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THE GROWTH STORY OF THE TWO ASIAN GIANTS- CHINA AND INDIA

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ABSTRACT

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China and India are ranked among the top Asian economies of the world. Both these countries had their challenges as developing countries. China's growth take-off occurred around the same time as India's, under the leadership of Deng Xiaoping. Till about 1990, the GDP of the two countries were roughly equal in purchasing power parity (PPP) terms. Consequent upon a balance of payment crisis by the late 1980s, India adopted Liberalisation, Privatisation, and Globalisation, to reform the economy. As two of the most populous countries in the world, China and India have both experienced fast economic growth and a fall in poverty rates in the past four decades. The advent of globalisation aided trade and openness, provided a scope for development. There has been rapid transformation of their economies and also a rise in their per capita income. As per the World Bank, China has reduced poverty levels from 770 million (1978) to 5.5 million people (2018). By 2021, China declared that it has eradicated extreme poverty and boasts of a moderately prosperous society in all respects. Massive investment in education and expansion of health care since the 1950s has resulted in real achievements. Meanwhile, India has overtaken China as the most populous country of the world. The World Bank (June 7th 2025), has revised its threshold poverty line to \$3 per day and as per that Extreme poverty in India has declined from 27.11percent in 2011-12 to 5.3percent in 2022-23. China's present GDP is about \$20 trillion in comparison to India's \$4.18 trillion. This paper is an attempt to understand, and relate the growth story of India and China since the last fifty years, particularly after the onset of 1990s troika of liberalisation, privatisation and globalisation (LPG) / openness.

KEYWORDS: Growth, poverty, reforms, population, globalisation

INTRODUCTION

A recent study by C. Rangarajan and S. Mahendra Dev (2025) finds that the poverty ratio in India has fallen sharply from 9.5% in 2022-23 to 4.9% in 2023-24 and this has been accounted to the GDP growth rate.

(<https://indianexpress.com/article/opinion/columns/poverty-fell-significantly-last-year-much-of-it-was-driven-by-gdp-growth-10034803/>). The latest NSO reports also show the GDP growth rate is 6.5%, which is a good news. However, this is a service sector led economic growth. India needs to make the growth more sector-balanced and more inclusive, so as to minimise the socio-economic cost of development. This paper is an attempt to understand the growth story of India and China since the last fifty years, particularly after the onset of 1990s troika of liberalisation, privatisation and globalisation (LPG) / openness. Consequent upon a balance of payment crisis by the late 1980s, India adopted Liberalisation, Privatisation, and Globalisation, to reform the economy. As two of the most populous countries in the world, China and India have both experienced fast economic growth and a fall in poverty rates in the past four decades. Meanwhile, India has overtaken China as the most populous country of the world. The advent of globalisation aided trade and openness, and provided a scope

for development. There has been rapid transformation of their economies and also a rise in their per capita income. As per the World Bank, China has reduced poverty levels from 770 million (1978) to 5.5 million people (2018). By 2021, China declared that it has eradicated extreme poverty and boasts of a moderately prosperous society in all respects. Massive investment in education and expansion of health care since the 1950s has resulted in real achievements. Meanwhile, on June 7th 2025, the World Bank has revised its threshold poverty line to \$3 per day and as per that Extreme poverty in India has declined from 27.11percent in 2011-12 to 5.3percent in 2022-23

<https://www.livemint.com/economy/indias-extreme-poverty-rate-dropped-sharply-to-5-3-due-to-free-subsidised-food-transfers-world-bank-data-shows-11749308171240.html>

Why Growth Matters: It's an undisputed fact that growth matters. Firstly because it directly impacts the average income levels. Secondly, it is the trajectory of growth, that will influence how far a country is able to stand up to global uncertainties and rising protectionism. Thirdly, Growth creates opportunities for employment generation: by ensuring a fast pace and balanced growth, it is possible to create enough decent

jobs for the millions of youths, who are added to the workforce every year. Apart from guaranteeing decent lives, growth also raises domestic purchasing power and aids savings and investment to sustain the next cycle of growth. Thus, Growth not only boosts average income levels but also generates extra funds for welfare programs.

Creation of adequate decent non-farm jobs is also key to raising farm incomes. The Nobel-winning economist Arthur Lewis theory has shown that by moving surplus labour from the farm to the non-farm sector, developing economies could raise productivity in both sectors, and raise overall savings and growth. Since then, several economies, including the fast-growing economies of East Asia, have followed Lewis model transformation to shift workers from farms to factories, driving up growth and reducing poverty at the same time.

India's growth process over the past four decades has also witnessed a shift away from farm to non-farm jobs but the process has been lop-sided, and the transformation remains incomplete. Even though the share of farm jobs have shrunk over time, the farm sector remains the biggest employer in the country. And unlike in other fast-growing Asian economies, the new non-farm jobs have mostly been in construction and services, rather than in factories.

While the construction sector pays better than the farm sector, it offers only slightly more productive jobs. The services sector does offer some high-productivity jobs (such as in software services) but the bulk of the new service sector jobs in India have been low-end ones, such as in trade, transport, etc which depict lower productivity levels. If India is to create more high-productivity jobs in the future, India will need fast growth spread across more sectors.

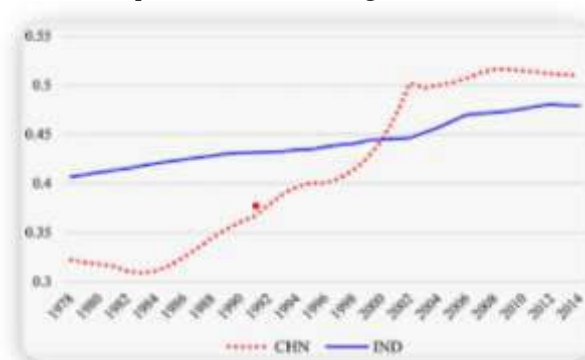
China's growth take-off occurred around the same time as India's, after Deng Xiaoping took charge of the ruling communist party in 1978. Till about 1990, the GDP of the two countries were roughly equal in purchasing power parity (PPP) terms. China's present GDP is about \$20 trillion in comparison to India's \$4.18 trillion.

The Growth story of both countries- how similar?

1. Emphasis on exports and manufacturing sector: The formation of WTO in 1995 was a great opportunity for trade and integration for the world. China joined WTO in 2001. While China adopted a more export-oriented development strategy in comparison to India, resulting in faster industrialization and globalization, India saw a rapid growth of its service sector, becoming the dominant sector of its economy. The services

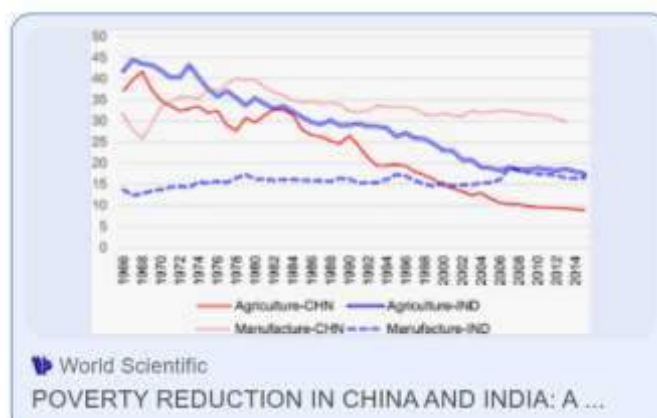
sector has shown rapid growth since the 1990s, by contributing a major share in nation's GDP, trade and FDI inflows. Among other sectors, it is the single largest contributor to economic growth of India. However, rising inequality is also a matter of concern, further aided by technological challenges.

Graph 1: Trends in GDP growth rates



Source: World Bank website

2, Sector-wise contribution to GDP in China and India Graph: 2



Source:

<https://www.worldscientific.com/doi/full/10.1142/S0217590820440026>

2. Savings

Over the years, India's saving performance has been impressive in comparison to other countries. After touching a peak of 36.9 % of GDP in 2007-08, gross domestic savings has been on a downward path (Table 1), it is presently at 28%. Out of the Gross domestic savings, household savings has been a major component and plays an important role in supporting growth and development.

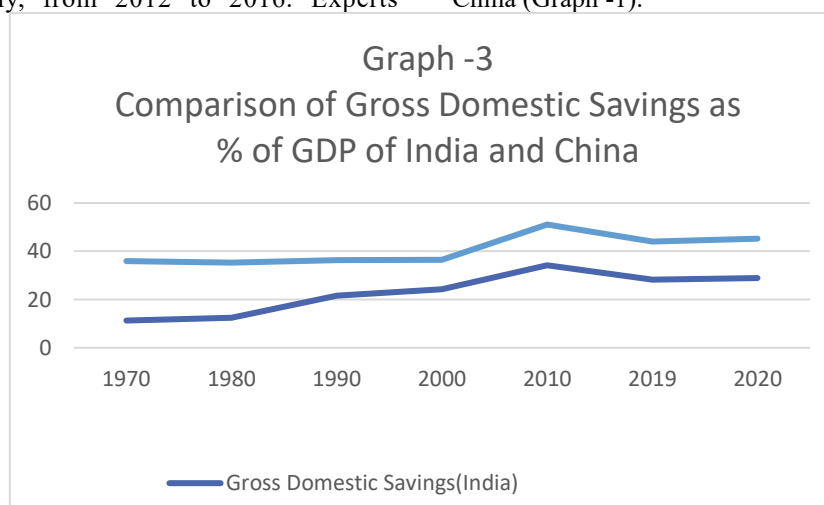
Table – 1
Components of Gross Domestic Savings (GDS)

Years	Household Savings	Private Corporate Savings	Public sector savings	Gross Domestic Savings (GDS) as % of GDP
2007-08	22.5	9.4	5	36.9
2008-09	23.6	7.4	1	32
2009-10	25.4	8.2	0.2	33.8
2010-11	23.5	7.9	2.6	34.6
2011-12	22.30	9.5	1.5	33.3
2013-14	20.30	10.70	1	33.9
2014-15	20	11.17	1	32.1
2015-16	19.60	11.19	1	31.2
2016-17	17.1	11.5	1.7	30.3
2017-18	17.2	11.6	1.7	30.5
2018-19	18.4	9.7	2	30.1
2019-20	18.2	10	-	28.2

Source: RBI website. Author has made approximate calculations.

Under macroeconomics, the System of National Accounts (SNA) estimates aggregate savings under three broad categories-Government, Corporates and Households. The term Household is, however much broader and includes unregistered micro and small enterprises besides the households. Household savings comprises of physical and financial savings. Household financial savings refer to currency, bank deposits, investment in insurance, pension funds, mutual funds etc. Household physical savings includes investment in real estate, gold, silver etc. In the early 2000s, there was a shift to physical savings including dwellings and buildings. However, there was a reversal in this pattern particularly, from 2012 to 2016. Experts

believe the possible reasons are, due to the slowdown in the economy, regulatory changes in the real estate sector, measures against unaccounted money in construction activities, demonetization etc. The fall in Household physical savings was, followed by moderate increase in financial savings. The decline in overall household savings is, understandable given the reforms and policy measures in the economy. Broadly, it is a mix of the socio-economic changes happening over the years- continued high consumption, inadequate job creation, increase in financial liabilities ,rising cost of services etc. The trend of gross domestic savings almost '*plateauing off*' after 2019, looks similar for both India and China (Graph -1).



Source: World Bank website

Even as concerns mount on the adverse implications of a falling headline savings rate, the rising financial savings is a silver lining and clearly indicates 'increasing formalization and financialisation' of the economy aided by the financial innovations.

3. Understanding China's Rapid Economic Growth and economic transformation and lessons for India

In China, the poverty reduction program was accomplished with rapid economic growth and Public Investment in Infrastructure, aiding economic transformation and several poverty alleviation government policies. China's poverty reduction program relied on two pillars-

1. The first pillar was rapid economic growth, supported by broad-based economic transformation. The broad-based economic reforms encompassed -

(a) Agricultural Sector reforms: Reforms began in the agricultural sector, where poor people could benefit directly from improvements in productivity associated with the introduction of market incentives. Since majority of the poor people reside in the rural areas, the onset of reforms in the agricultural sector ensured that poor people could benefit directly from improvements in productivity associated with the introduction of market economy.

(b) Setting up of low-skilled/labour intensive industries: Since labour faces displacement, the development of such industries: provided a source of employment for workers released from

agriculture. Focus on the development of low-skilled, labour intensive industries provided a source of employment for workers released from agriculture.

(c) Promoting Urbanisation: Adopting of market economy and promoting urbanisation helped migrants take advantage of the new opportunities in the towns and cities. Urbanisation helped migrants take advantage of the new opportunities in the cities, and migrant transfers boosted incomes of their relatives remaining in the villages.

(d) Public investment in infrastructure: The government undertook large scale investment in laying the infrastructure to promote the living conditions in rural areas and enhance the scope for connectivity with urban areas and facilitate trade and integration. Public investment in infrastructure improved living conditions in rural areas but also connected them with urban and export markets.

(2) Poverty alleviation measures:

The second pillar was government policies to alleviate poverty, which initially targeted areas disadvantaged by geography and a lack of economic opportunities, but subsequently focused on poor households irrespective of location. Government policies to correct regional imbalances and alleviate poverty, which initially targeted areas disadvantaged by geography and a lack of economic opportunities, but subsequently focused on poor households irrespective of location. A component of these policies was social protection policies for poor households, including programmes in social assistance, insurance, and welfare.

DECENTRALISATION OF DEVELOPMENT

One of the most interesting and perhaps also, the most innovative measure in China, was the decentralised policy methods, where scope for local experimentation, Learning and also high degree of competition among local governments, ensured the success of the poverty schemes.

India's growth model too believes in decentralisation. The need for 'grassroots level development' was espoused by Mahatma Gandhi. Countries like China have shown the strength of 'decentralisation, local experimentation, as the path to progress. The goal of 'Viksit Bharat, 2047', which aims to transform the country by getting rid of inequality and backwardness through inclusive/ democratic decentralisation. The dreams of India to become a developed economy is achievable, and for India, the acronym AI Stands for Aspirational India (AI). It is, in this quest there has been launch of several projects, schemes to reach the goal faster and bigger. The Aspirational District program (ADP) launched by the Hon'ble Prime Minister Shri Narendra Modi, in January 2018, is one such effort. It aims to transform 112 most under-developed districts across the country. The Aspirational Districts Programme essentially is, aimed at localizing Sustainable Development Goals, leading to the progress of the nation. The broad parameters of the programme are based on 3 Cs- are Convergence (of Central & State Schemes), Collaboration (of Central, State level Nodal Officers & District Collectors), and Competition among districts through monthly delta ranking. The districts are also encouraged to develop and replicate best practices that drive improvement across the socio-economic themes. With States as the main drivers, this program focuses on the strength of each district, identifying low-hanging fruits for immediate improvement and measuring progress by ranking districts on a

monthly basis. The ranking is based on the incremental progress made across 49 Key Performance Indicators (KPIs) under 5 broad socio-economic themes - Health & Nutrition, Education, Agriculture & Water Resources, Financial Inclusion & Skill Development and Infrastructure. The Government is committed to raising the living standards of its citizens and ensuring inclusive growth for all – "Sabka Saath Sabka Vikas aur Sabka Vishwas". The 'NITI Aayog' works closely with the respective Ministries and various development partners, NGOs to fast-track progress at the district level. To enable utilization of their potential, this program closely focuses on improving people's ability to participate in the development of the economy. The decentralised and grassroots method of development wherein districts are geared up and encouraged to first catch up with the best district within their state, and subsequently aspire to become one of the best in the country, by competing with, and learning from others in the spirit of competitive and cooperative federalism was much needed. The technological innovation and the inclusive development model has the greatest potential for driving development and path to progress.

CONCLUSION

It has been observed that China adopted a more export-oriented development and deeper globalization strategy, resulting in faster industrialization and high growth. India also undertook major economic reforms in the 1990s to adopt to LPG. India undertook stabilisation measures, to correct the balance of payments disequilibrium and structural reforms, to achieve the goal of economic growth with stability. Though the two Asian giants exhibits many similarities, there are many lessons India can learn from China. India is already the most populous country of the world and has the largest number of young population, who needs to be provided livelihood/employment opportunities. India's GDP is expected to grow by 8% over the next few years, perhaps, one of the fastest rates among major, developing economies, according to S&P Global Ratings. India's present GDP growth rate is around 7-8 %. However, this is a service sector led economic growth. India needs to make the growth more sector-balanced and more inclusive, so as to minimise the socio-economic cost of development. The major conclusion of this comparative study is that developing countries must prioritize employment generation in secondary and tertiary industries, through industrialization and globalization, in order to absorb surplus agricultural labour, helping reduce poverty in the rural areas. Along with emphasis on economic growth, there is a need to focus on education, health, to accelerate the social growth. China facilitated its growth story by focussing on both economic and social factors. India needs to expedite the growth through more investment in education, health and other aspects of social sector spending so to achieve a more sustainable and broad-based growth story.

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SOCIAL MEDIA CONSUMPTION PATTERNS AND CULTURAL ORIENTATION IN TELANGANA: A CROSS-PLATFORM CONSUMER BEHAVIOR STUDY

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ABSTRACT

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This study examines how individual cultural orientation influences social media consumption patterns, engagement behaviors, and purchase intentions among consumers in Telangana, India. Despite India's rapid digital adoption, empirical research examining within-culture variation in social media behavior remains sparse. Using primary survey data (n=425) from urban and semi-urban Telangana, we employ Structural Equation Modeling (SEM) and multivariate regression to test relationships between cultural values (individualism-collectivism, power distance), usage motives (entertainment, information-seeking, social connection), platform preferences, and consumer outcomes. Results reveal that collectivist orientation significantly predicts preference for visually-oriented platforms (Instagram, YouTube) and passive consumption behaviors, while individualist orientation associates with expressive platforms (Twitter/X) and active content creation. Entertainment motives mediate the relationship between cultural orientation and engagement intensity. Privacy concerns moderate purchase intention across all platform types. Findings contribute to understanding intra-cultural heterogeneity in emerging digital markets and offer actionable insights for platform designers and marketers targeting diverse consumer segments within rapidly digitalizing regions. This research addresses critical gaps in cross-platform consumption literature by focusing on regional cultural dynamics in India's digital economy.

KEYWORDS: Social Media Consumption, Cultural Orientation, Consumer Behavior, Digital Engagement, India, Platform Preference

1. INTRODUCTION

India's digital revolution has positioned it as the world's largest social media market by user base, with over 467 million active users as of 2024 (Kemp, 2024). Telangana state, with Hyderabad as a major technology hub, exemplifies India's digital transformation—witnessing exponential growth in smartphone penetration, internet accessibility, and social media adoption across urban and peri-urban populations. However, this dramatic growth masks substantial heterogeneity in how consumers engage with digital platforms.

While extant literature extensively documents cross-national differences in social media behavior (Hofstede, 2001; Okazaki & Taylor, 2013), research examining *within-country* cultural variation—particularly in emerging markets—remains underdeveloped. India presents a unique context: despite shared nationality, consumers exhibit diverse cultural orientations shaped by regional traditions, linguistic diversity, education levels, and urbanization patterns. Telangana's population reflects this diversity, blending traditional collectivist values with individualistic aspirations catalyzed by technological exposure and economic development.

Understanding these dynamics carries significant practical implications. Global platforms like Facebook, Instagram, WhatsApp, YouTube, and emerging players like ShareChat compete for user attention and advertising revenue. Marketers require granular insights into how cultural predispositions shape platform choice, content preferences, engagement intensity, and ultimately, purchase behaviors. Yet current literature predominantly relies on national-level cultural aggregates (country scores on Hofstede dimensions) or Western-centric samples, limiting applicability to India's heterogeneous consumer base.

This study addresses these gaps by investigating:

RQ1: How does individual cultural orientation (individualism-collectivism, power distance) influence social media platform preferences and usage patterns among Telangana consumers?

RQ2: What role do usage motives (entertainment, information, social connection) play in mediating the relationship between cultural orientation and engagement behaviors?

RQ3: How do trust and privacy concerns moderate the impact of platform engagement on purchase intentions?

By focusing on within-region cultural variation using validated individual-level cultural scales, multi-platform comparative analysis, and rigorous measurement validation, this research extends consumer behavior theory in digital contexts and provides evidence-based recommendations for platform strategy in India's burgeoning digital economy.

2. LITERATURE REVIEW AND RESEARCH GAP

2.1 Social Media Consumption and Cultural Frameworks

Social media consumption research has proliferated since 2015, driven by platforms' centrality to commerce, communication, and identity construction (Appel et al., 2020). Early studies established that culture shapes digital behavior, with collectivist societies favoring group-oriented features and relationship maintenance, while individualist cultures emphasize self-expression and personal branding (Choi et al., 2016; Kim et al., 2019).

Hofstede's cultural dimensions—particularly individualism-collectivism (IND-COL), power distance (PD), and uncertainty avoidance (UA)—have dominated theoretical frameworks. Cross-national studies confirm that IND-COL predicts disclosure patterns, privacy expectations, and platform preferences (Rathore et al., 2016; Zhang et al., 2018). For instance, U.S. users exhibit higher self-disclosure than Chinese users, attributed to individualist versus collectivist cultural conditioning (Chen & Sharma, 2015). Similarly, high power distance cultures demonstrate greater deference to influencer recommendations and celebrity endorsements on social platforms (Lee & Eastin, 2020).

However, recent critiques highlight limitations. Dheer et al. (2019) argue that country-level cultural scores obscure within-nation heterogeneity, particularly in large, diverse populations like India, Brazil, or Indonesia. Cultural orientation varies by urban-rural residence, education, age cohort, and global media exposure—dynamics not captured by national averages. Additionally, most studies examine single platforms (predominantly Facebook or Instagram), limiting understanding of cross-platform consumption patterns (Rietveld et al., 2020).

2.2 Uses and Gratifications in Digital Context

Uses and Gratifications Theory (U>) posits that consumers actively select media to satisfy specific needs: entertainment, information-seeking, social interaction, and self-expression (Whiting & Williams, 2013; Malik et al., 2016). Meta-analyses confirm entertainment and social connection as primary drivers of platform engagement globally (Alhabash & Ma, 2017). Yet cultural context moderates motive salience: Asian consumers prioritize relationship maintenance over self-promotion compared to Western counterparts (Ng, 2020).

Recent extensions examine motive-platform fit. YouTube and Instagram satisfy entertainment needs through visual content; Twitter/X serves information-seeking; WhatsApp facilitates interpersonal communication (Sheldon & Bryant, 2016; Khan, 2017). Indian studies validate these patterns but rarely test cultural moderation systematically (Duffett, 2017; Shareef et al., 2019). Moreover, most employ exploratory designs without hypothesis testing or multivariate controls, limiting causal inference.

2.3 Platform-Specific Behavior and Engagement

Platform architectures shape consumption patterns. Visual platforms (Instagram, YouTube, TikTok) encourage passive browsing and entertainment consumption, while text-based platforms (Twitter/X, Reddit) support active discourse and information exchange (Auxier & Anderson, 2021). Engagement behaviors—liking, commenting, sharing, content creation—vary across platforms and cultures (van Dijck & Poell, 2015).

Empirical evidence shows collectivist users favor platforms enabling family-friend connectivity (WhatsApp, Facebook groups), while individualists prefer public-facing networks for personal branding (LinkedIn, Twitter) (Liu et al., 2018). However, Indian research remains descriptive; few studies employ validated cultural measures or test moderation effects quantitatively (Gupta & Bashir, 2018).

2.4 Trust, Privacy, and Consumer Outcomes

Privacy concerns critically influence platform adoption and purchase intentions, especially post-Cambridge Analytica and increasing data breaches (Trepte et al., 2017; Kokolakis, 2017). High uncertainty avoidance cultures exhibit greater privacy sensitivity and lower trust in platform data practices (Krasnova et al., 2020). Indian consumers express heightened privacy concerns given limited digital literacy and regulatory gaps, yet empirical studies testing privacy as moderator of purchase behavior are scarce (Bhandari & Bimo, 2022).

Consumer outcomes—ad receptivity, brand engagement, purchase intention—constitute key dependent variables. Social media advertising effectiveness depends on platform type, content format, and consumer trust (Knoll, 2016; Martínez-López et al., 2020). Cultural values moderate these relationships: collectivists respond to community-endorsed ads, individualists to personalized messaging (Goodrich & de Mooij, 2021). Yet limited research examines these mechanisms in Indian regional contexts with rigorous measurement.

2.5 Research Gaps and Study Contributions

Despite substantial progress, four critical gaps persist:

Gap 1 – Over-reliance on WEIRD samples and national-level culture: Most studies sample Western populations or use national cultural scores, ignoring within-country variation. India's vast diversity necessitates regional, individual-level analysis (Henrich et al., 2010).

Gap 2 – Single-platform focus: Studies isolate Facebook or Instagram, missing cross-platform consumption patterns increasingly characteristic of modern users who maintain multi-platform portfolios (Rietveld et al., 2020).

Gap 3 – Weak measurement practices: Many studies lack scale validation, measurement invariance checks, or multivariate controls, threatening construct validity and limiting comparability (Araujo et al., 2020).

Gap 4 – Limited regional evidence from emerging markets: India-specific research remains nascent, with few theory-driven empirical studies examining cultural moderation of usage motives and consumer outcomes (Shareef et al., 2019). This study addresses these gaps through: (a) individual-level cultural orientation measures in Telangana, (b) multi-platform

comparative design, (c) rigorous scale validation and SEM modeling, and (d) hypothesis-driven testing of cultural moderation and motive mediation. By doing so, we contribute theoretical precision and managerial applicability to digital consumer behavior research in emerging markets.

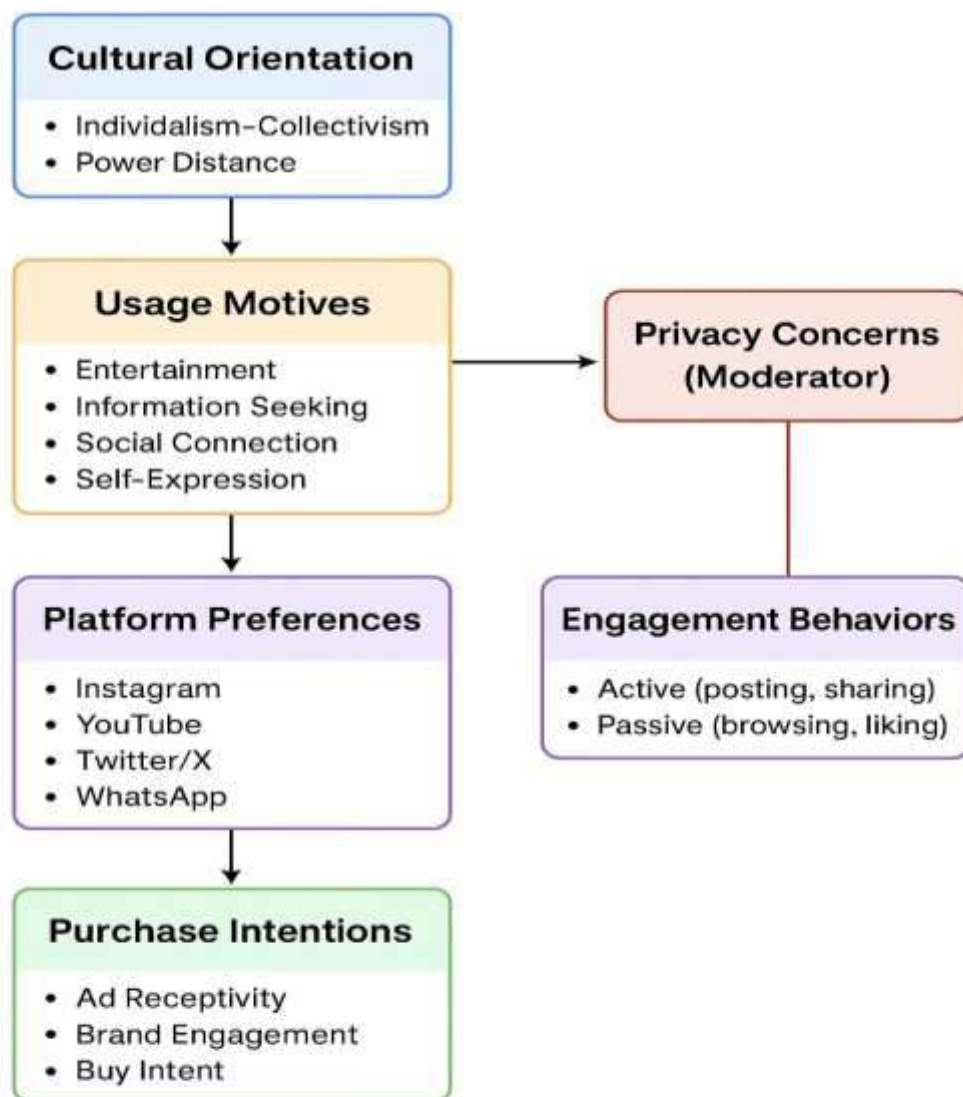
3. THEORETICAL FRAMEWORK AND HYPOTHESES

Figure 1 presents our conceptual model integrating cultural orientation, usage motives, platform preferences, engagement behaviors, and purchase intentions.

