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A Data Driven Approach

Econometrics Modeling for Strategic

Highlights

Discourse Analysis of CEO

Social Media's Role in Food Preferences

Discovering Thoughts, Inventing Future

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Econometrics Modeling for Strategic Warehouse Optimization: A Data Driven Approach

By Ali K. Fardan

Abstract- Warehouse inventory and layout optimization are critical to inventory and logistics management in organizations. In many instances, limited warehouse space is a constraint and a barrier to expanding operations and increasing demand. In this paper, I explore various econometric optimization models to improve inventory management and space utilization. I present various case studies to illustrate the applicability and use benefits. Additionally, I've applied one such econometric model to a sample inventory dataset from Saudi Aramco demonstrating its effectiveness in identifying opportunities for improving inventory management and space optimization.

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Econometrics Modeling for Strategic Warehouse Optimization: A Data Driven Approach

Ali K. Fardan

Abstract- Warehouse inventory and layout optimization are critical to inventory and logistics management in organizations. In many instances, limited warehouse space is a constraint and a barrier to expanding operations and increasing demand. In this paper, I explore various econometric optimization models to improve inventory management and space utilization. I present various case studies to illustrate the applicability and use benefits. Additionally, I've applied one such econometric model to a sample inventory dataset from Saudi Aramco demonstrating its effectiveness in identifying opportunities for improving inventory management and space optimization.

I. Introduction

Econometrics is a branch of economics that applies statistical and mathematical models to test hypotheses and forecast future trends based on real-world data. In the context of inventory management and warehousing, econometrics enables data-driven decision-making, optimizing operations, reducing costs, and enhancing customer satisfaction through predictive analytics and demand forecasting. Among key applications of econometrics are Demand Forecasting, Inventory Optimization, Supply Chain Risk Management and Warehouse Space Optimization. Empirical studies show that organizations utilizing econometrics approaches in supply chain gain 10-30% reduction in inventory cost, improved demand prediction accuracy by 50% and faster response time to market changes. [1, 2, 3, 4].

Optimizing warehouse layout is also, crucial for enhancing operational efficiency, reducing costs, and improving order fulfillment rates. Lack of data driven warehousing layout strategies results in a lot of inefficiencies and unoptimized resources. There are several mathematical models developed to design and optimize warehouse layouts. In the literature we explore several warehouse inventory and layout optimization models. Among key econometric models for warehouse layout optimization include.

- Mixed Integer Linear Programming
- Systematic Layout Planning
- Simulation-Based Optimization
- Reinforcement Learning

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And the Inventory Optimization Models:

- Autoregressive Integrated Moving Average (ARIMA).
- Vector Autoregression (VAR).
- Cointegration and Error Correction Models (ECM).
- Panel Data Models (Fixed-effects and Random-effects models).
- Generalized Autoregressive Conditional Hetero-skedasticity (GARCH).

This paper aims to explore the practical application of econometric modeling to an oil and gas warehouse layout optimization.

II. Literature Review

a) Warehouse Layout based Models

An orthogonal warehouse layout is characterized by its simple, straight-line or parallel aisle design. This layout is commonly used due to its straightforward nature and ease of implement-tation. However, it can sometimes lead to longer travel distances for pickers or material handling equip-ment. Among warehouses layouts simulated is the CPU-Based Layout methodology which is based on Intel based CPU structure. The layout segments warehouse space into 3 specialized zones.

- *Performance Zone:* Ground storage nearest outbound area for high-frequency SKUs, minimizing retrieval time.
- *Efficiency Zone:* High-density vertical storage racks for low frequency SKUs maximizing spatial efficiency.
- *Shared Zones:* Flexible buffer storage for overflow and mid-frequency SKUs.

The study conducted by Timo Looms and Lin Xiein 2025 resulted in clear advantage of CPU-based layouts compared to other Orthogonal and Flying-V layouts. [5].

Sanjaya Mayadunne, Hari Rajagoalan and Elizabeth Sharer utilized a two-step mixed integer programming approach to optimize layout of a warehouse for Mitsubishi Electric Trane. They found that linear programming approach to maximizing storage can be tailored to yield multiple optimal solutions. The case study undertook provided insights into organizations' needs during the process of determining a warehouse layout. Mitsubishi increased the total available storage space by 7% with no additional

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investment and reduced the average picking distance by 3.8%. [6]

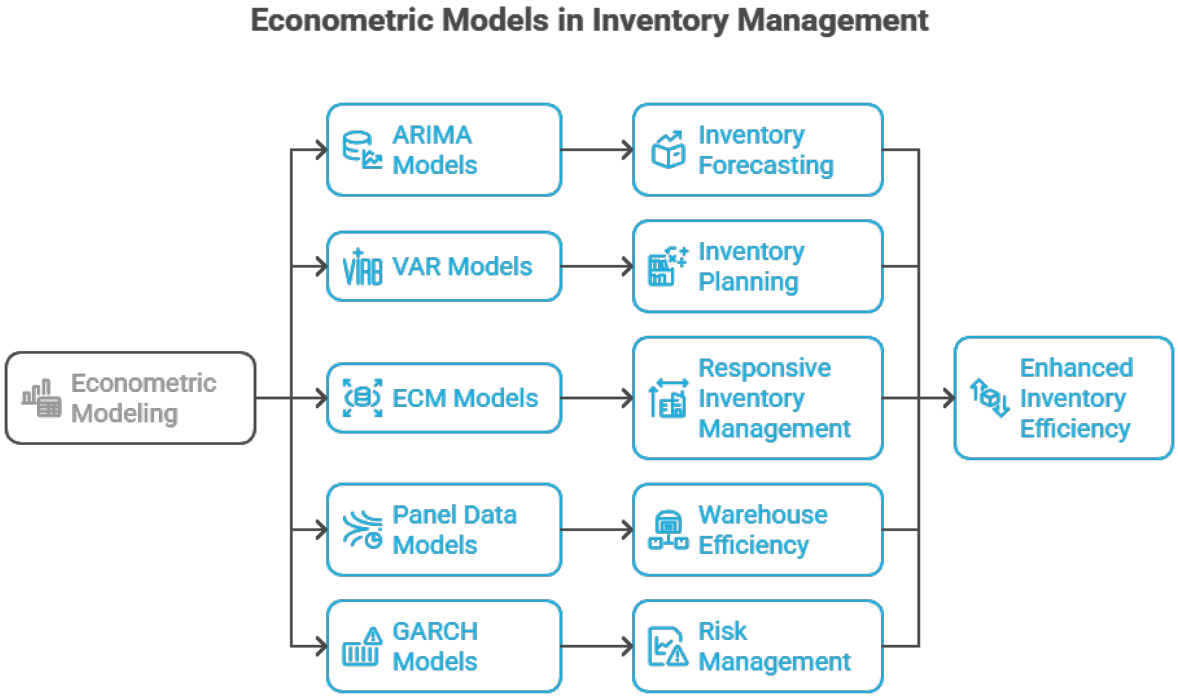
b) Inventory-based Models

Econometric modeling is integral to optimizing inventory management and warehouse operations by enabling data-driven decision-making processes. Various econometric models have gained prominence due to their effectiveness and versatility in handling inventory forecasting and warehouse optimization challenges.

- *Autoregressive Integrated Moving Average (ARIMA)* ARIMA models are among the most extensively applied econometric techniques for inventory forecasting. ARIMA models are extensively employed for univariate time-series forecasting. They effectively capture historical trends, autocorrelation, and seasonality in data by using past observations and errors to predict future values. Such a model was implemented by Walmart to optimize seasonal inventory management. [7] Walmart utilized ARIMA to forecast the demand for seasonal products like holiday decorations, adjusting inventory levels proactively. Walmart achieved significant reductions in overstocks and stockouts, lowering carrying costs and enhancing customer satisfaction through improved availability (Mentzer & Moon, 2005). [7] ARIMA is ideal for straightforward, univariate forecasting scenarios with clear seasonal patterns.
- *Vector Autoregression (VAR):* Models extend ARIMA principles to multivariate contexts. VAR is a multivariate time-series model capturing the dynamic interdependencies between several time-series variables simultaneously, crucial for comprehensive inventory management involving multiple products or related factors. Tesco (Grocery Retail) implemented the model with the objective of optimizing inventory and warehouse space by modeling relationships among multiple product categories. The model improved warehouse stocking strategies, optimized storage space allocations, and significantly reduced excess inventory, enhancing overall operational efficiency (Coelho & Laporte, 2014). [8] VAR suits situations requiring simultaneous modeling of multiple interdependent inventory series where the model strength lies in its capability to manage dynamic interrelationships in inventory data effectively.
- *Cointegration and Error Correction Models (ECM):* Are particularly valuable in examining long-term relationships between inventory variables and external economic indicators, such as demand, prices, and supply chain disruptions. ECM models identify both short-term adjustments and long-term equilibrium relationships among variables such as inventory levels, prices, and market demand, making them invaluable during economic shifts or supply chain disruptions. Toyota (Automotive Parts Manufacturing) applied ECM models to manage inventory levels dynamically by considering long-term relationships between parts inventory, production rates, and market demand and achieved a reduction in inventory holding costs, optimizing warehouse space through strategic inventory alignment (Johansen, 1995). [9] ECM is beneficial for managing inventories influenced by long-term economic relationships or external market factors.
- *Panel Data Models (Fixed-effects and Random-Effects Models):* Are extensively utilized for analyzing inventory data collected across multiple warehouses or locations. Panel Data Models leverage both cross-sectional and time-series data, allowing for nuanced analysis across multiple warehouse locations or regions, capturing both location-specific and time-based effects. Amazon (Multinational Electronics Distributor) utilized this model to analyze the performance of inventories across different warehouses, factoring in regional market characteristics and warehouse-specific attributes. Amazon, improved inventory distribution efficiency, allocation of products based on localized demand forecasts, and significantly optimized warehouse space utilization across diverse geographic regions (Baltagi, 2021). [10]
- *Generalized Autoregressive Conditional Heteroskedasticity (GARCH):* Models have found utility in managing inventory risks and uncertainty. Warehouses adopting GARCH models benefit from refined estimates of inventory volatility, aiding decisions regarding safety stock levels, storage requirements, and contingency planning.

Collectively, these econometric models equip warehouse managers with precise, actionable insights, significantly enhancing inventory efficiency, reducing costs, and optimizing warehouse operations.

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III. Business Case

I applied a panel data model to a sample Saudi Aramco inventory dataset to evaluate the effectiveness of inventory distribution in response to regional demand across multiple warehouses and products over time. Both fixed-effects and random-effects specifications were tested, and the Hausman test was conducted to determine the most appropriate model. The objective was to assess the degree to which inventory inflows align with demand variations by product, warehouse, and time period. The analysis was performed using R version 4.5.1.

Hausman Test:

```
> hausman <- phtest(model_fe, model_re)
> print(hausman)

        Hausman Test

data:  Inventory_In ~ Demand
chisq = 29.222, df = 1, p-value = 6.454e-08
alternative hypothesis: one model is inconsistent
```

As p value is less than 0.05, I utilized fixed effects model as shown on next screenshot.

Model Estimation (Two-Way Fixed Effects):

```
> summary(model_fe)
Twoways effects Within Model

Call:
plm(formula = Inventory_In ~ Demand, data = pdata, effect = "twoways",
    model = "within")

Unbalanced Panel: n = 13, T = 1-4, N = 42

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-28960.01  -2205.58   -217.55   3652.35  24117.45

Coefficients:
       Estimate Std. Error t-value  Pr(>|t|)
Demand 0.594622   0.043381  13.707 3.947e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    3.6965e+10
Residual Sum of Squares: 4341100000
R-Squared:      0.88256
Adj. R-Squared: 0.8074
F-statistic: 187.877 on 1 and 25 DF, p-value: 3.9471e-13
```


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With an R squared of 0.88256, this shows that 88% of the variation in the inventory inflow is explained by the model. The F-statistic of 187.877 and p-value less than 0.05 indicates a statistical significance model overall. So, each unit increase in demand leads to approximately 0.6 unit increase in inventory inflow. The model suggests a *strong and statistically significant relationship* between demand and inventory received with consistency across panels.

IV. Conclusion

The application of a two-way fixed effects panel data model revealed a statistically significant and robust relationship between regional customer demand and inventory inflows across multiple warehouses and products. With demand explaining over 88% of the variance in inventory receipts and a highly significant coefficient estimate, the results indicate a strong alignment between supply actions and customer needs. However, while this responsiveness suggests a sound demand-driven approach, it does not in isolation confirm optimal inventory management or distribution efficiency. As supported by literature, panel data models are effective for analyzing cross-sectional and temporal variations in inventory behavior, particularly in multi-warehouse, multi-product contexts. Their integration with other econometric approaches- such as ARIMA for forecasting, VAR for product interdependencies, and ECM for long-term equilibrium adjustments- can provide a more comprehensive framework for warehousing optimization. To fully evaluate inventory performance, future analyses should incorporate additional KPIs such as inventory turnover, service levels, and responsiveness to demand volatility, ensuring a holistic assessment of operational efficiency.

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Regret and Responsibility: A Discourse Analysis of CEO Apologies in Corporate Crisis Management

By Dr. Constantin Ilas

Abstract- This study investigates the rhetorical strategies employed in public CEO apologies issued in response to major corporate crises between 2010 and 2024. Drawing from a corpus of ten high-profile apology statements- including video transcripts, written releases, and interview excerpts- this paper applies a combined framework of Appraisal Theory and Image Repair Theory to analyze how top executives linguistically construct responsibility, express regret, and attempt to repair stakeholder trust. The findings reveal consistent patterns in evaluative language use, responsibility-taking, emotional appeals, and institutional ethos. Variations in tone, modality, and audience engagement across industries are also examined. By situating these discursive features within the broader context of crisis management and leadership communication, this study offers interdisciplinary insights into how language functions as a managerial tool for damage control and reputational rehabilitation.

Keywords: *CEO apologies, crisis communication, corporate discourse, appraisal theory, image repair theory, reputation management, business ethics, evaluative language, stakeholder trust, leadership communication.*

GJMBR-G Classification: *JEL Code: M12, M14, Z13*

REGRETANDRESPONSIBILITYADISCOURSEANALYSISOFCEOAPOLOGIESINCORPORATECRISISMANAGEMENT

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Keywords: CEO apologies, crisis communication, corporate discourse, appraisal theory, image repair theory, reputation management, business ethics, evaluative language, stakeholder trust, leadership communication.

I. Introduction

In the era of instantaneous digital visibility and heightened consumer awareness, corporate crises are no longer confined to boardrooms or buried in back-page press releases. Today, they unfold under relentless public scrutiny- on social media platforms, in newsfeeds, and across global stakeholder networks. A defining ritual in the management of such crises is the public apology delivered by the organization's highest-ranking official: the Chief Executive Officer (CEO). These apologies do more than express remorse; they serve as strategic discourse acts, meticulously crafted to contain reputational fallout, affirm corporate values, and rebuild fractured trust (Coombs, 2007; Benoit, 1995). At the intersection of ethical leadership, stakeholder management, and media accountability, the CEO apology has become a powerful tool for institutional self-representation. As Fombrun (1996) suggests, organizational reputation is a strategic asset, particularly vulnerable during public crises.

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However, the communicative efficacy of these apologies remains a subject of debate. Some are praised for their transparency and moral courage- such as Satya Nadella's handling of diversity concerns at Microsoft- while others, like United Airlines' early response to the Flight 3411 incident, are criticized for being tone-deaf or evasive. Despite their growing prevalence in corporate life, CEO apologies remain under examined as linguistic and rhetorical artifacts. This aligns with the call for more discursive approaches to leadership communication (Frandsen & Johansen, 2017). Most existing analyses focus on their legal or managerial implications, often neglecting the rich textual and interpersonal features that shape how these messages are received and interpreted by audiences (Hearit, 2006; Ulmer, Sellnow, & Seeger, 2014).

This study seeks to fill that gap by conducting a detailed discourse analysis of ten public CEO apologies issued between 2010 and 2024, each responding to high-profile crises ranging from racial profiling and sexual harassment to environmental disasters and product safety failures. These cases represent acute reputational threats that demanded rapid, rhetorically credible responses from senior leadership. By applying an interdisciplinary framework that combines Appraisal Theory (Martin & White, 2005) with Image Repair Theory (Benoit, 1995), this research examines how language is used to signal accountability, express emotional alignment, and navigate the fine line between justification and contrition.

The analysis pays particular attention to key linguistic features such as evaluative adjectives, stance-taking devices, and modal verbs that CEOs deploy to shape audience perceptions. Special emphasis is placed on how tone, emotional resonance, and strategic ambiguity function in the process of institutional self-defense. The study also considers broader social and pedagogical implications, demonstrating how such discourse can serve as instructional material in both Business English and management communication curricula. As recent scholarship suggests, analyzing corporate apologies offers valuable insights into stakeholder engagement, ethical positioning, and leadership performance under pressure (Wang, Ngai, & Singh, 2021; Liu & Li, 2021).

Ultimately, this article argues that CEO apologies are not merely reactive performances. Rather, they constitute complex communicative acts that blend

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rhetorical strategy, affective alignment, and managerial foresight. Understanding the linguistic architecture of these statements sheds light on how corporate leaders attempt to restore legitimacy, reassert control, and redefine organizational identity in the aftermath of reputational harm.

II. Theoretical Framework

The apology has long functioned as a cornerstone of image restoration in both interpersonal and institutional settings. In the context of corporate communication, the CEO apology occupies a particularly charged rhetorical space. It is simultaneously a speech act, a performance of moral leadership, and a discursive attempt to contain reputational fallout in high-stakes situations. The increasing visibility of corporate failures- often amplified through digital media ecosystems- has led to a parallel rise in public apologies from executives attempting to reassert institutional control. These communicative events offer a rich field for academic analysis, situated at the intersection of management studies, media discourse, and applied linguistics.

While early studies of corporate apologies tended to focus on their legal or managerial dimensions, more recent scholarship emphasizes their rhetorical and linguistic construction. Central to this shift is Image Repair Theory, developed by William Benoit (1995), which offers a robust framework for categorizing and interpreting the communicative strategies employed by speakers to repair damaged public images. Grounded in classical rhetoric and public relations theory, the model identifies five principal strategies: denial, evasion of responsibility, reduction of offensiveness, corrective action, and mortification. These are not merely abstract categories- they serve as heuristics for tracing how speakers construct narratives of accountability or deflection. For instance, CEOs often employ mortification ("We are deeply sorry") in tandem with corrective action ("We are taking steps to ensure this never happens again") to signal both contrition and institutional competence. Other tactics, such as bolstering or minimizing, may be used to mitigate blame by emphasizing past achievements or framing the crisis as isolated and uncharacteristic.

Scholars such as Hearit (2006), Coombs (2007), and Brinson and Benoit (1996) have demonstrated how Image Repair Theory applies across a wide range of corporate crises, from environmental disasters to product recalls. Particularly in CEO discourse, where the individual's ethos is perceived to embody the institution, these strategies take on heightened importance. The use of active versus passive constructions, the presence or absence of first-person pronouns, and the rhetorical sequencing of explanation and apology all contribute to how responsibility is framed. Recent findings by Tyler and Cameron (2020) show that leadership apologies emphasizing first-person accountability and agentive verbs tend to yield higher public approval, especially when combined with an acknowledgment of audience emotions.

While the theory has been critiqued for privileging speaker intention over audience interpretation, its utility as a taxonomic tool for mapping discourse strategies remains widely accepted in both communication and business ethics research.

Yet, understanding what CEOs say in response to crisis is only half the task. Equally important is how they say it- how their language conveys emotional resonance, ethical stance, and institutional alignment. To address this dimension, the present study incorporates Appraisal Theory, a linguistic framework developed by Martin and White (2005) within the broader tradition of Systemic Functional Linguistics. Appraisal Theory offers a detailed model of how language performs evaluative functions in discourse. It is particularly useful for analyzing expressions of emotion (affect), moral judgment, and value-based appreciation, as well as for tracking how speakers engage with alternative viewpoints or intensify/de-intensify claims.

Appraisal Theory distinguishes between three interrelated domains: attitude, engagement, and graduation. In the context of CEO apologies, attitude captures the ways in which executives express grief, concern, regret, or outrage- whether through affective language ("we are devastated"), judgment ("this was a failure of leadership"), or appreciation ("our employees deserve better"). Engagement concerns the positioning of the speaker relative to other voices or perspectives: for example, whether the CEO invokes expert opinion, acknowledges public outrage, or asserts institutional authority. Graduation refers to the modulation of intensity, which affects how strongly a claim is made or how deeply an emotion is felt. The choice between "regret" and "deep regret," or "we made an error" versus "we failed catastrophically," carries significant implications for how the apology is interpreted.

The strength of Appraisal Theory lies in its ability to uncover the interpersonal dynamics embedded in seemingly neutral or formulaic statements. As Wang, Ngai, and Singh (2021) argue, the evaluative texture of CEO apologies can reveal implicit hierarchies of concern- whether the emphasis is placed on victims, shareholders, the company's reputation, or legal liability. Moreover, by attending to the fine-grained structure of evaluative meaning, researchers can explore how linguistic choices align with or diverge from broader social expectations of sincerity, humility, and responsibility.

The integration of Image Repair Theory and Appraisal Theory in the present study allows for a multi-

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scalar analysis of CEO apologies, combining macro-level patterns of rhetorical strategy with micro-level features of linguistic choice. This dual approach responds to recent calls for more linguistically-informed models of crisis communication that can account for both what is said and how it is said (Liu & Li, 2021; Bednarek, 2006). It also offers significant pedagogical value. Further support for the dual-theory model comes from Johansson and Elsbach (2022), who advocate for combining evaluative linguistics with corporate image theory to better decode the ethical impact of CEO rhetoric during reputational crises. In the context of Business English and management education, the ability to decode and produce ethically persuasive language is increasingly viewed as a core leadership competency. As Hutchinson and Waters (1987) and later Tardy (2020) emphasize, effective communication in professional contexts is not simply about clarity or correctness but about navigating complex rhetorical demands in culturally and ethically sensitive ways.

