cities like Delhi and Mumbai facing dangerously high levelsof pollution on a regular basis. Diesel automobiles, which generate high quantities of particulate matter and nitrogen oxides, are a key contributor to the problem.The proposed ban would have a severe impact on India's auto industry, which is highly reliant on diesel automobiles. It is, however, viewed as a crucial step in tackling the country's pollution crisis.

Experts have praised the initiative while also calling for more forceful action. Some have urged that the restriction be expanded to include all automobiles, not simply those older than ten years.

India aims to raise the share of gas in its energy mix to 15% by 2030 from 6.2% now. The panels said new registrations of only electric-powered city delivery vehicles should be allowed from 2024 and suggested for higher use of railways and gas-powered trucks for the movement of cargo. The railway network is expected to be fully electric in two to three years.

The transport sector consumes 80.7% of diesel as against the non-transport sector's 19.3%.

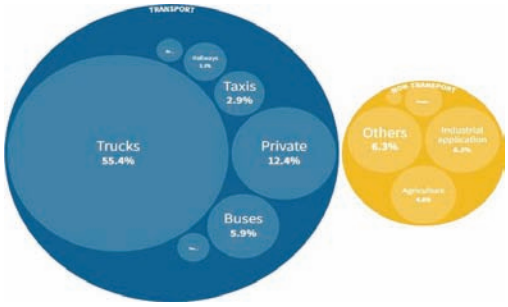

Fig 2: Diesel consumption (%) by sector (Source: Newspaper the hindu.com/news)

II. What is the background of this Proposal?

The panel's recommendations come in the wake of the government's stated aim to reduce greenhouse gas emissions, and to produce 40% of its electricity from renewables as part of its 2070 net zero goal. Diesel currently accounts for about40% of India's petroleum products consumption, according to estimates by the Petroleum Planning & Analysis Cell.

The proposed ban will have a significant footprint—a large number of cities in India have more than 1 million people, and include not just the metropolitan centers, but also smaller towns and cities such as Kota, Raipur, Dhanbad, Vijayawada, Jodhpur and Amritsar.

Long-distance buses in India will have to be powered by electricity in the long-term, it said, adding that gas can be

used as a transition fuel for 10-15 years. India aims to raise the share of gas in its energy mix to 15% by 2030 from 6.2% now. The panel said India should consider building underground gas storage, equivalent to two months' demand as demand is expected to rise at a compound average growth rate of 9.78% between 2020 and 2050. It suggested the use of depleted oil and gas fields, salt caverns and aquifers for building gas storage with the participation of foreign gas-producing companies.

The ministry said that the recommendations of the panel are futuristic. It also added that it requires a lot of deliberation with all stakeholders and manufacturers to take a final call on whether to implement such bans.

Currently, diesel-powered vehicles contribute to about 40 percent of sales in India. This includes both commercial and private vehicles. The transport sector depends almost 80 per cent on diesel for their operation. A ban like this would require proper planning to offer alternate fuel options. Hence the minister said, "No decision has yet been taken on ETAC recommendations."

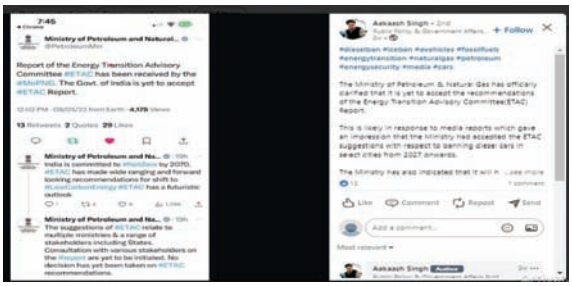

Fig-4: Social media posts of Government officials

Who will benefit and who will lose out?

From a climate perspective, if a ban were imposed on diesel engines, the result would be a great reduction of the carbon footprint in the atmosphere. Apart from this, the ones to benefit from would be manufacturers of electric and hybrid vehicles. A transition from diesel cars to hybrid and electric cars will mean an increased demand for batteries in these vehicles.