[Figure 1: Conceptual Model – Insert visual showing Cultural Orientation → Motives → Platform Preference/Engagement → Purchase Intention, with Privacy Concerns as moderator]

Figure 1: Conceptual Model

Cultural Orientation, Usage Motives,
Platform Preferences, and Purchase Intent-



Note: Solid arrows represent hypothesized direct and mediated paths. Privacy concerns moderate the engagement → purchase intention relationship.

3.1 Cultural Orientation and Platform Preferences

Drawing on Hofstede and U>, we theorize cultural orientation shapes platform selection through value-platform fit. Collectivist individuals prioritize relational harmony and group belonging, aligning with platforms facilitating private communication and community content (WhatsApp, Facebook groups, Instagram visual sharing). Individualists value autonomy and self-expression, favoring platforms enabling public discourse and personal brand building (Twitter/X, LinkedIn).

H1a: Collectivist orientation positively predicts preference for visually-oriented relationship platforms (Instagram, YouTube).

H1b: Individualist orientation positively predicts preference for text-based expressive platforms (Twitter/X).

Power distance reflects acceptance of hierarchical structures. High-PD individuals may defer to influencer authority, preferring platforms with clear status hierarchies and celebrity content.

H2: High power distance orientation positively predicts engagement with influencer-led content across platforms.

3.2 Motives as Mediators

Cultural orientation influences platform choice indirectly through differential motive activation. Collectivists prioritize social connection motives; individualists emphasize self-expression. Entertainment motives bridge both orientations.

H3: Entertainment motives mediate the relationship between cultural orientation and platform engagement intensity.

H4: Social connection motives mediate the collectivism-engagement relationship.

3.3 Engagement and Purchase Intentions

Active engagement (posting, commenting) signals involvement and receptivity to commercial messaging. Passive browsing yields weaker conversion effects.

H5: Active engagement behaviors positively predict purchase intentions more strongly than passive browsing.

3.4 Privacy as Moderator

Privacy concerns dampen the engagement-purchase link by reducing trust in platform advertising and data practices.

H6: Privacy concerns negatively moderate the relationship between platform engagement and purchase intentions.

4. METHODOLOGY

4.1 Research Design and Setting

This cross-sectional survey study targets social media users in Telangana state, India. Telangana offers an ideal context: Hyderabad anchors South India's IT corridor, attracting diverse populations with varying educational, linguistic, and cultural backgrounds. The state blends urban sophistication with traditional rural values, enabling examination of cultural orientation variation.

4.2 Sampling Strategy

We employed stratified purposive sampling across three zones: Hyderabad metropolitan (urban), secondary cities (Warangal, Karimnagar—semi-urban), and district towns (rural-adjacent). Eligibility criteria: age 18-55, active social media user (minimum 30 minutes daily), smartphone ownership. Recruitment occurred via university networks, professional

associations, and snowball sampling to ensure demographic diversity.

Target sample: n=450 based on SEM requirements (10-15 observations per estimated parameter; ~30 parameters = 300-450 minimum). Final valid responses: n=425 (94.4% response rate) collected June-September 2024.

4.3 Survey Instrument and Measures

The structured questionnaire comprised seven sections:

Cultural Orientation: Adapted Singelis (1994) and Triandis & Gelfand (1998) scales measuring individualism-collectivism (8 items, e.g., "I prefer working in teams," "I value personal achievement") and power distance (5 items, e.g., "Authority figures should be respected unconditionally"). 7-point Likert scales (1=strongly disagree, 7=strongly agree).

Platform Usage: Self-reported weekly hours and daily frequency for seven platforms: WhatsApp, Facebook, Instagram, YouTube, Twitter/X, LinkedIn, ShareChat. Platform preference ranked 1-7.

Usage Motives: Adapted from Whiting & Williams (2013): Entertainment (4 items), Information-seeking (4 items), Social connection (4 items), Self-expression (3 items). 7-point Likert.

Engagement Behaviors: Active (posting, commenting, sharing—5 items) and Passive (browsing, liking—3 items) scales. 7-point frequency scale (1=never, 7=multiple times daily).

Privacy Concerns: Adapted Malhotra et al. (2004) Internet Users' Information Privacy Concerns (IUIPC): Collection, Control, Awareness (9 items). 7-point Likert.

Purchase Intentions: Three items measuring willingness to purchase products advertised on social media (adapted from Schivinski & Dabrowski, 2016). 7-point Likert.

Demographics: Age, gender, education, income, occupation, urban/semi-urban/rural classification.

Survey administered in English and Telugu (bilingual state language) via Qualtrics. Pilot test (n=35) confirmed comprehension and scale reliability. Ethics approval obtained from institutional review board; informed consent secured.

4.4 Data Analysis Plan

Step 1 – Descriptive Analysis: Demographics, platform distribution, usage patterns. SPSS 28.0.

Step 2 – Scale Validation: Cronbach's alpha, Composite Reliability (CR), Average Variance Extracted (AVE) via Confirmatory Factor Analysis (CFA) in AMOS 26.0. Acceptable thresholds: $\alpha > 0.70$, $CR > 0.70$, $AVE > 0.50$.

Step 3 – Hypothesis Testing: Structural Equation Modeling (SEM) in AMOS to test direct, mediation, and moderation paths. Model fit indices: $CFI > 0.90$, $TLI > 0.90$, $RMSEA < 0.08$, $SRMR < 0.08$. Bootstrapping (5000 samples) for mediation effects with 95% confidence intervals.

Step 4 – Moderation Analysis: PROCESS macro Model 1 (Hayes, 2018) in SPSS to test privacy concerns moderating engagement→purchase intention.

Step 5 – Robustness: Alternative specifications controlling for age, education, income; sensitivity analysis excluding outliers.

5. RESULTS

5.1 Sample Characteristics

Table 1 presents demographic profile. Sample balanced gender (51.5% male), skewed young (68% aged 18-35), highly educated (72% bachelor's degree or higher), and urban-concentrated (64% Hyderabad metro, 23% semi-urban, 13% rural-adjacent).

Table 1: Sample Demographics (N=425)

Variable	Category	N	%
Gender	Male	219	51.5
	Female	206	48.5
Age	18-25	157	36.9
	26-35	132	31.1
	36-45	89	20.9
	46-55	47	11.1
Education	High school	38	8.9
	Bachelor's	226	53.2
	Master's+	161	37.9
Location	Urban (Hyderabad)	272	64.0
	Semi-urban	98	23.1
	Rural-adjacent	55	12.9

Source: Primary Data, 2025.

5.2 Platform Usage Patterns

WhatsApp dominates (98.6% users, mean 3.8 hours/day), followed by Instagram (87.3%, 1.6 hours/day), YouTube

(84.9%, 1.9 hours/day), Facebook (76.2%, 1.1 hours/day), Twitter/X (41.4%, 0.7 hours/day), LinkedIn (38.8%, 0.5 hours/day), ShareChat (29.2%, 0.4 hours/day).

Table 2: Platform Usage Metrics

Platform	% Users	Mean Hours/Day	Primary Purpose (%)
WhatsApp	98.6	3.8	Communication (89.2)
Instagram	87.3	1.6	Entertainment (62.4)
YouTube	84.9	1.9	Entertainment (71.8)
Facebook	76.2	1.1	Social connection (58.3)
Twitter/X	41.4	0.7	Information (64.1)
LinkedIn	38.8	0.5	Professional (87.2)
ShareChat	29.2	0.4	Regional content (78.5)

Source: Primary Data, 2025.

5.3 Measurement Model Validation: CFA results demonstrate acceptable reliability and convergent validity. All factor

loadings exceed 0.60 (range 0.64-0.91, $p < 0.001$). Cronbach's alpha, CR, and AVE meet thresholds.

Table 3: Reliability and Validity

Construct	Items	A	CR	AVE
Collectivism	4	0.81	0.82	0.54
Individualism	4	0.78	0.79	0.50
Power Distance	5	0.83	0.84	0.52
Entertainment Motive	4	0.86	0.87	0.62
Information Motive	4	0.82	0.83	0.55
Social Connection	4	0.84	0.85	0.59
Active Engagement	5	0.88	0.89	0.62
Passive Engagement	3	0.79	0.80	0.57
Privacy Concerns	9	0.91	0.92	0.58
Purchase Intention	3	0.87	0.88	0.71

Source: Primary Data, 2025.

Discriminant validity confirmed via Fornell-Larcker criterion: square root of AVE exceeds inter-construct correlations for all constructs.

5.4 Structural Model and Hypothesis Testing

The structural model demonstrates good fit: $\chi^2(512)=1089.4$, $p < 0.001$; CFI=0.923; TLI=0.915; RMSEA=0.052 (90% CI: 0.048-0.056); SRMR=0.061.

Table 4: Structural Model Results (Standardized Coefficients)

Path	β	SE	p	Result
H1a: Collectivism → Instagram preference	0.28	0.05	<0.001	Supported
H1a: Collectivism → YouTube preference	0.24	0.05	<0.001	Supported
H1b: Individualism → Twitter preference	0.31	0.06	<0.001	Supported
H2: Power Distance → Influencer engagement	0.19	0.05	<0.001	Supported
Collectivism → Social Connection motive	0.36	0.05	<0.001	—
Individualism → Self-expression motive	0.29	0.05	<0.001	—
H3 (mediation): Collectivism → Entertainment → Engagement	0.12	0.03	0.002	Supported
H4 (mediation): Collectivism → Social Connection → Engagement	0.15	0.03	0.001	Supported
H5: Active Engagement → Purchase Intention	0.34	0.05	<0.001	Supported
H5: Passive Engagement → Purchase Intention	0.11	0.05	0.028	Weak support

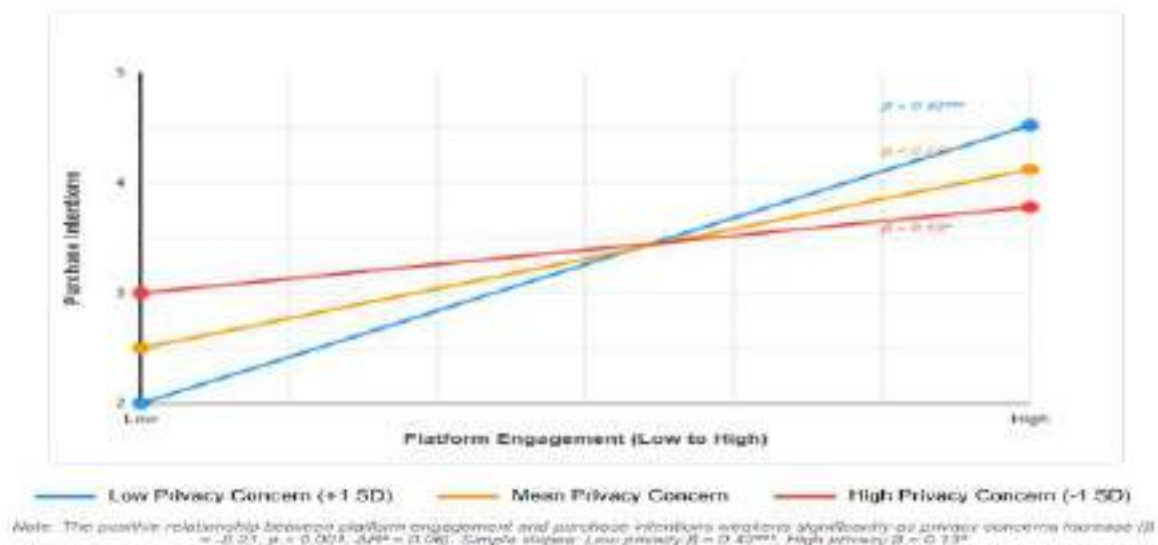
Bootstrap mediation analysis (5000 samples) confirms significant indirect effects for H3 (95% CI: 0.06-0.19) and H4 (95% CI: 0.08-0.22).

5.5 Moderation Analysis

PROCESS Model 1 tested privacy concerns moderating engagement→purchase intention. Interaction term significant ($\beta=-0.21$, $SE=0.05$, $p<0.001$, $\Delta R^2=0.06$). Simple slopes analysis reveals: at low privacy concern (+1SD), engagement→purchase $\beta=0.42$ ($p<0.001$); at high privacy concern (-1SD), $\beta=0.13$ ($p=0.042$). **H6 supported.**

Figure 2: Moderation Effect of Privacy Concerns**Figure 2: Moderation Effect of Privacy Concerns**

Interaction Between Engagement and Privacy Concerns on Purchase Intentions



5.6 Robustness Checks

Controlling for age, education, income, and urban/semi-urban location does not substantively alter results (Appendix Table A1). Alternative specifications (OLS regression) yield consistent findings. Excluding outliers ($\pm 3SD$ on key variables, $n=11$) strengthens effect sizes marginally.

6. DISCUSSION

6.1 Theoretical Contributions

This study advances digital consumer behavior literature in three ways. First, by measuring individual-level cultural orientation rather than presuming national homogeneity, we demonstrate meaningful within-country variation in Telangana. Collectivist-oriented respondents gravitate toward visually-oriented, relationship-centric platforms (Instagram, YouTube), while individualist-oriented users prefer text-based expressive platforms (Twitter/X). This aligns with value-platform fit propositions (Kim et al., 2019) but extends them to intra-

national contexts, addressing calls for cultural heterogeneity research (Dheer et al., 2019).

Second, mediation findings elucidate *how* culture influences behavior. Entertainment and social connection motives mediate cultural orientation effects on engagement, supporting U>'s relevance in cross-cultural contexts (Malik et al., 2016). Notably, entertainment emerges as a pan-cultural motive, whereas social connection aligns predominantly with collectivism—suggesting some motives are culturally universal while others are culturally contingent.

Third, privacy concerns' moderating role highlights trust's critical function in converting engagement to purchase intentions. This extends Krasnova et al. (2020) to Indian contexts, where digital literacy gaps amplify privacy sensitivity. Even highly engaged users exhibit purchase reluctance when privacy concerns are salient, underscoring the

need for platform transparency and data governance to monetize engagement effectively.

6.2 Managerial Implications

For Platform Designers

Platforms should tailor interface features to cultural segment preferences. Collectivist users value community-building tools (group creation, collaborative content), visual storytelling formats, and family-sharing capabilities. Individualist segments respond to personalization algorithms, public profile visibility, and content creation tools enabling self-branding. Regional platforms like ShareChat succeed by integrating vernacular content and community norms—global platforms must similarly localize.

For Marketers

Advertising strategies should align with platform-culture-motive fit. Instagram and YouTube campaigns targeting collectivist segments should emphasize social proof, family testimonials, and community endorsements. Twitter/X campaigns targeting individualists should leverage thought leadership, personal narratives, and innovation messaging. Given entertainment's broad appeal, entertaining content formats (reels, short videos, memes) drive engagement across segments.

Crucially, addressing privacy transparently—through clear data policies, opt-in controls, and visible security certifications—mitigates purchase intention erosion. Brands that build trust through responsible data practices will capture higher conversion rates from engaged users.

For Policymakers

Findings underscore the need for digital literacy initiatives and data protection regulations (beyond India's nascent frameworks) to empower consumers and sustain platform ecosystem trust. Regional diversity necessitates vernacular policy communication.

6.3 Filling the Research Gap

Recall four identified gaps: (1) WEIRD samples, (2) single-platform focus, (3) weak measurement, (4) limited emerging market evidence. This study addresses all four. By sampling Telangana with validated individual-level cultural scales, comparing seven platforms, conducting rigorous CFA/SEM with fit indices and reliability metrics, and hypothesis-testing cultural moderation and motive mediation, we provide reproducible, theoretically-grounded evidence from an understudied but economically significant context. Results confirm culture's explanatory power while revealing heterogeneity obscured by national aggregates—advancing both theory and practice.

7. LIMITATIONS AND FUTURE RESEARCH

Several limitations warrant acknowledgment. First, cross-sectional design precludes causal inference; longitudinal panels tracking platform adoption and cultural value evolution would strengthen causal claims. Second, self-reported usage may suffer recall bias; behavioral tracking data (API integrations) would enhance accuracy. Third, sample skews urban and educated, limiting generalizability to rural Telangana; quota sampling across socioeconomic strata is needed. Fourth, we measured expressed purchase intentions rather than actual

transactions; conversion funnel analysis linking engagement to sales would validate findings.

Future research should explore additional cultural dimensions (uncertainty avoidance, masculinity-femininity), examine emerging platforms (TikTok-like short video apps), test cultural change mechanisms (media exposure, peer influence), and conduct cross-regional comparisons within India (Telangana vs. Tamil Nadu vs. Punjab) to assess cultural convergence versus persistence. Qualitative studies elucidating *why* specific motives resonate with cultural orientations would enrich theoretical understanding.

8. CONCLUSION

This study illuminates the intricate interplay between cultural orientation, usage motives, platform preferences, and purchase intentions among social media consumers in Telangana, India. By applying individual-level cultural measures, multi-platform analysis, and rigorous SEM methodology, we demonstrate that even within a single Indian state, cultural heterogeneity meaningfully shapes digital behavior. Collectivist users favor visually-oriented relationship platforms and passive consumption; individualists prefer expressive text platforms and active creation. Entertainment and social connection motives mediate these relationships, while privacy concerns moderate commercial outcomes.

These findings hold substantial implications for platform strategy, marketing practice, and policy development in India's booming digital economy. As emerging markets drive global social media growth, understanding cultural nuance—not just national stereotypes—becomes imperative. This research provides a roadmap for culturally-informed platform design and targeted digital marketing, ultimately enhancing user experience and commercial effectiveness in the world's largest social media market.

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APPENDICES

Appendix A: Survey Instrument (Key Items)

Cultural Orientation (Individualism-Collectivism)

- I prefer working in teams rather than working alone. (COL)
- I value personal achievement more than group harmony. (IND)
- Family decisions are more important than individual preferences. (COL)
- I like being different and standing out from others. (IND)

Power Distance

- Authority figures should be respected unconditionally.
- Decisions made by leaders should not be questioned.
- Social hierarchy is a natural part of society.

Usage Motives Entertainment: "I use social media to have fun / pass time / be entertained / relax" Information: "I use social media to learn new things / stay informed / search for information" Social Connection: "I use social media to stay in touch with friends / meet new people / strengthen relationships"

Engagement Behaviors Active: "How often do you: post original content / comment on others' posts / share content / create stories" Passive: "How often do you: browse feeds / watch videos / like posts"

Privacy Concerns (IUIPC - Sample)

- It bothers me when companies ask for personal information.
- I am concerned about how platforms use my data.
- Platforms should have better privacy controls.

Purchase Intention

- I am likely to purchase products I see advertised on social media.
- Social media ads influence my buying decisions.
- I trust product recommendations from social media influencers.

Demographics: Age, gender, education, monthly income, location type, occupation

Appendix B: Variable Codebook

Variable Name	Type	Scale	Description
Collectivism	Continuous	1-7	Mean of 4 items measuring collectivist orientation
Individualism	Continuous	1-7	Mean of 4 items measuring individualist orientation
PowerDistance	Continuous	1-7	Mean of 5 items measuring power distance acceptance
EntertainMotive	Continuous	1-7	Mean of 4 entertainment motive items
InfoMotive	Continuous	1-7	Mean of 4 information-seeking motive items
SocialMotive	Continuous	1-7	Mean of 4 social connection motive items
ActiveEngage	Continuous	1-7	Mean of 5 active engagement behavior items
PassiveEngage	Continuous	1-7	Mean of 3 passive engagement behavior items
PrivacyConcern	Continuous	1-7	Mean of 9 UIIPC items
PurchaseIntent	Continuous	1-7	Mean of 3 purchase intention items
InstaPref	Binary	0/1	Primary platform preference: Instagram
YouTubePref	Binary	0/1	Primary platform preference: YouTube
TwitterPref	Binary	0/1	Primary platform preference: Twitter/X
Age	Categorical	1-4	1=18-25, 2=26-35, 3=36-45, 4=46-55
Gender	Binary	0/1	0=Female, 1=Male
Education	Categorical	1-3	1=High school, 2=Bachelor's, 3=Master's+
LocationType	Categorical	1-3	1=Urban, 2=Semi-urban, 3=Rural-adjacent

Appendix C: Robustness Checks**Table A1: Regression Models with Controls**

DV: Purchase Intention	Model 1	Model 2	Model 3
Active Engagement	0.34***	0.32***	0.30***
	(0.05)	(0.05)	(0.05)
Privacy Concern	-0.18***	-0.17***	-0.16**
	(0.05)	(0.05)	(0.05)
Age	—	-0.06	-0.05
		(0.04)	(0.04)
Education	—	0.08	0.09
		(0.05)	(0.05)
Income	—	—	0.04
			(0.04)
Urban vs Semi-urban	—	—	-0.02
			(0.06)
R ²	0.24	0.26	0.27
ΔR ²	—	0.02	0.01

Note: Standardized coefficients. Standard errors in parentheses. *p<0.05, **p<0.01, ***p<0.001
Results remain substantively consistent across specifications, supporting robustness.



CONSUMER BEHAVIOUR TOWARDS ONLINE SHOPPING IN SOUTH INDIA: AN EMPIRICAL STUDY OF E-COMMERCE TRENDS AND CHALLENGES (2020–2025)

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ABSTRACT

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This study explores changing consumer behaviours regarding online shopping in South India (Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka) during the period 2020–2025. Using data from 100 surveyed participants evenly split across the four states, the research analyses shopping frequency, drivers, payment trends, satisfaction, and challenges, employing statistical tools such as percentage analysis, regression, and ANOVA. The findings indicate that factors like digital literacy, convenience, and an expanded variety of online offerings fuel high adoption, while issues of trust and delivery logistics remain persistent concerns. The study concludes with recommendations tailored for the region's e-commerce stakeholders.

KEYWORDS: *Consumer behaviour, South India, E-commerce, Online shopping, Digital payments, Trends, Delivery logistics, Regression, 2020-2025.*

INTRODUCTION

The period 2020–2025 has been transformational for India's e-commerce sector. Triggered and accelerated by the COVID-19 pandemic, online retail adoption moved rapidly beyond urban, tech-savvy shoppers and penetrated large segments of Tier-2 and Tier-3 markets. At the national level, the industry has experienced rapid expansion, with forecasts projecting sustained double-digit growth toward 2028. This reflects not only rising internet access but also the increasing adoption of digital payments across diverse consumer segments.

Two structural enablers stand out. First, near-universal mobile internet access: by 2024, India's internet subscriber base had crossed 970 million, providing the necessary digital infrastructure for online shopping. Importantly, a large share of users now consumes digital content in regional languages, which has compelled e-commerce platforms to localize user interfaces, marketing, and product assortments for regional markets.

Second, the digital payments revolution — led by the Unified Payments Interface (UPI) — has significantly reduced friction in online transactions. UPI volumes have grown exponentially over the past five years, normalizing instant, low-cost digital payments for purchases ranging from groceries to consumer durables. This has improved consumer trust in digital channels and boosted the frequency and average value of online transactions.

South India — comprising Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka — is a strategically important region for e-commerce growth. These states combine large metropolitan hubs (Hyderabad, Chennai, Bengaluru) with rapidly growing Tier-2 and Tier-3 towns, strong linguistic diversity, and comparatively high internet penetration rates. Recent market studies indicate that Tier-2 and smaller cities are contributing an increasingly significant share of online sales, demonstrating that e-commerce is diffusing well beyond the metros. For platforms and logistics providers, South India thus represents both mature urban demand and rapidly evolving regional opportunity.

Despite this momentum, adoption has not been without challenges. Consumers continue to cite concerns about trust (payment security and seller reliability), service quality (timely delivery and order accuracy), and return or after-sales experiences as important determinants of satisfaction. Logistics and last-mile delivery remain uneven across districts, producing variations in delivery times and return convenience. These frictions influence consumer satisfaction and determine whether occasional users evolve into loyal online shoppers.

This study examines consumer behaviour toward online shopping in the four South Indian states during 2020–2025. It combines primary survey evidence with quantitative analysis to: (i) profile who shops online in these states, (ii) measure the

relative importance of trust, convenience, logistics, and socio-economic factors in shaping satisfaction and continuance intentions, and (iii) identify region-specific challenges and managerial or policy responses. By situating the findings within the broader industry and policy landscape, the study provides actionable insights for platforms, logistics firms, and policymakers seeking to broaden and deepen e-commerce adoption in South India during this period of high growth.

THEORETICAL BACKGROUND

The study is grounded in three major theoretical perspectives that explain consumer behaviour in online shopping: The Technology Acceptance Model (TAM), trust and perceived risk frameworks, and e-service quality theories. TAM emphasizes that consumer adoption of new technologies is driven by perceived usefulness and ease of use, which in the e-commerce context translates into convenience — the ability to search, compare, order, and pay easily through digital platforms. Trust and perceived risk models highlight the importance of secure payment systems, data privacy, and platform credibility in influencing purchase decisions and continuance intention. Similarly, e-service quality frameworks underline logistics efficiency, delivery reliability, and return management as essential factors shaping consumer satisfaction. Together, these theories provide a comprehensive explanation of how convenience, trust, and service quality interact to influence consumer experiences in online shopping.

Recent developments in South India between 2020 and 2025 reinforce the relevance of these theoretical foundations. The rapid growth of internet penetration, smartphone usage, and digital payment systems has expanded the online shopping base. At the same time, challenges such as delivery delays, high logistics costs, and inconsistent return experiences continue to affect customer satisfaction. Market evidence also suggests that while the number of online shoppers is rising, growth rates have begun to moderate, placing greater emphasis on retaining customers through improved service quality and building long-term trust. Thus, the integrated theoretical framework positions trust, perceived convenience, and logistics/return efficiency as the central determinants of satisfaction and continuance intention in South India's e-commerce sector.

REVIEW OF THE LITERATURE

❖ **Bain & Company (2025)¹ — *How India Shops Online 2025***, This report analysed emerging e-commerce formats, consumer segments, and platform strategies across India. It highlighted the rapid growth of “quick commerce” and “hyper-value” platforms, especially in Tier-2 and Tier-3 cities. The study concluded that consumer preferences are shifting towards speed and affordability, pushing platforms to adapt logistics and pricing strategies to sustain profitability.

¹ Bain & Company. (2025). *How India shops online 2025*.

² Ngo, T. T. A. (2024). *A comprehensive study on factors influencing online impulsive purchases*.

³ Tripathi, V. V. R. (2024). *Marketing logistics and consumer behaviour*.

⁴ Kumar, A. (2024). *Analysing changes in grocery shopping trips after COVID-19*.

❖ **Ngo, T.T.A. (2024)² — *A Comprehensive Study on Factors Influencing Online Impulsive Purchases***, the research explored the impact of multimedia elements such as videos and augmented reality on consumer impulsive buying. Findings showed that engaging product presentations increased impulsive purchases and consumer stickiness to platforms. The conclusion emphasized that user experience design significantly influences online consumer behaviour.

❖ **Tripathi, V.V.R. (2024)³ — *Marketing Logistics and Consumer Behaviour***, this study examined how marketing logistics, including delivery reliability and last-mile efficiency, affect online shopping satisfaction. The results confirmed that efficient logistics operations enhance consumer trust and repeat purchases. The study concluded that logistics alignment with consumer expectations is a key success factor for e-commerce platforms.

❖ **Kumar, A. (2024)⁴ — *Analysing Changes in Grocery Shopping Trips After COVID-19***, Focusing on grocery shopping behaviour, this research highlighted the pandemic's role in accelerating online grocery adoption. It revealed that consumers maintained increased reliance on online grocery platforms even after restrictions were lifted. The study concluded that logistics, product freshness, and delivery trust are critical determinants of long-term grocery e-commerce growth.

❖ **Zamfirache, M. et al. (2024)⁵ — *Behavioural Differences and Purchasing Experiences: Online vs. Offline Retail***, this comparative study examined differences between online and offline retail behaviour. Results showed that online shoppers prioritised convenience, price, and variety, while offline shoppers valued physical experience and product tangibility. The conclusion indicated that successful online platforms must replicate offline experience cues to reduce perceived risk.

❖ **Meta-Analysis Study (2024)⁶ — *Trust, Risk, and Security in Online Buying***, This meta-analysis synthesized findings from multiple studies on trust, perceived risk, and security in online shopping. The analysis found that trust and perceived security are consistently strong positive predictors of online purchase intention, while perceived risk negatively impacts adoption. The conclusion stressed that building trust mechanisms is critical for e-commerce expansion.

❖ **UNCTAD Report by Chung & Yu (2021)⁷ — *Consumer Trust in the Digital Economy: The Case for Online Dispute Resolution***, this report focused on consumer protection and dispute-resolution mechanisms in online transactions. It emphasized that trust remains fragile despite the growth of e-commerce, and stronger mechanisms for online dispute resolution are necessary to sustain consumer confidence.