Ultimately, CEO apologies are more than reactive tools for crisis containment. They are discursive enactments of institutional identity and ethical positioning. By analyzing their linguistic structure through the combined lenses of Appraisal Theory and Image Repair Theory, this study contributes to a deeper understanding of how corporate leaders use language to negotiate reputational stakes, reaffirm values, and re-establish trust in moments of vulnerability.

III. Methodology

This study adopts a qualitative, corpus-based discourse analysis approach to examine the rhetorical and linguistic strategies employed in CEO apologies following corporate crises. Guided by the dual frameworks of Image Repair Theory (IRT) and Appraisal Theory, the research aims to uncover how institutional leaders navigate moments of reputational vulnerability through language. This integrative approach enables both macro-level classification of apology strategies and micro-level examination of evaluative linguistic features. By doing so, the study reveals how corporate ethos, emotional alignment, and moral positioning are discursively constructed in the aftermath of public failure. Corpus-based qualitative methods have become central to the analysis of strategic discourse in crisis events, offering nuanced insights into genre-specific patterns.(Baker, P., & McEnery, T. 2015). This approach aligns with recommendations by Flowerdew and Richardson (2018), who emphasize the importance of discourse-informed frameworks in analyzing ideologically charged corporate narratives.

The corpus comprises ten CEO apologies issued between 2010 and 2024, each of which addresses a high-profile incident of reputational damage. These apologies were selected according to the following criteria:

- *Public Visibility:* Each apology received widespread media coverage and was disseminated through official channels such as press releases, public statements, and televised interviews.
- *Direct Authorship:* Each apology was delivered or authored by the Chief Executive Officer, not a public relations department or legal representative.
- *Crisis Relevance:* Each apology responded to a crisis involving ethical transgression, consumer harm, or organizational misconduct.

The Selected Cases Span Multiple Industries: Aviation, finance, technology, and entertainment, which reflect a range of communicative contexts and stakeholder audiences. As recommended by Wodak (2019), sampling across diverse industries strengthens the representativeness of crisis discourse studies, especially when institutional contexts shape communicative constraints. For spoken apologies delivered in video format, full verbatim transcripts were produced. All texts were anonymized during the coding process to reduce bias and ensure consistency. While nonverbal elements such as tone, posture, and facial expression were noted for context, the analysis focused exclusively on verbal data to maintain methodological consistency across both written and oral formats.

Data analysis proceeded through iterative, interpretive coding using NVivo software, with each apology segmented into rhetorical units and tagged according to the theoretical frameworks employed. At the macro level, Image Repair Theory was applied to identify the presence of the following discursive strategies:

- Denial (e.g., “We did not do what was alleged”)
- Evasion of responsibility (e.g., “This was an isolated mistake”)
- Reduction of offensiveness (e.g., “We have a long-standing commitment to…”)
- Corrective action (e.g., “We are implementing new protocols”)
- Mortification (e.g., “I am deeply sorry”)

These strategies were not treated as mutually exclusive; rather, their co-occurrence and sequencing were analyzed to understand how CEOs layered rhetorical moves in response to complex reputational threats.

At the micro level, Appraisal Theory was used to investigate the evaluative texture of each apology. Specific attention was given to the following categories:

- Attitude, encompassing affect (e.g., “We are devastated”), judgment (e.g., “This was unacceptable”), and appreciation (e.g., “Our employees deserve better”)

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- Engagement, including voice and stance (e.g., inclusive pronouns, hedging, acknowledgment of external perspectives)
- Graduation, reflecting the degree of intensity or modulation (e.g., "regret" vs. "profound regret," "we may have failed" vs. "we failed catastrophically")

This layered analytical approach allowed for the exploration of how CEOs expressed emotional resonance, allocated blame, demonstrated institutional accountability, and negotiated the expectations of multiple audiences. Inclusive language, modal verbs, and syntactic structures were examined as indicators of rhetorical stance and strategic positioning.

The choice of a qualitative discourse analysis is justified by the inherently complex and situated nature of CEO apologies. As these are often highly curated, multimodal, and high-stakes communications, they demand a methodology capable of interpreting both explicit rhetorical moves and implicit interpersonal meanings. Unlike quantitative content analysis, which may identify frequencies but not function, the current approach attends to how linguistic choices serve persuasive, ethical, and strategic aims within a specific communicative event.

Ultimately, the methodology combines rhetorical analysis and functional linguistics to offer a holistic understanding of CEO apologies as artifacts of institutional discourse. It supports both theoretical advancement and pedagogical applicability in fields such as Business English, management training, and corporate ethics education.

IV. Analysis & Results

This section presents a two-tiered analysis of the apology corpus, integrating macro-level rhetorical strategies from Image Repair Theory (IRT) with micro-level linguistic evaluation via Appraisal Theory. Together, these perspectives illuminate not only *what* CEOs said in response to reputational crises, but *how* they shaped emotional, ethical, and institutional meaning through language.

Analysis of the ten CEO apologies reveals a strong preference for three core strategies: mortification, corrective action, and reduction of offensiveness. Each apology contained at least one instance of mortification, with CEOs expressing direct remorse for the event and accepting personal or organizational accountability. Corrective action was also universal, as leaders attempted to assure stakeholders that concrete measures would prevent future recurrence. Reduction of offensiveness typically involving appeals to company values, legacy, or mitigating circumstances- was present in every case.

Notably, denial was absent from all statements, signaling an awareness that overt deflection of blame is increasingly viewed as insincere or irresponsible in the public eye. Only one apology (Volkswagen) included subtle forms of evasion of responsibility, primarily by attributing the scandal to systemic or departmental shortcomings rather than individual decisions.

Table 1: CEO Apology Corpus Analysis

CEO	Company	Crisis Type	Mortification	Corrective Action	Denial	Reduce Offense	Evasion
Oscar Munoz	United Airlines	Passenger mistreatment	1	1	0	1	0
Mark Zuckerberg	Facebook	Data privacy	1	1	0	1	0
Dennis Muilenburg	Boeing	Aircraft safety	1	1	0	1	0
Martin Winterkorn	Volkswagen	Emissions scandal	1	1	0	1	1
Tony Hayward	BP	Environmental disaster	1	1	0	1	1
Kevin Johnson	Starbucks	Racial profiling	1	1	0	1	1
Richard Smith	Equifax	Data breach	1	1	0	1	1
Tony Fernandes	Air Asia	Plane crash	1	1	0	1	1
John Stumpf	Wells Fargo	Fraudulent accounts	1	1	0	1	1
Nikesh Arora	Palo Alto Networks	Sexist imagery	1	1	0	1	1

Source: author's interpretation

This table documents the presence or absence of each rhetorical strategy across the corpus. The pattern suggests a strong convergence toward a rhetoric of accountability, in which CEOs aim to perform

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contrition while restoring confidence through promises of reform.

Beyond rhetorical categories, the apologies demonstrate clear and repeated use of evaluative language aligned with the dimensions of Appraisal Theory: affect, judgment, appreciation, engagement, and graduation.

1. *Affect*

Expressions of negative affect- such as sorrow, regret, or devastation- appeared in nearly every apology. These emotional terms served to signal empathy and humanize the speaker. Positive affect, while less common, was occasionally invoked to reaffirm the company's vision or future direction (e.g., "we are committed to rebuilding trust").

2. *Judgment*

Both positive and negative judgments played a key role in framing the ethical stakes of each crisis. CEOs frequently condemned the events or actions under scrutiny ("this was unacceptable," "we failed to live up to our standards"), while simultaneously offering affirmations of corporate values or moral commitments ("we are a company that takes responsibility," "this is not who we are").

3. *Appreciation*

The language of appreciation was used to reinforce stakeholder value and institutional legacy. CEOs often praised the dedication of employees, the loyalty of customers, or the company's historical contributions. These appraisals worked to balance the emotional tone of the apology with forward-looking reassurance.

4. *Engagement*

The use of inclusive pronouns (e.g., "we," "our team") and references to stakeholders created a sense of engagement, fostering shared responsibility and community. However, in some cases, contractive engagement (e.g., avoiding alternative viewpoints, downplaying ambiguity) appeared to protect corporate positioning.

5. *Graduation*

Most apologies employed high degrees of graduation to amplify the severity of the situation ("deeply sorry," "unacceptable failure," "profound regret"). This linguistic intensification functioned to underscore sincerity and emotional alignment with aggrieved stakeholders.

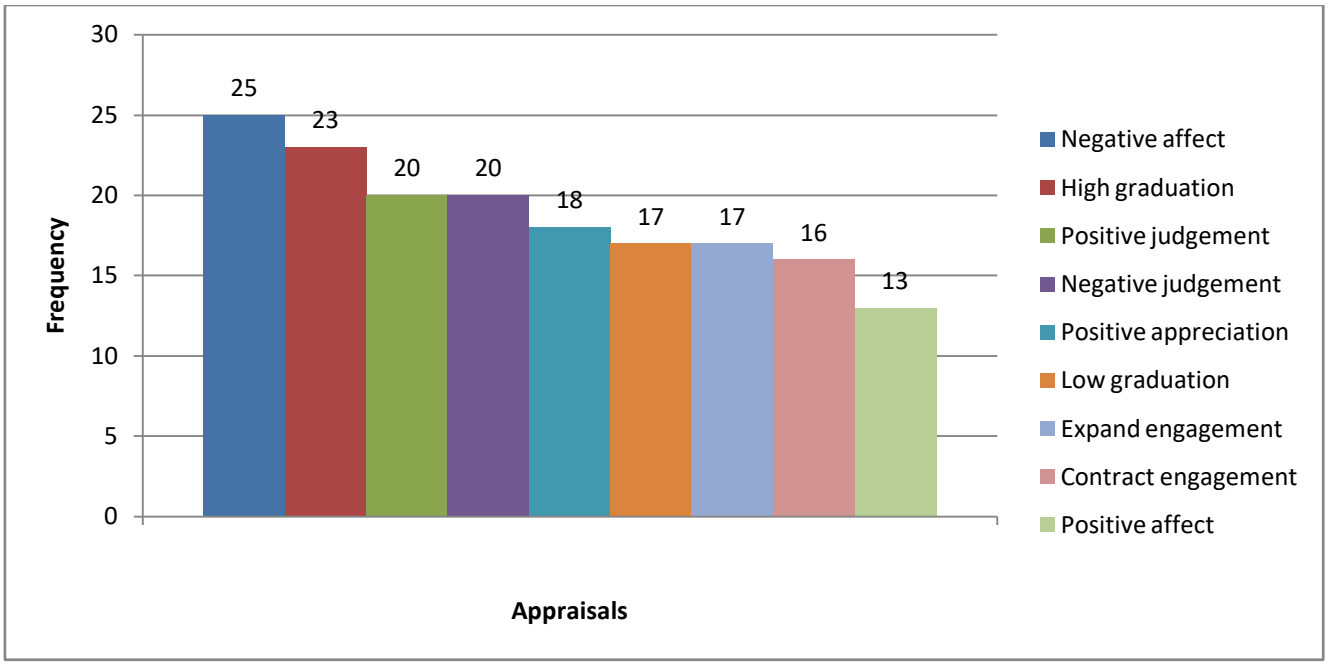
Table 2: Appraisal Theory Analysis of CEO Apologies

CEO	Positive Affect	Negative Affect	Positive Judgement	Negative Judgement	Positive Appreciation	Expand Engagement	Contract Engagement	High Graduation	Low Graduation
Oscar Munoz	2	2	3	1	2	2	1	3	1
Mark Zuckerberg	1	3	2	2	2	1	2	2	2
Dennis Muilenburg	1	3	2	2	2	2	2	2	2
Martin Winterkorn	0	3	1	3	1	1	2	1	2
Tony Hayward	1	4	1	3	1	1	2	3	1
Kevin Johnson	2	2	3	1	2	2	1	3	1
Richard Smith	1	3	2	2	2	1	2	2	2
Tony Fernandes	2	2	3	1	2	2	1	3	1
John Stumpf	1	2	2	2	2	1	2	2	2
Nikesh Arora	1	3	2	2	2	2	1	2	2

Source: author's interpretation

This table quantifies the use of appraisal resources across all ten apologies, demonstrating the widespread reliance on emotional, ethical, and reputational framing devices.

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Source: author's interpretation

Figure 1: Distribution of Appraisal Theory Features in CEO Apologies

Figure 1 presents a detailed visual analysis of the distribution of Appraisal Theory features across the CEO apology corpus. The data show a pronounced reliance on negative affect, confirming that emotional resonance is the central pillar of modern corporate apologies. CEOs overwhelmingly employ language that conveys regret, sorrow, and distress. For this reason, terms like "devastated," "ashamed," and "deeply sorry" dominate the discourse. These expressions function as interpersonal signals of vulnerability and remorse, allowing the speaker to humanize their role while acknowledging public discontent. The prominence of negative affect suggests that emotional alignment is no longer optional but essential in the performance of institutional accountability. This pattern echoes findings by Thompson and Alba-Juez (2014), who argue that negative affect and intensification are key discursive tools in restoring perceived sincerity during reputational crises.

Closely following is high graduation, which amplifies meaning and emotion through intensifying modifiers and emphatic constructions. CEOs use phrases like "complete failure," "utterly unacceptable," and "deep remorse" to heighten the perceived seriousness of the event and their own sincerity. The high frequency of intensification underscores its strategic value as a credibility-enhancing device, helping to foreground the gravity of the situation and validate stakeholder outrage.

Judgment, both positive and negative, ranks next in frequency. As Hartelius (2020) points out, moral evaluation enables speakers to navigate public blame and reclaim ethical positioning, particularly when facing institutional fallout. CEOs engage in moral evaluation not only by condemning the actions that led to the crisis ("we fell short," "this was wrong"), but also by reasserting ethical standards and leadership values ("we are committed," "this is not who we are"). The dual presence of both types of judgment affirms that CEO apologies are morally performative. These leaders must demonstrate both contrition and moral resolve, restoring institutional ethos by clearly articulating right and wrong.

Appreciation features moderately in the data and serves a rhetorical function of rebuilding relational capital. CEOs often praise their employees, customers, or company legacy ("we value your support," "our proud tradition") as a way to anchor the apology in a broader narrative of stability and resilience. These appreciative gestures soften the tone of the apology and position the crisis as a deviation rather than a defining characteristic of the organization.

The use of engagement resources, particularly expand engagement, appears next in the frequency hierarchy. This includes inclusive language ("we," "our customers," "all of us") that fosters a sense of collective responsibility or shared experience. Such language helps CEOs cultivate solidarity and alignment with stakeholders. However, contractive engagement, which limits or preempts alternate interpretations ("this does not reflect our values," "let me be clear"), is used more sparingly. This suggests that while CEOs aim to control the narrative, they avoid appearing overly defensive or autocratic, especially in highly scrutinized public settings.

Graduation (low) appears with similar frequency to engagement markers. Here, linguistic downtoning

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(with phrases like "some missteps," "challenging moment," or "partial breakdown") is used in conjunction with more forceful elements to moderate tone, avoid panic, or position the crisis as manageable. Its modest use reflects a delicate balancing act between dramatization and reassurance.

Finally, positive affect is the least employed resource in the corpus. CEOs rarely express emotions such as pride, hope, or optimism within the apology itself, likely due to the genre constraints of crisis discourse. In moments of reputational threat, it seems that excessive positivity may appear insincere or out of touch. Instead, CEOs strategically reserve positive affect for post-apology messaging, once the emotional damage has been addressed.

In summary, Figure 1 reveals that CEO apologies are constructed through a layered blend of emotional gravity, ethical positioning, and strategic tone management. Negative affect and high graduation dominate, establishing the apology's emotional and rhetorical seriousness. This is followed by judgment and appreciation, which build ethical credibility and relational repair. Engagement and graduation (low) moderate these dynamics, while positive affect is minimized, reinforcing the communicative imperative of humility, intensity, and remorse in the face of institutional failure.
Several cross-cutting themes emerge from the combined analysis:

- *Humanization of Leadership:* CEOs often portrayed themselves as emotionally affected individuals, not distant executives, in an effort to build trust and relatability.
- *Institutional Distancing:* While individuals accepted responsibility, companies were sometimes linguistically distanced from the wrongdoing (e.g., use of passive voice: "mistakes were made").
- *Chronotopic Alignment:* Apologies often positioned the crisis as a deviation from past achievements and a pivot toward future reform, aligning past–present–future in a narrative of recovery.
- *Moral Positioning:* The repetition of ethical terms and moral judgment (e.g., "responsibility," "integrity," "failure") reinforces the crisis as a moral, not merely procedural, event.

These patterns indicate that CEO apologies are not mere acts of damage control; they are highly strategic discursive performances shaped by social expectations, brand identity, and the genre conventions of crisis communication.

V. Conclusion and Managerial Implications

The results of this study offer critical insights into how corporate leaders navigate reputational crises through language. The CEO apology is a carefully crafted communicative act that negotiates a delicate balance between emotion, ethics and institutional authority. This observation aligns with research by Coombs (2014), who emphasizes that emotional resonance and ethical framing enhance the perceived legitimacy of corporate responses during crises. By analyzing a corpus of high-profile CEO apologies through the frameworks of Image Repair Theory and Appraisal Theory, this article demonstrates how leaders deploy specific rhetorical strategies to shape public perception, re-establish trust, and protect long-term organizational legitimacy.

The dominance of negative affect and high graduation in the apology texts reflects a key managerial insight: successful apologies must acknowledge wrongdoing while also coming across as authentic. Emotional resonance has become a managerial imperative, particularly in an era of hyper-scrutiny, where corporate responses quickly become viral and are dissected not only by affected stakeholders but by a broader public on social media, news outlets, and investor platforms. By projecting strong negative emotions and intensifying them sentiments through amplifying language, CEOs seek to align themselves with public sentiment and present a leadership persona that is emotionally attuned and morally responsive.

This emotional framing is complemented by the extensive use of judgment resources, which allow CEOs to publicly evaluate behavior in moral terms. These evaluations perform a dual function: on one hand, they acknowledge ethical failure. On the other hand, they also reassert the company's normative values. The strategic use of positive judgment (such as reaffirming commitments to safety, integrity, or customer care) helps to reposition the company's ethos as one that, although momentarily compromised, remains fundamentally sound. In this way, apologies serve not only as reactive measures but as opportunity spaces for ethical recalibration.

The study also underscores the calculated use of engagement resources, particularly those that build solidarity through inclusive pronouns ("we," "our," "together"). These serve to draw audiences into a shared framework of resolution and renewal. At the same time, limited use of contractive engagement indicates a preference for controlled openness, where CEOs seek to manage public interpretation without appearing authoritarian. This balance is delicate: an apology that asserts too much control risks coming off as defensive, while one that is too open may invite further scrutiny or legal liability. Skilled communicators navigate this space by crafting messages that appear personal and humble yet remain institutionally safe.

From a strategic communication standpoint, this research affirms that CEO apologies are high-stakes rhetorical performances that require precision, emotional intelligence, and ethical clarity. In moments of crisis, the

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CEO becomes the voice of the corporation. Apologies that fail to strike the right tone or omit key evaluative moves may exacerbate the reputational damage they seek to contain. As such, corporate communication teams and crisis managers must be equipped not only with legal and public relations frameworks but also with a deep understanding of evaluative language dynamics and public affect.

Moreover, the findings suggest a growing public expectation for moral leadership. The frequent use of judgment and affect reveals that audiences are no longer satisfied with procedural explanations or technical fixes: they demand emotional engagement and ethical transformation. Similarly, Claeys and Cauberghe (2015) highlight that stakeholders tend to respond more favorably to crisis messages that explicitly integrate emotional language and ethical accountability. A successful apology today must signal not only that a problem occurred but that the company has learned, evolved, and recommitted to its foundational values. In this context, language becomes a form of reputational currency. It should be capable of restoring trust and realigning stakeholder relationships.

In conclusion, this study illustrates how the intersection of linguistic analysis and crisis management reveals the inner architecture of effective corporate apologies. The application of Appraisal Theory and Image Repair Theory to real-world CEO statements offers a replicable model for assessing the discursive strategies that underlie successful image restoration. As organizations face increasing reputational risks in volatile global markets, the ability to craft sincere, ethically grounded, and strategically sound apologies becomes a core element of executive leadership skills. Future research may expand this approach across cultural contexts, industries, and digital platforms, but the central insight remains: in the aftermath of corporate failure, proper use of language has become synonymous with proper leadership.

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Virtual Influences, Real Consequences: Social Media's Role in Food Preferences and Nutrition among Punjab's Adolescent Girls

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Punjab Agricultural University

Abstract- This study investigates the influence of social media usage on the food choices and nutritional status of school-going adolescent girls in Punjab. A total of 520 subjects, aged 16-18 years, were selected from rural and urban schools across Punjab. The sample was divided into social media users and non-users based on daily usage duration, with further subdivision into rural and urban categories. Comprehensive data was collected on socio-economic status, dietary habits, physical activity and anthropometric parameters. Dietary intake was assessed using the 24-hour recall method and compared with the Recommended Dietary Allowances (RDA). Nutrient adequacy and dietary diversity scores were calculated, while body composition was analyzed using advanced tools. Results revealed significant differences in dietary patterns, nutrient intake, and body composition between users and non-users of social media. Rural non-users displayed healthier eating habits, including higher fruit consumption and lower fat intake, while urban users reported greater consumption of processed and junk foods.