While we see the greener side of the grass, we at the same time would be undergoing major losses. The petroleum refineries might slash employees by almost 50 per cent. Moreover, this will also bring in a major down phase in the life of entrepreneurs dealing in transportation. This will indirectly affect the running cost per km resulting in price hikes for goods and public transportation.

On the other hand, EV's with Lithium-ion batteries can reduce Environmental effects, Reduce dependency on fossil fuels, Technological advancement etc and can make India diesel free. Also, the decline in the market share of the diesel industry has been drastic as the EV is disrupting the Automobile industry with its new Environmentally Friendly Values and Benefits.

III. Rationales for BAN ON DIESEL CAR:

➔ Environmental Impact: Diesel vehicles contribute significantly to air pollution, which is a major environmental and health concern. They emit high levels of particulate matter, nitrogen oxides, and other harmful pollutants that can cause respiratory problems, lung cancer, and other health issues. By banning diesel vehicles, we can reduce the amount of air pollution and improve the quality of air for everyone.

➔ Climate Change: Diesel vehicles are also major contributors to green house gas emissions, which are a major cause of climate change. By banning diesel vehicles, we can reduce the amount of greenhouse gas emissions and slow down the pace of climate change. This is particularly important given the urgent need to address climate change and its potential impacts on our planet.

➔ Public Health:Diesel vehicles not only harm the environment but also public health. Studies have shown that air pollution from diesel vehicles can lead to serious health problems such as asthma, heart disease, and cancer. By banning diesel vehicles, we can protect public health and improve the overall well-being of the population.

➔ Technological Advancements: Banning diesel vehicles can also stimulate the development of new and innovative technologies that are less harmful to the environment and public health. This can lead to a shift towards cleaner and more sustainable modes of transportation, such as electric or hybrid vehicles, which are less harmful to the environment and public health.

➔ International Agreements: Many countries around the world have already committed to phasing out diesel vehicles as part of their efforts to address climate change and reduce air pollution. By banning diesel vehicles, we can align our policies with international agreements and take a leadership role in promoting sustainable transportation globally.

IV. Discussion Questions

1. What will be the alternate solution for manufacturers who have been manufacturing diesel cars?

2. What will happen to the existing diesel cars owned by customers? Will there be any exchange benefits provided for existing cars?

3. Which of the Business environment factors is/are influencing most in this case and how?

4. What are the potential economic implications of the diesel car ban, including the cost of transitioning to alternative fuels and infrastructure upgrades?

5. What are the environmental implications of scaling up EV production, particularly in terms of battery production and disposal?

6. How can the industry address concerns have related to the extraction of raw materials for lithium-ion batteries and the recycling or disposal of used batteries?

V. Conclusion

The Indian government has already made initiatives to promote electric and other alternative fuel vehicles, such as granting tax breaks and subsidies for the purchase of electric vehicles. However, acceptance of these cars has been gradual, and many believe that more should be done to encourage their use.

The proposed ban on diesel vehicles could have both positive and negative implications. It may lead to a reduction in green house gas emissions and air pollution, potential investment opportunities in the automotive sector, and accelerate the transition to renewable energy.

However, there may also be job losses in the diesel vehicle manufacturing sector and challenges in implementation, especially for commercial vehicles. Additionally, there could be resistance from stakeholders who have already invested in transitioning to the BS-VI emission norms. Overall, careful consideration and planning are necessary to ensure a smooth transition to alternative fuels.

To conclude, the proposed ban on diesel vehicles in key Indian cities by 2027 is an important step toward tackling the country's air pollution crisis. While it will have a significant influence on the automobile industry, it is regarded as an important step toward encouraging cleaner and more sustainable transportation. The government must now work to successfully execute the prohibition and encourage the use of alternative fuel cars. This decision is an significant effect of the existing business environment for Indian automotive industry.

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Printed, Published and owned by Manish Gupta, at MOR Pkt. 105, Kalkaji, (Opp. Kalkaji Police Station), New Delhi - 110019.
Printed by Applauze Creative, No. 3, 2nd Floor, DSIDC, Okhla Indl. Area, Phase-I, New Delhi - 110020. Editor: Amit Gupta