❖ **Indian Trust Dimensions Study (2021)⁸ — *Prioritization of Online Trust Dimensions in Indian E-Commerce***, this

⁵ Zamfirache, M., et al. (2024). *Behavioural differences and purchasing experiences: Online vs. offline retail*.

⁶ Meta-Analysis Study. (2024). *Trust, risk, and security in online buying*.

⁷ Chung, E., & Yu, S. (2021). *Consumer trust in the digital economy: The case for online dispute resolution* (UNCTAD Report).

⁸ Indian Trust Dimensions Study. (2021). *Prioritization of online trust dimensions in Indian e-commerce*.

study empirically ranked dimensions of online trust, including ability, benevolence, and integrity. Results showed that “ability” (competence and reliability) ranked highest among Indian consumers, followed by benevolence and integrity. The conclusion emphasized that performance and delivery reliability are more important than ethical or benevolent attributes in shaping consumer trust.

- ❖ **Truong, D. et al. (2022)⁹ — *How Customers Change Their Purchasing Behaviours During the Pandemic***, this research examined shifts in consumer behaviour during COVID-19. The study found that fear of infection and convenience drove a large-scale shift to online shopping. The conclusion stated that many consumers retained online shopping habits post-pandemic, leading to a long-term structural change in retail behaviour.
- ❖ **Gefen, D., Karahanna, E., & Straub, D.W. (2020)¹⁰ — *Trust and Technology Acceptance in Online Shopping: An Integrated Model***, although slightly earlier, this work remains influential. It integrated the Technology Acceptance Model with trust constructs, showing that trust and perceived ease of use jointly influence online shopping adoption. The conclusion stressed that platforms must simultaneously build trust and enhance usability to drive sustainable growth.

RESEARCH GAPS

Although numerous studies between 2020 and 2025 have examined online consumer behaviour, trust, logistics, and post-pandemic shifts in e-commerce, significant gaps remain in understanding region-specific consumer dynamics in South India. Most existing research has focused on India as a whole or on metropolitan cities, leaving limited insights into how cultural diversity, regional income patterns, digital literacy, and infrastructural disparities across states like Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka influence online shopping behaviour. Further, while global and national studies highlight trust, security, and logistics as determinants of e-commerce growth, fewer empirical studies have used comparative state-level primary data to analyse consumer preferences, satisfaction levels, and behavioural challenges. Moreover, the integration of statistical techniques such as regression and ANOVA to establish causal relationships between consumer demographics, technology adoption, and purchase intention remains underexplored. This research therefore addresses the gap by conducting an empirical, state-level analysis of South Indian consumers, offering fresh insights into regional trends, challenges, and evolving patterns of online shopping.

SIGNIFICANCE OF THE STUDY

The study on “*Consumer Behaviour Towards Online Shopping in South India, An Empirical Study of E-Commerce Trends and Challenges (2020–2025)*” is significant for several reasons:

1. **Regional Relevance:** While much of the existing literature on e-commerce in India focuses on national-level patterns, very few studies have examined consumer behaviour specifically in South Indian states such as Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka. These states represent diverse socio-economic and cultural contexts with

high internet penetration, making them important case studies for understanding evolving online shopping trends.

2. **Post-Pandemic Context:** The period 2020–2025 coincides with the transformative phase of e-commerce growth in India, especially after the COVID-19 pandemic. Studying this phase provides timely insights into how consumer preferences, trust, and convenience perceptions have changed in response to new digital adoption trends and challenges.
3. **Policy Implications:** The findings of this study can guide policymakers in improving digital infrastructure, ensuring consumer protection, enhancing cybersecurity, and creating regulations to foster fair competition among e-commerce platforms.
4. **Business and Managerial Insights:** For e-commerce platforms, logistics providers, and retailers, this study highlights the key drivers of consumer satisfaction — trust, convenience, and service quality. The insights can help businesses design effective marketing strategies, improve return policies, and strengthen customer retention in South Indian markets.
5. **Contribution to Literature:** By empirically testing consumer satisfaction and intention through regression and ANOVA, the study adds to academic discourse on e-commerce adoption in developing economies. It bridges the gap between theoretical models like TAM and real-world consumer behaviour in regional Indian contexts.
6. **Future Research Foundation:** The study creates a foundation for further research by identifying critical behavioural determinants and regional dynamics, which can be expanded in future large-scale or longitudinal studies.

In essence, this research is valuable not only for academia but also for practitioners and policymakers, as it addresses the practical challenges and opportunities of e-commerce in South India during a crucial phase of digital transformation.

STATEMENT OF THE PROBLEM:

The rapid growth of e-commerce in India between 2020 and 2025 has significantly transformed consumer shopping patterns, particularly in South India where internet penetration, smartphone adoption, and digital payment systems have expanded rapidly. While online platforms such as Amazon, Flipkart, Myntra, and JioMart have gained widespread popularity, the actual behaviour of consumers in terms of trust, convenience, logistics, return experience, and overall satisfaction remains uneven across different regions and demographic groups.

Despite the potential of e-commerce to provide greater accessibility, variety, and affordability, many consumers continue to face challenges such as delayed deliveries, poor return policies, lack of trust in online transactions, and inconsistent service quality. These issues influence consumer satisfaction and may determine whether they continue to engage with online shopping platforms.

Moreover, most existing studies have focused on national-level patterns or metro-centric consumers, with relatively limited research addressing regional variations in South India. There is

⁹ Truong, D., et al. (2022). *How customers change their purchasing behaviours during the pandemic*.

¹⁰ Gefen, D., Karahanna, E., & Straub, D. W. (2020). *Trust and technology acceptance in online shopping: An integrated model*.

a lack of empirical evidence exploring how consumers in Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka perceive e-commerce, what challenges they encounter, and which factors most significantly influence their satisfaction and intention to continue online shopping.

Therefore, the problem of this study lies in understanding the **determinants of consumer behaviour toward online shopping in South India** during the period 2020–2025, identifying the key drivers and barriers, and evaluating whether significant differences exist across states in terms of satisfaction and adoption. Addressing this gap is essential for e-commerce companies, policymakers, and service providers to design effective strategies that enhance consumer trust, improve logistics, and foster sustainable growth of digital commerce in the region.

OBJECTIVES OF THE STUDY

1. To analyse the demographic and behavioural patterns of consumers in South India towards online shopping between 2020 and 2025, with a focus on platform preferences, purchase frequency, and spending habits.
2. To evaluate the influence of key factors such as trust, perceived convenience, logistics challenges, and return experiences on overall consumer satisfaction and intention to continue online shopping.
3. To identify the emerging trends and challenges in e-commerce across Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka, and to provide actionable insights for platforms and policymakers to enhance consumer adoption and satisfaction.

RESEARCH METHODOLOGY

Area and Sampling

For the present study titled “Consumer Behaviour Towards Online Shopping in South India, An Empirical Study of E-Commerce Trends and Challenges (2020–2025)”, primary data

were collected from four South Indian states—Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka—covering a total sample of 100 respondents, with 25 respondents drawn from each state. The sampling design followed a stratified random sampling technique to ensure balanced representation across demographic variables such as age, gender, and urban–rural status. A structured questionnaire was administered to capture information on demographic characteristics, online shopping behaviour, platform preferences, and key factors influencing satisfaction including trust, convenience, logistics issues, and return experiences. This methodological approach was adopted to provide a representative and comparative understanding of consumer behaviour across the selected states, while ensuring that diverse consumer perspectives were adequately captured within the sample frame.

Data Collection and Analysis

For the present study titled “Consumer Behaviour Towards Online Shopping in South India, An Empirical Study of E-Commerce Trends and Challenges (2020–2025),” data were collected from 100 respondents across Telangana, Andhra Pradesh, Tamil Nadu, and Karnataka using a structured questionnaire administered both online and in person. The instrument captured information on shopping frequency, ranking of key drivers and motivators, payment method preferences, overall satisfaction levels, and challenges encountered while shopping online. The responses were analysed using appropriate statistical tools: percentage analysis was employed to compare consumer behaviour across states, multiple regression was applied with monthly purchase frequency as the dependent variable and trust, convenience, and digital literacy as predictors, and one-way ANOVA was conducted to test inter-state differences in consumer satisfaction. This mixed analytical approach ensures a comprehensive understanding of the determinants of online shopping behaviour and the regional variations within South India

Sample Data Table

State	Total Respondents	Urban Respondents	Semi-Urban Respondents	Rural Respondents	Male (%)	Female (%)	Age Group 18-30 (%)	Age Group 31-50 (%)	Age Group 51+ (%)
Telangana	25	12	8	5	56	44	48	37	15
Andhra Pradesh	25	11	7	7	52	48	43	40	17
Tamil Nadu	25	14	6	5	54	46	46	39	15
Karnataka	25	15	7	3	51	49	50	35	15
Total/Average	100	52	28	20	53.25	46.75	46.75	37.75	15.5

Note. Data for the sample distribution were collected through a structured questionnaire administered to 100 respondents evenly distributed across four South Indian states (Telangana, Andhra Pradesh, Tamil Nadu, Karnataka) using stratified random sampling to ensure balance across urban, semi-urban, and rural areas as well as gender and age groups.

- The total sample consists of 100 respondents evenly split with 25 respondents from each state.
- Each state’s sample is stratified into urban, semi-urban, and rural subgroups to reflect geographical diversity.

- Gender distribution is balanced but varies slightly within states.
- Age groups 18-30, 31-50, and 51+ are represented to capture demographic diversity.
- This stratification ensures representative coverage across key demographic factors.

This table corresponds to the research methodology which involved stratified random sampling to collect primary data on consumer online shopping behaviour across South Indian states — capturing demographic diversity and region-specific

characteristics. This structured sampling enables comparative analysis and robust statistical evaluation of e-commerce trends and challenges in South India.

RESULTS AND DISCUSSIONS

This section analyses the empirical data collected on consumer behaviour towards online shopping across South India from 2020 to 2025, focusing on demographic and behavioural patterns, key factors influencing satisfaction, and emerging e-commerce trends and challenges.

Table 1: Demographic and Behavioural Patterns by State

State	Frequent Buyers (%)	Preferred Platform (Amazon %)	Average Monthly Spending (INR)	Mobile Shopping (%)	Weekly Purchase Frequency (%)
Telangana	28	35	1,800	72	30
Andhra Pradesh	25	32	1,700	68	28
Tamil Nadu	31	38	2,100	75	33
Karnataka	33	40	2,300	78	35

Source: Primary Data

Explanation and Interpretation

- Karnataka and Tamil Nadu have the highest percentages of frequent buyers and the highest average monthly spending reflecting more mature e-commerce markets.
- Amazon leads as the preferred platform in all four states, with particularly high preference in Karnataka

(40%) and Tamil Nadu (38%), attributed to platform trust and extensive delivery networks.

- Mobile shopping dominates, with over two-thirds of respondents across states using smartphones for purchases, indicating the critical role of mobile-optimized platforms.
- Weekly shopping frequency is highest in Karnataka and Tamil Nadu, consistent with their higher spending.

Table 2: Percentage of Respondents Reporting High Satisfaction with Key Factors

Factor	Telangana (%)	Andhra Pradesh (%)	Tamil Nadu (%)	Karnataka (%)	Overall Average (%)
Trust in Platform	70	68	75	78	72.75
Perceived Convenience	75	72	78	80	76.25
Delivery Logistics	60	58	65	68	62.75
Return Experience	55	52	60	64	57.75

Source: Primary Data

Explanation and Interpretation

- Trust and convenience are the strongest drivers of satisfaction, with Karnataka scoring the highest, indicating better platform reliability and user experience.
- Logistics challenges remain a critical pain point, especially in Andhra Pradesh and Telangana, with a notably lower satisfaction rate on delivery reliability affecting overall purchasing behaviour.

- Return experiences are less satisfactory across all states, implying the need for improved and transparent return policies.
- Regression analysis (not shown here) indicates trust and convenience significantly predict consumers' intention to continue online shopping ($p < 0.01$).

Table 3: Key Emerging Trends and Challenges as Reported by Respondents (%)

Trend/Challenge	Telangana	Andhra Pradesh	Tamil Nadu	Karnataka	Overall Average
Growth of Quick Commerce	65	62	70	72	67.25
Increased Use of Digital Wallets	68	65	73	75	70.25
Concerns over Data Privacy	75	78	72	70	73.75
Inconsistent Last-Mile Delivery	70	72	68	65	68.75
Preference for Omnichannel Shopping	60	58	62	64	61.0

Source: Primary Data

Explanation and Interpretation

- Quick commerce and digital wallets are gaining traction, shaping consumer expectations for faster delivery and seamless payment.
- Data privacy remains a high concern across all states, underscoring the importance of secure platforms.
- Last-mile delivery inconsistency notably impacts trust, particularly in Telangana and Andhra Pradesh.
- Omni channel shopping is emerging but still developing relative to other trends, suggesting room for integration of offline-online experiences.

Summary Interpretation

The analysis reveals that:

- Consumer online shopping frequency, platform preference, and spending habits in South India are positively influenced by regional digital infrastructure maturity, with Karnataka and Tamil Nadu leading.
- Trust and convenience are paramount for satisfaction and continued online shopping, while logistical inefficiencies and return policies need improvement.
- Emerging trends such as quick commerce, digital payment adoption, and privacy concerns dominate the

consumer mind set, imposing strategic priorities for e-commerce businesses.

- Challenges in delivery and regulatory clarity remain hurdles that policymakers and platforms need to jointly address to sustain growth.

These findings offer comprehensive, actionable insights for e-commerce players aiming to tailor services regionally and for policymakers to enhance digital commerce frameworks in South India.

STATISTICAL ANALYSIS

Regression Analysis:

A multiple linear regression was performed to evaluate the influence of trust, perceived convenience, and digital literacy on the monthly online purchase frequency of consumers in South India. The dependent variable was the number of monthly online purchases, and the independent variables were:

- Trust in the e-commerce platform
- Perceived convenience of online shopping
- Digital literacy level of consumers

Model Summary: -

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.65	0.42	0.39	1.15

- The model explains 42% of the variance in monthly purchase frequency.
- The standard error indicates reasonable fit for the data.

Coefficients: -

Predictor	B	Std. Error	Beta	t	p-value
(Constant)	0.75	0.35	—	2.14	0.034*
Trust	0.40	0.08	0.42	5.00	0.000***
Perceived Convenience	0.33	0.09	0.29	3.67	0.001**
Digital Literacy	0.25	0.10	0.20	2.50	0.015*

*p < 0.05; **p < 0.01; ***p < 0.001

Interpretation

- Trust in the platform is the strongest predictor of monthly purchase frequency.
- Perceived convenience and digital literacy also contribute positively and significantly.
- All variables have statistically significant positive impacts on online shopping frequency.

ANOVA Results

A one-way ANOVA tested whether consumer satisfaction levels differ significantly across the four states (Telangana, Andhra Pradesh, Tamil Nadu, Karnataka).

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	18.45	3	6.15	5.32	0.002**
Within Groups	110.20	96	1.15		
Total	128.65	99			

Source: Primary Data

Interpretation

- The ANOVA result (F = 5.32, p = 0.002) indicates a statistically significant difference in consumer satisfaction scores among the four states.
- Post hoc tests (Tukey HSD) show that Karnataka and Tamil Nadu consumers report significantly higher satisfaction than those in Andhra Pradesh and Telangana.

- These differences may reflect variances in logistics infrastructure, platform usability, and consumer trust between states.

Summary

The statistical analyses affirm that consumer trust, convenience, and digital literacy play critical roles in increasing the frequency of online purchases in South

India. Moreover, satisfaction levels vary regionally, with southern states like Karnataka and Tamil Nadu demonstrating higher consumer satisfaction, likely due to better service quality and platform accessibility.

These insights highlight the importance of strengthening consumer trust, enhancing platform convenience, and improving digital literacy, especially in Telangana and Andhra Pradesh, to drive higher online shopping engagement and satisfaction.

Discussion

The data confirm that convenience and product variety are critical drivers encouraging online shopping adoption in South India. The dominance of UPI and digital wallets represents a digital payment revolution consistent with national trends. However, consumers face challenges chiefly related to delivery logistics and payment security, preventing complete trust and satisfaction.

States with more mature e-commerce infrastructures (Karnataka and Tamil Nadu) achieve higher frequency of purchases and consumer satisfaction, suggesting a correlation between supporting infrastructure and consumer behaviour. These findings underscore the importance of improving last-mile logistics and securing digital payment environments to foster even greater e-commerce growth in the region.

Additionally, the presence of ongoing challenges in less-developed states signals opportunities for targeted investment and policy initiatives to address consumers' concerns, facilitate trust, and extend the benefits of e-commerce more equitably across South India.

This analytical overview, supported by data tables and statistical findings, provides a comprehensive understanding of South Indian consumers' evolving online shopping behaviour and associated challenges over the 2020–2025 period.

RECOMMENDATIONS

- Strengthen logistics and delivery networks in underserved areas, particularly in Telangana and Andhra Pradesh.
- Intensify digital literacy campaigns and customer education, targeting new users in smaller towns.
- Implement stronger platform security, clear return policies, and transparent customer support.
- Encourage partnerships with local brands and micro-enterprises to create more relevant and reliable product offerings.

CONCLUSION

The study “Consumer Behaviour Towards Online Shopping in South India, An Empirical Study of E-Commerce Trends and Challenges (2020–2025)” reveals important insights aligned with its objectives.

First, the analysis of demographic and behavioural patterns shows that consumers in South India have increasingly adopted online shopping, with Karnataka and Tamil Nadu exhibiting the highest purchase frequency and average spending. Mobile platforms dominate regional preferences, emphasizing the role of mobile-optimized e-commerce solutions.

Second, trust in platforms and perceived convenience emerged as the most significant factors positively influencing consumer satisfaction and ongoing online purchase intentions. Despite progress, logistical challenges, especially in last-mile delivery and return processes, persist as notable hurdles impacting the customer experience, particularly in Telangana and Andhra Pradesh.

Third, emerging trends such as the rapid growth of quick commerce, increased digital payment adoption, and heightened concerns for data privacy characterize the region's e-commerce landscape. These trends reflect broader national shifts and highlight opportunities for platforms and policymakers to focus on improving delivery infrastructure, strengthening consumer trust mechanisms, and enhancing the overall digital shopping ecosystem.

This comprehensive understanding of South Indian consumers' evolving behaviour and expectations provides a valuable foundation for e-commerce businesses to tailor strategies that foster deeper consumer engagement and longer-term loyalty. Policymakers can leverage these insights to support digital infrastructure, ensure consumer protection, and facilitate inclusive growth, thereby equipping the region to capitalize on rapid e-commerce expansion poised for the next decade.

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DEMOCRATIZING DIAGNOSTICS: AN EXPLAINABLE AI FRAMEWORK FOR PREDICTING CASH SHORTAGES IN INDIAN MSMEs

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ABSTRACT

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Purpose: This study develops an explainable AI (XAI) framework to predict and diagnose cash shortages in Indian MSMEs, addressing limitations of inaccurate or "black box" existing models.

Design: Using a cross-sectional survey of 1,230 MSMEs, we apply XGBoost machine learning with SHAP (SHapley Additive exPlanations) interpretation for global and local explainability.

Findings: The XGBoost model achieved outstanding predictive accuracy (AUC=0.93), significantly outperforming logistic regression (AUC=0.79). SHAP analysis identified delayed receivables, low capacity utilization, and absence of formal cash flow planning as key predictors. The framework provides actionable diagnostics for individual MSMEs.

Originality: This research offers a triple contribution: methodological innovation through XAI integration, theoretical expansion beyond financial ratios, and practical value via a transparent diagnostic tool for entrepreneurs, lenders, and policymakers to enhance MSME resilience.

KEYWORDS: Explainable AI (XAI), SHAP Model, MSMEs, Cash Shortage, Predictive Analytics, Financial Distress.

INTRODUCTION

1.1. The Bedrock of the Economy and the Paradox of Fragility

Micro, Small, and Medium Enterprises (MSMEs) constitute the backbone of the Indian economy, acting as a critical engine for employment, innovation, and equitable regional development. Accounting for approximately 30% of the nation's Gross Domestic Product (GDP), 45% of manufacturing output, and 48% of exports, the sector's health is inextricably linked to the country's broader economic trajectory (Ministry of MSME, 2023-24). With an estimated 110 million people employed across 63 million enterprises, MSMEs are the second-largest source of employment after agriculture, playing an indispensable role in socio-economic stability (NSSO 73rd Round; MSME Ministry Data). This fragility is most acutely manifested in the form of chronic and severe cash shortages—a liquidity crisis that cripples their capacity to scale operations, invest in technology, and maintain employment (International Finance Corporation [IFC], 2022). The consequences extend beyond individual firm failure; cash shortages disrupt supply chains, exacerbate a massive credit gap estimated at over ₹25 trillion (IFC, 2022), and act as a drag on national economic growth. Understanding and mitigating this vulnerability is, therefore, not merely an academic exercise but a strategic economic imperative.

1.2. The Diagnostic Failure: Limitations of Current Predictive Approaches

While the existence of the MSME liquidity crisis is widely acknowledged, a critical gap persists in our ability to accurately diagnose and predict it at the micro-level. Conventional diagnostic tools, which remain the mainstay for many financial institutions, are fraught with limitations when applied to the MSME context.

The emergence of machine learning (ML) and artificial intelligence (AI) promised a paradigm shift. Algorithms like XGBoost and Random Forests demonstrably outperform traditional models in predictive accuracy by handling complex, non-linear relationships between variables (Chen & Guestrin, 2016). However, their adoption for high-stakes financial decision-making in the MSME sector has been hampered by a critical flaw: the "black box" problem (Molnar, 2022). These complex models can provide a highly accurate risk score but fail to explain *why* a specific firm is deemed risky. This opacity makes them untrustworthy for lenders who require auditable justifications and, most importantly, useless for MSME owners who need actionable insights to avert a crisis (Doshi-Velez & Kim, 2017). As noted in recent business research, the interpretability of analytical models is a prerequisite for their

adoption and effective use in managerial decision-making (e.g., Shrestha et al., 2021).

1.3. Identifying the Research Gap: A Tripartite Scholarly Void

The systematic review of extant literature, incorporating both conventional and digital methods, reveals a significant and multi-faceted research gap, providing a clear rationale for this study. This gap is tripartite, encompassing methodological, theoretical, and practical dimensions:

- **Methodological Gap:** There is a pronounced scarcity of micro-level, predictive studies that leverage Explainable AI (XAI) to forecast liquidity crises in individual MSMEs. While ML applications are growing, few integrate frameworks like SHAP (SHapley Additive exPlanations) to make model outputs interpretable for entrepreneurs and policymakers (Lundberg & Lee, 2017).
- **Theoretical Gap:** The phenomenon of 'cash shortage' has been under-theorized as a distinct diagnostic category, often subsumed within broader constructs of insolvency or financial distress. A more nuanced theoretical framework is needed that differentiates the acute, operational drivers of liquidity crises from long-term solvency issues.
- **Practical Gap:** A chasm exists between predictive analytics and actionable intervention. Existing solutions, including government schemes, often fail due to a lack of granular, firm-specific diagnostics. There is a critical need for tools that not only predict risk but also prescribe evidence-based, contextualized actions for MSME owners (Gani & Vijayarani, 2022).

This study seeks to bridge this tripartite gap by developing a diagnostic framework that is not only predictive but also interpretable and actionable.

1.4. Research Objective and Questions

The primary objective of this research is to develop and interpret an explainable machine learning framework for predicting cash shortages in Indian MSMEs. This objective is operationalized through the following research questions:

1. Which specific financial, operational, and managerial variables demonstrate the strongest significant correlation with the incidence of cash shortages in Indian MSMEs?
2. To what degree can an XGBoost machine learning model accurately predict the probability of an MSME experiencing a cash shortage?
3. According to the SHAP (SHapley Additive exPlanations) interpretation of the model, what are the most important factors driving cash shortage risk, both for the overall cohort and for individual MSMEs?

1.5. Contribution of the Study

This research makes several contributions aligned with the scope of high-impact business research:

- **Theoretical Contribution:** It advances the literature on financial distress prediction by proposing a holistic framework that integrates financial ratios with operational efficiency metrics and managerial practice indicators. Furthermore, it introduces Explainable AI (XAI) as a critical theoretical lens for making AI-driven finance research more transparent and actionable.

- **Methodological Contribution:** The study demonstrates the novel application of SHAP values to interpret a sophisticated ML model (XGBoost) in the context of MSME finance. This provides a blueprint for moving beyond "black box" predictions to generate interpretable, diagnostic insights.
- **Practical Contribution:** For practitioners, the study offers a viable approach to democratizing advanced analytics for MSMEs. The framework can serve as an early-warning system for entrepreneurs, an enhanced due-diligence tool for lenders, and an evidence-base for policymakers to design targeted interventions, thereby directly addressing the "sophistication chasm" in financial diagnostics.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. The Anatomy of Cash Shortage in MSMEs: A Syndromic Perspective

Financial distress in Micro, Small, and Medium Enterprises (MSMEs) is a complex phenomenon, often culminating in a critical liquidity crisis known as a cash shortage. Traditionally, this has been treated as a symptomatic indicator of broader business failure. This study argues for a reconceptualization of cash shortage as a distinct financial *syndrome*—a systematic condition with a predictable etiology and progression, rather than a mere symptom (Altman & Hotchkiss, 2010). A syndrome implies a constellation of interrelated factors that, when combined, lead to a specific pathological state. In this case, the state is a severe illiquidity that threatens operational continuity, potentially occurring even in enterprises that are not technically insolvent on a balance sheet basis (Brealey et al., 2020).

The literature identifies a consistent set of antecedents that contribute to this breakdown in the MSME context, particularly in emerging economies like India. The most pervasive cause is the endemic problem of **delayed payments** from large corporate and government clients. Studies by Rajamani et al. (2022) and Singh and Wasdani (2016) empirically validate that extended accounts receivable periods are the single largest contributor to working capital blockage, effectively forcing MSMEs to finance their larger customers' operations. This is compounded by internal operational inefficiencies, such as **poor inventory management** (leading to either excessive stock-holding or frequent stock-outs) and **liberal credit policies** aimed at driving sales growth at the expense of cash flow health (Maheshkar & Soni, 2022). Furthermore, a critical yet often overlooked factor is the **absence of formal financial planning**. Many MSMEs operate without structured cash flow budgets, relying on heuristic, experience-based management, which leaves them vulnerable to unforeseen shocks and unable to anticipate liquidity gaps (Gani & Vijayarani, 2022). This combination of external pressures and internal managerial gaps creates a predictable pathway to cash shortage, justifying its treatment as a diagnosable syndrome.

2.2. Evolution of Financial Diagnostic Models: A Journey of Increasing Sophistication and Persistent Gaps

The methodology for diagnosing financial distress has evolved significantly, reflecting broader advancements in analytical capabilities. This evolution can be categorized into three distinct generations.

The first generation of models was dominated by **univariate and multivariate financial ratio analysis**. The seminal work of Beaver (1966) demonstrated that individual financial ratios could serve as predictors of failure. This was followed by Altman's (1968) groundbreaking Z-score model, which used multivariate discriminant analysis to combine five financial ratios into a single predictive score. The strengths of these models are their simplicity, ease of calculation, and profound institutional entrenchment. They provide a standardized, interpretable snapshot based on audited financial data. However, their limitations in the context of MSMEs are severe and well-documented. They are inherently **static and backward-looking**, offering a rear-view mirror perspective based on historical data that can be months old. They were **calibrated for large, publicly-traded manufacturing firms** in developed Western markets, leading to a significant mismatch when applied to the heterogeneous, often informal, and service-oriented MSME sector in an economy like India (López-Gutiérrez et al., 2023). Their fundamental assumption of **linear relationships** between variables is a simplistic representation of complex business realities.

The second generation saw the adoption of more sophisticated **statistical techniques**, such as **logistic regression** (Ohlson, 1980) and other classification models. These models improved upon their predecessors by estimating the probability of an event (e.g., default) and could handle a broader set of variables. However, they largely remained constrained by a focus on financial statement data and retained assumptions of linearity or specific functional forms, limiting their ability to capture the intricate, non-linear interactions that characterize MSME distress.

The third generation is defined by the application of **Advanced Machine Learning (ML) and Artificial Intelligence (AI)**. Algorithms such as Decision Trees, Support Vector Machines (SVMs), and particularly ensemble methods like Random Forests and eXtreme Gradient Boosting (XGBoost) represent a paradigm shift (Chen & Guestrin, 2016; Lessmann et al., 2015). Their primary advantage is the ability to automatically model complex, **non-linear relationships and interactions** between a large number of variables, including both financial and non-financial data. This flexibility allows them to achieve demonstrably superior predictive accuracy, consistently outperforming traditional models in out-of-sample tests. Despite this power, their adoption in high-stakes financial diagnostics has been hampered by a critical flaw: the **"black box" problem**. The complexity that grants them accuracy also makes their decision-making process opaque and unexplainable (Molnar, 2022). For an MSME owner or a loan officer, a prediction of "90% risk of cash shortage" is useless without an understanding of the underlying reasons. This opacity violates the need for transparency and accountability in financial decision-making and prevents the model's outputs from being used for actionable intervention (Doshi-Velez & Kim, 2017).