Keywords: *adolescents, social media, dietary patterns, nutritional status, food marketing, physical activity.*

GJMBR-G Classification: *DDC: 641.3*



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Virtual Influences, Real Consequences: Social Media's Role in Food Preferences and Nutrition among Punjab's Adolescent Girls

Dr. Simran Kaushal [α], Dr. Amarjeet kaur [σ], Dr. Monika Choudhary [ρ] & Jaspreet kaur [ω]

Abstract- This study investigates the influence of social media usage on the food choices and nutritional status of school-going adolescent girls in Punjab. A total of 520 subjects, aged 16-18 years, were selected from rural and urban schools across Punjab. The sample was divided into social media users and non-users based on daily usage duration, with further subdivision into rural and urban categories. Comprehensive data was collected on socio-economic status, dietary habits, physical activity and anthropometric parameters. Dietary intake was assessed using the 24-hour recall method and compared with the Recommended Dietary Allowances (RDA). Nutrient adequacy and dietary diversity scores were calculated, while body composition was analyzed using advanced tools. Results revealed significant differences in dietary patterns, nutrient intake, and body composition between users and non-users of social media. Rural non-users displayed healthier eating habits, including higher fruit consumption and lower fat intake, while urban users reported greater consumption of processed and junk foods. Social media users, particularly urban ones, showed increased exposure to food marketing and reported emotional eating behaviors linked to stress and peer influence. Despite differences in dietary patterns, both groups exhibited insufficient nutrient intake, a high prevalence of anemia and sedentary lifestyles. The study highlights the critical role of social media in shaping dietary habits and influencing adolescent health behaviors. It emphasizes the need for targeted public health interventions to mitigate the adverse impacts of social media while leveraging its potential to promote healthier eating habits and active lifestyles among adolescents in Punjab.

Keywords: adolescents, social media, dietary patterns, nutritional status, food marketing, physical activity.

I. Introduction

The word adolescence originated from the Latin term '*adolescere'*, which means to mature. Adolescence is defined as the age between 10 to 19 (WHO 2019). After infancy, adolescence is the only another time where rapid growth and development along with significant biological and psychological changes occur and these changes are greatly influenced by sociocultural factors. The two typical stages include early adolescence (10-14 years) and late adolescence (15-19 years). From a physiological perspective, pubertal changes rule the early years whereas sexual maturation and establishment of adult roles and responsibilities rule the later years (Patton *et al* 2016). Adolescents make about 16 percent of the world's population (Bhargava *et al* 2020). Asia is home to more than half of the world's adolescents, while India has 20 percent of its people under the age of 18 (UNICEF 2016).

There is a link between adult comprehension of dietary guidelines and healthy eating behaviors. Nutritional knowledge is crucial for promoting healthy eating patterns and maintaining a healthy body weight. Relation among nutrition knowledge and food nutrient consumption as well as the positive effects of nutrition knowledge in adolescents cannot be ignored. Adolescence is a critical period of rapid growth requiring increased nutrients, such as amino acids for muscle development and calcium and vitamin D for bone growth. Adolescents, often engaged in physical activities, have higher energy needs, but those who are sedentary may accumulate fat, contributing to global adolescent obesity. According to WHO, about 1/5th of the world consist of adolescents, during this period good nutrition is very important for the growth and development. Inadequate nutrition during adolescence can have serious consequences throughout the reproductive years and beyond. Under-nutrition in adolescent girls is a major public health problem in developing countries (Das *et al* 2017).

Dietary problems among adolescent girls must be addressed as they can bring a negative effect on future generations if right information is not given at right time (Choudhary *et al* 2010).Each year, 16 million babies are born to girls aged 15-19, with adolescent fertility rates much higher in low-and middle-income countries (LMICs) due to factors like poverty, lack of education and limited healthcare access. Adolescent pregnancies pose significant risks, including competition for nutrients between mother and fetus, leading to stunted growth, low birth weight, preterm delivery and higher maternal mortality. Young mothers are also at increased risk for neonatal complications. During lactation, a mother's micronutrient status is vital for her infant's health, especially in the first six months. Nutrient needs during

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pregnancy and lactation are significantly higher compared to other stages of life (Das *et al* 2017).

Globally, the prevalence of overweight and obesity in children aged 5-19 has grown from 4 to 18 per cent since 1975 to 2016 (Abarca-Gomez *et al* 2017). Due to eating patterns influenced by obesogenic environments, such as the broad availability, high cost and promotion of foods with a high energy density, particularly in the digital era, health status of children and adolescents is deteriorating. Obesity has been related to prolonged television viewing (Olafsdottir *et al* 2014), primarily because it is associated with unfavourable eating habits such as skipping breakfast (Lipsky *et al* 2012) and consuming unhealthy foods more frequently (Lissner *et al* 2012) as well as fewer vegetables and fruits (Bornhorst *et al* 2015).

'*Social Media'* is a broad term used to describe online technical solutions that make it simple for users to communicate with one another and the online community by sharing and exchanging information online. There are a few examples of these technological tools such as social networking sites (SNS), video-sharing websites, virtual worlds, blogs, group projects etc (Mangold and Faulds 2009; Kaplan and Haenlein 2010). SNS have shown the fastest and most steady growth of any of these social media tools (Chang *et al* 2015). Social networking sites (SNS) have become a crucial source of information for customers, significantly influencing their choices and purchase intentions (Li and Chang 2016, Wang *et al* 2012). This impact encourages continued engagement with these platforms (Chang *et al* 2015). Over the past decade, the use of Facebook has surged from about 2% to nearly 30% of the global population by 2019, highlighting the growing importance of SNS in daily life, especially among adolescents (Ortiz-Ospina 2019). Children's and adolescents attention spans can be impacted by the need to often check highly engaging online content and incoming notifications from SM applications (Reid *et al* 2016). This effect is particularly concerning when people are eating thoughtlessly in front of screens which may lead to overeating, consequently resulting in overweight and obesity (Robinson *et al* 2017). Food communications have permeated our surroundings in the form of social media photos, videos, advertisements and posts from food influencers, cookery shows and peer-to-peer messages. These signals can be virtual or nonvirtual and frequently support unhealthy non-core eating norms while glorifying non-core food consumption and enticing excessive energy consumption (Qutteina*et al* 2021).

Social media influencers, defined as individuals who cultivate their own audiences on these platforms, significantly affect the attitudes and behaviors of their followers (Gross and Wangenheim 2018, Freberg *et al* 2011). Often referred to as "cyber celebrities," these influencers gain fame through sharing personal narratives, similar to traditional celebrities and leverage their social influence to promote branded products (De Veirman *et al* 2017, Chatterjee 2011). Their promotional strategies can range from subtle integrations of branded content to more explicit calls for followers to engage with their posts (Abidin, 2016). Research indicates that such marketing can notably impact food preferences; for instance, exposure to influencers promoting unhealthy snacks has been linked to increased consumption of non-core foods and preferences for branded over non-branded options among preado-lescents (Coates *et al* 2019b, Coates *et al* 2019c). Thus, food marketing by social media influencers plays a significant role in shaping dietary choices and behaviors.

Adolescents are heavily influenced by food-related posts from peers and influencers on social media, which often highlight non-core foods, such as soft drinks and fast food. This exposure shapes their perceptions of food norms, leading them to believe that overconsumption of non-core foods is typical, while underestimating the popularity of healthier options. This misperception is concerning, as food norm perceptions significantly affect eating behaviors. The constant portrayal of non-core foods may create a feedback loop where adolescents internalize these norms, increasing their consumption of unhealthy foods. Thus, social media not only reflects but also reinforces eating behaviors, making it crucial to understand how these online food messages impact adolescents' food choices (Qutteina*et al* 2021).

Punjab is an economically successful state with a high per capita income. Punjab has always been known for its delectable cuisine and adolescents in particular have exceptional taste preferences. Because of industrialization, urbanization and increased spending power in this century, lifestyle and eating habits have altered. Adolescence is seen as a crucial period for establishing dietary habits since it affects the likelihood of developing a variety of ailments later in life. Foods that provide enough energy and nutrients to sustain physical health, cognitive development and social growth are the foundation of children's and teenagers health. The consumption of a balanced diet is essential for children's growth and development and is also responsible for preventing non-communicable diseases. During this time, family plays a crucial role.

In light of these ambiguities, it is crucial to appreciate and incorporate the body of research that can analyze the positive or negative use of online social networking as a component intervention to promote health in order to strengthen future research and practices. The purpose of the present research study is to look into how adolescent girls use social media in terms of food information in relation to nutritional status of rural and urban girls, particularly belonging to Punjab.

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II. Material and Methods

The purpose of the present study was to investigate Influence of Social Media Usage on Food Choices and Nutritional Status of School Going Adolescent Girls Residing in Punjab. This research encompassed investigations from the selected district city will be considered as urban sample whereas the samples from the selected villages will constitute rural sample and further categorized into users and non-users of social media, employing the methodologies outlined below:

a) Location/place of Work

In order to identify social media users and non-users, the research was carried out in the private and government schools of urban and rural areas of Punjab.

b) Selection of Subjects

A total sample of 520 girls in the age group of 16-18 years was selected from private and government schools of Punjab. There were a total of 23 districts in Punjab, with the Malwa region occupying the largest part of the state, comprising 15 districts. The remaining districts were located in the Majha and Doaba regions, with an equal number in each. For this study, districts from each region were selected using a proportionate sampling technique, applying a 1:1:3 ratio. Thus, two districts each from Majha and Doaba and six districts from the Malwa region were selected to ensure coverage of the entire state. In the chosen villages and district cities, government and private schools were selected for the subject sample. The samples from the selected district cities were considered urban, while those from the selected villages constituted the rural sample. The subjects were divided into the following groups, with an equal number of subjects in each:

Control: Subjects who used social media for 1-1.5 hours were categorized as non-users or classified according to the data obtained from the subjects.

Experimental: Subjects who used social media for more than 1-1.5 hours were categorized as users.

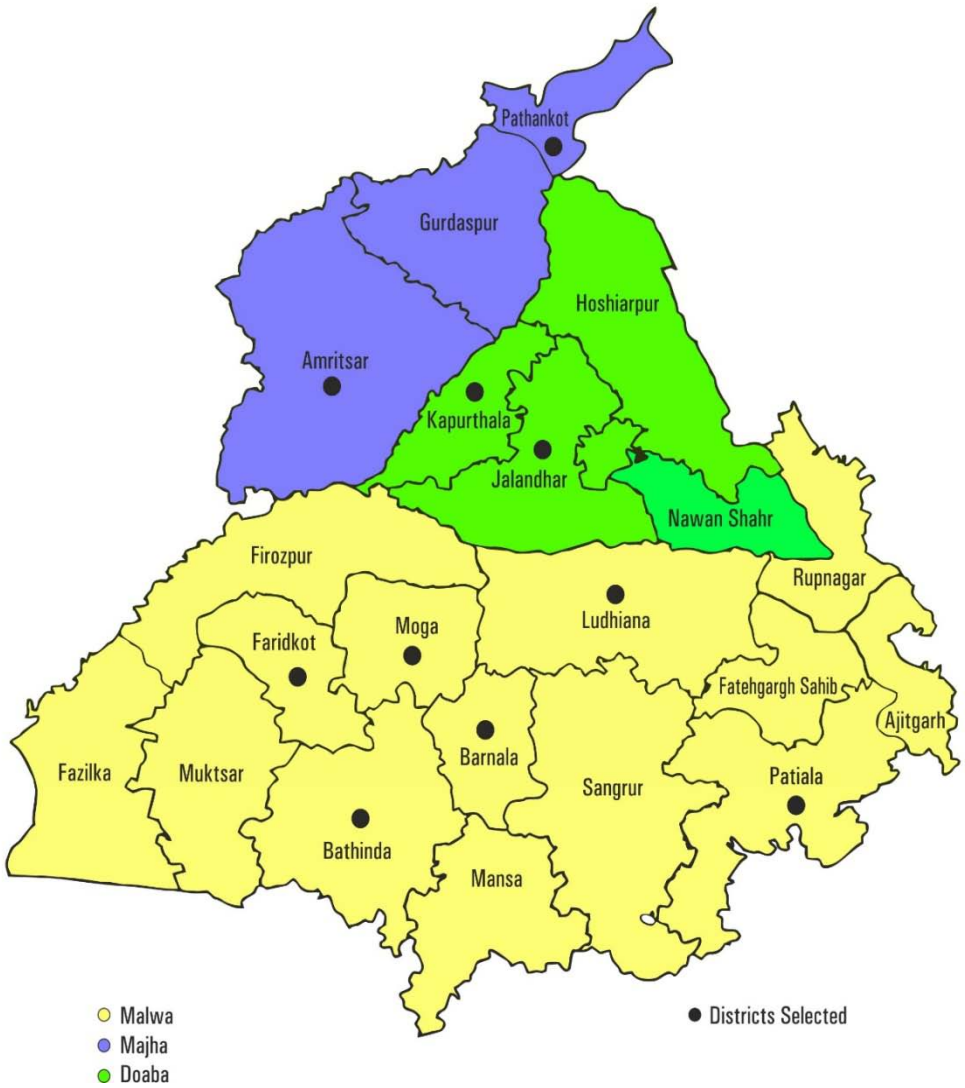


Figure 3.1: Areas of Three Regions of Punjab

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c) *Drafting a Questionnaire*

The questionnaire was thoughtfully created to gather comprehensive information from the chosen participants in a systematic way. A wide range of information was covered in the survey, such as age, caste, family type, income and dietary habits assessed through a structured dietary survey, 24-hour recall technique was applied and questions about food and nutrient intake, anthropometric measurements, body composition and social media platform use were asked.

d) *Data Collected from 520 Subjects*

A well-constructed and pretested interview schedule was used to look into a number of topics related to the study's goals throughout the data gathering phase. The interview schedule included inquiries regarding topics like socio-economic and demographic profile, the influence of social media on food information, dietary habits, physical activity, anthropometric parameters and body composition.

i. *Socio-Economic and Demographic Profile*

The information related to the subject's age, caste, type of family, family composition, educational and occupational status of parents and total monthly income of the family were collected using pretested interview schedule. The per capita monthly income of the individual family members was calculated by dividing the total income of the family by the number of members. Modified Kuppuswamy's socio economic status scale was used to know the socio economic class of the subjects. Education, occupation and per capita income were considered to socio-economic status (Wani 2019).

Table 3.1: Modified Kuppuswamy's Socio Economic Status Scale

Socio-Economic Class	Total Score
Upper Class	26-29
Upper Middle	16-25
Lower Middle	11-15
Upper Lower	5-10
Lower	Below 5

ii. *Influence of Social Media on Food Information*

The data pertaining to the type of social media platform used, duration of usage, frequency of usage, purpose and attributes given importance, as well as the food brands and type of food influencer followed by the subjects was recorded.

iii. *Dietary Information*

a. *Dietary Pattern*

A general dietary assessment include dietary habits, meal frequency and the consumption of water, beverages, green leafy vegetables, fruits and meat products.

The frequency of common food items, especially those popular among children, was recorded.

b. *Food Intake*

Data on the dietary intake of adolescents was collected using the 24-hour recall method over three consecutive days, including one Sunday or holiday. Days selected were not fasting or feasting days to ensure typical dietary patterns.

Standardized cups, glasses and spoons, which had been previously calibrated, were used as aids to assist participants in recalling the quantities of food consumed during the 24-hour period prior to the investigation.

c. *Nutrient Intake*

The daily nutrient intake was determined using DIETCAL software (Kaur, 2017), and the results were compared with the recommended dietary allowances to evaluate nutrient adequacy.

d. *Nutrient Adequacy Ratio (NAR)*

The average amount of each food ingested by each subject over the course of three days was entered into the software, and the software then estimated the subject's nutritional intake and compared it to the RDA (ICMR 2020).

NAR % = (Intake of nutrient/Recommended intake of nutrient)* 100

Table 3.2: Categorization of Nutrient adequacy ratio (NAR%) using a classification given by (Rani and Rani 2016)

Adequate	100% and above
Marginally adequate	75% and above
Marginally inadequate	50 to 74.9%
Inadequate	Below 50%

e. *Dietary Diversity Score (DDS)*

The Dietary Diversity Score (DDS) was measured by categorizing the food items consumed in a day into 14 groups. The participants were categorized into three classes according to their scores, using the classification given by Nithya and Bhavani (2018).

Table 3.3: Categorization of Dietary Diversity Score (DDS) using a Classification given by Classification by Nithya and Bhavani (2018)

Low Dietary Diversity	DDS of 1-4
Moderate Dietary Diversity	DDS of 5-9
High Dietary Diversity	DDS of 10-14

f. *Height and Weight*

For height measurement, a stadiometer or measuring tape was used. The measuring area was ensured to be flat and well-lit and participants were asked to remove shoes and hats. They stood straight against the measuring device, making sure their heels, buttocks, shoulders and heads were in contact with the surface. Participants looked straight ahead, with their eyes level to the horizon, while the horizontal headpiece of the stadiometer was gently lowered onto their heads.

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The height was recorded in centimeters, accurate to the nearest 0.1 cm.

For weight measurement, a calibrated weighing scale was utilized. The scale was placed on a flat, hard surface to ensure accuracy and it was zeroed before use. Participants were asked to remove shoes and heavy clothing and to stand still in the center of the scale, with feet evenly spaced. The weight was recorded in kilograms, accurate to the nearest 0.1 kg. All measurements were taken under consistent conditions to effectively assess growth and nutritional status, following the guidelines established by Jelliffe.

g. *Waist and Hip Circumference*

The waist and hip circumferences were measured using a non-stretchable measuring tape. The participant was instructed to stand upright with their feet together and arms relaxed at their sides, wearing light clothing. For the waist circumference measurement, the midpoint between the lower rib and the top of the hip bone (iliac crest) was located. The measuring tape was wrapped around the waist at this midpoint, ensuring it was parallel to the ground and snug but not compressing the skin. The participant was asked to breathe normally, and the waist circumference was recorded at the end of a normal expiration in centimeters.

For the hip circumference measurement, the widest part of the hips or buttocks was identified. The measuring tape was then wrapped around this area, ensuring it remained parallel to the ground. The hip circumference was also recorded in centimeters. Both measurements were accurately documented for further analysis, aiding in the assessment of body fat distribution and the associated risk of noncommunicable diseases.

Table 3.4: Waist and Hip Circumference Classification as Outlined by the WHO (2008)

Classification	Waist Circumference (Inches)	Hip Circumference (Inches)
Normal	Women: < 31.5	Women: < 34.5
Increased Risk	Women: 31.5 - 34.5	Women: 34.5 - 37
High Risk	Women: > 34.5	Women: > 37

h. *Body Mass Index (BMI)*

Using the following formulas, BMI was computed from weight and height records (WHO, 2004):

$$\text{Body Mass Index (BMI)} = \frac{\text{Weight (kg)}}{(\text{Height})\ (\text{m}^2)}$$

Asian-Pacific BMI Classification

BMI Category	BMI Range (kg/m²)
Underweight	< 18.50
Normal range	18.5 - 22.99
Overweight	23- 24.99
Pre-obese	25- 29.99
Obese	>30.0
Grade I	30-40
Grade II	40.1-50
Grade III	>50

i. *Waist to Hip Ratio (WHR)*

A continuous tension tape was used to measure the circumference of the waist and hip in centimeters. Measurements were taken after wrapping the tape around the hip. The waist-hip ratio (WHO 2008) was calculated. Additionally, the waist to hip ratio was computed by entering the appropriate values into the procedure below.

$$\text{Waist Hip Ratio} = \frac{\text{Hip circumference}}{\text{Waist circumference}}$$

According to WHO, abdominal obesity is indicated by a waist-hip ratio more than 0.85 for women (WHO2008).

j. *Waist to Height Ratio*

This helped in assessing health risks related to central obesity

$$\text{WHtR} = \frac{\text{Waist circumference}}{\text{Height}}$$

Table 3.5: Categorization of Waist to Height Ratio (Ashwell and Hsieh 2005)

WHtR	Risk
< 0.40	Low (Underweight)
0.40 - 0.49	Healthy (Low Risk)
0.50 - 0.59	Increased Risk
≥ 0.60	High Risk (Obesity)

The health risks related to obesity affected both men and women, but evidence suggested that women faced greater health risks due to obesity compared to men in some areas. However, the distribution and type of health risks varied by gender due to biological, hormonal and behavioral differences (WHO 2004).

e) Statistical Analysis

A variety of statistical analyses were performed on the data to ascertain various parameters.

- Calculating certain descriptive statistical metrics for every research variable, including the mean, standard deviation and percentage distribution.
- An independent t-test was applied to test the difference between parameters.
- Pearson's correlation coefficient is evaluated with respect to other variables.

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III. Results

a) Socio-Demographic Profile of Participants

The study sample (Table 4.1) included adolescent girls from rural and urban areas, predominantly aged between 16 and 18. The 16–17-year-old age group had a higher percentage in rural areas (87.69%) compared to urban areas (86.93%), while 18-year-olds constituted a small proportion across both groups. A majority of participants in rural areas were Sikh (72.31%), with a slightly higher prevalence than in urban areas (60.77%). Hindu participants formed 25.77% of the rural and 37.69% of the urban sample. Minority religious groups included Muslims (1.54% in rural, 0.77% in urban) and Christians (0.38% in rural, 0.77% in urban). Participants' caste affiliations varied, with the scheduled caste comprising 58.85% of rural participants and 29.62% of urban participants. The general caste was more prevalent in urban areas (44.61%) compared to rural areas (20.77%). Other caste groups included the backward class (4.62% rural, 11.54% urban) and other backward classes (15.77% rural, 14.23% urban). Nuclear families were more common, with 70.38% in rural and 64.62% in urban areas. Joint family structures were also present but less predominant, representing 29.62% of rural and 35.38% of urban participants.

Most participants came from medium-sized families (5 to 8 members), accounting for 59.23% in rural and 54.23% in urban areas. Large families (more than 8 members) were less common, while small families (less than 4 members) were represented by 27.31% in rural and 26.54% in urban areas.