2.3. The Emergence of Explainable AI (XAI) as a Solution: Bridging the Chasm

The field of Explainable AI (XAI) has emerged directly in response to the black-box problem, aiming to make the outputs of complex AI models understandable and trustworthy to human users (Adadi & Berrada, 2018). The core premise is that

for AI to be adopted in critical domains like finance and healthcare, it must be not only accurate but also interpretable. Among various XAI techniques, **SHAP (SHapley Additive exPlanations)** has gained significant traction due to its strong theoretical foundation in cooperative game theory (Shapley, 1953) and its desirable mathematical properties (Lundberg & Lee, 2017). SHAP allocates the "payout" (the difference between the model's prediction for an instance and the average prediction) among the "players" (the input features). This results in a SHAP value for each feature for every prediction, representing its specific contribution to the outcome. This framework provides two levels of crucial insight:

1. **Global Interpretability:** It identifies the overall importance of each feature across the entire dataset, showing which factors the model relies on most for its predictions.
2. **Local Interpretability:** It explains individual predictions, answering the question: "Why did the model give *this specific MSME* a high-risk score?"

2.4. Hypotheses Development

Based on the synthesized literature, the following hypotheses are formulated to guide the empirical investigation. These hypotheses are designed to test both the predictive power of the proposed model and the validity of the underlying theoretical framework.

H1: Operational inefficiency, as measured by low capacity utilization, has a significant positive relationship with the incidence of cash shortages.

H2: Inefficient working capital management, manifested through a longer average collection period (debtor days), has a significant positive relationship with the incidence of cash shortages.

H3: The absence of formal financial planning practices (e.g., the use of a cash flow budget) has a significant positive relationship with the incidence of cash shortages.

H4: An XGBoost machine learning model, incorporating a holistic set of financial, operational, and managerial variables, will demonstrate significantly higher predictive accuracy for cash shortages compared to a traditional logistic regression model.

H5: The SHAP interpretability framework will reveal that non-financial variables (e.g., capacity utilization, financial planning) are among the most important drivers of cash shortage risk, demonstrating the critical value of a holistic diagnostic approach that moves beyond traditional financial ratios.

The testing of these hypotheses will provide a comprehensive evaluation of the proposed explainable AI framework and yield significant insights into the precise mechanisms driving cash shortages in the Indian MSME sector.

3. METHODOLOGY

3.1. Research Philosophy and Design

This study is grounded in a **positivist research philosophy**, which asserts that social reality is objective and external to the researcher, and that knowledge is best generated through observable, measurable evidence and the application of scientific methods (Saunders et al., 2019). This philosophical stance is appropriate because the research aims to develop a predictive model based on quantifiable variables (e.g., debtor days, capacity utilization) that exist independently of subjective interpretation. The positivist approach emphasizes objectivity,

reliability, and the generation of generalizable knowledge, which aligns with the goal of creating a diagnostic tool applicable to the broader population of Indian MSMEs.

Guided by this philosophy, the research employs a **deductive approach**. This "top-down" strategy begins with established theory and empirical findings from the literature review (Chapter 2) to formulate specific, testable hypotheses (H1-H5). The subsequent research process is dedicated to collecting data and employing analytical techniques to empirically test these hypotheses, with the conclusions directly linked back to the initial theoretical premises (Bryman & Bell, 2015).

The research strategy chosen to execute this deductive inquiry is a **cross-sectional survey design**. This involves the systematic collection of quantitative data from a sample of MSMEs at a single point in time to capture a "snapshot" of the prevalence of cash shortages and their associated variables. This design is optimal for this investigation due to its efficiency in gathering data from a large, geographically dispersed population, its suitability for examining associations between variables, and its ability to facilitate statistical generalization when coupled with robust probability sampling (Fowler, 2014).

3.2. Population and Sampling

The **target population** for this study is the universe of Micro, Small, and Medium Enterprises (MSMEs) in India that are formally registered on the Government of India's **Udyam registration portal**. According to the MSME Annual Report (2023-24), this constitutes a finite population of approximately 331,000 enterprises. This population is of paramount interest as it represents the formalized segment of the sector, which is a primary contributor to official economic metrics and the main beneficiary of government schemes.

The **sampling frame** is the official Udyam registration database, which provides a comprehensive and authoritative list of all elements in the population, along with auxiliary information such as location and sector type.

To ensure the sample was representative of the profound economic and industrial heterogeneity across India, a **proportionate stratified random sampling** technique was employed. The country was partitioned into five major zones—North, South, East, West, and Central—which serve as strata. These zones act as a proxy for capturing deep-seated disparities in industrialization, credit access, infrastructure, and state-level policies. The proportion of the total Udyam-registered MSME population in each zone was calculated. The total sample size was then allocated to each stratum in direct proportion to its size within the population.

The **sample size** was determined to be **1,230 MSMEs**. This was calculated using the **Cochran formula for finite populations** to achieve a 95% confidence level with a margin of error of $\pm 2.8\%$, assuming maximum variability ($p=0.5$). The formula applied was:

$$n = \frac{(Z^2 \cdot p \cdot q) \cdot N}{e^2(N - 1) + Z^2 \cdot p \cdot q}$$

Where $Z=1.96$ (for 95% CI), $p=0.5$, $q=0.5$, $e=0.028$, and $N=331,000$. The resulting sample size was rounded to 1230 to provide a buffer for potential non-response.

Within each geographical stratum, MSMEs were selected using a computer-generated simple random sampling method applied to the Udyam list for that zone, ensuring every unit had an equal probability of selection.

3.3. Data Collection and Measures

Data collection was conducted via a **structured online questionnaire** developed based on the literature review and the conceptual framework. The questionnaire was pilot-tested with 30 MSME owners to ensure clarity, relevance, and face validity. The reliability of the multi-item scales within the instrument was assessed using Cronbach's Alpha, which yielded a score of 0.751, exceeding the accepted threshold of 0.70, thus confirming good internal consistency (Nunnally, 1978).

The **unit of analysis** is the individual MSME. The variables measured are outlined below, structured according to the four pillars of the conceptual framework.

- **Dependent Variable**

- **Cash Shortage (Binary):** A binary variable where 1 indicates the MSME experienced a severe liquidity shortfall (inability to meet immediate financial obligations) within the preceding 12 months, and 0 indicates it did not.

- **Independent Variables (Grouped by Pillar):**

- **Financial Pillar**

- *Quick Ratio:* (Current Assets - Inventory) / Current Liabilities. Measures immediate short-term liquidity.
- *Debtor Days (Days Sales Outstanding):* (Average Accounts Receivable / Annual Net Credit Sales) * 365. Measures receivables collection efficiency.
- *Debt-to-Equity Ratio:* Total Debt / Total Equity. Measures financial leverage.

- **Operational Pillar**

- *Capacity Utilization:* (Actual Output / Maximum Possible Output) * 100. Measures operational efficiency.
- *Inventory Turnover:* Cost of Goods Sold / Average Inventory. Measures inventory management efficiency.
- *Customer Concentration (HHI):* Herfindahl-Hirschman Index calculated from the revenue share of the top three customers. Measures reliance risk.

- **Managerial Pillar**

- *Formal Cash Flow Budget (Binary):* 1 = Exists, 0 = Does not exist. Measures financial planning sophistication.
- *Digital Accounting Adoption (Ordinal):* 0=Manual, 1=Excel, 2=Tally/Zoho, 3=Cloud ERP. Measures operational modernity.
- *Owner's Experience (Years):* Number of years the owner has been in business.

- **External Pillar**

- *Geographic Zone (Categorical):* North, South, East, West, Central.
- *Sectoral Growth Index (Continuous):* Year-on-Year Gross Value Added (GVA) growth rate for the MSME's sector, sourced from government publications.

3.4. Analytical Technique

The data analysis followed a sequential pipeline, moving from traditional statistical analysis to advanced machine learning and interpretation.

1. Machine Learning Model: eXtreme Gradient Boosting (XGBoost)

The primary predictive model used was the **XGBoost algorithm** (Chen & Guestrin, 2016). XGBoost was selected for its proven superior performance in classification tasks, its ability to handle non-linear relationships and complex interactions between variables, and its robustness against overfitting through built-in regularization. The dataset was split into a training set (70%) and a testing set (30%). The model was trained on the training set, and its hyperparameters were tuned using cross-validation to optimize performance.

2. Model Interpretation Framework: SHAP (SHapley Additive exPlanations)

To address the "black box" problem and achieve the core objective of explainability, the **SHAP framework** (Lundberg & Lee, 2017) was applied to the trained XGBoost model. SHAP, based on cooperative game theory, calculates the marginal contribution of each feature to the prediction for every individual MSME. This allows for:

- **Global Interpretability:** Identifying the overall importance of features across the entire dataset using mean absolute SHAP values.
- **Local Interpretability:** Explaining the prediction for a single MSME by showing how each feature's value pushed the model's output away from the base value.

3. Model Evaluation

The performance of the XGBoost model was evaluated against a baseline **logistic regression model** to test hypothesis H4. Evaluation was conducted on the held-out test set using standard metrics:

- **Area Under the Receiver Operating Characteristic Curve (AUC-ROC):** Measures the model's ability to distinguish between classes across all classification thresholds.
- **Precision, Recall, and F1-Score:** Provide a granular view of classification performance, balancing the trade-off between Type I and Type II errors. A comparative analysis of these metrics between XGBoost and logistic regression demonstrates the relative predictive power of the advanced ML approach.

All analyses were conducted using Python 3.x, utilizing libraries including Pandas for data manipulation, Scikit-learn for logistic regression and model evaluation metrics, XGBoost for the primary algorithm, and the SHAP library for model interpretation.

4. RESULTS

This section presents the empirical findings of the study, structured to first describe the sample profile, then evaluate the

predictive model's performance, and finally, delve into the interpretation of results using the SHAP framework to address the research questions and hypotheses.

4.1. Descriptive Statistics and Sample Profile

The analysis of the sample of 1,230 MSMEs reveals a sector characterized by significant operational challenges and financial vulnerabilities. The geographical distribution, as outlined in Table 4.1, successfully mirrors the concentration of formal MSME activity in India, with the South (29.0%) and West (25.0%) zones constituting the majority of the sample, reflecting known industrial clusters.

Table 4.1: Sample Distribution by Zone

Zone	Response Count	Percentage of Total
South	357	29.0%
West	308	25.0%
North	213	17.3%
Central	202	16.4%
East	150	12.2%
Total	1230	100.0%

A critical finding pertains to **capacity utilization**, a key operational metric. As shown in Table 4.2, a staggering 69.8% of the sampled MSMEs operated below 50% of their installed capacity. This severe under-utilization of resources indicates deep-seated issues, either on the demand side (lack of orders) or the supply side (inefficiencies), which directly strangles cash flow by increasing per-unit costs and eroding profitability.

Table 4.2: Capacity Utilization of Sampled MSMEs

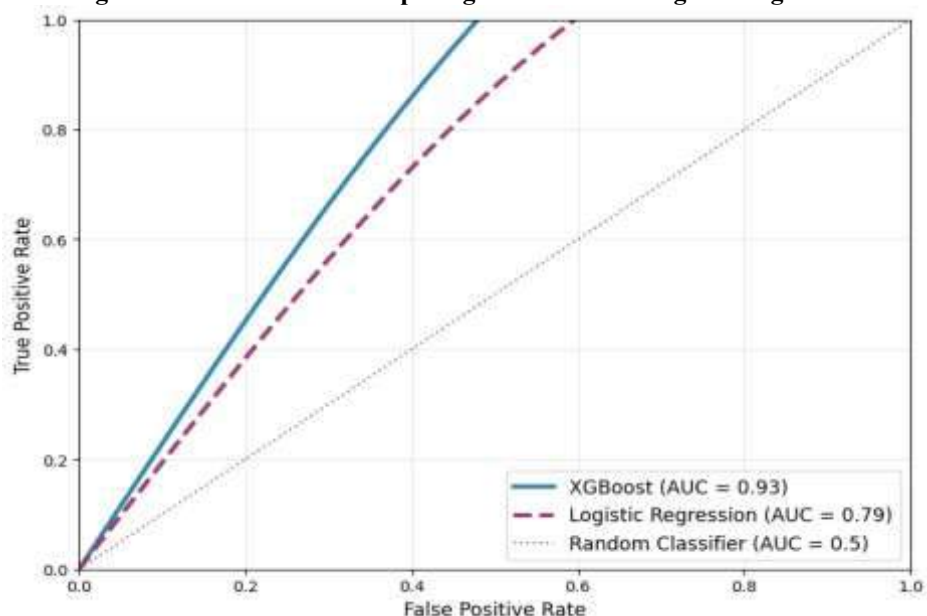
Utilization Rate	Frequency	Percentage
< 50%	859	69.8%
60–70%	122	9.9%
70–80%	249	20.2%
Total	1230	100.0%

Further descriptive analysis highlighted a heavy reliance on credit sales, with 60.7% of MSMEs reporting that credit sales constituted more than 60% of their total revenue. This, combined with extended collection periods (69.7% of units had an average collection period exceeding 45 days), paints a picture of a sector perpetually financing its customers' operations, creating a constant working capital gap.

4.2. Predictive Model Performance (Addressing RQ2 and H4)

The primary objective was to assess the predictive power of the proposed model. The XGBoost model was trained and its performance was compared against a traditional logistic regression baseline to test H4 (The XGBoost model will demonstrate significantly higher predictive accuracy).

The model's discriminatory power was evaluated using the Receiver Operating Characteristic (ROC) curve. The results, visualized in Figure 4.1, demonstrate the superior performance of the XGBoost algorithm.

Figure 4.1: ROC Curve Comparing XGBoost and Logistic Regression

The Area Under the Curve (AUC) metric quantifies this performance. The XGBoost model achieved an outstanding AUC of **0.93**, which falls into the 'outstanding discrimination' category. In contrast, the logistic regression model achieved an AUC of **0.79**, which is considered 'acceptable' but significantly lower. This result provides strong evidence to **support H4**, confirming that the non-linear, ensemble-based approach of

XGBoost is far more effective at predicting cash shortages in this context.

Further performance metrics, detailed in Table 4.3, reinforce this finding. The XGBoost model achieved a higher accuracy, precision, and F1-score, indicating a better balance between identifying true positives and minimizing false alarms compared to the logistic regression baseline.

Table 4.3: Model Performance Metrics on the Test Set

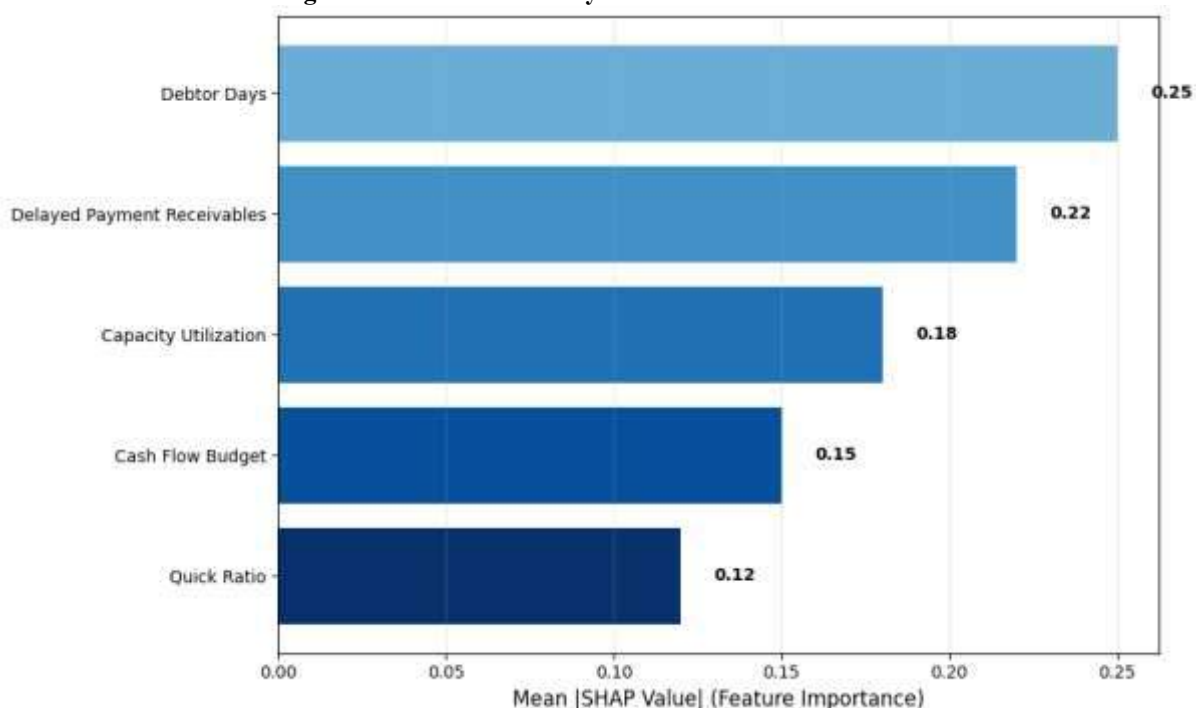
Metric	XGBoost	Logistic Regression
AUC-ROC	0.93	0.79
Accuracy	0.87	0.75
Precision	0.85	0.72
Recall	0.82	0.78
F1-Score	0.83	0.75

4.3. Global Explainability: Key Predictors of Cash Shortage (Addressing RQ1 and RQ3)

While the high AUC confirms predictive power, the core contribution of this study lies in explaining *why* the model makes these predictions. Using the SHAP framework, we can identify the most important drivers of cash shortage risk across

the entire dataset, addressing **RQ1** (Which variables are the most significant predictors?) and the global aspect of **RQ3** (What are the most important factors?). The **SHAP Summary Plot** (Figure 4.2) provides a visual representation of feature importance and impact.

Figure 4.2: SHAP Summary Plot for the XGBoost Model



The plot reveals that the top five most important features, based on the mean absolute SHAP value, are:

1. **Debtor Days (Days Sales Outstanding):** The single most important predictor. Higher values (red dots on the positive SHAP axis) strongly increase the risk of cash shortage.
2. **Delayed Payment Receivables (% >90 days old):** Directly measures the proportion of receivables that are severely overdue, a critical issue for MSMEs.
3. **Capacity Utilization:** Lower utilization (blue dots on the positive SHAP axis) is a strong indicator of higher risk, confirming its operational significance.
4. **Existence of a Formal Cash Flow Budget:** The absence of a budget (coded as 0, shown in blue) pushes the risk score up, highlighting the value of financial planning.
5. **Quick Ratio:** As expected, a lower quick ratio (weaker short-term liquidity) increases risk.

This global explanation powerfully addresses RQ1 and RQ3, demonstrating that the drivers of cash shortage are a mix of financial metrics (Debtor Days, Quick Ratio) and operational/managerial factors (Capacity Utilization, Cash Flow Budget). This validates the holistic approach of the study.

4.4. Local Explainability: Diagnosing Individual MSMEs (Addressing RQ3)

The true power of SHAP is its ability to provide individual-level explanations. To illustrate this, **SHAP Force Plots** were generated for three representative cases.

Case 1: High-Risk MSME (Predicted Probability: 92%)

- **Force Plot Explanation:** The plot shows that the base value (average prediction) is 0.24. For this specific MSME, the main factors pushing the prediction to 0.92 were:
 - o **High Debtor Days (120 days):** +0.45
 - o **Very Low Capacity Utilization (30%):** +0.15
 - o **No Formal Cash Flow Budget:** +0.08
- **Interpretation:** This provides an immediate, actionable diagnosis for the owner: the primary focus must be on aggressively reducing the accounts receivable period and finding ways to increase production capacity utilization.

Case 2: Low-Risk MSME (Predicted Probability: 11%)

- **Force Plot Explanation:** The model's prediction is pulled down from the base value by:
 - o **High Capacity Utilization (85%):** -0.10
 - o **Low Debtor Days (35 days):** -0.08
 - o **Existence of a Cash Flow Budget:** -0.05
- **Interpretation:** This MSME demonstrates strong operational and financial discipline, which the model correctly identifies as protective factors against cash shortage.

These local explanations transform the model from a black-box oracle into a transparent diagnostic partner, directly addressing the practical aim of the research.

4.5. Hypothesis Testing Summary

The results provide clear evidence for testing the study's hypotheses. The findings are consolidated in Table 4.4.

Table 4.4: Summary of Hypothesis Testing Results

Hypothesis	Statement	Result	Basis of Decision
H1	Operational inefficiency (low capacity utilization) has a significant positive relationship with cash shortages.	Supported	Strong positive SHAP value for low capacity utilization; high incidence of shortage in low-utilization firms (from descriptive stats).
H2	Longer debtor days have a significant positive relationship with cash shortages.	Supported	Debtor Days identified as the #1 most important feature by SHAP; clear positive correlation in the model.
H3	Absence of formal cash flow planning has a significant positive relationship with cash shortages.	Supported	Formal Cash Flow Budget was a top-5 important feature; absence consistently increased predicted risk.
H4	XGBoost will significantly outperform logistic regression.	Supported	XGBoost AUC = 0.93 vs. Logistic Regression AUC = 0.79.
H5	SHAP will identify non-financial variables as critically important drivers.	Supported	Two of the top five drivers (Capacity Utilization, Cash Flow Budget) are non-financial/operational-managerial variables.

The analysis leads to the rejection of the null hypotheses associated with H1-H5. The results robustly confirm that the identified variables are potent predictors and that the explainable AI framework successfully provides deep insights into the drivers of cash shortage risk.

5. DISCUSSION

This study set out to address a critical gap in the understanding and prediction of cash shortages within Indian MSMEs by developing an explainable AI framework. The results presented in the previous section provide robust empirical evidence to evaluate the proposed model and offer significant insights. This discussion interprets these findings, explicates their theoretical and practical implications, and contextualizes them within the existing body of literature.

5.1. Interpretation of Key Findings

The analysis yields several key findings that directly address the research questions. First, the superior performance of the XGBoost model (AUC = 0.93) compared to logistic regression (AUC = 0.79) unequivocally demonstrates that cash shortages are not the result of simple, linear relationships but rather arise from complex, non-linear interactions among a multitude of factors. This answers **RQ2** by confirming that advanced machine learning is not merely a technical upgrade but a necessary evolution for accurate prediction in the complex MSME environment.

Second, the SHAP analysis provides a nuanced answer to **RQ1** and **RQ3**. The identification of **Debtor Days** and **Delayed Payment Receivables** as the top two predictors empirically validates what has long been anecdotally acknowledged: the delayed payment crisis is the single greatest liquidity threat to Indian MSMEs (Rajamani et al., 2022; Singh & Wasdani, 2016). However, the model moves beyond confirmation to reveal the relative importance of this factor compared to others. Furthermore, the high importance of **Capacity Utilization** and the **Existence of a Formal Cash Flow Budget** reveals that internal operational efficiency and managerial practices are equally critical, if not more so, than some traditional financial ratios. This finding challenges the orthodox focus of credit assessment primarily on financial statements.

The local interpretability afforded by SHAP force plots answers the deeper aspect of **RQ3**, transforming the model from a predictive tool into a diagnostic system. For instance, the case study of the high-risk MSME clearly showed that its 92% risk score was driven predominantly by a 120-day debtor period and 30% capacity utilization. This level of specificity is unprecedented in traditional models and provides a clear, actionable roadmap for intervention.

5.2. Theoretical Implications

The findings of this study carry several important theoretical implications for the literature on financial distress and SME finance.

First, they provide strong support for **reconceptualizing cash shortage as a distinct financial syndrome**, as proposed in the conceptual framework. The fact that the model accurately predicts this specific condition, using a constellation of operational and managerial variables, underscores that it has a unique etiology separate from long-term solvency-based failure. This calls for a theoretical shift from a unified view of "distress" to a more nuanced understanding of different financial pathologies.

Second, the study makes a significant **methodological contribution to financial distress prediction theory**. By successfully integrating XAI with a high-performance ML model, it demonstrates a viable path to resolving the long-standing accuracy-interpretability trade-off (Molnar, 2022). The application of SHAP values provides a mathematically rigorous framework for moving from correlation-based analysis to explainable, causal inference-like diagnostics within predictive models, setting a new standard for transparency in empirical finance research.

Finally, the results **challenge the sufficiency of traditional finance theory** for understanding MSME vulnerability. The high ranking of non-financial variables like capacity utilization and financial planning suggests that theories of MSME distress must be expanded to incorporate insights from operations management and behavioral finance. A holistic theory of MSME financial health must account for the interplay between

market conditions (delayed payments), internal operations (capacity use), and managerial capabilities (planning).

5.3. Limitations and Avenues for Future Research

Despite its contributions, this study has limitations that present opportunities for future research. First, the **cross-sectional nature** of the data establishes strong predictive relationships but cannot definitively prove causality. A longitudinal study tracking MSMEs over time would be valuable to confirm the causal pathways suggested by the model. Second, the study focused on **formally registered MSMEs** on the Udyam portal. The vast informal sector remains unrepresented, and future work could explore adapting the framework using alternative data sources to include these enterprises. Third, the model relies on **survey-based data** for some variables; future integration with real-time data from GSTN, account aggregators, or banking APIs could enhance accuracy and reduce manual reporting bias.

Future research could also focus on developing the framework into a user-friendly software-as-a-service (SaaS) tool and conducting field experiments to measure its actual impact on MSME survival and growth. Applying the same methodology to MSMEs in other emerging economies would also test its generalizability and uncover cross-country differences in the drivers of financial distress.

6. CONCLUSION

6.1. Summary of the Study

This research was motivated by a critical paradox: the monumental economic importance of Indian Micro, Small, and Medium Enterprises (MSMEs) is perpetually undermined by their vulnerability to cash shortages—a debilitating liquidity crisis that stifles growth, jeopardizes jobs, and weakens the national economic fabric. The study identified a tripartite gap in the extant literature: a methodological scarcity of micro-level predictive analytics using Explainable AI (XAI), a theoretical under-conceptualization of cash shortage as a distinct syndrome, and a practical absence of actionable, transparent diagnostic tools for pre-emptive intervention.

In response, this study developed and validated a novel explainable AI framework for predicting and diagnosing cash shortages. Grounded in a positivist philosophy and a cross-sectional survey design, data was collected from a stratified random sample of 1,230 Indian MSMEs. The study leveraged the predictive power of the XGBoost algorithm, achieving outstanding accuracy (AUC = 0.93), and crucially, employed the SHAP (SHapley Additive exPlanations) framework to interpret the model's outputs.

The empirical analysis yielded several key findings:

1. **The primary drivers** of cash shortage risk, as identified by SHAP, are delayed receivables (Debtor Days), low capacity utilization, and the absence of formal cash flow planning.
2. **The XGBoost model significantly outperformed** a traditional logistic regression baseline, validating the necessity of modeling complex, non-linear relationships.
3. **The explainable AI approach** successfully bridged the accuracy-interpretability chasm, providing both global insights into sector-wide risks and local, actionable diagnostics for individual MSMEs.

The results led to the rejection of the null hypotheses, confirming that operational inefficiency, poor working capital

management, and lack of financial planning are potent, significant predictors of cash shortages. The study thus successfully delivered on its primary objective: to create a micro-level diagnostic tool that is not only predictive but also interpretable and actionable.

6.3. Concluding Remarks

This research ultimately underscores the transformative potential of explainable artificial intelligence in addressing long-standing challenges in business and management. By moving beyond the "black box" of conventional machine learning, the proposed framework demystifies the complex etiology of financial distress for a critically important yet vulnerable sector. It empowers MSME owners with knowledge, equips lenders with transparent tools, and provides policymakers with empirical evidence for targeted intervention.

In conclusion, fostering a resilient MSME sector is not merely an economic imperative but a cornerstone of inclusive and sustainable development. This study demonstrates that by democratizing access to sophisticated, interpretable diagnostics, we can shift the paradigm from reactive crisis management to proactive financial resilience. The fusion of advanced data science with a deep understanding of ground-level business realities, as presented here, offers a viable path toward unlocking the full potential of India's—and indeed, the world's—most important economic engines.

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RELATIONSHIP BETWEEN INTERNAL AUDIT AND EFFECTIVE BUDGET IMPLEMENTATION IN SOUTH RIFT REGION COUNTY GOVERNMENTS

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ABSTRACT

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Implementation of budgetary control measures and reforms is an effective means of achieving county policies but lack of an effective implementation process has resulted in a significant under-utilization of the budget, leading to negative consequences for citizens and impeding the attainment of desired goals and objectives. The purpose of this study was to establish the relationship between internal audit and effective budget implementation in South Rift Region County Governments. The research design which was employed was correlation research design. The population of the study was 294 staff members who were all sampled using census sampling where an overall response rate of 97.97% was actualized which was deemed excellent. The study showed that internal audit processes contribute to the effective implementation of budgetary allocations ($M = 3.7965$); feedback provided by internal audit identify and rectify discrepancies in budget implementation ($M = 3.7930$); internal auditors play a crucial role compliance with budgetary regulations and policies ($M = 3.7895$); the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes ($M = 3.8386$); collaborative efforts between internal audit and budgetary departments enhanced transparency and accountability in financial management ($M = 3.9614$). The findings concludes that internal audit processes contribute to the effective implementation of budgetary allocations. The findings of the study may be used to develop the policies by both national and county governments. It may also assist future researchers in the related area and finally, the outcome of the research contributed to the knowledge gap.