Income distribution showed that most families earned between 2.5 to 5 lakhs annually, with 48.56% of rural and 43.85% of urban participants falling into this income bracket. A smaller percentage reported incomes over 5 lakhs, and only a minimal proportion of families earned above 10 lakhs. The majority of participants were from the lower-middle and upper-lower socioeconomic classes.

b) Medical Background of Adolescent Participants

Among the adolescent girls surveyed (Table 4.2), the prevalence of major health disorders such as diabetes was absent in both rural and urban groups, with all participants reported as non-diabetic. A small percentage reported hypertension, with 1.53% of rural and 0.38% of urban participants diagnosed with the condition. Depression was identified in only one participant (0.38%) in rural areas, reflecting a low incidence across the sample. Allergic reactions were reported more frequently in urban participants, where 7.30% reported allergies, compared to 2.69% in rural areas. The majority of participants across both locations did not report any allergies. Medical check-up attendance showed significant variation; 42.31% of rural and 48.08% of urban participants had undergone recent check-ups. However, a larger portion, especially in rural areas (57.69%), did not attend regular medical evaluations. Medication usage was relatively low among participants, with only 5.77% in rural and 6.15% in urban areas actively using prescribed medications. Among these, the types of medication varied, with some use of homeopathic (3.07% rural, 1.54% urban), Ayurvedic (1.54% urban only) and allopathic medications (2.69% rural, 3.08% urban). The usage of corrective eyewear, such as spectacles during device usage, was more common among urban participants (29.62%) compared to those in rural areas (15.77%). These findings provide a comprehensive insight into the medical background of adolescent girls in rural and urban settings, highlighting both health conditions and medical practices across different demographic groups.

c) Menarche Status of Adolescent Participants

The distribution of menarche age among adolescent participants varied, with the majority experiencing menarche between ages 12 and 14 (Table 4.3). Specifically, 31.15% of rural and 34.62% of urban participants reported menarche at age 13, making it the most common age of onset. Menarche at age 12 was also prevalent, with 27.31% in rural and 21.92% in urban areas, followed by age 14 (25% rural, 24.23% urban). Fewer participants reported menarche at ages younger than 11 or older than 15, indicating that the majority reached menarche during early adolescence. Menstrual cycle regularity differed slightly between groups. In rural areas, 75.38% reported regular cycles, compared to 69.23% in urban settings. Irregular cycles were reported by 24.62% of rural and 30.77% of urban participants. Experiences of menstrual pain were common, with variations in pain timing. Pre-menstrual pain affected 47.69% of rural and 45.77% of urban participants, while pain throughout the menstrual period was reported by 42.31% in rural and 46.15% in urban areas. Post-menstrual pain was less frequent but present in 5.77% of rural and 6.54% of urban participants, while only 4.23% of rural and 1.54% of urban participants reported no menstrual pain. A notable portion of participants used medication to manage menstrual discomfort, with 10% of rural and 13.08% of urban participants taking pain relief medications. The remaining participants did not rely on medication for pain management. The volume of menstrual flow was predominantly reported as normal by both rural (85.77%) and urban (82.31%) participants. Heavy flow was less common, observed in 12.69% of rural and 13.46% of urban participants, while low flow was less (1.54% rural, 4.23% urban). These findings provide insight into the menstrual health of adolescent girls, highlighting common ages of menarche onset, regularity patterns, pain experiences and variations in menstrual flow across rural and urban populations.

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d) Influence of Social Media on Food Information

Table 4.4 provides a detailed analysis of social media (SM) usage patterns among adolescent participants, revealing significant behavioral differences between SM users and non-users.

Table 4.4: Parameters of Social Media (SM) usage among Respondents

Statements	User (n=260)	Non user (n=260)	Total (n=520)
Personal Mobile Phone or any other Device			
1. Yes	161(61.92)	126(48.46)	287
2. No	99(38.07)	134(51.53)	233
Keep a Check on Screen Time while using SM			
1. Yes	143(55)	155(59.61)	298
2. No	117(45)	105(40.38)	222
Frequency of Visiting SNS			
1. Everyday	260(100)	212(81.53)	472
2. Twice a day	-	-	-
3. Thrice a day	-	48(18.46)	48
Purpose of SM use			
1. Keeping in touch with friends & family	68(26.15)	74(28.46)	142
2. Just for fun	8(3.08)	10(3.84)	213
3. For health purpose	122(46.92)	91(35)	18
4. For updating yourself	62(23.84)	85(32.69)	147
Sites Attracted the Most			
1. Facebook	-	14(5.38)	14
2. Instagram	137(52.69)	92(35.38)	246
3. Youtube	79(30.38)	109(41.92)	171
4. Snapchat	31(11.92)	18(6.92)	49
5. Whatsapp	13(5)	27 (10.38)	40
Satisfaction from SM apps			
1. Highly satisfied	31(11.92)	63(24.23)	94
2. Satisfied	207(79.61)	187(71.92)	394
3. Dissatisfied	14(5.38)	7(2.69)	21
4. Highly dissatisfied	8(3.07)	3(1.15)	11
Time Spent on SNS			
1. <1.5	-	260(100)	260
2. 1.5-3	122(46.92)	-	122
3. 3-6	98(37.69)	-	98
4. ≥6	40(15.38)	-	40
Emotions Experienced while using SNS			
1. Rejection	5(1.92)	1(0.38)	6
2. Happiness	132(50.77)	80(30.77)	212
3. Boost Self Esteem	27(10.38)	39(15)	66
4. Jealousy	5(1.92)	-	5
5. Motivation/Inspiration	81(31.15)	135(51.92)	216
6. Fear Of Missing Out	9(3.47)	3(1.15)	12
7. Lower Self Esteem	1(0.38)	2(0.77)	3
SM used for Learning and Attract to People towards Healthy Behavior			
1. Yes	213(81.92)	239(91.92)	452
2. No	47(18.07)	21(8.07)	68
Access of Devices			
1. Mobile	250(96.15)	23(8.84)	273
2. Laptop	3(1.15)	-	3
3. Computer	5(1.92)	160(61.53)	165
4. Tablet	2(0.77)	77(29.61)	79
Mostly used Device			
1. Mobile	248(95.38)	27(10.38)	275
2. Laptop	4(1.53)	-	4
3. Computer	4(1.53)	153(58.84)	157
4. Tablet	4(1.53)	80(30.77)	84
SM Effected your Nutritional and Health Status			
1. Yes	159(61.15)	116(44.61)	275

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2. No	101(38.84)	144(55.38)	245
Use SM for Practical Nutrition Purposes, Including Recipes			
1. Yes	220(84.61)	184(70.77)	404
2. No	40(15.38)	76(29.23)	116
SM platforms used to access nutrition information			
1. Youtube	178(68.46)	210(80.77)	388
2. Instagram	78(30)	48(18.46)	126
3. Facebook	3(1.15)	-	3
4. Telegram	1(0.38)	2(0.77)	3
Follow any Fitness or Health Professional/Influencer Online			
1. Yes	154(59.23)	119(45.77)	273
2. No	106(40.77)	141(54.23)	247
Nutrition Information Gained from SM is Reliable in the Real World			
1. Yes	128(49.23)	108(41.53)	236
2. No	132(50.77)	152(58.46)	284
Influencers have the Power to Influence others by their Lifestyle, Behavior etc			
1. Yes	222(85.38)	176(67.69)	398
2. No	38(14.61)	84(32.30)	122
Consume/Purchase Food Brand Promoted by an Influencer			
1. Yes	42(16.15)	27(10.38)	69
2. No	218(83.85)	233(89.61)	451
Type of Influencer Followed			
1. Fashion	148(56.92)	121(46.53)	269
2. Gaming	12(4.61)	36(13.85)	48
3. Food	100(38.46)	103(39.61)	203
Interested in Joining Online Nutrition Camps through Any Social Networking Site			
1. Yes	96(36.92)	66(25.38)	162
2. No	164(63.07)	194(74.61)	358
Diet in Order to Change your Body Image Like your Favourite SM Personality			
1. Yes	91(35)	68(26.15)	159
2. No	169(65)	192(73.85)	361
Networking Sites Helped you Out in Gaining and Losing Weight			
1. Yes	96(36.92)	76(29.23)	172
2. No	164(63.08)	184(70.77)	348
Making use of these Apps have Altered Sleeping and Eating Pattern			
1. Yes	143(55)	125(48.08)	268
2. No	117(45)	135(51.92)	252
Qualities Leading to Follow an Influencer			
1. Professional/qualified	92(35.38)	103(39.61)	191
2. Funny/interactive	88(33.85)	84(32.30)	176
3. Evidence based/talented	17(6.53)	24(9.23)	41
4. Regular posting	16(6.15)	11(4.23)	27
5. Body image positivity	15(5.77)	8(3.07)	23
6. Shares personal experiences	32(12.30)	30(11.53)	62
Recipe and Food Purchasing Decision Changes After using SM			
1. Yes	174(66.92)	150(57.69)	324
2. No	86(33.07)	110(42.30)	196
How useful is SM for Learning			
1. Not useful	11(4.23)	-	11
2. Somewhat useful	96(36.92)	90(34.61)	186
3. Very useful	153(58.84)	170(65.38)	323
Search Content Related to Dieting, Fitness and Health			
1. Yes	93(35.77)	97(37.31)	190
2. No	41(15.77)	56(21.54)	97
3. Read only when it appears	126(48.46)	107(41.15)	233
Type of Content Like to See on SM			
1. Fitness	53(20.38)	61(23.46)	114
2. Nutrition	25(9.61)	10(3.85)	35
3. Health and lifestyle	182(70)	189(72.69)	371

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Tried a Diet Promoted by an Social Media Influencer			
1. Very frequently	27(10.38)	13(5)	40
2. Frequently	39(15)	25(9.61)	64
3. Occasionally	25(9.61)	19(7.31)	44
4. Rarely	71(27.31)	89(34.23)	160
5. Never	98(37.69)	114(43.85)	212
SM Helped in Providing Nutritional knowledge			
1. Yes	149(57.30)	112(43.07)	261
2. No	111(42.69)	148(56.92)	259
SM Platforms used to Access Nutrition Information			
1. Youtube	192(73.84)	228(87.69)	42
2. Instagram	65(25)	30(11.54)	95
3. Facebook	2(0.77)	-	2
4. Telegram	1(0.38)	2(0.77)	3
SM Leads to Opt more of			
1. Healthy foods	128(49.23)	163(62.69)	291
2. Junk foods	132(50.77)	97(37.31)	229
Make use of Any Health-App to Stay Healthy			
1. Yes	66(25.38)	53(20.38)	119
2. No	194(74.62)	207(79.62)	401
Heard about Different Types of Diets among the Options			
1. Mediterranean diet	19(7.31)	17(6.54)	39
2. Intermittent fasting	11(4.23)	2(0.77)	13
3. Vegan diet	45(17.31)	23(8.85)	68
4. Low carb diet	21(8.08)	7(2.69)	28
5. Ketogenic diet	3(1.15)	12(4.62)	15
6. None of the above	161(61.92)	199(76.54)	360
Change in Existing Diet and Physical Activity Patterns After using SM Platforms			
1. Yes	73(28.08)	62(23.85)	135
2. No	187(71.92)	198(76.15)	385
Like to Entertain the Nutritional Advice			
1. SM influencers	121(46.54)	91(35)	212
2. Qualified expert	139(53.46)	169(65)	308
Prefer while Choosing Food			
1. Taste of food	185(71.15)	188(72.31)	373
2. Nutrition content	52(20)	56(21.53)	108
3. Colour of food	5(1.92)	5(1.92)	10
4. Aroma of food	18(6.92)	11(4.23)	29
Prefer the Most			
1. Ordering online	82(31.54)	63(24.23)	145
2. Visiting store	178(68.46)	197(75.77)	375
Sleeping Hours			
1. 4-6 hours	71(27.31)	121(46.54)	192
2. 6-8 hours	144(55.38)	122(46.92)	266
3. More than 8 hour	45(17.31)	17(6.54)	62
Posts on SM Leads to Cravings			
1. Yes	187(71.92)	162(62.31)	349
2. No	73(28.08)	98(37.69)	171
Usage of SM Affected your Food Consumption			
1. Yes	114(43.85)	78(30)	192
2. No	146(56.15)	182(70)	328
Use SM to Receive Information about Healthy Eating			
1. Yes	162(62.31)	179(68.85)	341
2. No	98(37.69)	81(31.15)	179
Check out the Nutritional Quality of Food Product before Consuming			
1. Yes	159(61.15)	196(75.38)	355
2. No	101(38.85)	64(24.62)	165
Make Food Choices According the Healthiness of Food			
1. Yes	130(50)	162(62.31)	292

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2. No	130(50)	98(37.69)	228
Utilize SM while Making Decisions in Regards to the Food you Eat at Restaurants			
1. Yes	68(26.15)	62(23.85)	130
2. No	192(73.85)	198(76.15)	390
Skip Meals While using SM Platforms			
1. Yes	98(37.69)	74(28.46)	172
2. No	162(62.31)	186(71.54)	348
More Prone to Eating While using SM Platforms			
1. Yes	135(51.92)	92(35.38)	227
2. No	125(48.07)	168(64.62)	293
Ever Shared Information or Advice Related to Nutrition with Friends and Family			
1. Yes	167(64.23)	164(63.07)	331
2. No	93(35.77)	96(36.92)	189
Skip any Outdoor Activity to Watch SM			
1. Yes	118(45.38)	102(39.23)	220
2. No	142(54.62)	158(60.77)	300
SNS Affected Mental Health and Overall Wellbeing			
1. Yes	151(58.08)	148(56.92)	299
2. No	109(41.92)	112(43.08)	221

Figures in parenthesis indicate percentages
SM (Social Media)
SNS (Social Networking Sites)

e) Dietary Information

i. *Dietary Pattern*

The study evaluated food preferences and dietary behaviors among rural and urban populations, each consisting of 260 participants divided equally into users and non-users (n=130 in each group). In terms of food habits, 51.92% of the total sample (n=270) identified as vegetarians, with rural users (59.23%) having the highest proportion, followed by urban non-users (55.38%). Non-vegetarians accounted for 30.77% (n=160) of the participants, with similar proportions across all subgroups. Ova-vegetarians, making up 17.31% (n=90) of the sample, were most common among rural non-users (24.62%).

Regarding meal frequency, the majority of respondents (71.15%, n=370) reported consuming three meals per day, with urban non-users (91.54%) being the most consistent in this pattern. A smaller group (19.23%, n=100) reported having four meals daily, particularly among rural users (27.69%). Only 9.62% (n=50) reported eating two meals, mostly rural users (26.15%).

Water intake varied across the sample, with 47% (n=244) consuming 4–6 glasses daily and 37.88% (n=197) reporting drinking more than six glasses, with non-users generally exhibiting higher water consumption. A small percentage (15.19%, n=79) drank less than four glasses of water, more notably among rural users (24.62%). Snacking behavior was prevalent, with 92.12% (n=479) of participants reporting a preference for snacking or munching. This behavior was especially prominent among rural users (96.15%) and urban users (94.62%), indicating that both populations strongly favored between-meal snacks.

ii. *Food Intake*

1. *Cereals and Millets*

Rural participants showed slightly higher cereal and millet intake overall, with users averaging 137.88 ± 47.82 grams compared to non-users at 129.47 ± 38.83 grams. Interestingly, urban non-users reported consuming more (131.19 ± 39.86 grams) than users (125.60 ± 54.30 grams). These differences, however, were statistically non-significant, suggesting that cereal consumption was fairly consistent across both settings, possibly reflecting the staple nature of these foods in both rural and urban diets. Vegetarian as well as non-vegetarian dietary pattern of Indians include consumption of cereals as staple and rice remains priority.

2. *Pulses and Legumes*

Consumption of pulses and legumes varied slightly. In rural areas, non-users reported a higher intake (75.25 ± 47.27 grams) than users (67.45 ± 51.84 grams). Similarly, in urban settings, non-users consumed more (70.75 ± 51.98 grams) than users (60.11 ± 37.03 grams). While pulses are excellent, inexpensive sources of protein, the non-significant differences suggest that both users and non-users, irrespective of setting, access these foods to meet their nutritional needs.

3. *Green Leafy Vegetables (GLV)*

Green leafy vegetables (GLV) intake was generally higher in urban areas compared to rural ones. Urban users consumed 48.56 ± 19.22 grams, while non-users averaged 45.45 ± 16.21 grams. Conversely, rural participants reported a lower intake, with users consuming 42.05 ± 15.97 grams and non-users 44.22 ± 12.10 grams. The lack of significant differences indicates that GLV consumption is maintained at

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comparable levels across all groups, though slightly elevated among urban participants, possibly due to better availability or awareness.

4. *Other Vegetables*

The intake of other vegetables also varied between groups. Rural users consumed an average of 105.90 ± 63.21 grams, slightly more than non-users at 94.91 ± 59.59 grams. In urban areas, however, non-users reported slightly higher consumption (93.47 ± 34.41 grams) compared to users (87.70 ± 57.39 grams). Despite these minor variations, the differences remained non-significant, suggesting that both rural and urban populations, regardless of social media usage, incorporate a similar amount of vegetables into their diet.

5. *Fruits*

Fruit consumption displayed a significant difference in rural settings ($p < 0.05$). Rural non-users consumed more (92.67 ± 58.24 grams) than users (61.97 ± 30.85 grams). This may indicate that rural non-users rely more heavily on fruits as a part of their regular diet. However, in urban areas, no significant difference was observed, with users consuming 47.84 ± 33.30 grams and non-users 44.47 ± 25.26 grams. The discrepancy in rural fruit intake might reflect lifestyle or economic differences between users and non-users.

Table 4.7: Food Intake of the Selected Subjects

Food groups	SDI (g)#	Rural (n=260)			Urban (n=260)		
		User (n=130)	Non user (n=130)	t test (p value)	User (n=130)	Non user (n=130)	t test (p value)
Cereals and millets	315	137.88±47.82	129.47±38.83	1.556(0.120) NS	125.60±54.30	131.19±39.86	0.947(0.344)NS
Pulses and legumes	105	67.45±51.84	75.25±47.27	1.264(0.207)NS	60.11±37.03	70.75±51.98	1.900(0.058)NS
GLV	100	42.05±15.97	44.22±12.10	1.234(0.218)NS	48.56±19.22	45.45±16.21	1.410(0.159)NS
Other vegetables	200	105.90±63.21	94.918±59.59	1.441(0.150)NS	87.70±57.39	93.47±34.41	0.983(0.326)NS
Fruits	150	61.97±30.85	92.67±58.24	4.083(0.000)*	47.84±33.30	44.47±25.26	0.550(0.583)NS
Roots and tubers	100	53.93±39.02	60.71±50.10	1.217(0.224)NS	49.69±26.83	54.66±37.84	1.409(0.165)NS
Milk and milk products	400	341.60±135.8	337.05±140.8	0.264(0.791)NS	327.55±129.8	326.58±160.9	0.053(0.957)NS
Edible oils and fats	40	30.19±6.92	21.93±8.67	8.455(0.000)*	21.34±10.24	16.13±11.39	3.872(0.000)*

#Suggested dietary intake
Values indicates Mean and Standard Deviation
**Values are significant at 1% level*
***Values are significant at 5% level*
NSValues are Non-Significant

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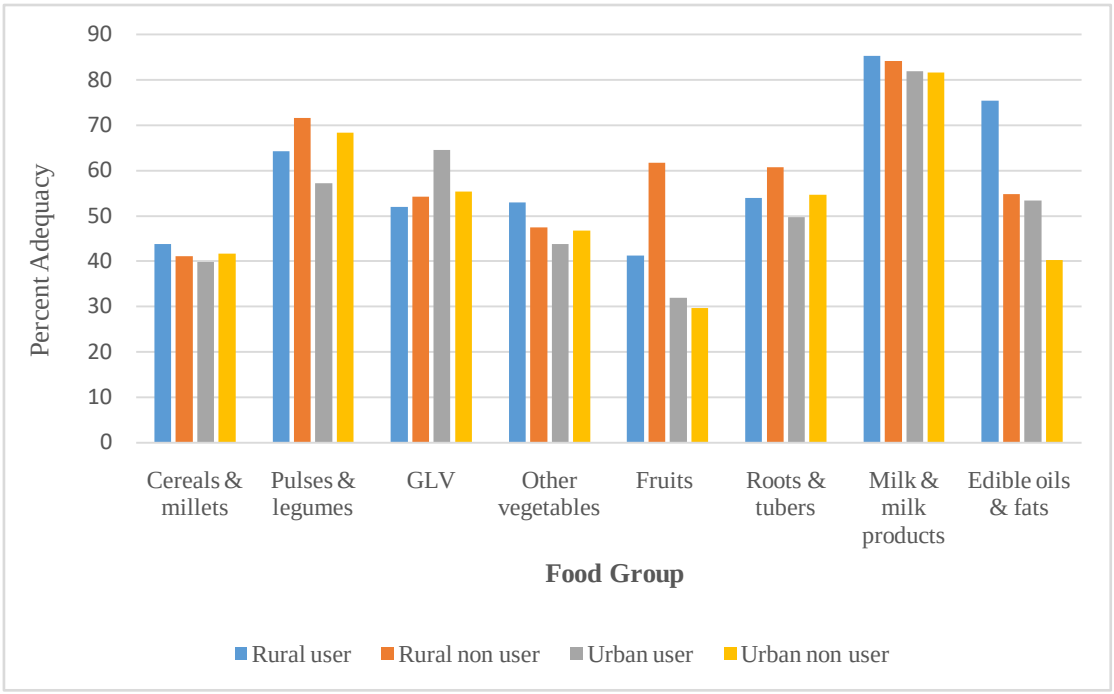


Fig. 4.1: Nutrient Adequacy Ratio of Food Groups among Rural user and Non-User Group and Urban User and Non-User Groups

6. *Roots and Tubers*

Rural users reported a slightly lower intake of roots and tubers (53.93 ± 39.02 grams) compared to non-users (60.71 ± 50.10 grams). Similarly, in urban areas, users consumed 49.69 ± 26.83 grams, slightly less than non-users (54.66 ± 37.84 grams). These differences were not statistically significant, indicating that roots and tubers are consumed consistently across different groups.

7. *Milk and Milk Products*

The intake of milk and milk products was relatively high across all groups, with rural users consuming 341.60 ± 135.8 grams and non-users reporting 337.05 ± 140.8 grams. In urban areas, users reported a similar intake (327.55 ± 129.8 grams) compared to non-users (326.58 ± 160.9 grams). The lack of significant differences suggests that milk is an essential dietary component for both users and non-users, regardless of their geographical location.

8. *Edible Oils and Fats*

Significant differences in edible oils and fats consumption were observed in both rural and urban areas ($p < 0.05$). Rural users consumed significantly more (30.19 ± 6.92 grams) compared to non-users (21.93 ± 8.67 grams). Similarly, in urban areas, users reported a higher intake (21.34 ± 10.24 grams) than non-users (16.13 ± 11.39 grams). These findings suggest that social media users may be more inclined to consume higher amounts of fats, potentially influenced by trends in cooking practices or the promotion of specific diets online.

iii. *Nutrient Intake*

1. *Energy*

Both rural and urban populations reported average energy intakes below the recommended 2500 kcal per day. Rural users exhibited a mean energy intake of 2083 kcal, compared to 1920.62 kcal in rural non-users, while urban users and non-users reported 1863.55 kcal and 1714.8 kcal, respectively. Despite these differences, no statistical significance was observed ($p > 0.05$).

2. *Protein*

Protein intake also remained below the RDA of 46g for all groups. Rural users consumed an average of 31.87±14.52g, while non-users reached 33.65±12.75g. In urban areas, users averaged 27.54±14.51g, with non-users at 28.11±15.44g. Again, differences between groups were not statistically significant ($p > 0.05$).

3. *Total Fat*

Rural and urban populations consumed levels of fat just under the recommended 25g, with rural users averaging 22.14g compared to 17.92g for non-users, while urban users and non-users consumed 20.34g and 16.83g, respectively. Differences were statistically signifycant in both settings ($p < 0.05$), suggesting that users generally had higher fat intakes.

4. *Total Dietary Fibre*

Dietary fiber intake showed close adherence to the 38g RDA among rural users (32.04g) and non-users (33.20g), while urban users and non-users recorded averages of 27.95g and 29.50g, respectively, with no significant difference between groups ($p > 0.05$).

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5. *Calcium*

Calcium intake fell short of the 1050mg RDA across all groups. Rural users averaged 1005.6mg, and rural non-users reported 966.52mg, while urban users and non-users had averages of 673.14mg and 714.32mg, respectively, without significant differences ($p > 0.05$).

6. *Iron*

Iron intake was markedly lower than the RDA of 32mg for both rural and urban participants. Rural users averaged 11.91±4.03mg, while non-users consumed 14.97±3.65mg, with a significant difference between these groups ($p < 0.05$). In urban areas, users and non-users reported averages of 10.85mg and 11.64mg, respectively, though this difference was not significant ($p > 0.05$).

7. *Magnesium*

With an RDA of 380mg, magnesium intake was reported as lower among all groups, with rural users consuming 288.93mg compared to 302.46mg in non-users. Urban users and non-users reported 221.29mg and 229.32mg, respectively, with no significant differences across groups ($p > 0.05$).

Table 4.8: Mean Daily Average Consumption of Different Nutrients among Selected Adolescents

Nutrients	RDA#	Rural (n=260)			Urban (n=260)		
		User (n=130)	Non user (n=130)	t test (p value)	User (n=130)	Non user (n=130)	t test (p value)
Protein (g)	46	31.87±14.52	33.65±12.75	1.047(0.295)^{NS}	27.54±14.51	28.11±15.44	0.305(0.760)^{NS}
Total fat (g)	25	22.14±7.08	17.92±6.00	5.179(0.000)*	20.34±8.97	16.83±11.73	2.706(0.007)*
Total dietary fibre (g)	38	32.04±9.18	33.20±8.28	1.069(0.285)^{NS}	27.95±8.36	29.50±9.54	1.397(0.165)^{NS}
Energy (kcal)	2500	2083±805.96	1920.62±784.4	1.563(0.119)^{NS}	1863.55±903.8	1714.8±679.9	1.499(0.135)^{NS}
Calcium (mg)	1050	1005.6±270.7	966.52±240.46	1.379(0.168)^{NS}	673.14±296.27	714.32±300.7	1.111(0.267)^{NS}
Iron (mg)	32	11.91±4.03	14.97±3.65	4.308(0.000)*	10.85±4.26	11.64±4.47	1.458(0.145)^{NS}
Magnesium (mg)	380	288.93±62.37	302.46±80.71	1.511(0.131)^{NS}	221.29±53.41	229.32±44.76	1.314(0.190)^{NS}
Zinc (mg)	14.2	8.63±5.01	8.99±4.97	0.578(0.563)^{NS}	6.37±2.59	7.06±2.81	2.059(0.040)**

#Recommended Dietary Intake

**Values are significant at 1% level*

***Values are significant at 5% level*

^{NS} Values are Non-significant

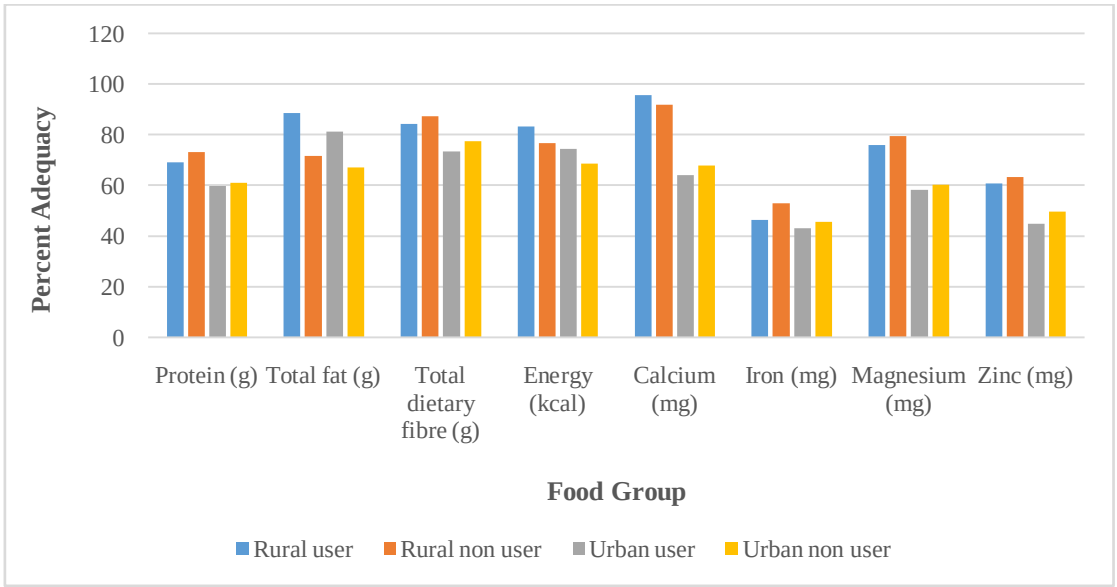


Fig. 4.2: Nutrient Adequacy Ratio of Nutrient Intake among Rural User and Non-User Group And Urban User and Non-User Groups

8. *Zinc*

Zinc consumption levels were below the RDA of 14.2mg for both rural and urban populations. Rural users consumed 8.63mg, and non-users 8.99mg, while urban users and non-users reported 6.37mg and 7.06mg, respectively. A significant difference was observed among urban participants ($p < 0.05$), indicating that non-users tend to have a higher zinc adequacy.

iv. *Dietary Diversity Score (DDS)*

The Dietary Diversity Score (DDS) among the selected rural and urban subjects revealed notable

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differences between users and non-users. Table 4.9 presents these findings, where the DDS was classified into three categories: low (1-4), moderate (5-9) and high (10-14).

Rural Users had a mean DDS of 8.94 ± 1.44, significantly higher than the Non-users (7.25 ± 1.6) with a p-value of 0.000, indicating a statistically significant difference. Urban Users presented a mean DDS of 8.76 ± 1.6, also higher than Urban Non-users (8.06 ± 1.55), with a significant p-value of 0.001.

The majority of both rural and urban subjects fell within the moderate DDS category (5-9), with73.85% of rural users and 91.53% of rural non-users in this range. A smaller but notable portion of the sample achieved a high DDS (10-14), with 26.15% of rural users and 27.7% of urban users meeting this criterion, indicating a higher dietary diversity among users in both settings.

There is a clear trend showing higher dietary diversity scores among users across both rural and urban settings, highlighting the possible influence of certain factors (e.g., socio-economic, education) on dietary choices.

Table 4.9: Dietary Diversity Score (DDS) of Selected Adolescent Girls

Dietary Diversity Score	Rural (n=260)			Urban (n=260)		
	User (n=130)	Non-user (n=130)	t test (p value)	User (n=130)	Non-user (n=130)	t test (p value)
Mean±SD	8.94±1.44	7.25±1.6	8.92(0.000)*	8.76±1.6	8.06±1.55	3.495(0.001)*
Low (1-4)	-	-		-	-	
Moderate (5-9)	96(73.85)	119(91.53)		94(72.3)	116(89.23)	
High (10-14)	34(26.15)	11(8.46)		36(27.7)	14(10.77)	

Values indicates Mean and Standard Deviation

**Values are significant at 1% level*

f) Anthropometric Measurement of the Selected Subjects

In the rural group, the height for users was recorded at 159.097 ± 7.00 cm, closely aligning with non-users at 159.139 ± 6.85 cm. The p-value (0.738) indicates no statistically significant difference. In the urban group, users had a height of 159.178 ± 6.90 cm compared to non-users at 158.754 ± 9.35 cm, also showing no significant variation (p=0.383).

Weight analysis revealed a statistically significant difference in both rural and urban populations. Rural users weighed 44.246 ± 8.943 kg compared to non-users at 47.030 ± 5.378 kg, with a p-value of 0.002. Urban users were heavier at 48.920 ± 10.08 kg, contrasting with 45.473 ± 6.503 kg for non-users, yielding a significant p-value of 0.001.

BMI showed significant differences within both groups. Rural users had a BMI of 17.620 ± 3.554 kg/m^2, whereas non-users recorded 18.769 ± 2.253 kg/m^2 (p=0.002). Urban users displayed a BMI of 19.274 ± 4.140 kg/m^2 compared to 17.897 ± 2.151 kg/m^2 in non-users, resulting in a highly significant p-value of 0.000.

The waist-to-hip ratio remained consistent, with rural users having a ratio of 0.79 ± 0.299 and non-users at 0.78 ± 0.283 (p=0.506). Urban values were similarly close, with users at 0.785 ± 0.291 and non-users at 0.783 ± 0.277 (p=0.643).

Both rural and urban groups exhibited a waist-to-height ratio of approximately 0.43. Rural users had a mean of 0.43 ± 0.061, while non-users presented 0.43 ± 0.060. Urban users maintained a ratio of 0.43 ± 0.0614, slightly lower than non-users at 0.44 ± 0.187. Neither group demonstrated significant differences in this parameter (rural p=0.101, urban p=0.571).

Table 4.13: Basic and Derived Anthropometric Parameters of the Subjects

Anthropometric parameters	Rural (n=260)		T test (p value)	Urban (n=260)		T test (p value)
	User (n=130)	Non user (n=130)		User (n=130)	Non user (n=130)	
Height (cm)	159.097±7.00	159.139±6.85	0.334(0.738)^{NS}	159.178±6.90	158.754±9.35	0.873(0.383)^{NS}
Weight (kg)	44.246±8.943	47.030±5.378	3.041(0.002)*	48.920±10.08	45.473±6.503	3.275(0.001)*
BMI (kg/m^2)	17.620±3.554	18.769±2.253	3.115(0.002)*	19.274±4.140	17.897±2.151	3.363(0.000)*
Waist to hip ratio	0.79±0.299	0.78±0.283	0.665(0.506)^{NS}	0.785±0.291	0.783±0.277	0.463(0.643)^{NS}
Waist height ratio	0.43±0.061	0.43±0.060	1.643(0.101)^{NS}	0.43±0.0614	0.44±0.187	0.567(0.571)^{NS}

Values are Mean±S.D.

Values are significant at 1 percent

^{NS} *Values are Non-significant*

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Classification of Subjects based on BMI

The nutritional status of the selected participants, measured through Body Mass Index (BMI), revealed that under nutrition was prevalent in both rural and urban areas.

Table 4.15: Nutritional Status among Selected Subjects in Reference to Body Mass Index

Selected subjects	Rural(n=260)	Urban(n=260)	Total(N=520)
Underweight(<18.50)	151(58.07)	152(58.46)	303
Normal(18.5-22.99)	95(36.53)	87(33.46)	182
Overweight(23-24.99)	12(4.61)	9(3.46)	21
Pre-obese(25-29.99)	2(0.77)	10(3.84)	12
Obese(>30)	-	-	-
Grade I (30-40)	-	2(0.77)	2

Figures in parenthesis indicate percentage

g) Correlation Coefficient

The study evaluated the relationship between dietary intake, food consumption patterns, fast food frequency and anthropometric indices in adolescents (n = 520).

1. *Dietary Intake*

Protein: Negatively correlated ($r = -0.153$, $p < 0.01$), suggesting its potential protective role in managing weight.

Total Fat and Carbohydrates: Positive correlations ($r = 0.127$ and 0.129, respectively, $p < 0.01$), indicating their contribution to weight gain.

Dietary Fiber: Showed a protective negative correlation ($r = -0.119$, $p < 0.01$).

Energy: Positive correlation ($r = 0.140$, $p < 0.01$) reinforces its association with weight increase.

Micronutrients: Magnesium showed a negative correlation ($r = -0.159$, $p < 0.01$), while calcium was not significantly related.

2. *Food Intake*

Cereal and Millets: Positive correlation ($r = 0.104$, $p < 0.01$), potentially reflecting refined grain consumption.

Other Vegetables: Negative correlation ($r = -0.176$, $p < 0.05$), suggesting protective effects.

Fruits and Pulses: No significant associations.

Edible Fats: Positive correlation ($r = 0.116$, $p < 0.01$).

3. *Frequency of fast-food consumption*

Significant positive correlations were observed for chocolates ($r = 0.182$), ice creams ($r = 0.32$), and potato chips ($r = 0.217$) ($p < 0.01$), indicating their association with weight gain. Other items like namkeen, French fries, and burgers showed moderate positive correlations.

4. *Anthropometric Parameters*

Waist-to-Hip Ratio, Waist-to-Height Ratio and BMI: No significant associations, reflecting potential limitations of these measures for assessing adolescent body composition.

Table 4.17: Relationship of Social Media usage with Various Parameters

Parameters	Total (n=520)
	Correlation coefficient 'r'
Dietary Intake	
Protein	-0.153**
Total Fat	0.127**
Total Dietary Fiber	-0.119**
Carbohydrates	0.129**
Energy	0.140**
Calcium	-0.120 NS
Magnesium	-0.159**
Food Intake	
Cereal and Millets	0.104**
Pulses and Legumes	-0.002 NS
Other Vegetables	-0.176*
Fruits	0.061 NS
Edible Fats and Oils	0.116**
Frequency Of Fast Food Consumption	
Chocolates	0.182**
Maggi	0.112**
Ice creams	0.32*
Namkeen	0.132**

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French fries	0.108**
Potato chips	0.217**
Burger	0.116**
Waist to Hip ratio	0.023 NS
Waist to Height ratio	0.010 NS
Body Mass Index	0.035NS

***Significant at 1% level (2-tailed)*

**Significant at 5% level (2-tailed)*

NS-Non-significant

IV. Discussion

The research, titled "Influence of Social Media Usage on Food Choices and Nutritional Status of School-Going Adolescent Girls Residing in Punjab," investigates the intricate relationship between social media engagement and its influence on the nutritional health of adolescent girls. Set against the backdrop of Punjab, a region with diverse socio-cultural influences, the study offers an in-depth look at the impact of social media on the daily lives and nutritional outcomes of young girls. With a substantial sample size of 520 students from government schools in both rural and urban settings, the study ensures a broad and representative perspective, capturing variations across different socioeconomic and geographic contexts.

a) Comprehensive Parameter Assessment

To capture a holistic view of social media's influence on nutritional status, the study meticulously incorporated a diverse array of parameters. These parameters extend beyond mere social media use to include broader aspects of participants' health, lifestyle, and personal background. First, general demographic information was collected, providing foundational data on age, family background, and educational context, all of which shape an adolescent's access to social media and their perspectives on nutrition. This was complemented by an in-depth exploration of social media habits, where the study examined frequency of usage, preferred platforms, and types of content consumed. By assessing how often participants engage with social media and identifying the specific types of content they gravitate towards (e.g., health tips, influencer recommendations, recipes), the study could map a direct connection between online exposure and offline food choices.

b) Analyzing Health and Dietary Patterns

To further understand the impact of social media, the study incorporated a thorough examination of the participants' medical history and dietary patterns. Recording any pre-existing health conditions provided insight into how social media may intersect with specific health vulnerabilities, such as predisposing factors for undernutrition or obesity. Dietary patterns, on the other hand, revealed the regular food habits of the participants, documenting meal frequency, types of food typically consumed, and any patterns of meal-skipping. This element of the study was essential to determine if social media influences behaviors such as snack preferences, junk food consumption, or adherence to diets promoted by online influencers. The study also explored whether participants made food choices based on social media content, including health claims from influencers or nutrition tips from popular posts.

V. Anthropometric Measurements and Menarche Status

The research utilized anthropometric measurements to establish a baseline for assessing the nutritional status of participants. Measurements such as height, weight, body mass index (BMI), and waist and hip circumference were taken in alignment with WHO (2008) classification standards. These metrics provided objective data to evaluate the physical health and growth of participants, enabling a comparative analysis between those heavily engaged with social media and those with limited or no exposure. Additionally, the inclusion of menarche status- the age at which participants experienced the onset of menstruation- offered insight into physical development and its relationship with nutritional intake, as menstruation significantly affects nutrient needs during adolescence. By considering menarche status, the study could explore whether social media's influence on body image and food choices intersected with physical and hormonal changes typical of this age group.

This structured discussion provides a multifaceted understanding of how social media intertwines with various aspects of adolescent life, highlighting both the benefits and challenges it poses to their nutritional well-being. For instance, while social media can serve as a valuable resource for health education, the influence of idealized body standards and the normalization of restrictive diets may also compromise the participants' nutritional status and overall health. The study ultimately underscores the complexity of social media's role in shaping adolescent health behaviors, especially in a culturally diverse region like Punjab, where traditional dietary practices intersect with modern digital influences.

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a) Socio-economic and Demographic Profile

The socio-demographic characteristics outlined in Table 4.1 reflect the diverse cultural, economic, and structural factors influencing adolescent health behaviors across rural and urban settings. While rural adolescents benefit from structured family environments and culturally rooted dietary practices, they often face nutritional limitations due to restricted food variety and lower income levels (Government of India, 2019; Kumar et al., 2020). Urban adolescents, although exposed to a wider range of food choices and greater autonomy, are increasingly susceptible to unhealthy dietary trends driven by convenience and modern lifestyles (Narayan et al., 2021; Gupta & Verma, 2021).

These contrasting realities emphasize the importance of designing context-specific health interventions. For rural areas, strategies should focus on enhancing awareness and access to affordable, nutrient -rich foods within culturally acceptable frameworks (Banerjee & Dey, 2018; Kumar & Kaur, 2020). Urban interventions, on the other hand, must promote mindful eating and reduce dependency on processed foods by leveraging nutrition education and family-based approaches (Sharma et al., 2020; Chaudhary et al., 2017). Tailored public health initiatives that respect socio-demographic nuances will be crucial in fostering sustainable improvements in adolescent nutrition and well-being across both rural and urban populations.

b) Medical History

The health and medical background (Table 4.2) showcases minimal prevalence of chronic health conditions such as diabetes and hypertension, which are expectedly low in an adolescent population but present notable urban-rural contrasts. Rural subjects exhibited a slightly higher rate of hypertension (1.53% rural vs. 0.38% urban). Although hypertension is generally uncommon in adolescents, those from rural areas might face stressors related to lower socio-economic status or limited healthcare access, which can increase health risks (Patel et al., 2020).

A greater portion of urban subjects reported regular medical check-ups (48.08%) compared to rural counterparts (42.31%), possibly due to urban areas' greater healthcare accessibility. Regular medical check-ups are vital for early detection of potential health issues, which may otherwise go unnoticed in rural settings where healthcare resources are limited (Sharma et al., 2019). This urban-rural discrepancy is further reflected in the slightly higher usage of medications among urban adolescents (6.15%) versus rural (5.77%).

c) Menarche Status

In conclusion, the analysis of menstrual health in Table 4.3 underscores the close interplay between age at menarche, menstrual irregularities, and nutritional status among adolescents. The observed differences between rural and urban participants in menstrual patterns and associated symptoms highlight the role of environmental, dietary, and lifestyle factors in shaping reproductive health outcomes (Raj & Sagar, 2019). The higher prevalence of dysmenorrhea and menstrual irregularities among nutritionally compromised adolescents points to a pressing need for integrated health strategies that address both nutrition and menstrual well-being.