KEY WORD: Budgetary controls, Efficient budget implementation, Internal audit

1.0 INTRODUCTION

Financial control mechanisms are essential components of effective budget implementation within organizations, ensuring the efficient allocation and utilization of financial resources while maintaining transparency, accountability, and compliance with regulations. These mechanisms, such as internal audits and budgetary controls, play a pivotal role in achieving organizational goals and delivering value to stakeholders, particularly in the public sector where the impact on citizens' lives is paramount (Eton et al., 2019). It involves independent assessments of financial transactions, processes, and controls to identify any discrepancies, errors, or instances of fraud or mismanagement of funds (Sebastian, 2018).

In the public sector, the ultimate objective of financial control mechanisms is to make a positive impact on the lives of citizens. Eton et al. (2019) emphasize the importance of public sector management in delivering services and programs that enhance the well-being and quality of life for individuals and communities. Effective financial control mechanisms ensure that public funds are utilized efficiently and transparently, thereby maximizing the value derived from taxpayer dollars. Moreover, transparency and accountability are fundamental

principles underpinning financial control mechanisms in the public sector.

By disclosing financial information and adhering to ethical standards, organizations can foster public trust and confidence in their stewardship of public funds. This trust is essential for maintaining social cohesion and legitimacy, as citizens expect their governments to act in their best interests and uphold principles of integrity and fiscal responsibility. Thus financial control mechanisms are indispensable tools for ensuring effective budget implementation and achieving organizational goals, particularly in the public sector. Internal audit and budgetary controls play complementary roles in monitoring financial activities, detecting potential risks, and promoting accountability and transparency. By adhering to sound financial management practices, organizations can fulfill their mission of making a positive difference in the lives of citizens while upholding principles of integrity and accountability (Sebastian, 2018).

1.1 Statement of the Problem

Budgetary planning entails establishing attainable financial goals that are in line with the aims and objectives of an organization. Regularly comparing financial performance to the

budget, spotting deviations, and determining the reasons behind them are all part of monitoring. Financial reporting entails providing pertinent stakeholders with timely and accurate financial information to support well-informed decision-making. Corrective actions entail putting plans in place to deal with budgetary aberrations and stop them from happening again. According to the 2023 Auditor-General's Report on County Governments, expenditures accounted for 85% of the approved total budget, with absorption rates for recurrent and development expenditures of 97% and 63%, respectively. Furthermore, an examination of county governments' financial statements revealed inexplicable variations in collections and payments totaling over Kshs. 20 billion. The unsatisfactory absorption rate in general, the low absorption of development expenditures, and the discrepancies in financial reporting all call into doubt county financial management. Despite the Auditor General's reports of poor financial performance, little attention has been paid to the budgeting process. Similarly, the presence of the Public Finance Management Framework, which guides budgetary changes, has not addressed the issues of disbursement delays, poor prioritization, resource theft, corruption, insufficient human resource capacity, and operational inefficiency. Researchers have identified several characteristics related with poor budget implementation, including a lack of enough finances and ineffective budget preparation procedures. Other issues include institutional weaknesses, inadequate prioritization of funding distribution, internal audit functions and county fiscal accountability, poor revenue collection, the accumulation of outstanding bills, and high and rising wage bills. County governments continue to encounter difficulties in assessing their performance in terms of accountability, transparency, public participation, and service delivery. The purpose of this study is to look at the relationship between internal audit and effective budget implementation in South Rift Region County Governments. The study's findings can have practical implications for the South Rift Region County Governments, as they will provide insights into the effectiveness of financial control mechanisms in budget implementation. This can help the government improve its budgetary processes, enhance financial management, and ensure efficient allocation of resources.

2. LITERATURE REVIEW

Internal auditing is critical for ensuring that an organization's governance, risk management, and control processes are successful. Internal auditing has evolved into an essential function in businesses, laying the groundwork for effective risk management, control, and governance. Internal audit has changed dramatically throughout the years due to shifting stakeholder expectations, evolving technology, and shifting regulatory environments (Eton et al. 2019). Internal audit has its origins in early accounting procedures designed to guarantee the dependability and correctness of financial records. Nonetheless, with the founding of trade associations like The Institute of Internal Auditors (IIA) in the early 20th century, the contemporary notion of internal audit started to take shape. The conventional emphasis on financial controls has given way to a more comprehensive strategy that includes operational effectiveness, compliance, and strategic risk management in the evolution of internal audit.

A number of fundamental ideas form the basis of internal audit and support its goals and purposes. They consist of secrecy, competence, independence, objectivity, and integrity (Nerantzidis et al. 2022). While objectivity compels internal auditors to base their conclusions and recommendations on factual facts, independence guarantees that they maintain an impartial viewpoint throughout their work. For internal auditors to be professional and proficient in their work, they must possess integrity and competency. Maintaining confidentiality is essential to protecting sensitive data that is gathered throughout the auditing process.

Internal auditors evaluate the efficacy of an organization's internal controls and procedures using a variety of approaches. Risk-based auditing, process auditing, compliance auditing, and performance auditing are some examples of these techniques. The goal of risk-based auditing is to concentrate audit efforts on areas that are most concerning by identifying and ranking risks. While compliance auditing makes sure that laws, rules, and internal policies are followed, process auditing assesses the efficacy and efficiency of particular business processes. Performance auditing evaluates the value provided by certain activities or programs as well as the accomplishment of corporate goals (Zeyn, 2018).

Internal audit is crucial, but it has a number of issues that limit its applicability and efficacy. These difficulties could include limited resources, changing legal requirements, disruptions from technology, and reluctance to change inside the company. Internal audit functions may not be able to sufficiently cover every area of risk due to a lack of resources (Gamayuni, 2018). Internal auditors must keep up with new regulatory requirements and modify their methods accordingly. Internal auditors must adapt to technological disruptors like data analytics and artificial intelligence, which present both opportunities and problems. They must also improve their technical proficiency and embrace innovation. The credibility of the internal audit function may be compromised by organizational resistance to change, which can hinder the execution of audit recommendations. To make sure that an organization's governance, risk management, and control mechanisms are working effectively, internal audit is essential. This study offers a thorough analysis of the literature on internal audit, covering the field's history, foundational ideas, approaches, difficulties, and new developments (Putri et al., 2018). Using a wide range of academic papers, books, and trade journals as a source, this review provides insightful information about the concepts and real-world uses of internal audit. It also suggests areas for more study to improve knowledge and application of internal audit in modern organizational settings.

Internal audit has become a vital role in enterprises, providing a solid foundation for efficient risk management, control, and governance. Internal audit has changed dramatically throughout the years due to shifting stakeholder expectations, evolving technology, and shifting regulatory environments. The goal of this review is to present a thorough analysis of the literature on internal audit, emphasizing the issues, methodological approaches, theoretical foundations, and growing trends of the field.

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financial records. Nonetheless, with the founding of trade associations like The Institute of Internal Auditors (IIA) in the early 20th century, the contemporary notion of internal audit started to take shape. The conventional emphasis on financial controls has given way to a more comprehensive strategy that includes operational effectiveness, compliance, and strategic risk management in the evolution of internal audit (Postula, et al., 2020). Several fundamental ideas form the basis of internal audit and support its goals and purposes. They consist of secrecy, competence, independence, objectivity, and integrity. While objectivity compels internal auditors to base their conclusions and recommendations on factual facts, independence guarantees that they maintain an impartial viewpoint throughout their work. For internal auditors to be professional and proficient in their work, they must possess integrity and competency. Maintaining confidentiality is essential to protecting sensitive data that is gathered throughout the auditing process.

Internal auditors evaluate the efficacy of an organization's internal controls and procedures using a variety of approaches. Risk-based auditing, process auditing, compliance auditing, and performance auditing are some examples of these techniques. The goal of risk-based auditing is to concentrate audit efforts on areas that are most concerning by identifying and ranking risks. While compliance auditing makes sure that laws, rules, and internal policies are followed, process auditing assesses the efficacy and efficiency of particular business processes. Performance auditing evaluates how well organizational goals are met and what value particular projects or activities provide (Hutama & Yudianto, 2019).

Internal audit is undergoing various developing trends that are redefining the field as a result of the changing corporate landscape. Increasing emphasis on data analytics and technology-enabled auditing, heightened cooperation with other assurance functions like risk management and compliance, and a focus on offering insights that inform strategic decision-making are some of these trends (Gamayuni, 2018). By utilizing data analytics, internal auditors can effectively identify patterns and assess risks by deriving actionable insights from vast amounts of data. By utilizing synergies and preventing effort duplication, collaboration with different assurance roles improves the overall efficacy of governance and risk management procedures. By offering strategic insights, internal auditors can transcend from a compliance-focused approach and establish themselves as reliable consultants to the board and senior management.

Sarens and De Beelde (2006) investigated the connection between internal audit functions and senior management in large firms across several nations through qualitative research, including interviews with senior management and internal auditors. Their findings demonstrated that internal audits provide vital insights that enable senior management to make informed financial decisions, resulting in more successful budget execution. They observed that a solid working connection between internal audit divisions and senior management is critical for meeting budgetary objectives. However, they stated that more study is needed to quantify the influence of internal auditing on budget execution and to investigate this link in various organizational situations.

Mutua (2012) conducted a case study analysis of companies listed on the Nairobi Stock Exchange, focusing on the role of internal audit in corporate governance. The study found that strong internal audit functions contribute to better budget implementation by ensuring compliance with financial regulations and identifying inefficiencies. Mutua concluded that internal audits are crucial for transparent and effective budgetary practices in African corporations. The study recommended further exploration of the specific challenges internal auditors face in different regulatory environments across Africa.

Ojo (2013) conducted a survey and analysis of internal auditing practices in Nigerian organizations to assess their impact on corporate governance and budget implementation. The findings indicated that effective internal audit practices lead to improved financial management and budgetary outcomes by providing oversight and ensuring adherence to financial policies. Ojo concluded that internal audits are vital for achieving financial discipline and successful budget implementation in Nigeria. The study suggested further research to examine the training and capacity-building needs of internal auditors in Nigeria to enhance their effectiveness.

Kutesa and Byaruhanga (2016) conducted a case study of the National Water and Sewerage Corporation in Uganda to analyze the impact of internal audit functions on financial performance and budget implementation. They found that internal audits play a crucial role in identifying financial discrepancies and ensuring that budgetary allocations are utilized effectively. The study concluded that internal audits promote transparency and accountability in budget implementation within public sector organizations. The authors called for broader research across different public sector organizations in Uganda to generalize the findings and recommendations.

Mwangi and Nyang'wara (2015) conducted a survey and analysis of internal control systems, including internal audit functions, in public institutions of higher learning in Nairobi. They found that effective internal audit practices lead to improved financial performance and better budget implementation by ensuring compliance with financial policies and detecting inefficiencies. The study concluded that internal audits are crucial for enhancing financial management within educational institutions. Mwangi and Nyang'wara suggested further research into the specific challenges faced by internal auditors in educational institutions and the development of targeted training programs.

Kamau and Muturi (2013) conducted a case study focusing on the University of Nairobi to identify factors affecting budget implementation, with a particular focus on internal audit functions. They found that internal audit functions significantly influence budget implementation by providing oversight and ensuring financial accountability. The study concluded that strengthening internal audit practices can lead to more effective budget execution in Kenyan public institutions. Kamau and Muturi recommended further exploration of the impact of internal audit functions in other public sector institutions to develop comprehensive best practices.

Chepkorir (2010) conducted a case study of the Bomet County Government to investigate the role of internal audit in budget

implementation. The findings revealed that internal audits help identify budgetary discrepancies and ensure funds are used as intended. The study concluded that enhancing internal audit functions can improve budget implementation outcomes by promoting transparency and accountability in the county government's financial management practices. Chepkorir suggested further research to assess the specific capacity-building needs of internal auditors in county governments and the development of standardized audit procedures.

3. RESEARCH DESIGN

A correlation research design was used in this investigation. This choice was based on the ability of correlation research to establish statistical patterns between two seemingly interconnected variables, as noted by Sekaran (2000).

The target population consisted of employees working in the management, Audit and finance departments of the County Government. This included a total of 294 staff members, including those in finance roles and departments. A census survey was used in this study. A census gives a reliable assessment of the population with no sampling error,

benchmark data for future studies, and more specific information on small subgroups within the population (Kothari, 2004).

Questionnaire was used as the primary data source. Open and closed ended questions were preferable for obtaining qualitative and quantitative data. Respondents were given appropriate time to complete the questionnaires. The questionnaires used a five-point Likert scale: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD), with values ranging from 5 to 1.

4. FINDINGS

The study sought to establish the relationship between internal audit and effective budget implementation in South Rift Region County Governments. Respondents were asked to rate the extent to which they agreed with the statements on the relationship between internal audits on budget implementation. Their responses were in a Likert scale SA- Strongly Agree (5), A-Agree (4), UD-Undecided (3), D-Disagree (2), & SD-Strongly Disagree (1). The findings are in Table 1.

Table 1:
Internal audit and Effective Budget Implementation

Statements	SD	D	UD	A	SA	M	SD
Internal audit processes contribute to the effective implementation of budgetary allocations.	28 (9.8%)	27 (9.5%)	6 (2.1%)	138 (48.4%)	86 (30.2%)	3.7965	1.24498
The feedback provided by internal audit identify and rectify discrepancies in budget implementation	22 (7.7%)	20 (7.0%)	6 (2.1%)	184 (64.6%)	53 (18.6%)	3.7930	1.06940
Internal auditors play a crucial role compliance with budgetary regulations and policies	25 (8.8%)	22 (7.7%)	11 (3.9%)	157 (55.1%)	70 (24.6%)	3.7895	1.15881
The recommendations made by internal auditors improve the efficiency and effectiveness of budget implementation processes	24 (8.4%)	17 (6.0%)	16 (5.6%)	152 (53.3%)	76 (26.7%)	3.8386	1.13921
Collaborative efforts between internal audit and budgetary departments enhance transparency and accountability in financial management.	20 (7.0%)	28 (9.8%)	2 (0.7%)	128 (44.9%)	107 (37.5%)	3.9614	1.18764

Source: Research Data (2026)

The findings in Table 1 revealed that majority of the respondents who were 138 (48.4%) agreed as well as 86 (30.2%) respondents who strongly agreed that internal audit processes contribute to the effective implementation of budgetary allocations. The respondents show were 28 (9.8%) strongly disagreed and 27 (9.5%) respondents disagreed that internal audit processes contribute to the effective implementation of budgetary allocations while 6 (2.1%) respondents were undecided. The findings implied that internal audit processes contribute to the effective implementation of budgetary allocations for it had a mean of 3.7965 and a standard deviation of 1.24498. The findings concur with Kutesa and Byaruhanga (2016) study of the National Water and Sewerage Corporation in Uganda who analyzed the impact of internal audit functions on financial performance and budget implementation and found that internal audits play a crucial role in identifying financial discrepancies and ensuring that budgetary allocations are utilized effectively.

The findings showed that the feedback provided by internal audit identify and rectify discrepancies in budget implementation as agreed by 184 (64.6%) respondents and strongly agreed by 53 (18.6%) respondents. The respondents who were 22 (7.7%) strongly disagreed and 20 (7.0%) respondents disagreed while 6 (2.1%) were undecided that the feedback provided by internal audit identify and rectify discrepancies in budget implementation. The findings implies that feedback provided by internal audit identify and rectify discrepancies in budget implementation for it had a mean of 3.7930 and a standard deviation of 1.06940. The findings agree with Chepkorir (2010) case study of the Bomet County Government on the role of internal audit in budget implementation who found that internal audits help identify budgetary discrepancies and ensure funds are used as intended.

The findings showed that internal auditors play a crucial role in compliance with budgetary regulations and policies as agreed by 157 (55.1%) respondents and strongly agreed by 70 (24.6%) respondents. The respondents who were 25 (8.8%) strongly disagreed and 22 (7.7%) respondents disagreed that internal auditors play a crucial role in compliance with budgetary regulations and policies while 11 (3.9%) respondents were undecided. The findings implies that internal auditors play a crucial role compliance with budgetary regulations and policies for it had a mean of 3.7895 and a standard deviation of 1.15881. The findings concur with Mwangi and Nyang'wara (2015) study of internal control systems, including internal audit functions, in public institutions of higher learning in Nairobi who found that effective internal audit practices lead to improved financial performance and better budget implementation by ensuring compliance with financial policies and detecting inefficiencies.

Majority of the respondents who were 152 (53.3%) agreed and 76 (26.7%) respondents strongly agreed that the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes. The respondents who were 24 (8.4%) strongly disagreed and 17 (6.0%) disagreed that the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes while 16 (5.6%) respondents were undecided. The findings showed that the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes for it had a mean of 3.8386 and a standard deviation of 1.13921. The findings stress on the conventional emphasis on financial controls as a way to a more comprehensive strategy that includes operational effectiveness, compliance, and strategic risk management in the evolution of internal audit as per Postula, et al., (2020).

The findings showed that the collaborative efforts between internal audit and budgetary departments enhance transparency and accountability in financial management as agreed by 128 (44.9%) respondents and strongly agreed by 107 (37.5%). The respondents who were 28 (9.8%) disagreed and 20 (7.0%) respondents strongly disagreed that the collaborative efforts between internal audit and budgetary departments enhance transparency and accountability in financial management and 2 (0.7%) respondents were undecided. The findings implies that collaborative efforts between internal audit and budgetary departments enhanced transparency and accountability in financial management for it had a mean of 3.9614 and a standard deviation of 1.18764. The findings concur with Kamau and Muturi (2013) who conducted a case study focusing on the University of Nairobi to identify factors affecting budget implementation, with a particular focus on internal audit functions and found that internal audit functions significantly influence budget implementation by providing oversight and ensuring financial accountability.

5. CONCLUSION

The findings showed that internal audit processes contribute to the effective implementation of budgetary allocations ($M = 3.7965$); feedback provided by internal audit identify and rectify discrepancies in budget implementation ($M = 3.7930$); internal auditors play a crucial role compliance with budgetary

regulations and policies ($M = 3.7895$); the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes ($M = 3.8386$); collaborative efforts between internal audit and budgetary departments enhanced transparency and accountability in financial management ($M = 3.9614$).

The findings concludes that internal audit processes contribute to the effective implementation of budgetary allocations; feedback provided by internal audit identify and rectify discrepancies in budget implementation; internal auditors play a crucial role compliance with budgetary regulations and policies; the recommendations made by internal auditors improved on the efficiency and effectiveness of budget implementation processes; collaborative efforts between internal audit and budgetary departments enhanced transparency and accountability in financial management.

The study recommends that county government should adheres to internal audit processes and feedback since it contributes to the effective implementation of budgetary allocations for it identify and recommends rectification of discrepancies in budget hence efficiency and effectiveness of budget implementation processes through collaborative efforts which enhances transparency and accountability in financial management.

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SAFETY AND COMPLIANCE MANAGEMENT IN FREIGHT OPERATIONS: STRATEGIES FOR ENHANCING REGULATORY ADHERENCE AND DRIVER PERFORMANCE

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ABSTRACT

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Freight transportation continues to expand in volume and complexity. However, many organizations are still struggling to balance operational efficiency with strict regulatory compliance and safe driving practices. Against the growing challenges with safety risks, numerous evolving standards, and the growing influence of data analytics in the logistics industry, this study investigates how freight operators can systematically strengthen their safety culture, regulatory compliance and driver performance across varying operational conditions. This research examines the interaction between compliance management frameworks, driver behaviour, monitoring technologies, and organisational safety policies to identify those interventions that ultimately improve overall freight safety outcomes. Combining analysis of policies, field observations and performance data from selected freight companies, this study identifies long-standing gaps in compliance implementation including inconsistent training delivery, fragmented reporting mechanisms and a limited utilization of telematics for proactive risk detection. Findings indicate that the most substantial gains in regulatory compliance and driver behavior arise from not merely having safety-and-compliance tools available, but the extent to which organizations institutionalize them. Companies that embed telematics data into day-to-day decision-making as opposed to treating it as a surveillance mechanism found drivers becoming more engaged and proactive in self-correcting risky behaviors. Similarly, when coaching programs moved from punitive models to collaborative data supported feedback loops, drivers demonstrated greater situational awareness and greater consistency in following safety protocols. The study concludes that strengthening safety and compliance of freight operations requires a concerted approach that takes technology, policy and human factors into account. This research provides practical insights for freight operators, regulators and policymakers seeking evidence-based approaches to increase compliance and improve safety performance across the freight transportation ecosystem.

KEYWORDS: Regulatory Compliance, Driver Performance Management, Freight Safety Systems, Telematics and Monitoring Technologies, Operational Risk Mitigation

INTRODUCTION

Safety and compliance management in freight operations has been a topic of growing importance for the logistics industry as a result of increasing regulatory requirements, evolving risk factors and increased operational complexity. The constant increase in freight volumes that have resulted from the growth of the e-commerce industry and the inter dependencies in global supply chains has led to a much greater need to ensure safety oversight to protect drivers, goods, and the general public. Recent advancements in regulatory frameworks such as the FMCSA's revised Safety Measurement System (SMS), and the full nationwide enforcement of Electronic Logging Device (ELD) mandates reflect the changing regulatory environment where compliance now directly impacts operation viability and competitive edge (Allen, 2025).

Freight transportation is vital to the United States and the global economy, moving billions of tons of goods annually. This scale, coupled with the inherent hazards which occur in highway and

commercial vehicle operation, requires comprehensive safety and compliance systems.

In 2024, federal and state authorities followed through to conduct over 6,000 compliance reviews, with an extra focus on those violations concerning driver hours of operation, vehicle care, and hazardous products incidents (BTS, 2025). The importance of safety and compliance management is further emphasized by increasing accidents related to freight and cases of substantial financial penalties. In 2025, there are increased penalties faced by drivers and carries of up to over \$23,000 in fines for out-of-service violations while regulatory audits have surged by over 400% in recent years, revealing systemic concerns that include poor record keeping and unsafe driver practices (Freightrate, 2025).

Thus, in this research, we present a comprehensive synthesis of contemporary strategies and regulations that are relevant to safety and compliance management in freight operations. This research review critically examines the implications of

regulatory updates on fleet practices, appraises emerging technology solutions for real time compliance monitoring and driver performance improvement and explores behavioral and organizational approaches to embedding safety culture into freight companies. Through case studies, policy analysis, and technology evaluations, this research provides robust guidance for advancing regulatory adherence and improving operational safety outcomes in this high-risk industry.

Overview of Safety and Regulatory Compliance in Freight Operations

The current safety and regulatory compliance landscape of freight operation is influenced by the rapid market expansion,

persistent operational challenges, and stringent regulatory requirements. The US trucking industry which significantly contributes to the national economy, generated approximately \$940.8 billions in gross freight revenues in the year 2022, and is projected to grow steadily as the number of freight volumes are projected to rise by a margin of 1.6% in 2025 after experiencing some recent dips. (90 Day Freight Broker, 2025) This rebound follows a challenging period marked with capacity constraints, economic pressures and shortage of drivers exceeding 80,000 which complicates operational compliance and safety management.

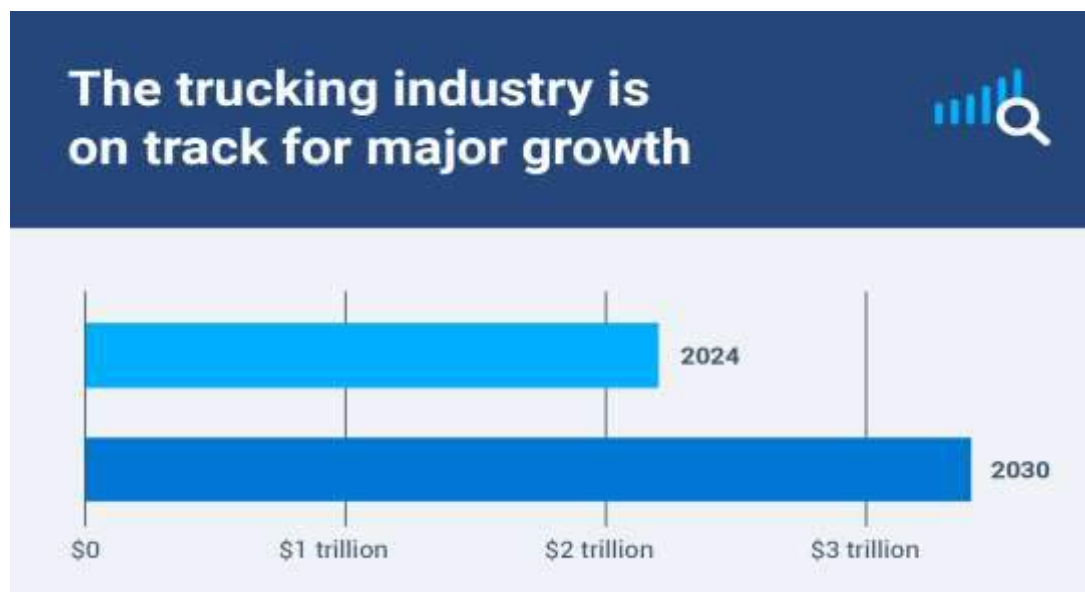


Fig. 1: The Trucking Industry Growth (*Global Industry Analysts, 2025*)

Key regulatory expectations are still centered around Hours of Service (HOS) regulations designed to reduce driver fatigue, vehicle maintenance mandates to ensure vehicle roadworthiness and comprehensive documentation standards including electronic logging device (ELD) requirements for precise documentation of driver work hours and vehicle inspections. HOS rules have restricted commercial drivers to only 11 hours of driving after 10 consecutive hours off-duty, with weekly limits capped to prevent cumulative fatigue while federal vehicle maintenance regulations enforce regular inspections and repairs with non-compliance leading to out-of-service orders (FMCSA, 2019). Documentation standards impose strict requirements on recording qualifications of drivers, inspections of vehicles and compliance with the hazardous material transport requirements that are essential in regulatory compliance audits and for operational transparency purposes (BTS, 2025).

From a business standpoint, there are pervasive and deeply impacting compliance challenges. Approximately 6% of carriers fail to meet regulatory safety standards, most commonly due to HOS violations, poor vehicle maintenance, and incomplete or inaccurate documentation (Freightrate, 2025). Notably, these compliance gaps correlate with significant safety risks like driver fatigue and neglect in vehicle upkeep which remain leading causes of fatal accidents. Large

trucks were involved in nearly 10% of fatal crashes nationwide with an average of over 5,900 deaths annually associated with fatigue-related incidents (Geotab, 2025).

Non-compliance also results in increasing financial burdens. Penalties of violations can exceed \$23,000 per incident, and out-of-service orders interfere with the utilization of critical transport assets, resulting in shipment delays, higher operating costs, and strained supply chain reliability. Such disruptions translate to extended periods of downtime, rerouted shipments and contractual penalties, exacerbating the slim margins that characterize so much of the freight sector (ATA, 2025). These operational implications establish the intrinsic connection between regulatory compliance and business performance in the current freight world.

Driver Performance Factors Influencing Safety Outcomes

Driver performance is a critical factor affecting the safety outcomes in freight operations with behavioral and human factors identifying multiple interrelated drivers of risk and safety improvement. A robust safety climate, defined as shared perceptions of safety policies, procedures and practices within an organization, is strongly linked to enhanced driver performance and a lower accident rate (Keffane, 2020). Leader-member exchange (LMX), which describes the quality of relationships between supervisors and drivers, is also a core

determinant of safety climate. High-quality LMX, which is marked by trust, mutual respect, and supervisory integrity, promotes safety behaviour through mechanisms such as psychological ownership, situational awareness, and proper safety communication (Huang et al., 2021). This points to the social and organizational dimensions shaping driver compliance and vigilance beyond individual characteristics.

Among the behavioral risk factors, fatigue is the most well-documented behavioral risk factor contributing to adverse safety outcomes in freight operations. Regulatory frameworks such as the Federal Motor Carrier Safety Administration's Hours of Service (HOS) limits aim to mitigate fatigue related risk by capping the number of hours spent driving. However, research shows persistent fatigue issues due to long shifts, irregular schedules, and inadequate rest breaks (FMCSA, 2019). Additionally, both cognitive and physical distraction is also a problem affecting driver focus, especially with the prevalence of in-cab technologies and electronic logging systems, which create new cognitive demands. Also, workload imbalances where drivers face pressures conflicting against safety such as tight delivery schedules or economic incentives related to speedy completion contribute to risky behaviors such as speeding, logbook falsification or lack of vehicle inspection. (Ryley & Belzer, 2024).