Iron, calcium, and vitamin D deficiencies- frequently observed among those with irregular or painful cycles- should be a central focus of adolescent health interventions. Efforts to improve awareness through school-based health education, community programs, and adolescent-friendly health services can play a vital role in promoting timely menarche and reducing the burden of menstrual disorders. Incorporating culturally appropriate and practical dietary guidance into routine adolescent health promotion can help ensure that young girls are better equipped to manage their menstrual health and overall development (Raj & Sagar, 2019).

d) Dietary Information

i. *Dietary Pattern*

Urban adolescents showed a greater preference for non-vegetarian diets (31.54%) compared to rural adolescents (29.23%), likely due to better food access in urban areas (Malik et al., 2020). Most adolescents in both areas preferred three meals a day (76.15% rural, 91.54% urban), suggesting structured eating habits (Narang & Mathur, 2018). Water intake was inadequate, with 24.62% of rural adolescents drinking fewer than four glasses daily, highlighting a need for better hydration awareness (Patel et al., 2019).

ii. *Food Intake*

Cereals and millets are key to both rural and urban diets. Rural SM users consumed 43.8% of the recommended intake, slightly higher than non-users (41.1%), but these differences were not significant (FAO, 2021). Pulses were consumed more by non-users in both areas, suggesting a shift towards processed protein sources among SM users (Popkin, 2020). Urban adolescents showed slightly better intake of Green Leafy Vegetables (GLVs), possibly due to health trends on SM platforms (WHO, 2021). However, fruit consumption was notably lower among SM users in rural areas, emphasizing the need for interventions to promote fresh fruit intake (FAO, 2021). Intake of roots, tubers, milk products, and oils showed some regional differences but were not statistically significant.

iii. *Nutrient Intake*

Protein intake was lower than recommended in both rural (31.87 g) and urban (27.54 g) adolescents, with rural diets benefiting from pulses and legumes (Reddy & Kumar, 2020). Fat intake exceeded the RDA in both groups, highlighting reliance on oils and fried foods

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(Malik et al., 2020). Fiber intake was higher in rural areas (32.04 g) compared to urban (27.95 g), suggesting that rural diets, which include more whole grains, are more fiber-rich (Patel et al., 2019). Both groups had caloric deficiencies, with rural adolescents consuming 2,083 kcal and urban 1,863 kcal, potentially affecting growth and energy levels (Verma & Thomas, 2019). Calcium intake was adequate in rural areas but deficient in urban areas (Gupta et al., 2021). Iron, magnesium, and zinc intakes were below the RDA in both groups, with urban adolescents showing lower intake of these minerals (Banerjee & Dey, 2018).

iv. *Dietary Diversity Score (DDS)*

The dietary diversity score (DDS) analysis reveals notable differences in food intake and nutritional status between rural and urban adolescents. Rural adolescents consume more fruits and protein but still fall short of recommended intakes for fruits and micronutrients like iron and calcium, which increases the risk of deficiencies (Patel et al., 2019; Rao et al., 2017; Banerjee & Dey, 2018). Urban adolescents, on the other hand, consume more fats, exceeding the recommended intake, which may contribute to higher BMI and fat percentage due to processed food consumption (Malik et al., 2020; Nelson et al., 2021). Despite this, urban adolescents have higher DDS, indicating a more varied diet, with over 27.7% achieving high diversity scores compared to 26.15% in rural areas (Gupta et al., 2021).

Social media users scored higher on DDS than non-users, suggesting that social media may influence dietary diversity by exposing adolescents to new food trends and recipes (Holmberg et al., 2019). However, higher dietary diversity does not necessarily imply improved nutritional quality, as social media can also promote high-calorie, low-nutrient foods (Dunlop et al., 2016). This emphasizes the need for health education programs that guide adolescents in making nutritious choices amidst diverse food options, combining the benefits of dietary diversity with an emphasis on nutrition (Tatlow-Golden et al., 2017).

e) Anthropometric Measurements

Anthropometric measurements reveal significant differences between rural and urban adolescents. Urban adolescents have higher mean weight (48.92 kg vs. 44.25 kg) and BMI (19.27 vs. 17.62), with the BMI of rural adolescents falling below the normal threshold (Rao et al., 2017). This reflects urban access to diverse, calorically dense foods (Verma & Thomas, 2019). Rural adolescents have a higher prevalence of underweight (58.07%), linked to limited food variety and economic constraints (Reddy & Kumar, 2020; Bhattacharya et al., 2020). Although waist-to-hip ratios were not significantly different, urban adolescents had a higher ratio (0.785 vs. 0.78), suggesting a risk for central obesity due to sedentary lifestyles and high-calorie diets (Sharma et al., 2019).

The findings highlight the dual burden of malnutrition, with both underweight and overweight trends. Rural areas face undernutrition due to poor dietary intake and limited resources, while urban areas experience rising obesity linked to sedentary behaviors and energy-dense diets (Khadilkar et al., 2021; Narain et al., 2016). Interventions are needed in both settings: rural areas require improved access to nutritious food, while urban areas need initiatives promoting physical activity and reducing processed food consumption (Singh et al., 2018; Gupta et al., 2019; WHO, 2020).

f) Correlation Coefficient

This study found significant correlations between dietary intake, food patterns, and anthropometric indices in adolescents. Protein intake showed a negative correlation ($r = -0.153$, $p < 0.01$), highlighting its role in satiety and lean mass maintenance (Smith et al., 2020), while fat ($r = 0.127$) and carbohydrates ($r = 0.129$) were positively correlated with weight gain (Johnson & Smith, 2019). Fiber ($r = -0.119$) and magnesium ($r = -0.159$) had protective effects against weight gain, supporting their role in digestion and metabolism (Li et al., 2021; Kumar et al., 2018).

Vegetable consumption was negatively correlated with anthropometric indices ($r = -0.176$), emphasizing its benefits for diet quality (Li et al., 2021), while refined cereals showed a positive correlation ($r = 0.104$), suggesting over-reliance on low-fiber grains (Chatterjee et al., 2020). Fruits and pulses showed no significant correlations, likely due to inconsistent intake.

Fast-food consumption, especially chocolates ($r = 0.182$), ice creams ($r = 0.32$), and chips ($r = 0.217$), was strongly associated with higher weight measures due to high sugar and fat content (WHO, 2021). Moderate correlations were also noted for items like French fries and burgers, reinforcing global concerns about fast food's role in adolescent obesity (Brown et al., 2022). These results call for targeted nutrition education and policy-level action.

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Effect of Self-Reliant Policy on FDI in India: Case Study of Automobile Multinationals

By Diya Mittal

Abstract- South Asia shows a trend of being the most critical location for foreign investors, especially the case of India, and it is ready to liberalise its FDI regulations further to boost FDI inflows. The car industry is one of India's most significant economic development drivers and a sector with significant involvement in international value chains. The COVID-19 epidemic had a significant influence on the volume of FDI inflows. However, the Indian government's remarkable resilience led to significant policy changes and prompt decision-making that lessened the impact and allowed the industry to forge its course among India's industrial sectors. While addressing the dearth of study on "self-reliant policy 2020," which incorporates the subject of "Make in India and Make for the World" among international business experts, this dissertation seeks to improve upon current institutional theory on FDI literature.

FDI inflows in India increased as the automobile and automotive component industries expanded into electric vehicle segments. This paper examines the roles of government policy, infrastructure, and other enabling variables in that development.

Keywords: *FDI, location, government policy, emerging markets, multinational companies.*

GJMBR-G Classification: *DDC: 641.3*



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Effect of Self-Reliant Policy on FDI in India: Case Study of Automobile Multinationals

Diya Mittal

Abstract- South Asia shows a trend of being the most critical location for foreign investors, especially the case of India, and it is ready to liberalise its FDI regulations further to boost FDI inflows. The car industry is one of India's most significant economic development drivers and a sector with significant involvement in international value chains. The COVID-19 epidemic had a significant influence on the volume of FDI inflows. However, the Indian government's remarkable resilience led to significant policy changes and prompt decision-making that lessened the impact and allowed the industry to forge its course among India's industrial sectors. While addressing the dearth of study on "self-reliant policy 2020," which incorporates the subject of "Make in India and Make for the World" among international business experts, this dissertation seeks to improve upon current institutional theory on FDI literature.

FDI inflows in India increased as the automobile and automotive component industries expanded into electric vehicle segments. This paper examines the roles of government policy, infrastructure, and other enabling variables in that development. This research is accomplished by adopting a qualitative approach and a research design based on various case studies focusing on the recent FDI decisions made by multinational automakers. The results emphasise the significance of host government policy changes that impact how enterprises operate in the nation. There have been occasions where businesses have supported these reforms while others have opposed them. These many points of view have been discussed. The study examines numerous frameworks and national policies in India that support these advancements. India surpassed Japan and Germany as the third-largest auto market in the world in 2022, and demand for Indian cars is still rising domestically and abroad. Manufacturers are catching up in modernisation, digitalisation, and automation to satisfy consumers' future expectations (including those of electric cars) and stay competitive.

Keywords: FDI, location, government policy, emerging markets, multinational companies.

I. Introduction

The context, rationale, goals, research questions, and objectives of this study are provided in this chapter, along with an introduction to the subject's fundamental ideas.

a) FDI and Background

As the world is going towards a significant globalisation process leading to the advancement of technology and information, there is an increasing rise of interest shown by nations in capturing foreign investment in the form of FDI (Borowicz, 2020). In the global battle for investment resources, MNCs' interest in procuring financial incentives from governments is seen as a common phenomenon to take up substantial investment projects (Mudambi, 1999). Through globalisation, a high degree of economic integration is achieved as there is a continuous flow of money from one nation to another in the form of FDI.

Businesses find it more suitable to establish their subsidiaries in a foreign country to achieve a comparative advantage not achieved by just importing and exporting certain products (Boghean and State, 2015). Some governments induce protectionist policies to safeguard local businesses and the economy and, therefore, impose FDI limitations such as local content requirements; if the limitations imposed by the government can show positive externalities in other nations, then the government might remove these protections and adopt similar policies to boost their economic growth (Varamini and Kalash, 2010). Modifications were made regarding attracting FDI by lowering import taxes, financial incentives, tax legislation, and training subsidies (UNCTAD, 2000). The simple rationale for the increased efforts to attract FDI stems from believing that FDI promotes growth (Herzer and Klasen, 2008).

For example, FDI may spur capital accumulation in developing nations, thereby accelerating further industrialization, whereas in industrialized nations, FDI is an effective channel for introducing new technology and production and labour practices (Cipollina et al., 2012). In other words, the consequences of FDI can be both good and harmful (Mencinger, 2003). FDI may bring gains for some parties and their supporters while causing losses for others. For instance, skilled workers may benefit from FDI because it boosts wages and labour demand, while local business owners may lose out because it boosts competition, which reduces their profits (Pinto and Pinto, 2008; Owen, 2019) cited in (Jiang et al., 2022)

b) Research Topic

By purchasing existing companies abroad or starting new ones, foreign direct investment entails the purchase of control shares, according to (Boghean and State, 2015) other examples of foreign direct investment include an equity increase of a subsidiary located abroad or a loan given to the division by the parent company. The research thoroughly examines the impact

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of host government policies on FDI inflows in the target market. The research is focused on India, a rising economy, and its self-reliant strategy, which intends to expand the Indian capital market in several industries.

The study will draw on various theoretical frameworks and literature to examine FDI and its impact on the host nation. The Hofstede cultural dimensions assist the multinational in adapting to the cultural environment (see appendix 9), which is essential for an MNC entering a target market to make a profit. Additionally, the OLI framework and internationalization theory assist in determining a market's potential strength while considering FDI location variables. The research will concentrate on the institutional theory of FDI, which explains how the host country's institutions affect the growth of foreign investments. The study will be conducted using qualitative analysis, and a deductive method of data analysis will be used to locate and conclude the report. Because the theory will be used as a foundation, interpretation and in-depth examination will follow.

Given that India is an emerging and rapidly expanding economy in the east, it is essential to comprehend FDI patterns and international companies' investment decisions here. Multinational corporations, particularly those in the automobile industry, can therefore detect essential patterns and flows in the Indian economy. The Indian government also plays a significant role in crafting policies that are more nationalist and less dependent on imports. In practically every industry, India's economy is currently the one that is expanding the fastest in the globe, surpassing most wealthy nations. India is overtaking China to become a more essential and significant partner for other nations, whether in the fields of defence, fast-moving consumer products, manufacturing, or services. MNCs in the automotive sector must invest in the nation since it directly influences top-level management's decisions on investments into the Indian economy as it impacts the businesses' supply chains and production, leading to a review of the corporate and business strategy.

c) *Research Objective and Questions*

Understanding the relationship between MNCs operating in the automotive industry and host government legislation is the goal of the study project. Second, the study would aid in analysing the variables impacting FDI in India and the contribution of FDI to economic expansion. Finally, it strives to increase awareness of the sectors that are expanding because of policies and investments in the Indian economy, assisting potential MNCs to make adequate investments in the future, leading to understanding the question:

Research Question: How does the "self-reliant India" policy affect the decision of automobile multinationals on FDI in India?

There are questions which are not explicitly asked but will be answered during the research project:

Question 1: what are various government initiatives to attract FDI in the automobile industry?

Question 2: why MNC'S are looking forward to shifting production plants from China to the neighbouring country India?

There has been thorough documentation on the influence of FDI on the host country, with advantages and disadvantages, in previous literature. Surprisingly, few prior empirical studies using strict econometric methodology have examined the connection between FDI and the host country's national economic development. While numerous and growing micro-based studies examine the productivity-enhancing impact of FDI on specific enterprises, such as (Aitken et al., 1996), these studies do not address whether to invest in a nation where the political landscape is changing. Because of this, the earlier studies failed to demonstrate the potential of FDI regarding the government's active involvement in fostering economic independence, the establishment of manufacturing facilities inside the nation, and the geographical issues considering shifting global economic conditions. The changing landscape has raised the question of how a policy change may affect MNCs and their strategy.

II. The Empirical Literature: Review and Critique

a) *Introduction*

The effect of host government policies on FDI in host nations is the subject of substantial empirical research. The critical contributions are reviewed in this part, and the empirical techniques used there are criticised. Numerous arguments have been made on how foreign direct investment affects the growth of the host economy. With the global surge in FDI, officials in developing nations began to focus more on luring in more foreign investment. Many nations have actively given tax incentives and subsidies, and most have lowered their barriers to FDI. The belief that FDI fosters growth is the primary justification for the increased attempts to attract FDI (Forte and Moura, 2013).

An all-encompassing framework for figuring out the scope and pattern of operations with foreign ownership is provided by Dunning's eclectic paradigm. It asserts that three sets of advantages-ownership, location, and internalisation (OLI) advantages-motivate multinational operations. The arrangement of these benefits motivates or deters a company from engaging in international business and becoming an MNC. By observing, for instance, that a firm's internalisation benefits are driven mainly by transaction cost concerns, the paradigm's all-encompassing character may be recognised (Ram, M., 2004). North has contributed to our knowledge of institutions at the macro level more

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than any other academic (North, 2005). Norms of behaviour, conventions, and self-imposed standards of behaviour are examples of informal limitations that North (2005) characterises as institutions. Formal rules include constitutions, laws, and regulations. The "rules of the game" are established by institutions (and their enforcement mechanisms), which organisations must abide by to achieve their learning and resource allocation objectives.(Dunning and Lundan, 2008)

"New institutional theory" Scott (1987); North (2005) has an impact on the overarching approach. According to this view, host nation institutions considerably impact how enterprises are governed. From an economic perspective, the core of modern institutional theory is that countries with institutions that permit markets to operate freely have more significant economic growth. The argument continues by saying that, as a result, it should be employed cautiously in countries like Japan and India, where a more interventionist (or nationalistic) approach to forming economic policy has traditionally been adopted(Buckley et al., 2014). The study of endogenous growth has also shown the importance of other variables, such as institutional framework, infrastructure, and macro-economics, in fostering growth. In addition to their positive effects on economic performance, many factors may influence a country's ability to benefit from incoming FDI flows and attract FDI. Some academics even claim that the interaction between FDI and these specific local characteristics ultimately decides the growth outcomes (Alguacil et al., 2011). A stable institutional framework may increase FDI spillovers because of its direct influence on business operating circumstances (Alguacil et al., 2011).

Foreign direct investment inflow has significantly increased due to trade liberalisation, which also benefits the development of emerging nations (Khan et al., 2022). Numerous studies have been conducted to determine whether attracting FDI could be a critical strategy to foster growth in developing countries due to the rapid pace of FDI inflows worldwide. To assess the effectiveness of policies that implement incentives for foreign investors, a response to this issue is essential (Alguacil et al., 2011).

b) Human Resources

The increase in the labour force or human resources is one way that FDI might influence the economic development of the host nation. This pathway could make both good and adverse outcomes more likely (Forte and Moura, 2013). De Mello Jr (1997) asserts that it is anticipated that FDI will increase labour force knowledge by offering training by introducing new techniques and production and management practises. MNC investments in the host market will aid in developing human capital through training offered to boost productive capacity by effectively and efficiently completing a job that, in turn, promotes economic growth (Ozturk, 2007).

Learning that employees gain from seeing new operations being established by multinationals is one method of enhancing the human capital of the host country (Loungani and Assaf, 2001; Alfaro et al., 2004). The labour force must be proficient in using new technologies since FDI serves as a vehicle for their acceptance in the host nation. It frequently happens that the host country's capability is lacking, which prompts international corporations to give the necessary training (Borensztein et al., 1998). Multinational corporations offer more training opportunities than regional businesses, claims the OECD (2002). This training is given by utilising new technology, techniques, and methodologies that local employees cannot govern and may restrict its application (Borensztein et al., 1998). Multinational corporations' training programmes have an impact on the national economy. According to Hanson et al. (2001), local businesses will hire these employees once they have completed training sessions supplied by global businesses. According to Lim (2001), many employees utilise their newly acquired knowledge to find their businesses, after which they impart their expertise to their employees. According to the OECD (2002), multinational corporations are also accountable for enhancing host country training since they convince local authorities that a skilled work force is essential.

Additionally, FDI inflows have a detrimental impact on the labour force. High-tech use by multinationals predicts that fewer people will be required than those employed by local businesses, and these businesses may be replaced by others that employ fewer workers, which would increase unemployment as a result (OECD, 2002). The scenario described by Ford et al. (2008) Is another one in which local businesses will experience a decrease in local government assistance. These authors highlight instances in which local governments have reduced public spending in this area, which harms the training of the labour force provided by FDI, after confirming that multinational corporations are a source of training, thereby raising education levels in the nation (Forte and Moura, 2013). Due to the lack of R&D opportunities in the host nation, employees with advanced degrees may choose to leave the country, according to another observed effect (Vissak and Roolaht, 2005).

c) Technology

A good or negative effect on the economy's expansion may result from transferring technology and know-how through FDI. Multinational corporations are substantial business buildings specially developed and outfitted with the most recent technology. (Forte and Moura, 2013). Because multinationals have such a large global footprint, they are seen as a significant source of technology dispersal. (Ford et al., 2008). Due to their

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fierce competition, multinational corporations are accountable for spending more on research and development than any other company. (Borensztein et al., 1998)

An essential role is played by technology in the development of an economy; a specific economy growth is measured by the advanced technology used by institutions, governments and businesses which will lead to innovations in the country. Economic growth in developing economies, according to Borensztein et al. (1998), depends mainly on the technology employed by the nation. According to Lim (2001), Investors frequently invest in rising economies, which results in a flow of capital and, consequently, a steady flow of knowledge and technology. Dutt (1997) claims there have been trends of decreasing employment as the advanced economies invest in the southern countries having lower wages and higher productivity. According to (Loungani and Assaf, 2001), this transfer may result in benefits that cannot be obtained through financial expenditures or the acquisition of goods and services. Varamini and Vu (2007) claim that the host Economy's GDP increases when businesses adopt more advanced technologies to boost their output. A decrease in R&D expenses is brought about by the availability of new technology that multinational corporations have launched. As a result, these businesses will be able to lower expenses and increase their competitiveness (Berthélemy and Demurger, 2000).

Technology transfer, however, can sometimes have unfavourable consequences. According to Vissak and Roolaht (2005), innovations by multinational corporations and other wealthy nations will increase dependence on the host nations. According to this report, local businesses are becoming less interested in creating innovative technology. In order to maintain their technological edge over local businesses, Şen (1998) argues that MNCs may respond negatively to host country research. Furthermore, the author points out that multinational corporations spread incorrect technology with the same intent. In these conditions, reliance on international companies' technologies will continue in the host country (Forte and Moura, 2013).Indeed, according to scholars, technical innovations are increased in the host nations, which require training to effectively use human resources (Alfaro et al., 2004). The increase in technology will pressure local businesses that are not capital-intensive (Mastromarco and Simar, 2015) and spread frontier management approaches (Bloom et al., 2012).

d) Firms Development and Organisation

Hansen and Rand (2006) assert that the flow of capital into the host country unquestionably improves the business climate and spurs economic growth. Companies in the host country alter because of FDI. It is found that Local businesses are notably affected by such changes in two circumstances. Multinational corporations can join markets when entry barriers for local businesses are high, thanks to their superior skills. According to Blomström and Kokko (1998), The entry of multinational companies may cause the business climate in the host country to shift structurally by destroying industry monopolies and boosting competition.

According to OECD (2002), FDI is done through a takeover or a privatisation process that modifies the host nation's structure. If the multinational's procedures are more effective than those in use, efficiency benefits will result, making the adjustments even more crucial. Local businesses' organisational structures are altered by mimicking international corporations' more effective organisational designs (Hansen and Rand, 2006). According to Zhang (2001), FDI has caused several changes in Chinese business. Before becoming publicly traded, businesses became private or entered public-private partnerships, sometimes due to joint ventures with foreign investors. Zhang (2001) noted another phenomenon: policy changes were accelerated by modifications to the laws and market operating procedures for an economy that approximates an open market.

e) Implementation of Social Policies

Making policies and initiatives to put them into effect is challenging since the host economy may face many difficulties. In reality, the complexity, if not impossibility, of anticipating FDI inflows makes them causes of instability (Vissak and Roolaht, 2005). This complexity might hinder the implementation of the local authorities' desired economic strategies and undermine the nation's economic growth (Şen, 1998; Vissak and Roolaht, 2005).

A sudden, large capital influx that would likely boost inflation in proportion to that inflow is another negative development for the host country's economy (Şen, 1998). Another negative impact of FDI in the host country is a reduction in the power of local authorities (Duttaray et al., 2008). Businesses that conduct international trade have enough control over resources. As a result, they frequently show interest in geopolitics, which might allow businesses to impact political and economic decisions. (Zhang, 2001). Additionally, multi-national corporations pressure local officials to fulfil business goals, which may lead to the adoption of laws unfavourable to the host nation's economic progress (Zhang, 2001).

Due to the capital-intensive nature of MNC investments, they significantly influence local governments and enterprises. If their strategic decisions contradict a nation's interests, the host government may be forced to adjust its policies significantly. (OECD, 2002). It is also argued that developed nations often use FDI as a source to exert influence on emerging

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economies by way of constant capital flows, according to Zhang (2001). Multinational corporations support the sustainability of the current economic system, according to (Loungani and Assaf, 2001).

f) Integration into Global Economy

Capital flows from countries help integrate host nations and the global economy with the help of FDI (OECD, 2002). Mencinger (2003) provides evidence by establishing a direct connection between the rise in FDI and quick integration into the world market. Economic growth is generated due to the country's opening up and integration into the global market (Barry, 2000). Local businesses are integrated into the global market by imitating and acquiring the information that multinational corporations have, according to Blomström and Kokko (1998). Since they have previously through this process, it is evident that multinationals have a greater understanding of internationalisation. The ability to sell effectively, the construction of networks, and the growth of worldwide lobbies are only a few of the significant competitive advantages multinational corporations enjoy.

According to Ford et al. (2008), MNCs frequently collaborate with local firms in the host country to connect with organisations and suppliers in a global network. Local firms thus can expand their presence globally and create strong connections. Additionally, it states that local governments could build infrastructures (particularly those related to transportation) in response to requests from multinational corporations. These infrastructures will help promote international trade and help local businesses to expand internationally. Gunaydin and Tatoglu (2005) support this claim, stating that these FDI effects make it easier for raw materials to be distributed across the host nation. When investment is limited to assembly lines, both the rise in component imports and the rise in exports of finished goods are evident (Zhang, 2001). According to Makki and Somwaru (2004), the rise in exports by FDI encourages local businesses to boost productivity by using their capacity and access to economies of scale.

However, the host nation may suffer from the FDI's increased integration into the world economy. According to Vissak and Roolaht (2005), FDI is the most straightforward way for economic issues to spread globally, particularly in the nations where multinational corporations are based. The integration into the world market is the cause of this issue. The economies of the hosts open and become more susceptible to changes in the global economy. According to Mencinger (2003), Due to increased imports from foreign economies, FDI influx might result in a trade imbalance for the host country. As a result of emerging countries' lack of self-sufficiency, businesses typically import raw materials from other countries to use in their production. This import of raw materials raises the nation's imports (OECD, 2002),and occasionally exports may not increase in tandem with an increase in investments because businesses' primary motivation for investing is to meet local market demand. (Ram, R. and Zhang, 2002).

g) Increased Competition

According to Lee and Tcha (2004), FDI dramatically aids in developing factors of production due to the rivalry it promotes, allowing firms to more efficiently complete their tasks and raise their part of the wealth. Local businesses are forced to compete to keep their market shares due to multinationals' increased supply of the host country's market (Pessoa, 2007). There may be drawbacks to the heightened competitiveness as local businesses spend more on R&D, and in some instances, they exploit the advancements gained to expand their market share and turn suppliers for global corporations (Blomström, 1986). Existing businesses are pressured by multinationals' rivalry to advance their technologies and business practices (Driffield, 2001; Varamini and Vu, 2007). Consequently, local businesses frequently invest in their staff and equipment (De Mello Jr, 1997). FDI is typically viewed as a strategy to increase domestic competitiveness in a nation. As a result, output increases, and the market stabilises efficiently using the production's resources. (Pessoa, 2007).

However, the host nation does not benefit only from the enhanced competitiveness brought forth by FDI. Multinational corporations currently here will utilise their clout with the authorities to ensure that the highly protected market position does not alter. Multinational corporations maintain their market position by avoiding host country capacity and supply increases. There by it helps preserve the use of the resources that are already accessible while preventing development through increased competition (Loungani and Assaf, 2001). Zhang (2001) and Ram, R. and Zhang (2002) argue that greater competition brought on by FDI necessarily results in Local companies with limited resources and investments closing their businesses, which might result in a more centralised industry with less competition.

According to Hanson et al. (2001) and Zhang (2001), not all participants in the national economy have seen an increase in income. Although government incentives enhance national income with the influx of FDI from the world, it also creates a challenging environment for domestic businesses to operate in, which results in the disappearance of businesses. According to Sahoo and Mathiyazhagan (2003), a condition of global oligopoly can develop. Sylwester (2005) asserts that international corporations are better able to recruit highly trained individuals than local businesses, either by displacing them or making it more difficult for them to hire these workers. Due to its less complex structure than that of international corporations, local enterprises

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may also be negatively impacted by the growth in FDI. According to Vissak and Roolaht (2005), local governments incur additional expenses to encourage FDI. As a result, it is vital to cut back on government spending.

Financial markets-particularly those in host nations-often provide some funding for international corporations. It is anticipated that the market would be impacted by the country's increased financial demands, resulting in changes to credit availability and pricing (Lim, 2001; Carkovic and Levine, 2005; Sylwester, 2005). Local businesses will find it more challenging to secure loans because multinationals financed in the destination nations reduce their capacity to do so. Due to the financing rivalry, some local businesses could decide not to make the essential expenditures for their growth or their upkeep, which might finally result in its oblivion.

When reading the empirical literature on FDI and growth, it is essential to process carefully as the issues persist. However, the data tends to indicate that the inflow of FDI in emerging markets shows an upward trendline for growth in major economic sectors, except Carkovic and Levine (2005). Discrepancies in the factors examined may explain this. FDI impacts the host country either favourably or unfavourably, depending on the circumstances surrounding the investment and the host nation. As we can see, outcomes are influenced by the surroundings of the host nation. Local government agencies play a crucial role in achieving the intended results in this way.

h) Research Gap

Many emerging Asian governments have been implementing different economic changes, notably on the supply side, as a countercyclical response to decreased FDI. For public infrastructures to compete in attracting FDI in essential industries, their number and quality must be improved. Financing public capital projects is a problem for many developing nations in the Asian area, particularly for those with current account deficits. These deficits are made worse by the requirement of high-tech imports for many infrastructure projects, which results in a negative trade balance and a decline in GDP.

Many of the works have discussed the impact of government policies on economic development and the ownership-location-internationalisation framework of Dunning. However, none of them has emphasised the significance of the relationship between multinational corporations' investment decisions and changes in governmental policies. Expansion of the economy through FDI is discussed in past literature on various levels, but it has forgotten how government policies impact the choice of multinationals to invest in each country.

III. Research Methodology

a) Research Design: The Basics

This study fills a knowledge gap regarding the variables that affect top-level management's decision to make FDI investments concerning the government of India's "self-reliant India" policy, which will allow India to become a hub for global manufacturing and serve as a supplier to the rest of the world in several sectors. The research on the cause-and-effect relationship between "self-reliant" policy and FDI in India is lacking, which is why this study was undertaken. Furthermore, a thorough policy analysis is necessary for a real-world environment to conclude.

The study topic context is interpreted and catered to using a multidisciplinary approach and a qualitative research method. Multiple case studies support this study's empirical evidence. According to (Heale and Twycross, 2018), case studies help generalise the units and gain a deeper understanding of a person, event, or organisation, considering them as a single unit. According to Stake (2013), the multiple case study approach works best for research goals that advance theory creation and extension. According to Yin, R.K. (2009), the multiple case study technique enables the researcher to move between instances and analyse the variations within and between each case.

It is advised for researchers using case studies to look for both the standard and unique aspects of the case. These aspects entail giving extensive and in-depth thought to the case's circumstances, including its nature, historical context, physical environment, and other institutional and political contexts (Stake, 1995). Since the study was conducted using secondary sources, CEOs were the primary target group for developing the cases (organisation members who actively participate in decision-making and strategy development for the company). The MNC's home and host governments and the vital ministries were also involved in the data-gathering process. The study aimed to gather data and explore viewpoints on FDI and how government policies affect MNCs (see Appendix 3).

The case for the study was chosen based on international companies' investments in India, notably between 2014 and 2022, while significant laws regarding the private sector were being introduced. Clarifying the research issue and formulation of the study design is aided by classifying the case and case selection techniques. (Hyett et al., 2014). Additionally, because of the study's international restrictions, it was challenging to negotiate access with the relevant informants with first-hand experience with the studied phenomena. This challenge resulted in a case selection that was both constrained and compatible with the research challenge.

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b) Data Collection

Secondary data in the form of published sources, including top-level management of international MNCs, were used because the primary focus of this paper is qualitative research. The research, therefore, went beyond individual organisations and management with the goal of decision-making, making it impossible to gather enough data to analyse through variables and perform a regression analysis properly. The Centre for Monitoring Indian Economy (CMIE), official publications from the Government of India, Reserve Bank of India, Ministry of Industry and Commerce, IMF, and UNCTAD, media interviews, and publications other than books, journals, and periodicals were among the additional reliable secondary data sources. The reference period for this study is from 2000 to 2021. The secondary data was chosen after thoroughly investigating the appropriate governmental bodies, supranational organisations, for-profit companies, and news sources that may offer trustworthy information on the subject.

Data from institutions like the World Bank and the OECD were added to the information provided by the relevant public bodies, notably the India Brand Equity Foundation. As a result, the risk of researcher bias in the sampling and selection of data was reduced by thorough research and using triangulation of data from a variety of sources in both the public and private spheres, which also increased the confidence that could be placed in the validity of the findings (Nielsen et al., 2020; Hurmerinta-Peltomäki and Nummela, 2006)

c) Data Analysis and Interpretation

According to Robert Stake (2005), the analysis looks at a subject to determine its individual or relative elements. According to(Stake, 1995), the case study method is intended to describe patterns in limited systems. In order to guarantee that all aspects of the case are assessed and accurately documented, a straightforward case study procedure is designed to ensure validity and potential bias by having a single truth to be confirmed by the researcher (Yin, R.K., 2009). As there is a presumptive idea or proposition that institutions are a factor in host nations for which to analyse facts or specifics, this case study research will utilise a deductive approach. Findings and discussions based on the critical characteristics of FDI attractiveness in the nation and various industries were thematised, and comparisons were made. These comparisons were made by generating a latent pattern, which was an integral approach to performing analysis.

As previously stated, it was not possible to obtain enough statistical information to guarantee quantifiable independent or dependent variables for conducting regression analysis and determining whether there was a correlation or a causal relationship between the new government policies implemented in business environments and FDI attractiveness. Therefore, how the data was presented and interpreted was crucial to ensuring an analytical approach to give fresh perspectives and potential connections between the data and current theory (Birkinshaw et al., 2011). The different types and sources of data were compiled and synthesised using a variety of presentation techniques, including tables to compile qualitative data from various sources and the application of the quadruple model of collaboration to evaluate the role of networks between academia, government, the public, and industry (Afonso et al., 2012).

d) Ethical Consideration

Names and organisations were classified for secrecy, and care was made to alter any identifying wording that would reveal identification. Since no sensitive information was collected during the research's fieldwork or using sensitive data sources, only data that had already been published was used, and all ethical requirements were followed. Additionally, a university-affiliated independent internal review board examined each component of this research (See Appendix 9). This procedure was crucial to ensuring that the researcher adhered to ethical standards and boosting the reliability of the study.

e) Limitations

As the study topic asks, analyse how multinational corporations invest overseas in cross-border situations. In these circumstances, performing experiments or surveys raises severe concerns regarding the comparability and equivalence of data gathered from other nations, which results in a lack of comprehension and interpretation of the questions and, as a result, leads to the research reaching false conclusions. The possibility of biased reporting was present, particularly by state bodies aiming to highlight the country's advantages. The reporting was exceedingly probable in the case of investment promotion organisations, which promote investment in the regions but also have political and economic agendas.

Finally, the case study technique had drawbacks in that it concentrated on a single nation and raised questions about the generalizability of any conclusions. It is neither realistic nor viable for a single researcher to perform a more significant size study in many national contexts, even though doing so may result in more generalisable conclusions. Additionally, the case of India is supported by increases in FDI in recent years due to the country's status as a developing market, which raises the possibility that there are location-related benefits luring investors to these places. However, using a methodological approach that synthesised the secondary data available to provide new insights and suggested potential links between various factors and statements in dependable news

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sources from representatives of firms involved in FDI in the nation, these limitations have been minimised as much as possible. It was gathered from various sources whenever available to evaluate the authenticity and dependability of the data.

f) Expected Findings

This study aims to understand how senior management choices about investments in a nation with dynamic market conditions are impacted. The objectives of the inquiries were to advance a deeper comprehension of the worldwide firm's decision-making process. The goal was to identify the fundamental tenets of the host government's policy and categorise them into themes and descriptions that an MNC operating in a new market could use as a guide and develop a strategy to lessen the impact of government policy on their business. It was anticipated that the themes would be varied and descriptive, depending on the type of private sector strategy used.

The study's findings reflect on host government institutions' potential to provide a safe environment for businesses to strive and have a competitive market in which all the stakeholders benefit themselves. Moreover, these government-provided initiatives should be in the nation's interest at its core.

IV. The Empirical Analysis: Results

a) Introduction: The Study

I will research the "AATMNIRBHAR BHARAT" (i.e., self-reliant policy) programme, which the Indian prime minister announced as a 20-lakh crore bailout from the covid epidemic in 2020. This package's primary goal was to support different areas of the Indian economy and help the industry become self-sufficient. The argument, which covers the seven years from 2014 to 2022, is about creating India's economy self-sufficient and includes topics like "local for global: make in India, make for the world" and "vocal for local." having a stable economy, a sizable young population, and increasing foreign direct investment. India has developed into a small-car manufacturing and assembly powerhouse capable of end-to-end production. Companies are now producing, assembling, and exporting to other countries. Indian manufacturers participate in global innovation networks and obtain technologies from around the world to boost their R&D efforts. (Bhatti, 2023)

b) Description of Samples: Process and Participants

Many organisations' CEOs and senior management make up the more significant population. This study focuses on the demographic of automobile manufacturers active in the Indian market and potential investors. Six distinct organisations comprised the sample size and were established using saturation criteria. The selection made the sample more diverse (see Appendix 2). Intense research was done to find those in authority positions involved in organisational decision-making and strategy analysis. All the participants had owner positions in the companies they ran and were qualified to offer adequate answers to the study questions. Other countries' governments were also involved and contacted because the study subject is international.

c) Research Methodology Applied to the Data Analysis

According to (Stake, 1995), analysis is the process of looking at something to identify its pieces or how they relate to the whole. The researcher transcribed the media and pre-recorded interviews to look for trends. He then further analysed the replies to derive generalisable conclusions. The codes connected topics from various approaches, such as interviews, field notes, historical literature, archive data, and connecting data sources (Stake, 2013). Choosing the right tools to create comprehensive, accurate, and trustworthy themes to support the insights became paramount.

I reviewed the press releases, media stories, and information from DPIIT, ACMA, SIAM, and the Union Budget 2022–23. I referenced data from entries and examined archive data, including reports from the United Nations, the World Bank, and the Indian government, for triangulation techniques during the data analysis. This triangulation of data sources improved the study's quality and encouraged a more comprehensive data analysis (Yin, R., 2017). I examined and interpreted the study's findings in the context of the conceptual framework and provided examples of how the results contributed to the knowledge of institutional policies for FDI in the car industry and automakers' choices to invest in India.

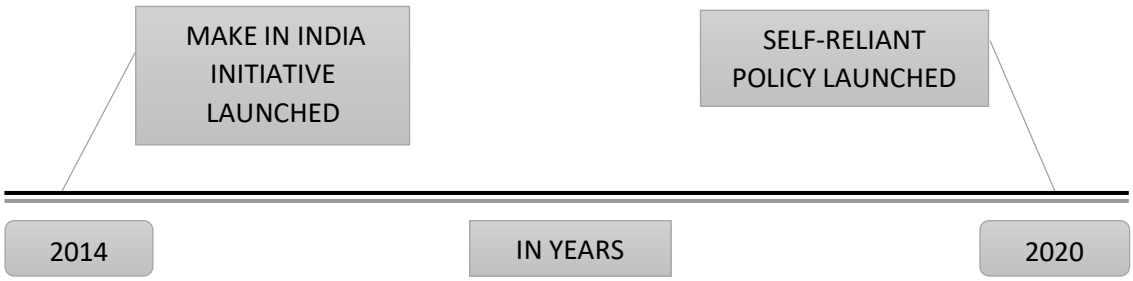


Figure 1: Timeline for Self-Reliance India Policy

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d) Description of Analysis

Thematic synthesis was used to examine the data gathered from the media interviews that were made accessible online, including the researcher's notes and the audio transcripts of the media interviews (Durst and Henschel, 2021). The recordings' audio was converted into written text using a specialised transcription service. The researcher concentrated on linking the trends they had discovered when identifying the four critical investing decisions made by the automobile sector in India. The researcher then created a codebook with categories, essential topics, supporting themes, definitions, and verbal excerpts from the interview transcripts. In addition, the researchers identified patterns and trends from the many interview transcripts by coding. The researcher then verified the authenticity of the coding material using the triangulation procedure before completing the codebook.

e) Results of the Study

To give answers within the framework of the empirical setting, the main research question for this theory-generating multiple case study was created following a thorough examination of the literature. Dense knowledge of the prospects presented by the execution of the policy and its consequences for the Automobile MNCs was provided by evaluating stakeholders' viewpoints regarding their ideas on the Indian government policy regarding the establishment of manufacturing plants in the nation. All the cases selected were constantly compared with each other throughout the research to contrast and analyse the thematic patterns among cases, and an analysis was conducted of the data collected from various sources (Yin, R., 2017). A detailed, dense commentary from each organisation was produced during this research phase to highlight each organisation's experiences and perspectives on the issue under investigation (Stake, 2005). The recurrent motifs were categorised, and the results were cross-referenced for visual representation.

f) Thematic Analysis of Textual Data

The literature offers step-by-step procedures that describe how to perform a pertinent and accurate theme analysis (Norris et al., 2017). I did a thematic analysis for this study following the (King, 2004) recommendation that the final report starts with direct participant quotes. Regarding the main study topic, this part examines and discusses the four themes that developed (see Appendix 1)

g) Economy

This subject focuses on creating the infrastructure necessary for the Indian economy to grow into a significant global supplier, including solid R&D facilities, affordable steel manufacturing, and the availability of a trained workforce. Due to beneficial government policies, India has recently become a desirable location for FDI. The Indian government has taken proactive steps in various initiatives to provide a favourable business environment which will boost India's FDI (IBEF, 2022a) but Organisation 5 believes that a revision of policies would be a viable solution to increase FDI in the country, saying:

> *"If there is some rationalisation of taxes, there will be more growth because the size of the market today does not reflect the kind of wealth and aspirations we have in this country." (Organisation 5, 2022)*

Organisation 1 thinks that policies are favourable and said:

> "We are happy to share with you that we are going to make an additional investment of $54 million in the upcoming project despite the COVID-19 global pandemic." *(Organisation 1, 2020).*

The organisation's four perspectives on the subject matter were the following:

> *"Our product is being manufactured at the state-of-the-art factory in Chennai. The vehicle is made in India for the entire world, and we will continue to explore new markets to expand our international presence." (Organisation 4, 2023).*

Table 1.1: Sectors Receiving Highest FDI (from April 2021-March 2022)

Industries	Software And Hardware	Automobile	Trading	Construction
Value (In US Dollars)	14.46 billion	6.99 billion	4.53 billion	3.37 billion

Table 1.1 demonstrates that the Indian automotive sector, the second-highest industry regarding FDI receipts, is crucial to macroeconomic growth and technical innovation.

Table 1.2: FDI Inflows from Countries

Countries	Singapore	USA	Mauritius	Netherlands
Value (In US Dollars)	15.87 billion	10.54 billion	9.39 billion	4.62 billion

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Table 1.3: Indian States that Received the Highest FDI

Indian States	Karnataka	Maharashtra	Delhi	Gujarat	Haryana
Value (In US Dollars)	22.07 billion	15.43 billion	8.18 billion	2.70 billion	2.79 billion

Tables 1.2 and 1.3 show that FDI flows into the nation's bigger cities worldwide, suggesting that as cities increase, the economy will expand more quickly (IBEF, 2022b)

h) Infrastructure

This issue relates to establishing suitable electric vehicle supply equipment (EVSE) infrastructure for EVs, and to achieve this, several public sector businesses, ministries, and railways have joined forces to build the necessary infrastructure and produce the necessary components. Infrastructure also includes linking towns, cities, and the final mile of connection, including becoming digital and improving the transportation system, which will help businesses save money by lowering additional expenses. Organisation 5 suggests by saying:

"We are aiming, in the next 8-10 years, to fully electrify the portfolio and be an electric manufacturer here. The intention is to build the capability now and, depending on how demand develops ... increase the numbers." (Organisation 5, 2022).

Organisation 2 thinks that policies will promote sustainable business by mentioning the following:

"These measures will help create a vibrant and competitive local manufacturing ecosystem for advanced and green technologies at global scales, thus making India a strong manufacturing hub. the benefits will also trickle down the entire supply chain, thereby also providing a boost to the MSMEs." (Organisation 2, 2022).

Organisation 1, for example, mentioned that:

"That EVs are catching up and the prediction of 5% by 2025 and 30% by 2030 looks reasonable because there are many launches which are going to happen, the infrastructure is improving, customer acceptance is there." (Organisation 1, 2022).

The government has started a US$ 10 billion incentive programme to develop an ecosystem for semiconductors, display, and design in India because of the significance of semiconductors to the world economy (Desk, 2022). This will support the Indian EV market, which is anticipated to reach Rs. 50,000 crores ($7.09 billion) by 2025 (IBEF, 2022c).

i) Demand and Supply Chain

This subject is about how demand for electric cars is increasing and how supply chains are being improved to meet that need locally and globally. Several automakers have recently begun making significant investments in various sectors of the business, but Organisation 6 holds the following views that are unfavourable to them:

"The company would like to test the demand for their product in the Indian market before committing to a facility as the government is unwilling to agree to those terms and has been trying to push to consider committing to a new production facility in India." (Organisation 6, 2022).

Organisation 4 believes that there has been a good demand for their product in the market by mentioning:

"Crossing the 2-lakh milestone in exports for the second consecutive year signifies the trust, quality, reliability, performance, and affordability of our products." (Organisation 4, 2023).