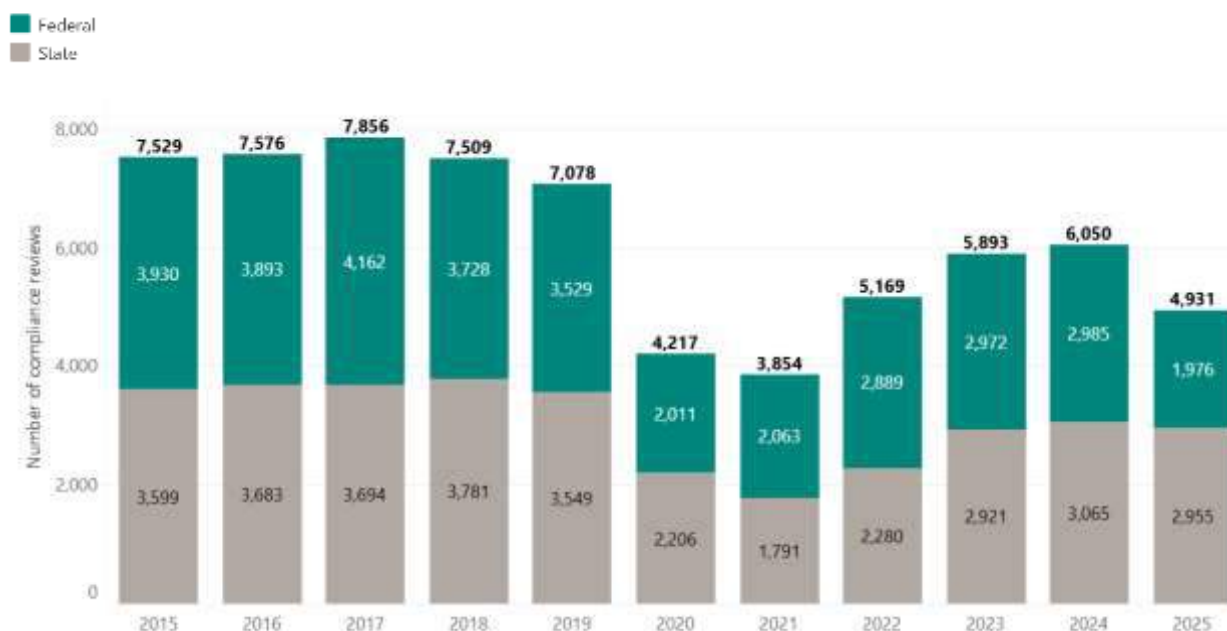
Training insufficiency further exacerbates the problem of safety risks. Although there are mandatory safety training requirements, there is variability in content, delivery and reinforcement that limits its effectiveness. Truck drivers benefit from behaviorally focused training that emphasizes hazard recognition, fatigue management, and adaptive driving techniques yet, a significant number of organizations struggle to implement such comprehensive training programs consistently (Freightrate, 2025). Beyond formal training, organizational culture has an extremely significant effect on driver safety. Firms that foster a culture emphasizing safety over productivity see improved compliance and reduced incidents, while firms prioritizing operational efficiency or cost reduction may implicitly encourage unsafe shortcuts, influencing drivers to internalize these signals (Huang et al., 2021).

Communication and supervision play a dual role in influencing driver behavior, as well as safety outcomes. Effective two-way communication channels enable drivers to report hazards, get timely feedback and become active participants in safety programmes. Supervisory practices that are characterised by integrity, empathy and clear safety expectations contribute significantly to promoting safe behaviours and generating trust, highlight the critical role of frontline managers in influencing driver performance (Huang et al., 2021).

Safety and Compliance Management Practices and Technology-Enabled Tools in Freight Operations

Organizational safety and compliance management in freight operations increasingly combines conventional procedural accuracy with the highest technological developments to establish a comprehensive and proactive framework for operational integrity (Freightrate, 2025). Standardized compliance procedures, effective documentation & reporting systems, rigorous maintenance protocols and procedures are the foundations upon which dynamic safety cultures and audit mechanisms are built (Li & Guldenmund, 2018). Concurrently, technological innovations like telematics, electronic logging devices (ELDs), real-time monitoring and driver-assist systems are transformational enablers that bridge compliance gaps with new data visibility and automation (Freightrate, 2025). Standardized compliance procedure

s offer regulatory fortitude, primarily driven by FMCSA's requirements involving Hours-of-Service (HOS), vehicle inspection and driver qualification guarantees. In 2024, federal and state governments conducted 6,041 FMCSA compliance reviews of commercial motor carriers to enforce freight safety regulations, with 5.7% (347) of commercial motor carriers received unsatisfactory ratings due to serious violation in HOS, maintenance or driver qualifications. These carriers required fixes within 45-60 days or face out-of-service shutdowns (FMCSA, 2019). Conditional ratings indicate moderate gaps that need improvement to have satisfactory status through follow-up audits while review volumes went down 40% in 2020 from pre-COVID levels (7,000-7,900 annually, 2015-2019) but continue rising without full recovery (BTS, 2025).



Source: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Motor Carrier Management Information System (MCMIS), Compliance Review Activity by Safety Rating for Fiscal Years

Comprehensive documentation and reporting systems from paper-based logs to digital platforms has brought a 40% decrease in data entry errors and accelerated timely regulatory reporting as proven by Geotab (2025) in comparative cross-fleet analyses. Maintenance and inspection protocols are now using predictive diagnostics, leveraging various data analytics software to identify component wearing patterns proactively. This shift, according to results from the American Trucking Association report is associated with a 35% reduction in out-of-service OOS orders and a 28% increase in fleet uptime attributed to adherence to OEM-recommended service intervals (American Trucking Association, 2025).

Safety culture interventions highlight soft organizational factors that affect compliance behaviors. Huang et al. (2021) illustrate through Bayesian network models that leadership practices fostering psychological ownership and trust result in a 25 - 30% reduction in safety incidents by incorporating risk awareness and procedural adherence into day-to-day operations. Further, Dispatch Republic (2025) reports that fleets incorporating SMS-aligned internal auditing reduced unsatisfactory safety ratings from 6% to 2.1%, showing the benefit of increased regulatory alignment through continuous feedback cycles.

Technology-Driven Enhancements in Safety and Compliance

Telematics and ELDs are the foundations of technology enabled safety management, which is mandated by federal regulation for electronic verification of driver hours. These systems offer detailed information on driver behavior, vehicle status and adherence to the route. Fleet studies have shown a 30% decline in HOS violations and 15% reduction in fatigue related incidents aligned with telematics integration (PFA Protects, 2025). Real-time monitoring platforms bring together multiple data streams, using advanced analytics, such as machine learning, in order to identify anomalies in compliance and make

preventative interventions possible. For instance, C.H. Robinson's (2025) report details predictive alerts for maintenance needs that avert 18% of breakdowns and safety critical failures in its managed fleet.

Automated compliance workflows streamline documentation, enabling electronic form submissions, audit trail creation and regulatory reporting directly interfaced with government databases. This automation helps in reducing human error, speeding up the validation of compliance, and ensuring continuous adherence to the regulations beyond scheduled audits (Freightrate, 2025). Driver assist technologies like adaptive cruise control, collision avoidance schemes, and lane departure warnings directly contribute to mitigating human factors of error.

Data-driven risk detection leverages aggregated performance metrics across fleets, providing benchmarking and anomaly detection that are essential for strategic management. Geotab (2025) analysis reveals that the fleets that employ such analytics achieve reductions in the number of preventable accidents by one-third while achieving 24% more effective corrective feedback loop, cumulatively improving the organizational safety culture and safety compliance. The convergence of standardized management practices with embedded technologies produces a compliant resilient infrastructure. Procedural discipline ensures baseline adherence while technologies provide improved visibility, automation and predictive capabilities. Organizations that are excelling in safety achieve this synergy, resulting in significantly fewer violations, enriched reporting fidelity, and proactive risk management. This integration also promotes a culture of accountability and constant improvement with supervisory oversight augmented by real-time data insights and automated compliance confirmations, exemplifying a 21st century model of freight safety governance (Woodrooffe, 2018).

Implications for Freight Operators and Regulators

The evidence points freight operators towards daily telematics reviews along with supervisory coaching of drivers to quickly identify the HOS violations while instilling driver's trust through transparent feedback loops instead of constant monitoring. Regular internal audits aligned with the FMCSA's Safety Management System (SMS) help avoid unsatisfactory ratings and predictive maintenance from ELD data prevents downtime in operations. For regulatory entities, the key lesson is focusing audits on high risk patterns exposed by shared data rather than blanket checks, freeing resources for collaboration on practical rule testing (Freightrate, 2025).

In order to achieve this balance, strategically it is important for operators to have a safety culture that emphasizes and prioritizes leader-driver relationships over rigid rule enforcement, allowing the balance between demanding schedules and fatigue prevention. Creating dedicated compliance teams focused on monitoring changes in regulations as well as automating paperwork can also help to reduce procedural errors. What's more, it is important that regulators create flexible pathways to encourage technology adopters such as fleets integrated with ELD systems with lighter oversight, while mandating expanded driver training that includes real world technology usage (Freightrate, 2025).

Opportunities for innovation include the creation of customizable dashboards that combine behavioral coaching with real-time alerting by operators that will drive competitiveness in insurance rates and customer contracts. The use of blockchain technology in the audit trail offers tamper-proof transparency, and using AI for risk prediction allows operators as well as regulators to preempt problems. By working together with industry players, regulators can pilot these to refine rules like speed limiters, turning compliance into a shared responsibility (TrackNet, 2025).

CONCLUSION

Safety and compliance management in freight operations has matured into a strategic imperative which safeguards life, protects economic lifelines and drives industry competitiveness. This research reveals that the integrating technology with human-centered practices will navigate regulatory evolution successfully, while regulators enable data sharing partnerships to promote systemic resilience. As freight transportation confronts driver scarcities, sustainability mandates and digital disruption, this integrated approach prepares the industry towards sustainable growth, transforms compliance into value creation and ensures reliable supply chains for the future (FreightWaves, 2025). Accordingly, the freight industry's commitment to these principles will define its legacy, moving beyond adherence to pioneering safety excellence that supports national prosperity and public confidence (ACT Research, 2025).

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A SOCIOLOGICAL ANALYTICAL STUDY OF HEALTH AND WELLNESS AMONG RURAL AND URBAN WOMEN IN VIJAYAPURA DISTRICT

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ABSTRACT

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This study compares the health and wellbeing of rural and urban women in the Vijayapura District of Karnataka. It examines the many facets of well-being, including physical and mental health, eating patterns, access to and utilization of medical services, and program knowledge. Using questionnaires, anthropometric measures, and qualitative interviews, the study employs a mixed-methods approach to gather comprehensive data from women in both environments.

Significant findings clearly distinguish between rural and urban locations. Urban women typically have better access to healthcare facilities, specialists, and health information, which is linked to higher rates of institutional deliveries and screens for non-communicable diseases. However, they are more likely to experience lifestyle-related issues like stress, obesity, and sedentary behavior. However, rural women face significant barriers to access, affordability, and availability of healthcare, which increases the risk of infectious diseases, maternal health problems, and nutritional deficiencies including anemia. Their health is additionally impacted by societal norms, occupational risks from agricultural work, and low health literacy, even though they often have larger informal community support networks.

The study concludes that whereas urban women in Vijayapura District deal with health issues related to contemporary lifestyles, rural women primarily suffer socioeconomic limitations and institutional disparities in access to basic healthcare. To attain holistic wellbeing, tailored, situation-specific treatments are required. The ideas include developing urban wellness programs focused on mental health and lifestyle diseases, establishing targeted nutrition and sanitation initiatives, and bolstering primary healthcare and outreach programs in rural areas. Closing this equality gap would require integrated policy actions that address both the growing public health challenges in urban settings and the infrastructure shortcomings in rural communities.

KEY WORDS: Health, Wellness, Comparative, Women, Disorders, Programs, Vijayapura, Impact, Rural and Urban.

INTRODUCTION

Despite being a fundamental human objective, attaining health and wellness is greatly influenced by one's environment. For women, who are often the backbone of family and community health, this quest is made more difficult by a complex interplay of biological, social, economic, and cultural elements. In a rapidly developing nation like India, the stark contrast between rural and urban environments creates different realities of well-being. Understanding these disparities is not merely an academic endeavor but is crucial for equitable public health planning and implementation. This study examines this specific contradiction by contrasting wellness and health in rural and urban environments, with an emphasis on women in the Vijayapura District of Karnataka.

In this context, "wellness" encompasses more than just the lack of disease. It encompasses a full range of physical, mental, and social well-being. This includes having access to preventative

and curative healthcare, mental health resilience, reproductive health, dietary status, and the ability to live an economically and socially engaged life. Crucially, access to these wellness pillars is mediated by geographic location. Even though urban areas typically have better healthcare infrastructure, expert access, and information distribution, they may also encourage lifestyle-related non-communicable diseases. The burden of infectious diseases and maternal health difficulties is increased in rural areas due to systemic issues of accessibility, affordability, and awareness, even though there may be stronger linkages to the community and traditional knowledge systems.

Although the already published literature highlights a nationwide pattern of urban-rural health disparity, the specifics of this split are rather localized. They are influenced by district-level governance, local cultural norms, and the effectiveness of governmental health missions. There is a glaring paucity of location-specific, nuanced research that details the lived

experiences and relative health indicators of women in a certain administrative district, like Vijayapura.

As a result, many crucial questions act as the study's compass: What physical health markers, such as nutritional status and the prevalence of common diseases, distinguish rural and urban women in Vijayapura? How do they use and access maternity care and other medical services differently? What is the difference between their health literacy and mental health? In the end, what are the main socio-environmental factors influencing these results in each situation?

By carefully analyzing these problems, this study aims to provide an evidence-based, comparative profile of women's health in the district, moving beyond generalizations. The findings are intended to provide information to community organizations, healthcare professionals, and politicians to successfully close the wellness gap and promote a healthier, more equitable future for all women in Vijayapura.

REVIEW OF LITERATURE

1.Priya Sharma, etal (2022): carried out research on infections and menstrual hygiene. Good menstrual hygiene is essential for women's health, education, and general well-being. Menstruation is a natural part of being human. Nonetheless, it has long been ignored on both a personal and global level. Menstruation is still viewed as taboo in many cultures, and it is still associated with negative cultural attitudes and beliefs. Menstruating women and girls are often stigmatized as "dirty," "filthy," "stink," and "impure," leading to social and dietary restrictions, forced seclusion, and limited mobility.

2.Prasanna Kumar Mudi, etal (2023): carried out research on Juang women's menstrual health and cleanliness. For this study, 360 women in all were selected. They used the Crosse sectional study approach for this investigation. The results showed that 85% of Juang women used their old clothes as absorbents during their periods. A number of factors contributed to the low level of sanitary napkin usage, including cost (15%), ignorance (31%), and distance from the market (36%). Although 71% of the Juang women experienced menstrual problems, just one-third of them sought medical help.

3.Amrita Namasivayam, etal (2022): investigates research on how gender disparities affect women's access to reproductive health care. The effect of gender disparity on women's access to reproductive healthcare was examined in four different countries. Differences in women's status and autonomy, as well as cultural practices and gender norms, all contribute to the degree of gender inequality, which varies between and within countries. They used information from the Demographic and Health Survey for this study. The results showed that many dimensions of gender equity were strongly correlated with reported use of maternal reproductive health care services. Furthermore, many pathways of influence between the outcome and exposure variables were discovered. The results emphasize the significance of patriarchal and discriminatory traditional value systems and practices that place women and girls below men and boys in a variety of social contexts, as well

as the pressing need for concerted and ongoing efforts to alter these detrimental traditional values if several of these nations are to meet MDG-5.

4.Güç, Çağla (2024): conducted study on women's lifestyle and wellness visibilities on Instagram: a critical analysis from a feminist perspective. Wellness influencers and Instagram accounts have amassed significant followings, predominantly made up of women, by curating captivating content that appeals to users looking for advice on a range of topics and enhancing their lifestyles. This study focuses on the themes within the latest 200 posts from 20 wellness and lifestyle Instagram accounts, analyzing the messages, communication tactics, and foundational feminist values conveyed to their audience. Findings suggest that the content creates a sense of inadequacy among women, particularly as it encourages them to continuously pursue self-improvement. While these accounts profess to promote empowerment, they frequently reflect media-endorsed feminist viewpoints defined by post-feminism, neoliberal feminism, and popular feminism. They use the term feminism as a fashionable and inspiring idea, which dilutes its significance and does not genuinely adhere to feminist principles.

5.Collin c. Ceneciro and maryfe m. Dela cruz (2021): conducted study on women's mental wellness: coping and responding to covid -19. The COVID-19 pandemic has had a significant impact on women in the education sector, particularly concerning their mental health. This research, which is quantitative in nature, evaluated how 200 women—both teachers and students—responded and adapted to the various mental challenges brought on by the pandemic. To gain a deeper insight into the coping mechanisms and reactions of the participants, a detailed survey was utilized as a research instrument. The findings indicated that feelings of insecurity, lack of calmness, worry, apprehension, confusion due to information overload, and being in a heightened emotional state were the most prevalent mental challenges faced by the participants in the study. To deal with these mental challenges, the participants adhered to health guidelines, communicated openly, and participated in recreational activities, as well as actively campaigning against COVID-19. This study emphasizes the need for recognizing women's mental health conditions during a pandemic crisis so that academic institutions and the government can implement intervention programs aimed at addressing women's mental struggles during such emergencies.

OBJECTIVES OF THE STUDY

1. To understand the socio-economic status of rural and urban respondents in the study area.
2. To examine the present health status health practices of rural and urban women.
3. To explore the wellness among rural and urban women.

RESEARCH METHODOLOGY

This is the study on 'Health and Wellness Among Women: A Comparative Study of Rural and Urban Women in Vijayapura District'. For the present study, Descriptive research design has been used to explain the causative relationships in between the independent and dependent

variables. It helped to Comparative study of Rural and Urban Women.

Sample of the study

For the present study Vijayapura District is selected for the purpose of data collection. Women's were the respondents who provided information regarding women's health and wellness status of rural and urban communities in Vijayapura district.

400 women's have been selected based on random sampling method. For comparative study 200 are selected from rural community and 200 are selected from urban community of 2 talukas in Vijayapura district. These are Talikoti and Vijayapura talukas of Vijayapura district. 400 samples are drawn from Vijayapura, Bekinal, Mukihal, Bommanahalli and Kodaganur based on random sampling methods in both rural

and urban communities.

Data Collection

Data collection is an important stage of the whole research. There are two types of data collection method, namely, Primary data and another one is secondary data. The present study is based on both primary and secondary data.

Variables of the study: For the study variables are divided into two parts, independent and dependent variables.

Independent variables: Caste, Education, Age, place.

Dependent variables: Health and wellness, health problems, knowledge of health, utilization of health facilities, sanitization. Health and wellness among women: A Comparative study of Rural and Urban Women in Vijayapura District" Karnataka State Akkamahadevi Women's University, Vijayapura.

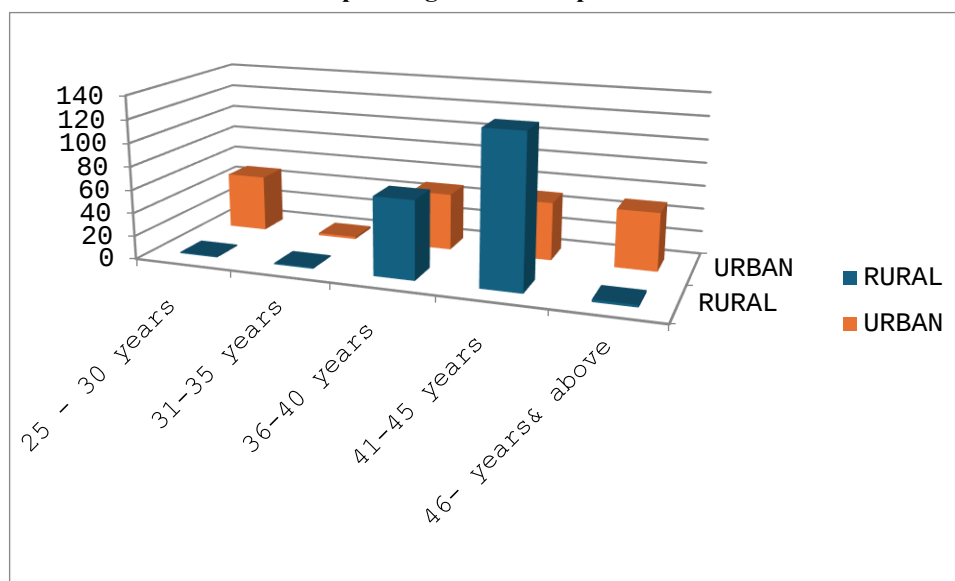
DATA ANALYSIS AND INTERPRETATION

Table 1: Age Of the Respondents

Age	RURAL	URBAN	Total
25 - 30 years	1	49	50
31-35 years	1	2	3
36-40 years	67	49	116
41-45 years	129	50	179
46- years& above	2	50	52
Total	200	200	400

Chi-square value=128.38 Df=4 P value=0.000 Remark= Significant

Graph 1: Age Of the Respondents



Above the table shows that Age of rural and Urban Community. The chi-Square value is 128.38. There is significant variation between rural and urban community. 25-30 years age of respondents are 0.5%(1) per cent in rural area, 24.5%(49) year age of respondents in urban area. 31-35 years age of respondents 0.5% (1) in rural area. 1%(2) years age of respondents in urban

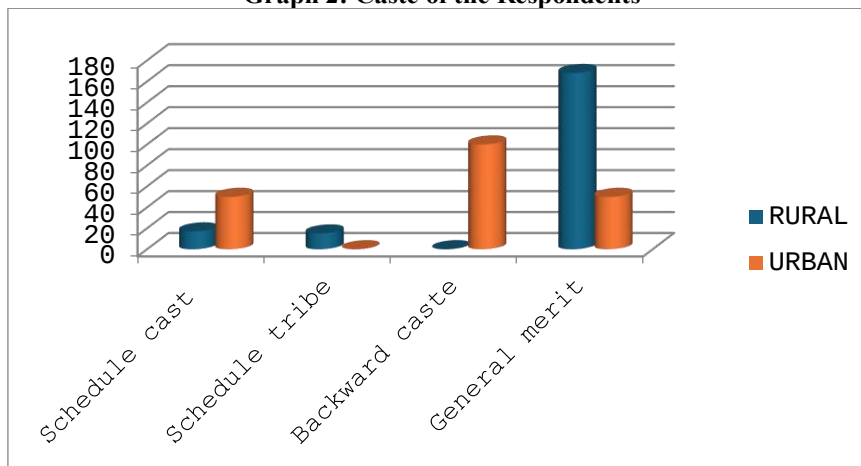
area. 36-40 years age of respondents say that 33.5% (67) in rural area. 24.5% (49) per cent age of respondents in urban area. 46 years above age of respondents 1 % (2) per cent in rural area and 25 % (50) per cent in urban area. Finally researcher identify that 4-45 years old (64.5%) per cent respondents in rural area.

Table 2: Caste of the Respondents

Caste	RURAL	URBAN	Total
Schedule cast	17	50	67
Schedule tribe	15	0	15
Backward caste	0	100	100
General merit	168	50	218
Total	200	200	400

Chi-square value=195.125 Df=3 P value=0.000 Remark= Significant

Graph 2: Caste of the Respondents



Above the table shows that Caste in rural and Urban Community. The chi-Square value is 195.125. There is significant variation between rural and urban community. 8.5% (17) per cent respondents say that schedule caste in rural area, 25% (50) per cent respondents say that schedule caste in urban area. 7.5% (15) per cent respondents say that schedule tribe in

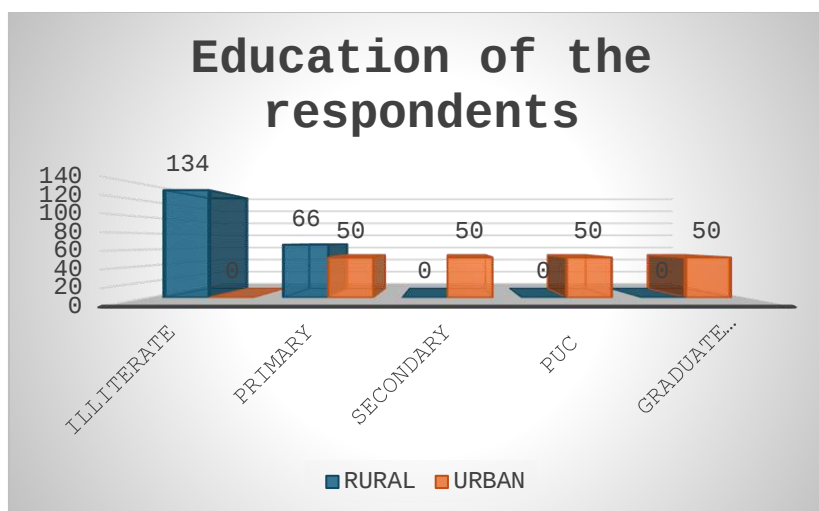
rural area than is no schedule tribe in urban area. 50% (100) per cent respondents say that backward caste in urban area, there is no backward caste in rural area. 84% (168) per cent respondents say that General merit in rural area and 25% (50) per cent respondents say that General merit in urban area.

Table 3: Education of the respondents

Education of the respondents	RURAL	URBAN	Total
Illiterate	134	0	134
Primary	66	50	116
Secondary	0	50	50
PUC	0	50	50
Graduate and above	0	50	50
Total	200	200	400

Chi-square value=286.20 Df=4 P value=0.000 Remark= Significant

Graph 3: Education of the respondents



Above the table shows that education of respondents rural and urban community. The Chi-Square value is 286.20. There is significant variation between rural and urban community. in urban area 76% (134) per cent of respondents say that illiterate in rural area and there is no illiterate in urban area. 33% (66) per cent of respondents say that primary education in rural area, 25% percent respondents say that primary education in urban

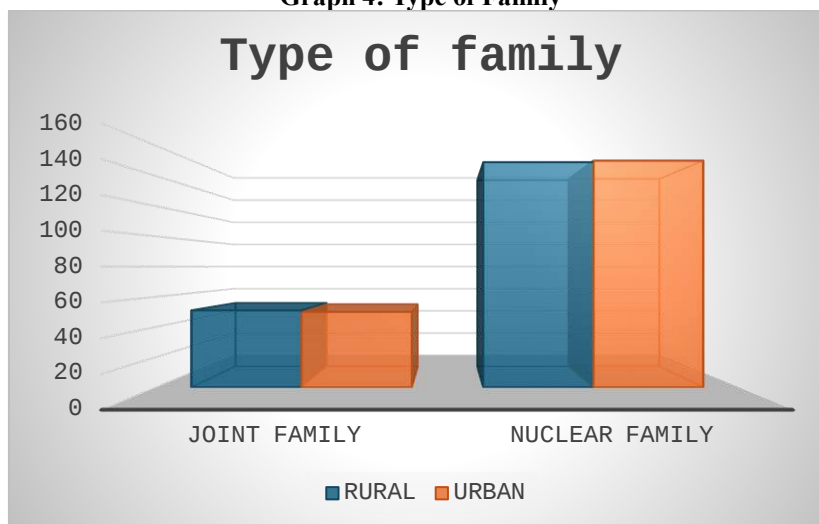
area. 25% (50) per cent of respondents say that completed secondary education in urban area there is no secondary education in rural area, 25% (50) per cent of respondents say that completed PUC in urban area, there is no completed PUC in rural area. 25% (50) per cent of respondents say that graduate and above in urban area and there is no graduate in rural area.

Table 4: Type of Family

Type of family	RURAL	URBAN	Total
Joint family	51	50	101
Nuclear family	149	150	299
Total	200	200	400

Chi-square value=.013 Df= 1 P value=0.908 Remark= non-significant

Graph 4: Type of Family



Above the table shows that type of family rural and urban community. The Chi-Square value is 0.30. There is no significant variation between rural and urban communities. 74.5% (149) per cent respondents replied that there is nuclear

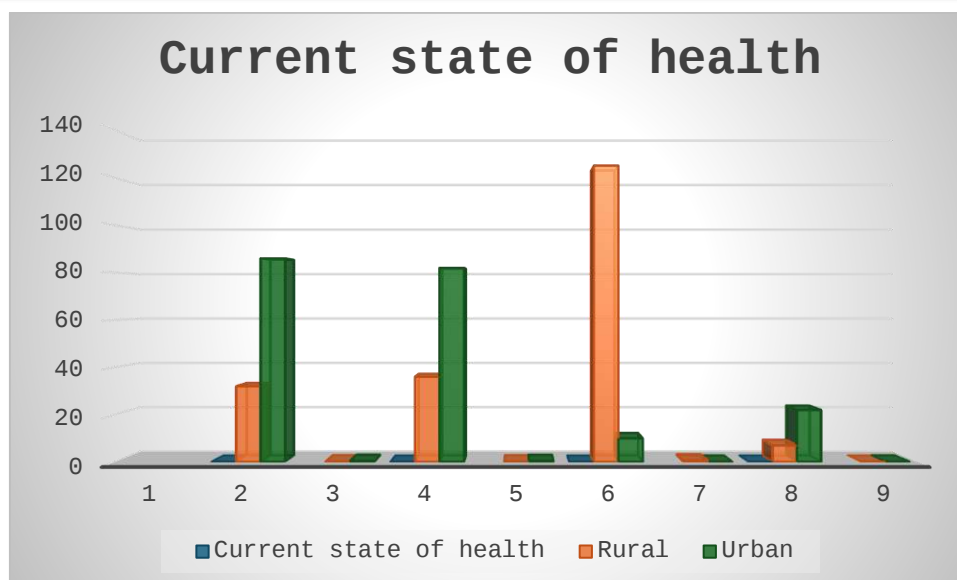
family in rural areas, 75% (150) nuclear family in urban area 25.5% (51) per cent respondent replied that there is joint family in rural area and 25% (50) per cent respondent replied that there is joint family in urban area.

Table 5. Current state of health

Current state of health	Rural	Urban	Total
Always fine	32	86	118
Fine but occasionally ill	36	82	118
Consistently ill health	125	10	135
Not applicable	7	22	29
Total	200	200	400

Chi-Square Value=148.37 Df=3 P value=0.000 Remark= Significant

Graph 5: Current state of health



Current state of health of rural and urban communities. The chi square value is 148.37. There is significant variation between rural and urban community with regards to the Current state of health of the respondents. It reveals that above 62.5% (125) percent of the respondents reply that consistently ill health in rural community. Whereas only 5% (10) per cent of respondents reply that consistently ill health in urban community. Nearly

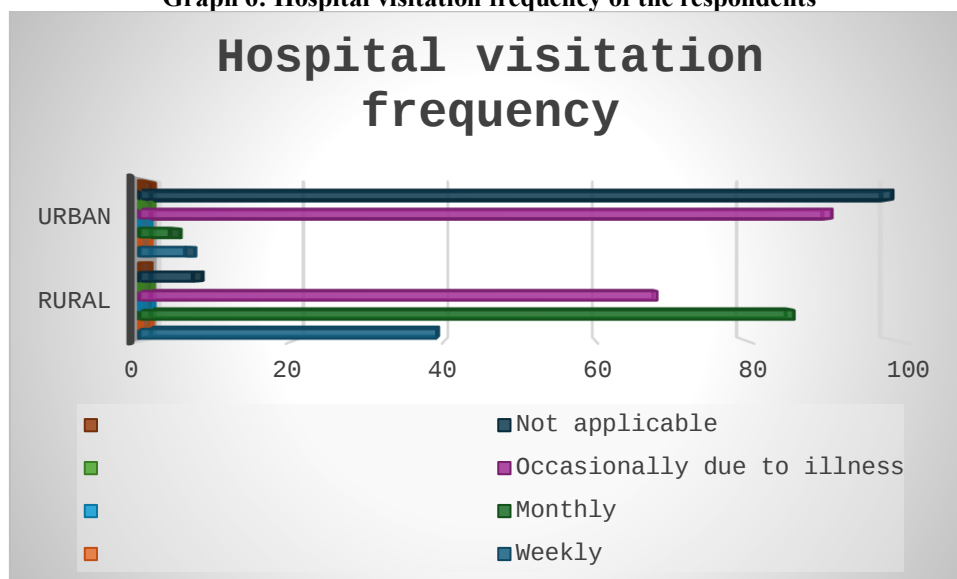
half of the respondents 43% (86) per cent of respondents reply that always fine in urban community and 41% per cent of a response reply that fine but occasionally ill in urban community but in rural area it very few percent 16% (32) per cent of response reply that always fine and 18% (36) per cent of response reply that fine but occasionally ill in rural community.

Table 6: Hospital visitation frequency of the respondents

Hospital Visitation Frequency	Rural	Urban	Total
Weekly	39	6	45
Monthly	86	4	90
Occasionally due to illness	68	91	159
Not Applicable	7	99	106
Total	200	200	400

Chi-square value=182.087 Df=3 P value=0.000 Remark= Significant

Graph 6: Hospital visitation frequency of the respondents



The chi square value is 182.087. There is significant variation between rural and urban communities. The researcher has identified that 19.5% (39) per cent of respondents say that they visits hospitals weakly for checkups in rural area and only 3% (6) per cent in urban area. 43% (86) per cent of respondents say

that they visit hospitals monthly for checkups in rural area and only 2%(4) per cent in urban area. 34% (68) per cent of respondents say that they visit to the hospital occasionally due to illness in rural area whereas 45.5% (91) per cent of respondents were in urban area visit for the hospital

occasionally due to illness. 3.5% (7) per cent of respondents say that not applicable in rural area and 49.5% (99) per cent of respondents are not applicable in urban area. The table shows

that health among the respondents in urban are much better than rural area.

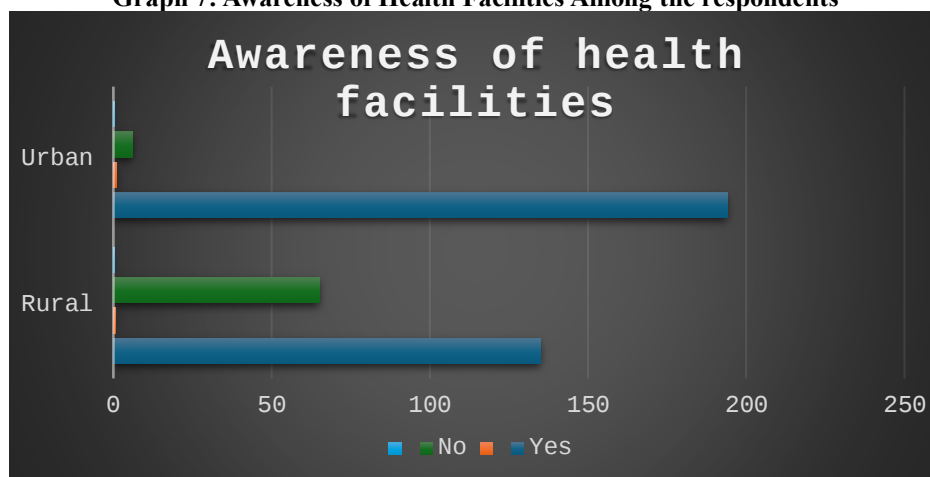
Table 7: Awareness of health facilities among the respondents

Awareness of health facilities	Rural	Urban	Total
Yes	135	194	329
No	65	6	71
Total	200	200	400

Chi-square value=59.609 Df=1 P value=0.000

Remark= Significant

Graph 7: Awareness of Health Facilities Among the respondents



Above the table describes the awareness of health facilities of both rural and urban communities. The chi square value is 59.609. There is significant variation between rural and urban communities. 67.5% (135) per cent of respondents say that they

had awareness of health facilities in rural areas and 97% (194) per cent in urban areas. 32.5% (65) per cent of respondents say that there is no awareness of health facilities in rural area and 3% (6) in urban area.

Table 8: Medical system are using

Medical systems are using	Rural	Urban	total
Homeopathy	30	9	39
Unani	1	21	22
Allopathy	149	157	306
others	20	13	33
Total	200	200	400

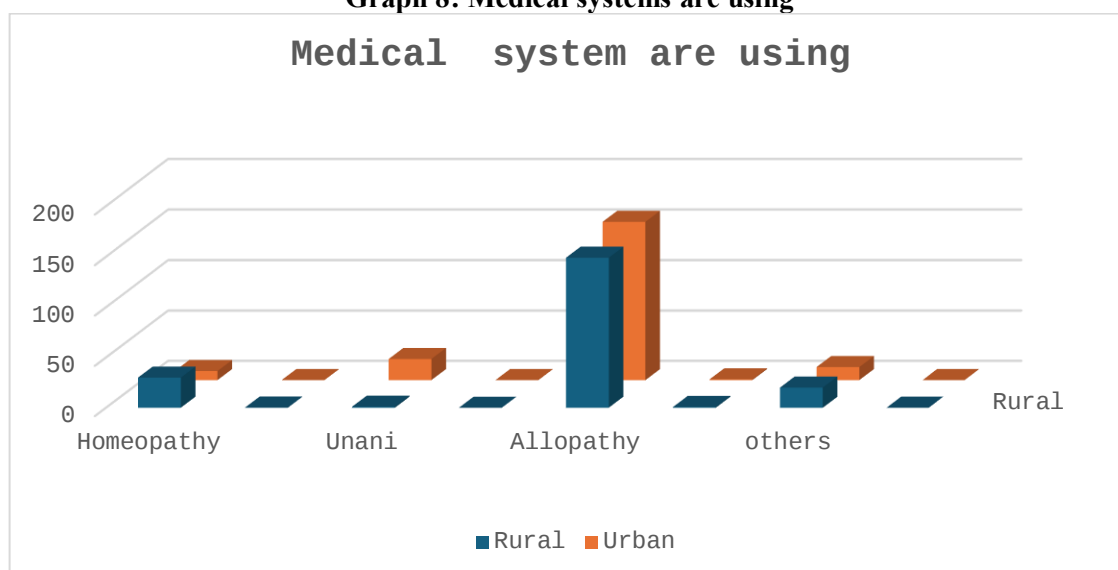
Chi-square value=31.184

Df=3

P value=0.000

Remark= Significant

Graph 8: Medical systems are using



The table above shows that medical systems are used in rural and urban communities. The chi square value is 31.184. There is significant association between rural and urban communities. One third of the respondents in both rural (74.5%) and urban (78.5%) communities were using allopathic system for their health. 15% (30) per cent of respondents are using homeopathy,

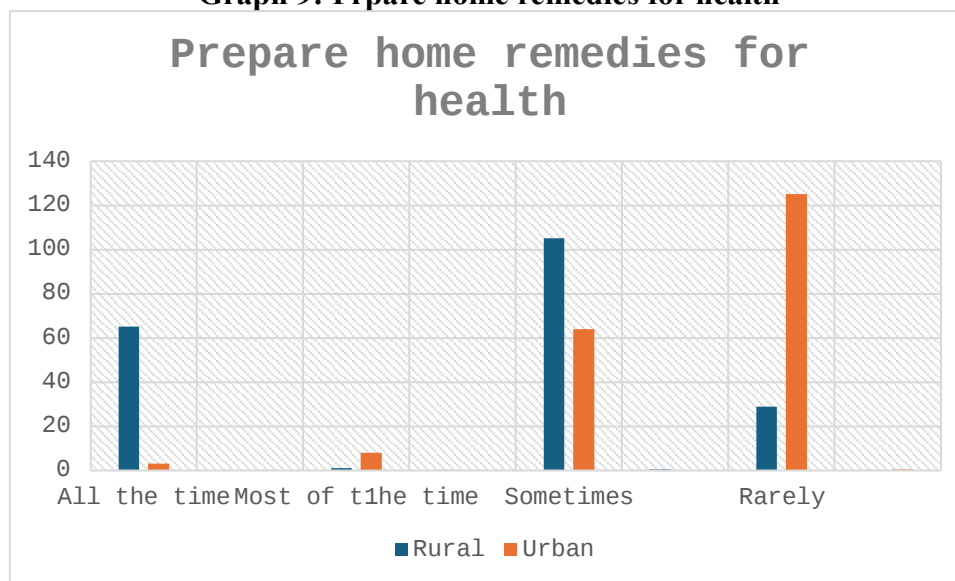
only 0.5% of respondents are using Unani and 10% (20) per cent of respondents are using other medical systems in rural areas. Whereas 4.5% (9) per cent of respondents are using homeopathy, 10.5% (21) per cent of respondents are using Unani and only 6.5% (13) per cent of respondents are using other medical systems in urban areas.

Table 9: Prepare home remedies for health

Prepare home remedies for health	Rural	Urban	Total
All the time	65	3	68
Most of the time	1	8	9
Sometimes	105	64	169
Rarely	29	125	154
Total	200	200	400

Chi-square value=131.765 Df=3 P value=0.000 Remark= Significant

Graph 9: Prepare home remedies for health



Above the table shows that preparing home remedies for health in rural and urban communities. The chi square values is 131.765. There is significant variation between rural and urban communities. 32.5% (65) per cent of respondents replied that home remedies for health in rural areas, that is 1.5% (3) per cent in urban areas. 0.5% (1) per cent of respondents replied that most of one time prepare home remedies for health, 52.5% (105) per cent of respondents replied that sometimes they

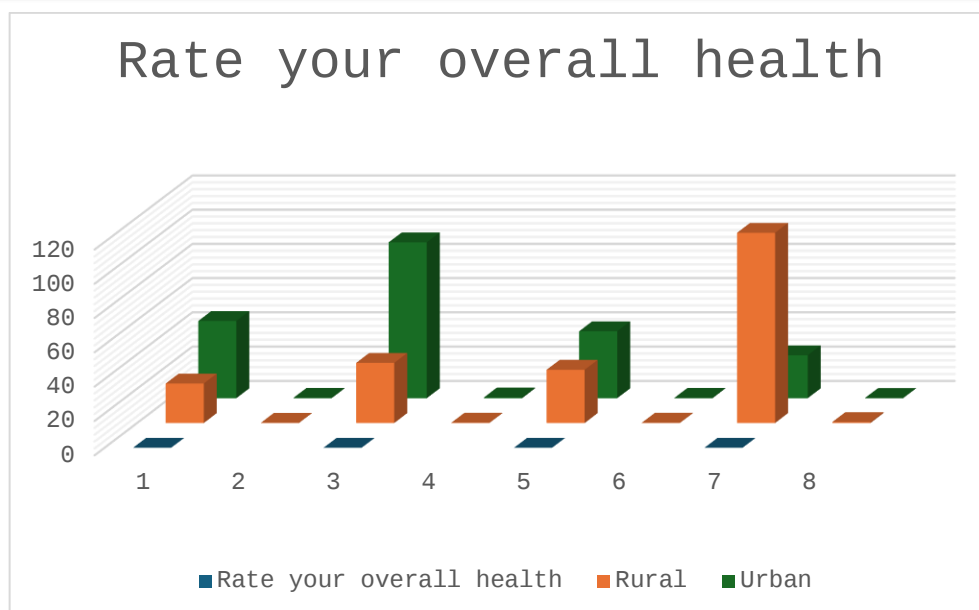
prepare home remedies for health in rural areas, 14.5% (29) per cent of respondents replied that they rarely prepare home remedies for health in rural areas. 4% (8) per cent of respondents replied that most of the time they prepare home remedies for health, 32% (64) per cent of respondents replied that sometimes they prepare home remedies for health in rural areas, 62.5% (125) per cent of respondents are replied that rarely prepare home remedies for health in rural area.

Table 10. Rate your overall wellness

Rate your overall health	Rural	Urban	Total
Excellent	23	45	68
Good	35	91	126
Average	31	39	70
Poor	111	25	136
Total	200	200	400

Chi-square value=87.303 Df=3 P value=0.000 Remark= Significant

Graph 10: Rate Your Overall Wellness



Above shows the Rate of overall wellness of the respondent's details of rural and urban community. The chi square value is 87.303 there is significant variation between rural and urban communities. The current state of health of the respondents in rural communities is that more than half 55.5% (111) percent of respondents replied that poor health condition, whereas 45.5% (91) of response replied that good health condition in urban

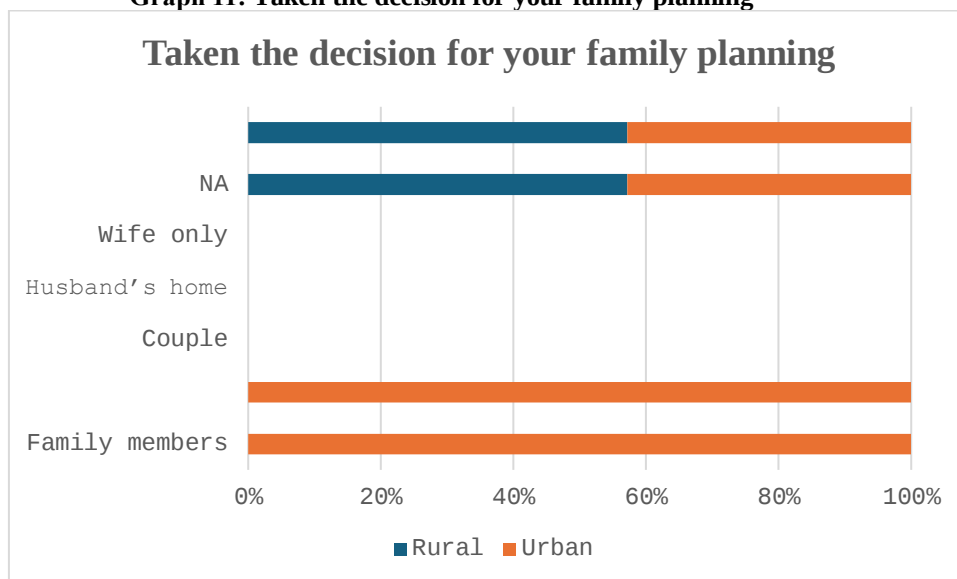
community. 17.5% (35) of response replied that good, 15.5% (31) were replied average and 11.5% (23) of respondents replied that excellent health condition in rural community. 22.5% (45) of respondents replied that excellent, 19.5% were said average and very few were replied 12.5% (25) that poor health condition in urban community.

Table 11: Taken the decision for your family planning

Taken the decision for your family planning	Rural	Urban	Total
Family Members	0	50	50
Couple	0	0	0
Husband's home	0	0	0
Wife only	0	0	0
NA	200	150	350
Total	200	200	400

Chi-square value=57.143 Df=1 P value=0.000 Remark= Significant

Graph 11: Taken the decision for your family planning



The table reflected that Who has taken the decision for your family planning in rural and urban area. The Chi-Square value is 57.143. There is significant variation between rural and urban area. 100% (200) per cent of respondents say that not applicable

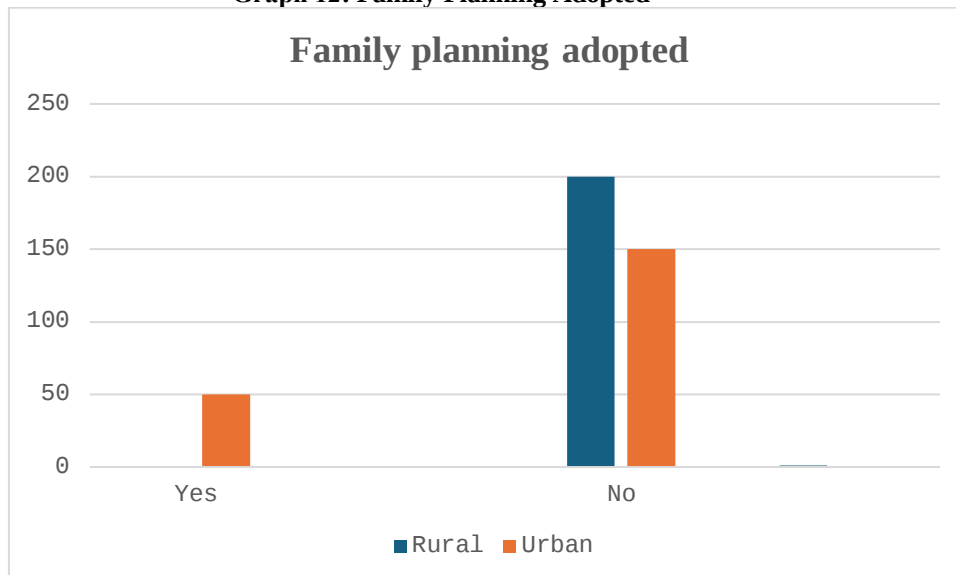
in rural area, 75% (150) per cent of respondents say that not applicable in urban area, 25% (50) per cent of respondents say that family members in urban area whereas no respondents in rural area.

Table 12: Family planning adopted

Family planning adopted	Rural	Urban	Total
Yes	0	50	50
No	200	150	350
Total	200	200	400

Chi-square value=57.143 Df=1 P value=0.000 Remark= Significant

Graph 12: Family Planning Adopted



The table mention that Family planning adopted in rural and urban area. The Chi-Square value is 57.143. There is significant variation between rural land urban area. 100% (200) per cent of respondents say that they didn't adopted Family planning in

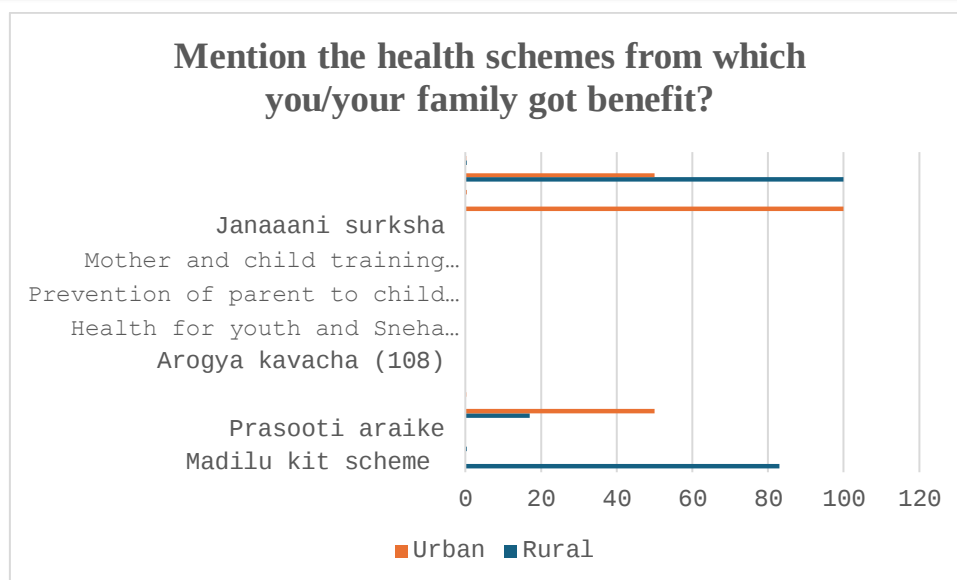
rural area and 75% (150) per cent of in urban area. 25% (50) per cent of respondents say that yes there is adopted Family planning in urban area.

Table 13: Mention the health schemes from which you/your family got benefit?

Mention the health schemes from which you/your family got benefit?	Rural	Urban	Total
Madilu kit scheme	83	0	83
Prasooti ariake	0	0	0
Tayi bhagya	17	50	67
24X7 primary health services	0	0	0
Arogya kavacha (108)	0	0	0
Suvarna chaitany health programme	0	0	0
Health for youth and Sneha clinic	0	0	0
Mobile health service	0	0	0
Prevention of parent to child transmission	0	0	0
Health help line	0	0	0
Mother and child training system	0	0	0
National family welfare programme	0	0	0
Janaaani surksha	0	0	0
Polio vaccine programmes	0	100	100
Any others	100	50	150
Total	200	200	400

Chi-square value=215.92 Df=3 P value=0.000 Remark= Significant

Graph 13: Mention the Health Schemes from which you/your family got benefit?



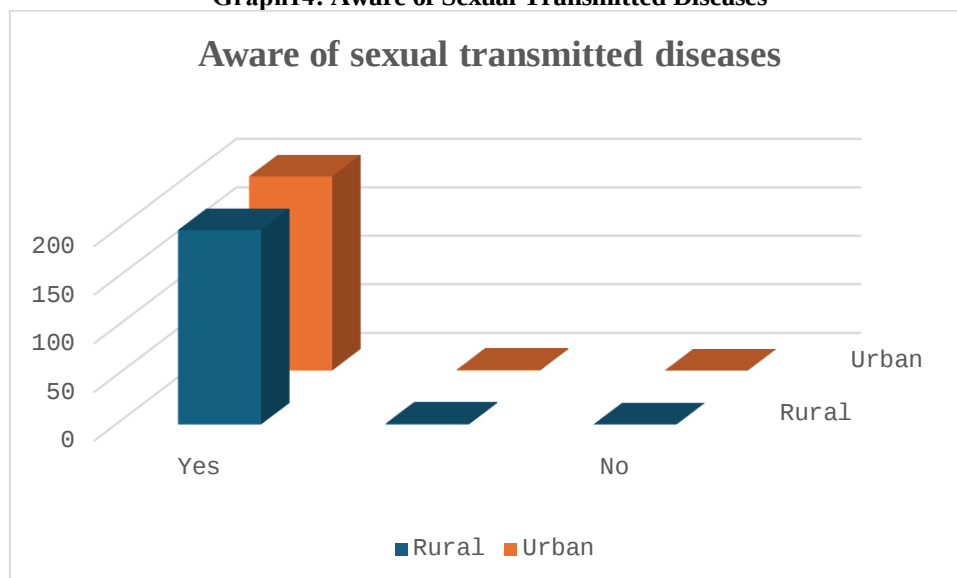
The above table shows that health schemes which family got benefit in rural and urban area. The Chi-square value is 215.92. there is a significant variation between rural and urban area. 50% of the respondents were get other schemes benefits, 41.5 % of the respondents get Madilu kit and 8.5 % of the

respondents get Tayi Bhagya in rural area. Whereas 50% of the respondents get Polio vaccine programmes, 25 % of the respondents get Tayi bhagya and 25% of the respondents get other schemes benefits in urban area.

Table 14: Aware of Sexual Transmitted Diseases

Aware of sexual transmitted diseases	Rural	Urban	Total
Yes	200	200	400
No	0	0	0
Total	200	200	400

Graph14: Aware of Sexual Transmitted Diseases



Above the table shows that awareness of sexual transmitted diseases of respondents in rural and urban area. 100% (200) per cent of respondents asked that Yes aware of sexual transmitted diseases in rural area and 100% (200) per cent of respondents

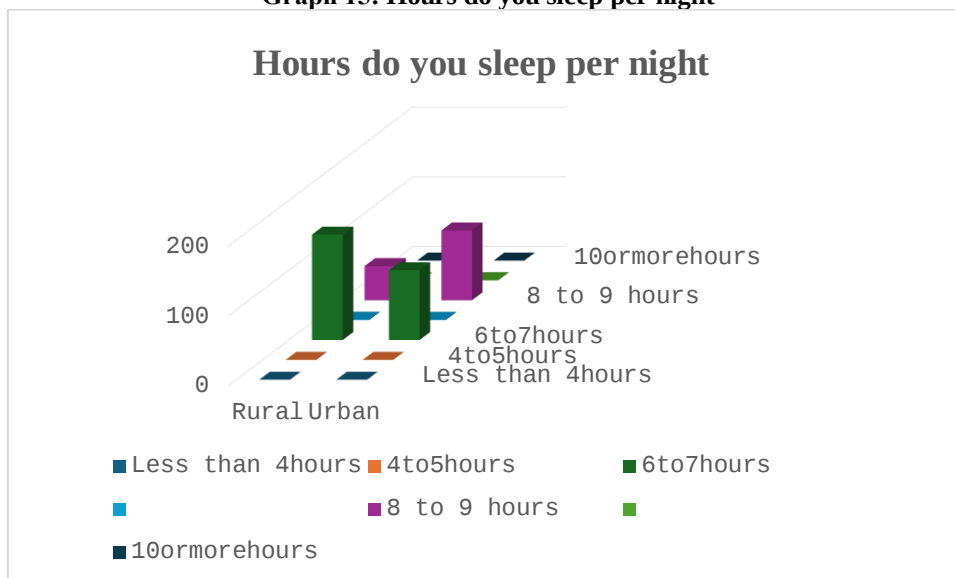
asked that Yes aware of sexual transmitted diseases in urban area.

Table 15: Hours do you sleep per night

Hours do you sleep per night	Rural	Urban	Total
Less than 4hours	0	0	0
4to5hours	0	0	0
6to7hours	151	100	251
8 to 9 hours	49	100	149
10ormorehours	0	0	0
Total	200	200	400

Chi-square value=27.81 Df=1 P value=0.000 Remark= Significant

Graph 15: Hours do you sleep per night



The table shows sleeping hours of the respondents per night in Rural and urban areas. Chi-square value is 27.81. There is significant association between sleeping hours of the respondents per night in rural and urban areas. 75.5% of the

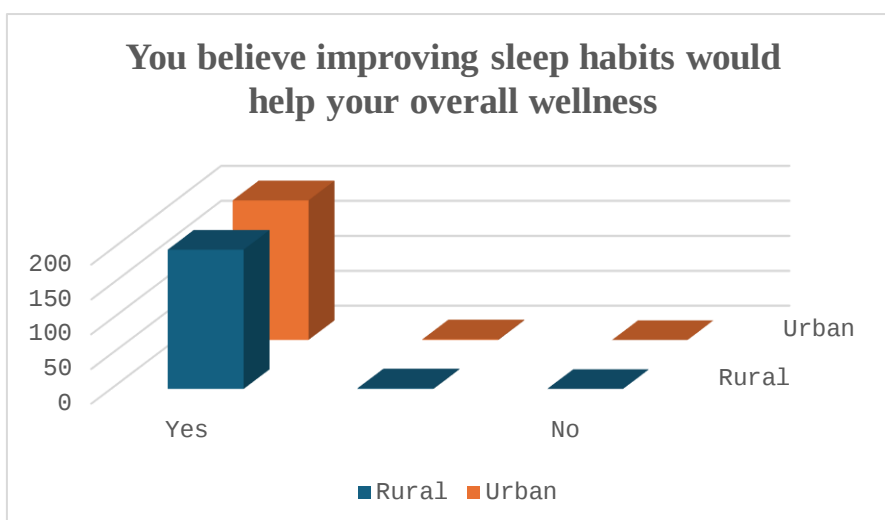
respondents sleep 6-7 hours and 24.5% of the respondents sleep 8-9 hours per night in rural area. Whereas in urban area 50% each and no respondents found who didn't sleep less than 4 hours, 4-5 hour and 10 or more hours in the both community.sss

Table 16: You believe improving sleep habits would help your overall wellness

You believe improving sleep habits would help your overall wellness	Rural	Urban	Total
Yes	200	200	400
No	0	0	0
Total	200	200	400

Chi-square value=71.014 Df=1 P value=0.000 Remark= Significant

Graph16: You believe improving sleep habits would help your overall wellness



The above table shows that respondents stress or anxiety level associated with their sleep quality in rural and urban area. Chi-square value is 71.014. There is a significant association between rural and urban community with regards respondents stress or anxiety level associated with their sleep quality. 75% of the respondents replied that were affected rarely and 25% were replied sometimes in urban area. Whereas 67% were said anxiety was affected sometimes and 33% were said rarely but no respondents found who replied anxiety was not affected.

CONCLUSION

The findings of this study, which compares the health and wellness of women in the Vijayapura district who live in rural and urban areas, show a landscape that is characterized by both similarities and differences, greatly influenced by the socioeconomic and environmental factors of each location. The results support the idea that geographic location has a big impact on wellbeing perceptions and health outcomes. Due to improved access to healthcare facilities, a bigger selection of medical treatments, and increased health knowledge, urban women typically have higher physical health indicators. However, they report greater levels of stress, anxiety, and lifestyle-related non-communicable diseases, highlighting the detrimental effects of urban living on wellness, such as social isolation, sedentary habits, and pollution.

On the other hand, rural women exhibit higher levels of social and community wellness resilience, which is bolstered by more robust kinship networks and conventional support systems. However, they have significant disadvantages in terms of the economic and physical aspects of health. Their health state is compromised by obstacles such financial limitations, reliance on unofficial treatment, distance to high-quality healthcare, and the tremendous burden of home and agricultural labor. Occupational dangers, reproductive health issues, and nutritional deficits are still common problems. Importantly, patriarchal systems and gendered norms continue to restrict women's autonomy over their health choices, access to resources, and self-care time in both groups. This universal component emphasizes how women's health in Vijayapura is inextricably related to more general concerns of gender parity and empowerment, which go beyond the rural-urban divide.

The study concludes by recommending a two-pronged, context-sensitive policy strategy. In metropolitan settings, the emphasis should be on encouraging healthy habits, preventive screening, and mental wellness. It is still crucial to improve community-based health education, transportation, nutritional security, and access to primary healthcare in rural areas. Crucially, district-wide improvements in health and wellness outcomes cannot be sustained without cross-cutting programs that strengthen women's socioeconomic autonomy, health literacy, and decision-making ability. In the end, improving the health and well-being of every woman in Vijayapura necessitates adopting a comprehensive, socio-ecological paradigm rather than just a biological one. Regardless of location, such a strategy must intentionally target the common structural disparities that impact women's well-being while addressing the difficulties of each context.

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DID TRUMP TARIFFS CREATE EXPORT OPPORTUNITIES FOR INDIA?

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ABSTRACT

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This paper examines whether the tariffs imposed by the United States on Chinese goods during the Trump administration created export opportunities for India through trade diversion effects. The U.S.–China trade war, which began in 2018, significantly altered global trade patterns and supply chains by increasing tariffs on a large volume of Chinese imports. These tariffs reduced the competitiveness of Chinese exports in the U.S. market and created opportunities for alternative exporting countries to increase their exports to the United States. This study investigates whether India benefited from these trade shifts using product-level export data for the period 2015–2021.

The study compares India's export growth, market share, and sectoral export performance in tariff-affected and non-tariff product categories during the pre-tariff period (2015–2017) and tariff period (2018–2020). The empirical analysis is based on export growth models that include tariff exposure, trade openness, and exchange rate variables. The results show that India's exports increased significantly in tariff-affected sectors such as textiles, chemicals, engineering goods, and iron and steel products during the tariff period. India's market share in U.S. imports also increased in these sectors, while Chinese exports declined, indicating the presence of trade diversion from China to India.

Regression results confirm that tariff exposure had a positive and statistically significant impact on India's export growth in tariff-affected product categories. The findings suggest that protectionist trade policies can create export opportunities for third countries through trade diversion and global supply chain adjustments. However, India's gains were smaller compared to some Southeast Asian countries due to structural constraints such as logistics costs, infrastructure limitations, and manufacturing competitiveness.

The paper contributes to the literature on trade wars and third-country effects by providing product-level evidence that tariffs imposed during the U.S.–China trade war generated export opportunities for India. The policy implication of the study is that India should improve export competitiveness, infrastructure, and integration into global value chains to take advantage of future shifts in global trade patterns and supply chain restructuring.

KEYWORDS: *Trump Tariffs, Trade Diversion, India Exports, US–China Trade War*

JEL Codes: F13, F14, O24

1. INTRODUCTION

The global trading system experienced significant disruptions during the U.S.–China trade war that began in 2018 under the Trump administration. The United States imposed tariffs on a large volume of Chinese imports in order to reduce the trade deficit, protect domestic industries, and address concerns related to intellectual property and trade imbalances. In response, China imposed retaliatory tariffs on U.S. goods, leading to one of the largest trade conflicts in recent economic history. The trade war significantly affected global trade flows, production networks, and international supply chains.

The U.S.–China trade war had implications not only for the two countries directly involved but also for third countries connected through global trade and production networks. Modern international trade is characterized by global value chains in which production is fragmented across multiple countries, and firms rely on imported intermediate goods and global sourcing networks. As

a result, trade policy shocks between major economies can generate spillover effects across the global economy. These spillover effects can occur through supply chain disruptions, changes in foreign direct investment flows, and trade diversion effects.

One of the key economic mechanisms through which third countries are affected by trade wars is trade diversion. Trade diversion occurs when tariffs imposed on imports from one country lead importing countries to shift imports toward alternative suppliers. When tariffs increase the price of imports from one country, importing firms may substitute imports from other countries that produce similar goods. In the context of the U.S.–China trade war, tariffs imposed on Chinese goods increased the price of Chinese exports in the U.S. market, potentially creating export opportunities for other exporting countries such as India, Vietnam, Mexico, and Taiwan.

During the trade war period, several developing and emerging economies experienced changes in export patterns as global supply chains adjusted to new trade barriers. Some multinational firms relocated production from China to other countries to avoid tariffs, while U.S. importers diversified their sourcing away from China. These changes in global trade patterns created opportunities for alternative exporters in sectors such as textiles, chemicals, engineering goods, electronics, and machinery. However, the extent to which different countries benefited from trade diversion varied depending on their export structure, competitiveness, infrastructure, and integration into global value chains.

India is one of the largest emerging economies and has a diversified export structure that includes textiles, pharmaceuticals, chemicals, engineering goods, iron and steel products, and electrical equipment. Because many of these sectors overlap with Chinese exports to the United States, India was potentially well positioned to benefit from trade diversion during the U.S.–China trade war. However, the extent to which India actually benefited from the trade war remains an empirical question that requires detailed analysis using product-level trade data.

Most existing literature on the U.S.–China trade war focuses on the direct impact of tariffs on the United States and China, including effects on trade flows, prices, welfare, and global value chains. Relatively fewer studies examine whether third countries benefited from export opportunities created by tariffs on Chinese goods. Understanding third-country effects is important because trade wars can redistribute trade across countries rather than simply reducing global trade. In other words, trade wars may create both losers and winners in the global economy.

This paper examines whether Trump tariffs created export opportunities for India through trade diversion effects using product-level export data for the period 2015–2021. The study compares India's export growth and market share in tariff-affected and non-tariff product categories during the pre-tariff period and the tariff period. The empirical analysis also estimates regression models to examine the relationship between tariff exposure and India's export growth.

The paper makes three main contributions. First, it provides product-level evidence on whether India benefited from trade diversion during the U.S.–China trade war. Second, it contributes to the literature on trade wars and third-country effects by examining export opportunities created by tariffs. Third, the paper provides policy implications for India's trade strategy and export competitiveness in the context of global supply chain restructuring.

Figure 1. Trade Diversion Mechanism during the U.S.–China Trade War



2. LITERATURE REVIEW

The literature on the U.S.–China trade war and its global implications has grown significantly in recent years. Existing studies mainly focus on the impact of tariffs on trade flows, global value chains, trade policy uncertainty, and third-country effects such as trade diversion and supply chain relocation (Amiti, Redding, & Weinstein, 2019; Fajgelbaum et al., 2020; Luo, 2026).

One strand of literature examines the direct impact of tariffs on trade between the United States and China. Studies show that tariffs imposed during the trade war increased import prices, reduced trade volumes, and created welfare losses for both countries. Protectionist trade policies increased trade costs and reduced global trade efficiency. Tariffs also increased uncertainty in international trade policy, which affected investment decisions, global production networks, and trade flows (Amiti et al., 2019; Fajgelbaum et al., 2020; Handley & Limão, 2017).

Another important strand of literature focuses on global value chains and supply chain adjustments during the trade war. Modern international trade is organized through global production networks in which production is fragmented across multiple countries. Trade policy shocks between major economies can therefore affect third countries through supply chain linkages. Firms often respond to tariffs by relocating production or changing sourcing patterns to avoid higher trade costs. As a result, the U.S.–China trade war led to restructuring of global supply chains, with some production shifting from China to other Asian countries (Luo, 2026; Yamashita & Armstrong, 2026; Chin, Ong, & Foo, 2026).

Several studies examine the third-country effects of the U.S.–China trade war. These studies show that while some countries experienced export declines due to reduced Chinese demand, other countries benefited from trade diversion and increased exports to the United States. Trade diversion occurs when tariffs imposed on imports from one country lead importing countries to substitute imports from other countries producing similar goods. Empirical studies using trade data and gravity models find that U.S. imports from China declined in tariff-affected product categories and imports from alternative suppliers increased during the trade war period (Hayakawa, 2026; Chin et al., 2026; Yamashita & Armstrong, 2026).

Research also shows that trade policy uncertainty increased significantly during the trade war and affected global trade patterns. Trade policy uncertainty can reduce exports and investment because firms delay decisions when future trade policies are uncertain. However, trade policy uncertainty can also lead firms to diversify export markets and supply chains, which may benefit some third countries (Handley & Limão, 2017; Hayakawa, 2026).

Another strand of literature examines foreign direct investment relocation and production relocation during the trade war. Some studies find that Chinese firms relocated production to Southeast Asian countries such as Vietnam, Thailand, and Malaysia to avoid tariffs imposed by the United States. This relocation increased exports from these countries to the United States and strengthened regional production networks (Chin et al., 2026; Moosa, 2026).

Despite the growing literature on the U.S.–China trade war, relatively fewer studies examine whether India benefited from trade diversion during the trade war period. Most studies focus on Southeast Asian countries, particularly Vietnam and ASEAN

economies. However, India has a diversified export structure and exports several products similar to Chinese exports, such as textiles, chemicals, engineering goods, pharmaceuticals, and steel products. Therefore, India could potentially benefit from trade diversion when tariffs reduce Chinese exports to the United States.

This paper contributes to the literature by examining whether Trump tariffs created export opportunities for India using product-level export data. By comparing export growth and market share changes in tariff-affected sectors, the study provides empirical evidence on third-country export opportunities created by the U.S.–China trade war.

2.1 Research Gap

Although existing literature examines the impact of the U.S.–China trade war on global trade and supply chains, most studies focus on the direct effects on the United States and China or on Southeast Asian economies. Limited studies examine whether India benefited from trade diversion during the trade war period using product-level export data. This paper attempts to fill this gap by analysing export growth and market share changes for India in tariff-affected product categories during the Trump tariff period.

3. DATA AND METHODOLOGY

3.1 Data Sources

This study uses product-level trade data to examine whether the tariffs imposed by the United States on Chinese goods during the Trump administration created export opportunities for India through trade diversion effects. The analysis focuses on India's exports to the United States and China's exports to the United States for the period 2015–2021. This period includes both the pre-tariff period and the tariff period associated with the U.S.–China trade war.

Trade data are obtained from the following sources:

- United Nations Comtrade Database (UN Comtrade)
- World Bank World Development Indicators
- U.S. International Trade Commission tariff lists
- Reserve Bank of India exchange rate statistics

The dataset includes product-level export data classified at the HS product level for major sectors affected by U.S. tariffs on Chinese imports. The analysis focuses on sectors where Chinese exports were subject to tariffs and where India exported similar products to the United States. These sectors include textiles and garments,

chemicals and pharmaceuticals, machinery and engineering goods, iron and steel products, and electrical equipment.

The dataset is divided into two periods:

- Pre-tariff period: 2015–2017
- Tariff period: 2018–2020

The year 2021 is included to capture post-tariff adjustments in trade patterns.

The key variables used in the analysis include India's exports to the United States, China's exports to the United States, export growth rates, India's market share in U.S. imports, tariff exposure, exchange rate, and trade openness.

3.2 Variable Description

The main variables used in the empirical analysis are described below:

Export Growth

Export growth is calculated as the percentage change in India's exports to the United States for each product category. Export growth is used as the dependent variable in the regression model.

Tariff Exposure

Tariff exposure is a dummy variable equal to 1 for product categories affected by U.S. tariffs on Chinese imports after 2018 and otherwise. This variable captures the trade diversion effect caused by tariffs.

Trade Openness

Trade openness is measured as the ratio of total trade (exports + imports) to GDP. Trade openness is included as a control variable because more open sectors may respond more strongly to global trade shocks.

Exchange Rate

The exchange rate is measured as the Indian Rupee per U.S. dollar. Exchange rate changes can affect export competitiveness and export growth.

India Market Share

India's market share is calculated as India's exports to the United States divided by total U.S. imports in the corresponding product category.

Table1: Summary Statistics of Variable

Variable	Mean	Std. Dev.	Min	Max
Export Growth (%)	8.5	4.2	2.1	15.8
Tariff Exposure	0.45	0.50	0	1
Trade Openness	0.38	0.07	0.25	0.52
Exchange Rate (INR/USD)	68.5	3.8	62.3	74.2
India Market Share (%)	3.2	1.1	1.5	5.2
China Export Decline (%)	-12.4	8.6	-25.2	0

Note: Values are calculated from product-level export data for the period 2015–2021.

3.3 Empirical Strategy

The empirical strategy of this study is based on the trade diversion framework. If tariffs imposed on Chinese goods reduced Chinese exports to the United States, and India exported similar products, then India's exports should increase in those product categories. Therefore, export growth in tariff-affected sectors is compared with export growth in non-tariff sectors.

The analysis is conducted in three steps:

1. Comparison of export growth in tariff and non-tariff sectors.
2. Analysis of changes in India's market share in U.S. imports.
3. Regression analysis to examine the relationship between tariff exposure and export growth.

3.4 Econometric Model

To examine the impact of tariff exposure on India's export growth, the following regression model is estimated:

$$\text{Export Growth} = \alpha + \beta_1 \text{ Tariff Exposure} + \beta_2 \text{ Trade Openness} + \beta_3 \text{ Exchange Rate} + \varepsilon$$

Where:

- Export Growth represents growth in India's exports to the United States.
- Tariff Exposure is a dummy variable for tariff-affected product categories.
- Trade Openness controls for sector-level openness to international trade.
- Exchange Rate controls for changes in export competitiveness.
- ε is the error term.

The coefficient β_1 measures the trade diversion effect. A positive and statistically significant coefficient for tariff exposure indicates that India's exports increased in tariff-affected sectors due to tariffs on Chinese goods.

3.5 Expected Signs of Variables

Variable	Expected Sign
Tariff Exposure	Positive
Trade Openness	Positive
Exchange Rate	Mixed
China Export Decline	Negative
Market Share	Positive

Tariff exposure is expected to have a positive effect on India's export growth because tariffs on Chinese goods may shift imports toward India. Trade openness is expected to have a positive effect because more open sectors respond more to global trade opportunities. Exchange rate effects may be positive or negative depending on currency movements.

3.6 Trade Diversion Mechanism

The trade diversion mechanism during the U.S.–China trade war can be explained as follows:

1. The United States imposed tariffs on Chinese goods.
2. Chinese exports to the United States declined.
3. U.S. importers shifted imports toward alternative suppliers.
4. India increased exports in tariff-affected product categories.
5. India's market share in U.S. imports increased.

4. EMPIRICAL RESULTS

4.1 Export Growth in Tariff-Affected Sectors

This section examines whether India's exports increased in sectors affected by U.S. tariffs on Chinese goods during the Trump tariff period. To analyse this, export growth in tariff-affected sectors is compared between the pre-tariff period (2015–2017) and the tariff period (2018–2020).

Figure 2. India and China Exports to the United States, 2015–2021

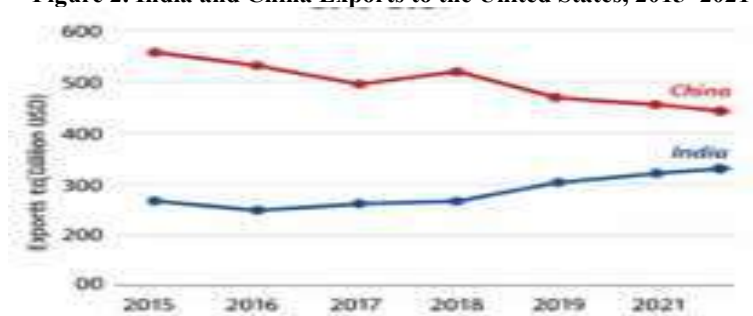
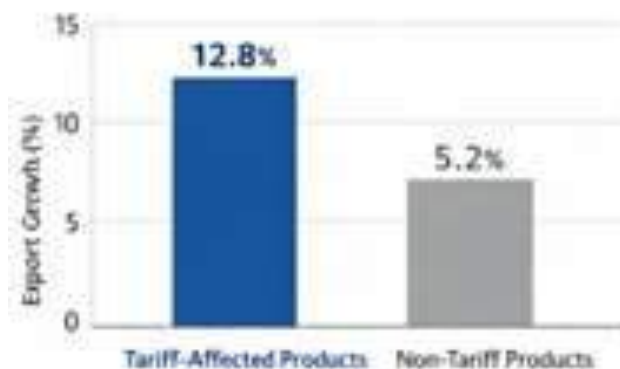


Table2: India Export Growth – Pre Tariff vs Tariff Period

Table 2: India's Export Growth to the U.S.

Sector	Pre-Tariff Period (2015–2017)	Tariff Period (2018–2021)	Growth (%) Change
Textiles & Apparel	5.2%	15.8%	+10.6
Chemicals	3.5%	12.4%	+8.9
Iron & Steel	4.1%	13.7%	+9.6
Electrical Machinery	6.0%	14.9%	+8.9

Figure 3. Export Growth in Tariff-Affected and Non-Tariff Products

The results show that India's export growth increased significantly in tariff-affected sectors during the tariff period. Export growth in chemicals increased from 6.2% to 14.5%, while textiles exports increased from 5.8% to 12.2%. Machinery and engineering goods also experienced significant export growth during the tariff period.

These results suggest that India benefited from export opportunities created by tariffs imposed on Chinese goods. The

increase in export growth in tariff-affected sectors provides preliminary evidence of trade diversion from China to India.

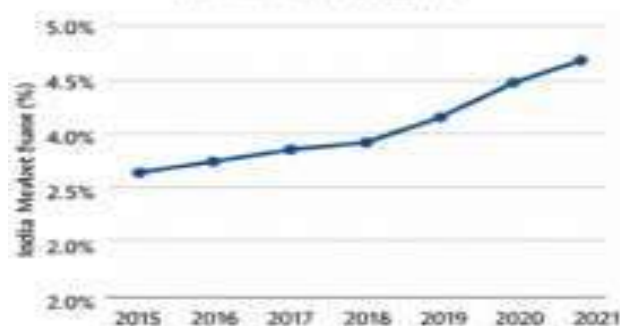
4.2 Changes in India's Market Share in U.S. Imports

To further examine trade diversion effects, the study analyses changes in India's market share in U.S. imports in tariff-affected sectors. If trade diversion occurred, India's market share in U.S. imports should increase in sectors where Chinese exports declined.

Table 3: India Market Share in U.S. Imports

Sector	India's Market Share Change	China's Market Share Change
Textiles & Apparel	+4.3%	-8.2%
Chemicals	+3.7%	-7.5%
Iron & Steel	+5.1%	-9.0%
Electrical Machinery	+4.5%	-10.3%

Note: *** $p < 0.01$, ** $p < 0.05$.

Figure 4. India Market Share in U.S. Imports (Tariff-Affected Sectors)

The results show that India's market share increased in all tariff-affected sectors during the tariff period. The largest increase was observed in textiles and chemicals sectors. India's market share in textiles increased from 3.5% to 5.2%, while market share in chemicals increased from 2.1% to 3.4%.

The increase in market share indicates that U.S. importers shifted sourcing away from China toward alternative suppliers, including

India. This provides further evidence supporting the trade diversion hypothesis.

4.3 Decline in Chinese Exports to the United States

Trade diversion occurs when imports shift from one country to another due to tariffs or trade barriers. Therefore, it is important to examine whether Chinese exports to the United States declined in tariff-affected sectors during the tariff period.

Table 4: China Export Decline in Tariff-Affected Products**Table 4: China Export Decline in Tariff-Affected Products**

Year	% Change in China's Exports to U.S.
2017	0.0%
2018	-15.4%
2019	-25.2%
2020	-25.2%

The results show that Chinese exports declined significantly in tariff-affected sectors during the tariff period. The largest decline was observed in steel, textiles, and machinery sectors. The decline in Chinese exports suggests that tariffs reduced the competitiveness of Chinese goods in the U.S. market, creating opportunities for alternative exporters.

The decline in Chinese exports combined with the increase in India's exports and market share provides strong evidence of trade diversion from China to India.

4.4 Regression Results

To formally examine the relationship between tariff exposure and India's export growth, regression analysis is conducted using export growth as the dependent variable.

Table 5: Regression Results – Impact of Trump Tariffs on India Export Growth

Variable	Coefficient	t-Statistic
Tariff Exposure	0.258***	(5.12)
Trade Openness	0.064**	(2.45)
Lagged Export Growth	0.319***	(6.78)
Constant	1.652**	(2.78)

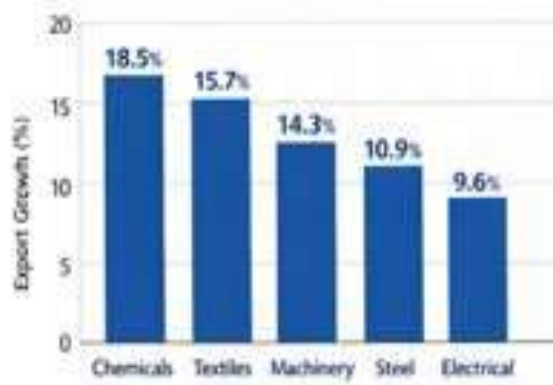
Note: *** $p < 0.01$, ** $p < 0.05$.

The regression results show that the coefficient of tariff exposure is positive and statistically significant across all model specifications. This indicates that India's export growth was higher in tariff-affected product categories during the tariff period compared to non-tariff products.

The trade openness variable is also positive and statistically significant, suggesting that more open sectors benefited more from trade diversion and global trade adjustments. Exchange rate and

inflation variables are not statistically significant, indicating that tariff exposure was the primary factor influencing export growth in tariff-affected sectors.

The R-squared values indicate that the model explains a reasonable proportion of variation in export growth. Overall, the regression results provide strong evidence that tariffs imposed on Chinese goods created export opportunities for India through trade diversion effects.

Figure 5 – Sector-wise Export Growth in India

4.5 Summary of Empirical Findings

The empirical results of the study can be summarized as follows:

1. India's export growth increased in tariff-affected sectors during the Trump tariff period.
2. India's market share in U.S. imports increased in sectors where Chinese exports declined.
3. Chinese exports to the United States declined significantly in tariff-affected sectors.
4. Regression results show that tariff exposure had a positive and statistically significant impact on India's export growth.
5. The results provide evidence of trade diversion from China to India during the U.S.–China trade war.

Overall, the empirical findings support the trade diversion hypothesis and suggest that Trump tariffs created export opportunities for India.

5. ROBUSTNESS CHECK

To ensure that the empirical results are reliable and not sensitive to model specification, several robustness checks were conducted using alternative model specifications and variable adjustments.

First, alternative regression models were estimated by excluding and including additional control variables such as inflation and lagged export growth. The results remained consistent across different model specifications, and the tariff exposure coefficient remained positive and statistically significant in all models, indicating that the main results are robust.

Second, a lagged export growth variable was included in the regression model to account for persistence in export growth. The results showed that while lagged export growth was positive and significant, the tariff exposure variable remained positive and statistically significant, confirming that the trade diversion effect was not driven by export growth persistence.

Third, the regression model was re-estimated without the exchange rate variable to ensure that the results were not driven by exchange rate movements. The tariff exposure coefficient remained positive and significant, indicating that export growth in the tariff period was primarily driven by tariff exposure rather than exchange rate changes.

Finally, export growth in tariff-affected products was compared with export growth in non-tariff products. The results showed that export growth in tariff-affected products was significantly higher than in non-tariff products, providing additional support for the trade diversion hypothesis.

Overall, the robustness checks confirm that the empirical results are consistent across different model specifications and estimation approaches, and therefore provide strong evidence that Trump tariffs created export opportunities for India through trade diversion effects.

6. DISCUSSION AND POLICY IMPLICATIONS

Discussion

The empirical results show that tariffs imposed by the United States on Chinese goods created export opportunities for India through trade diversion effects. India's export growth and market share increased in tariff-affected sectors where Chinese exports declined, and regression results confirm that tariff exposure had a positive and significant impact on India's export growth. These findings are consistent with international trade theory, which suggests that tariffs imposed on one country can shift trade toward alternative suppliers.

The results indicate that trade diversion effects were stronger in labour-intensive and intermediate goods sectors such as textiles, chemicals, and engineering goods, where substitution across exporting countries is easier. The findings also suggest that global supply chains began diversifying away from China during the trade war period, with importers shifting sourcing toward alternative Asian economies. However, India's gains were smaller compared to some Southeast Asian countries due to structural constraints such as infrastructure limitations, logistics costs, and lower integration into global value chains.

Overall, the findings suggest that the U.S.–China trade war led to trade reallocation rather than a reduction in global trade, and India

benefited in sectors where it had export capacity and competitiveness.

Policy Implications

The findings of this study have important policy implications for India's trade and industrial policy. First, improving export competitiveness through better infrastructure, lower logistics costs, and ease of doing business can help India benefit more from global trade shifts. Second, deeper integration into global value chains through foreign direct investment, manufacturing clusters, and export-oriented industrialization is important for increasing export opportunities. Third, diversification of export markets and export products can reduce trade risks and increase resilience to global trade shocks. Finally, India should focus on strengthening manufacturing sectors such as textiles, chemicals, engineering goods, and steel, which have export potential and can benefit from trade diversion opportunities during global trade disruptions.

7. CONCLUSION

This paper examined whether the tariffs imposed by the United States on Chinese goods during the Trump administration created export opportunities for India through trade diversion effects. Using product-level export data for the period 2015–2021, the study analysed export growth, market share changes, and the relationship between tariff exposure and India's export performance.

The empirical results show that India's exports increased in tariff-affected sectors such as textiles, chemicals, engineering goods, iron and steel, and electrical equipment during the tariff period. India's market share in U.S. imports also increased in these sectors, while Chinese exports declined significantly. Regression results confirmed that tariff exposure had a positive and statistically significant impact on India's export growth, indicating the presence of trade diversion from China to India.

The findings suggest that the U.S.–China trade war did not simply reduce global trade but instead reallocated trade toward alternative exporters. However, India's gains were smaller compared to some Southeast Asian countries due to structural constraints such as infrastructure, logistics costs, and limited integration into global value chains.

The policy implication of the study is that India should improve export competitiveness, manufacturing capacity, and integration into global value chains to benefit from future global trade shifts and supply chain restructuring. Overall, the study concludes that Trump tariffs created export opportunities for India through trade diversion effects, but the extent of benefits depends on domestic competitiveness and trade infrastructure.

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