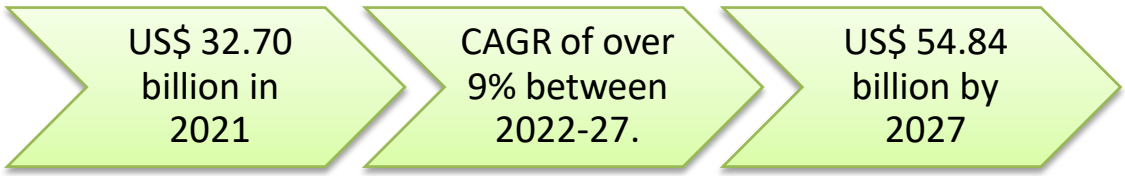


Figure 2: Value of the Indian Passenger Car Market

Figure 2 shows that by 2027, the passenger car market will be worth US$54.84 billion and grow at a CAGR of more than 9%. New trends fuel the automobile sector to reach the target by 2027, including electrification and hydrogen cars for a sustainable economy and lowering carbon emissions (IBEF, 2022d). India now has a larger population than China. However, compared to India, where 200,000 automobiles are sold monthly, roughly two million cars are sold there monthly. Indian subcompact automobiles, rather than the bigger, more expensive versions offered by global automakers, are often the most popular vehicles sold there (IBEF, 2022b).

j) Technology Driven Arrangements

This subject is about India improving its technological advancements to suit the demands of the

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twenty-first century. India's EV industry is tiny, accounting for only around 1% of all auto sales there in 2022. It is quickly growing thanks to new models being planned by domestic and foreign companies. Organisation 2 gave the following information on this aspect:

"We pioneer of electrified technologies will continue to focus on mass electrification through localisation of electrified vehicle parts." (Organisation 2, 2022)

The participant also adds the following comments:

"Taxation, being linked to transparent, easily measurable outcomes aligned to national objectives such as carbon reduction." (Organisation 2, 2022).

Organisation 3 believes that advancement in technology will allow the company to produce electric vehicles by saying:

"The company has always reinforced its commitment to national policies such as the 'Make in India initiative' and it is pushing for battery electric vehicles (BEVs)." (Organisation, 2023).

In the same line of rationality, organisation 4 explains the following:

"The Indian government's initiatives on EVs are powerful, and customers want to buy EVs. This will make the country's conversion to EVs faster than other markets, and I hope even faster than the US. We want to become the No. 1 EV player in India." (Organisation 4, 2023).

Table 2.1: Developments in the EV Market in India

Industry	Target Goal	Reference
EV finance industry	Rs. 3.7 lakh crore (US$ 50 billion) by 2030 (IBEF, 2022a)	NITI Aayog and the Rocky Mountain Institute (RMI) (IBEF,2022a)
The EV market in India	CAGR of 36% until 2026	India Energy Storage Alliance
EV battery market	CAGR of 30% until 2026	India Energy Storage Alliance

The most recent developments in the EV sector related to start-ups, finance, and battery production are shown in *Table 2.1*. Numerous local and foreign organisations and businesses have made significant investments in each of the EV production areas. According to this table, the industries eager to engage in the Indian vehicle industry will continue to see growth in technology, infrastructure, employment, and demand. The data and conclusions presented illustrate the four primary focuses on which the Indian government is trying to create an open and transparent system that will enable a significant increase in foreign investment in the nation. To reduce costs, increase sales profits, and enable MNCs to develop their operations further and manage their value chains, the automotive industry needs to get its raw materials from nations with established manufacturing facilities.

V. Discussion: The Findings

a) Development of Human Resources

According to De Mello Jr (1997) definition of human capital development, it is envisaged that FDI will boost labour force knowledge through training by introducing new techniques and production and management practises. My results confirm that the companies entering the Indian market have been involved in guiding and increasing human capital by developing training programs for the workforce as the economy and the global market shift towards electric vehicles.

Data from instances and reports I obtained supported (Borensztein et al., 1998) findings indicating that the host country's economic development increases if its human capital rises over a certain threshold. India's economy has grown slowly compared to other global economies since its human capital is inefficient. The findings of my investigation supported the notion that human capital is crucial for both businesses and the country. Positive trends indicate a demand for qualified human resources in the automotive sector as technical improvements rise.

b) Advancement of Technology

My findings support (Borensztein et al., 1998) claim that MNCs tend to invest mainly in their research centres to gain in a competitive market abroad, which will help the company increase its production capabilities and market share. This claim applies specifically to the evolution of technology in developing nations. My research's conclusions supported the many instances in which multinational corporations must establish their R&D facilities to serve local consumers and compete with domestic businesses. The study's results also align with assertions made by Varamini and Vu (2007) that the inflow of FDI brings in advance technology which improves host businesses' performance and, thereby, increases economies. Technology's rapid transformation can be seen in the nation's rapidly growing electric car market. The car sector is seeing a significant capital inflow, and as a result, local businesses are updating their technologies

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to increase manufacturing, releasing their goods for sale, and even expanding their supply networks into global value chains.

According to the quadruple helix, innovation occurs when government, universities, citizens, and corporations coexist (see Appendix 5). It may also be viewed as a value chain activity in the car sector, where an economy like India must have robust coexistence and co-relation between these four helices for the industry to expand and which would draw new investors in the form of FDI to the nation. In addition, users (Civil Society) are co-producers of the invention in user-oriented innovation, according to (Etzkowitz and Klofsten, 2005), who also note the significance of research institutions, government support agencies, and businesses.

c) Policies- Mobility, Infrastructure and Growth

As the host government incentivises businesses, there is a surge in market competitiveness; therefore, businesses compete to gain market share(Pessoa, 2007). My findings supported the idea that local firms have a beneficial influence because they can compete with more giant corporations by using resources in their manufacturing processes effectively and efficiently. Aside from that, the host government's policies aid Indian markets' local industries. In India, local enterprises are transforming the country into a hub for global design and manufacture, attracting foreign companies to invest in the Indian market, and this trend is increasingly visible in the electric vehicle category. Because of this, there is an increase in productivity, a decrease in price, and better resource allocation (Pessoa, 2007).

Furthermore, multinational firms exert pressure on local government officials to achieve their corporate objectives, which may result in making or changing laws according to the needs of MNCs, which can harm economic development (Zhang, 2001). No evidence of MNCs influencing local authorities to change regulations to accommodate business requirements was found in my research; instead, it was discovered that the Indian government and authorities had established a solid framework for FDI policies and conducting business in the nation. The Indian government's initiatives in the car sector assist companies in growing their market share and locating their production facilities there.

According to some academics, local governments might develop infrastructure (especially in the transportation sector) in response to demands from multinational firms. These infrastructures will aid local companies looking to go global and encourage international trade. The findings of my study are consistent with other investigations into how a country's growing infrastructure benefits firms, particularly in the automotive industry, by lowering costs and enhancing operational effectiveness. The study partially agrees with Blomström and Kokko (1998) research, which examined the likelihood that the entry of multinational corporations may weaken or end the existing monopolies in the car industry. These viewpoints frequently predicted that the industry would grow in the host country, and the results show that there has been an increase in brands competing for electric vehicles. However, some businesses ignored the Indian market, even though the initiatives were developed to grow the ease of doing business.

d) Export- Oriented Nature

The opening up of the nation and the ensuing integration of that nation into the global market, according to scholars, is what causes economic progress (Barry, 2000). India's decision to open its borders and liberalise its economy proves that it has grown steadily since international companies began investing there. Even though the car industry has not improved since at least 2014, government initiatives like "Make in India" and promoting a self-sufficient economy have encouraged the establishment of manufacturing facilities in the nation. Across cases in my study, there is still a need for action in several areas to increase the production of electric vehicles as the country is still reliant on acquiring raw materials, increasing its imports from nations like China because these are frequently unavailable (OECD, 2002) which in result affects the balance of payments Mencinger (2003).

The report also showed that businesses seek greater localisation strategies to seize raw materials and human resources as the global market shifts towards shared and autonomous vehicles. It may be argued that this does not mean conducting business in India is becoming more straightforward because of the investment. Instead, there is evidence that doing business in China is becoming more challenging because of the government's unfriendly policies, which makes India a fallback choice for establishing industrial facilities.

India scored more than 80 out of 100 on the ease of doing business index (see Appendix 7), indicating that the country's business climate is improving. Recent government changes in permitting private enterprises to participate in crucial industries serve as solid foundations to support the growth of India's economy and provide the nation with great potential to achieve economic independence. Additionally, Market Potential India (see Appendix 8) analyses the Indian economy's score between 2016 and 2022, showing a favourable growth potential for businesses looking to invest there, but it showed slow growth in some dimensions.

After conducting a critical analysis, I conclude that government initiatives in the host country positively impact giving businesses access to a competitive and developed market. Free trade agreements between

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states are also beneficial since they encourage multinational corporations to invest more in particular regions, giving the company a geographical advantage. Businesses also frequently reduce the expenses of their manufacturing facilities, which leads them to request a tax break on their foreign investments. According to the study report, India will participate in the EV market with a long-term strategy focused on developing the necessary infrastructure for shared and autonomous cars with technology and people resources. Since the Indian economy is working diligently enough on the future of mobility and consumer perspectives on vehicles, the market for automobiles and auto componentry will experience a sharp increase.

My Study Led me to the Following Conclusion: Given that the Chinese government is making it more difficult for businesses to operate there due to geopolitical concerns and consumer hostility towards China, investing in India may be a fallback option for many global corporations. Therefore, it can be concluded that geopolitics and consumer aversion play a significant role in the country's ability to draw in significant amounts of foreign investment. Even though India is taking steps to become a developed country, businesses still view India as unstable and lacking the raw materials necessary to establish large-scale factories.

VI. Conclusion

a) Research Objectives

How does the "self-reliant India" strategy impact automobile multinationals' decisions on FDI in India? This is the research issue that this study seeks to address. The use of multiple qualitative case studies was put into practice. This approach was appropriate because the study's main objective was to analyse the decision-making procedures employed by multinational corporations when making investments in various nations. According to the survey, while the government has opened the country's economy and investment prospects to foreign investors through brownfield and greenfield projects, some corporations have favourable attitudes towards institutional policies. In contrast, others are restricted from making more investments.

In line with other studies, we discovered that the host government is crucial to a nation's ability to draw FDI. Numerous instances showed that the Make in India programme did influence their choices to invest in the nation, and they regularly highlighted examples like businesses setting up manufacturing operations in the nation. India, a rising economy, suffers significant setbacks compared to its neighbour "China" regarding innovation, people resources, etc. For India to sustain its low-cost advantage or at least attain competitive dominance in the future, innovation in new product creation is behind. Continuous technological advancement is required in manufacturing. With significant investments in creating new indigenous technologies that are environmentally beneficial and conform to high-efficiency standards known worldwide, India may move up the value chain (Bhatti, 2023).

b) Managerial Implications

The following is a list of potential policy consequences. The results of this research, both at the organisational and institutional levels, suggest that organisations and institutions must cooperate; governments must offer safe and competitive investment environments, and businesses must invest in domestic projects to boost human resources, technology, and innovation as the nation's economy.

The host government's FDI policy and its effectiveness were shown to be significantly correlated. Local authorities must take the lead to achieve the desired results in the car industry since decision-making is much more dependent on the circumstances of the host nation and investments. Managers may be able to make decisions based on changes in local governments if they are made aware of this, creating the ideal environment for firms to maximise good benefits and lessen negative ones.

c) Limitations

I adopted a multiple case study technique to fill this gap, adhere to the qualitative paradigm, and lay a strong foundation for theory extension. To address the study's central research question, I gathered information from various sources, including archived data from government publications, media interviews, and corporate websites. The study's setting's limitations were identified and addressed. Although multiple case studies were employed, this prohibited a comprehensive analysis of the phenomenon being studied. Instead, it gave a general review of government policy related to the automotive industry. A detailed understanding of a single case would be beneficial to address the question thoroughly and might offer novel viewpoints.

According to Yin, R. (2017), the study's main flaw was the tiny sample size required for a qualitative multiple-case study. The sample size selected might not have represented the total population, which raises generalizability concerns, but from these investigations, hypotheses might be made for subsequent quantitative studies (Yin, R., 2017). Limited qualitative research can enrich pre-existing ideas and conceptual frameworks (Yin, R., 2017). This limitation was reduced by carefully analysing the data and drawing firm conclusions from the findings. I transparently and in-depth discussed each approach utilised for participant recruitment, participant interactions, data collection, recording, and analysis.

To some extent, using transcripts, digital recordings, and investigator triangulation served to lessen researcher bias. The Hofstede cultural index is also used in the study. The fact that Hofstede's

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dimensions were based on a single corporation, which may limit their application to an entire nation, is only one of the criticisms that have been levelled at them despite their widespread usage in academia (Shaiq et al., 2011). Since Hofstede's breakthrough, several new methods for assessing culture have been created (Minkov, 2012). Therefore, to assess the external validity of this result, future research might repeat it using different cultural measures.

d) Agenda for Future Research

The study's findings thoroughly grasp the potential and difficulties global companies in the automotive industry would face while expanding into India. There are still certain restrictions even though every attempt has been made to make the most of the resources available to carry out an effective and efficient investigation. These restrictions were somewhat addressed through data triangulation, but future research on attracting FDI should consider whether primary data collecting is feasible, for instance, via contacting businesses participating in FDI initiatives. Future studies can also examine a nation's balance of payments, currency strength, and FDI flow through time in various industries. The data may then be compared with different years of the host government's policy introduction. This comparison will provide a greater comprehension of the decision-making processes used by multinational corporations and their FDI investments.

Further investigation was needed when it was discovered that some of the most prominent players in the car industry left the nation, where government incentives to draw in foreign investment appear to have had a favourable impact on the choices of most multinational corporations. The logical inquiry is: why? Despite industry reforms, why do the big international corporations leave India? Although it is doubtful that more studies will refute the conclusions about the significance of solid government institutions and policies for luring FDI to the nation, it may be advantageous. A study on the overall influence on the economy for FDI attractiveness may bring fresh insights and variances or solidify the findings if future studies could identify the study issue outside the industry-specific context. This work is essential because it might contribute to a deeper comprehension of the phenomena under investigation and offer insightful advice for future research and policy initiatives (Yin, R., 2017).

Abbreviations

ACMA	Automotive Component Manufacturers Association of India
CAGR	Compound Annual Growth Rate
CEO	Chief Executive Officer
DPIIT	Department For Promotion of Industry, And Internal Trade
EV	Electric Vehicle
FDI	Foreign Direct Investment
FY	Financial Year
GDP	Gross Domestic Product
IMF	International Monetary Fund
MNC	Multinational Corporations
OECD	Organisation For Economic Co-Operation and Development
OLI	Ownership, Location, and Internationalization
QH	Quadruple Helix
R&D	Research and Development
SIAM	Society Of Indian Automobile Manufacturers
TH	Triple Helix
TNC	Transnational Corporations
UNCTAD	United Nations Conference for Trade and Development

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Appendices

Appendix 1: Thematic Analysis

Primary Themes	Secondary Themes	Concepts/Definition
India was among the top three global FDI destinations. 80% of the global respondents had plans to invest in India. FDI restrictions have reduced from 0.42 to 0.21 in the last 16 years.	ECONOMY	This themeconcerns the economic circumstances that make India attractive to most foreign businesses and investors.
Necessary to overhaul the country's transportation system. Create an integrated electric vehicle (EV) mobility ecosystem. Reform on Low carbon footprint and high passenger density urban transportation Investment of us$ 180 billion in vehicle production and charging infrastructure	INFRASTRUCTURE	This themerefers to constructing infrastructure around the country and expanding road networks for EV transportation. Increased infrastructure project expenditures will increase foreign direct investment (FDI) since ports, trains, and airports will be more conveniently accessible.
There is a substantial market in terms of domestic demand and exports. In fy22, total passenger vehicle sales reached 3.07 million. The Indian automotive industry is targeting to increase the export of vehicles by five times during 2016-26. Foreign companies have adapted to cater to the large Indian middle-class population by dropping their traditional structure and designs.	DEMAND AND THE SUPPLY CHAIN	The development of a successful supply chain for the domestic and international demand for vehicle products is meant by this. The use of supply chains will enable firms to reduce their transportation expenses and shorten the time it takes to reach customers.
India is currently shifting focus to electric cars to reduce emissions. India could be a leader in shared mobility by 2030, providing opportunities for electric and autonomous vehicles.	TECHNOLOGY-DRIVEN ARRANGEMENTS	Creating a technology geared towards the 21st century to meet the expanding demand and effectively increase output. Technology will also contribute to a sustainable environment and low carbon emissions.

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Appendix 2: Participants/Organisation Profile

Firms	No. of Employees	Age of the Firm (In Years)	Years Abroad	Foreign Country Presence	International Market: Servicing Mode(S)
1	3000	75	50	Almost All Countries	Joint Venture
2	6000	26	10	70 Countries	Joint Venture and Export Oriented
3	5000	18	6	8 Countries	Alliance
4	150000	56	45	Almost All Countries	Export Oriented
5	2000	60	40	50 Markets	Alliance
6	129000	20	14	20 Markets	Alliance

Appendix 3: Government Initiative in Automobile (Ibef, 2022)

Initiative	Meaning	Resultant
FAME INDIA SCHEME	Rs 871 crore (us$ 117 million) Oil companies have installed 532 EV charging stations.	87,659 electric vehicles have been supported through incentives (STANDARD, 2022)
RELIEF IN FOREIGN DIRECT INVESTMENT	100% FDI allowed under automatic route with full delicensing	Automobile sector to attract us& 8-10 billion foreign investments by 2023. (STANDARD, 2022) They are making it easier for investors to set up manufacturing plants in India. Making India a leader in shared mobility by 2030
BHARAT NCAP	India's vehicle safety assessment program (STANDARD, 2022)	It will provide consumers with added security and safety. (STANDARD, 2022)
PRODUCTION-LINKED INCENTIVES	Increase local vehicle manufacturing and attract new investors. Added more than 100 advanced technologies, including alternative fuel systems such as compressed natural gas (CNG), Bharat stage vi compliant flex-fuel engines, electric control units for safety, advanced driver assist systems and e-quadri cycles investments. (STANDARD, 2022)	The 20 automobile companies have proposed a total investment of around RS. 45000 crore (us$ 5.95 billion) and will create 7.5 lakh jobs in India (STANDARD, 2022)
BATTERY SWAPPING POLICY	Will allow drained batteries to be swapped with charged ones at designated charging stations. (STANDARD, 2022)	Making EVs more viable for potential customers
PRIME MINISTER'S GATI SHAKTI PLAN	India's national highways would be expanded by 25,000 km. (STANDARD, 2022)	It will provide seamless movement between places. Moreover, fuel costs will be saved, allowing vehicles to run for more extended periods.
VEHICLE SCRAPPAGE POLICY	It aims to phase out old polluting vehicles in an environmentally safe manner. (STANDARD, 2022)	It will allow companies to give a better deal to their consumers. This policy will make India more sustainable and carbon emission free.

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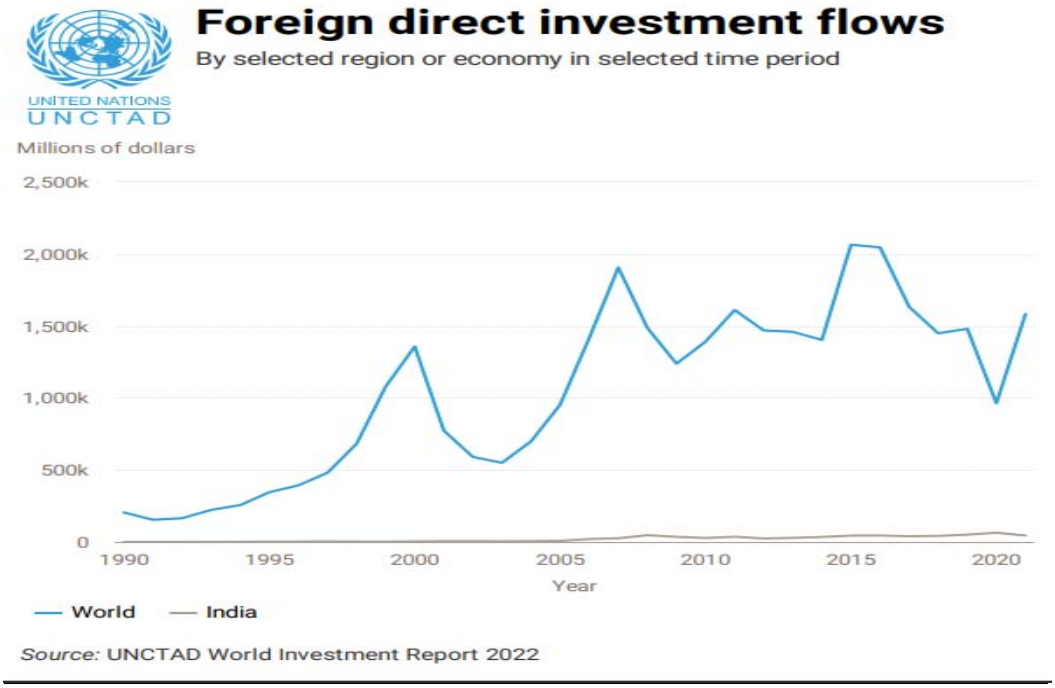
A REVAMPED SCHEME	It Encourages the production and export of clean technology vehicles.	Us$ 3.5 billion in incentives over five years until 2026 (STANDARD, 2022)
NATIONAL AUTOMOTIVE TESTING AND R&D INFRASTRUCTURE PROJECT (IBEF, 2022b)	Five testing and research centre have been established in the country since 2015 (IBEF,2022b)	Aims to develop India as a global manufacturing and research and development hub. (IBEF, 2022b)

Appendix 4: World Investment Report (Unctad)

Foreign direct investment (FDI) overview, selected years

(Millions of dollars and per cent)

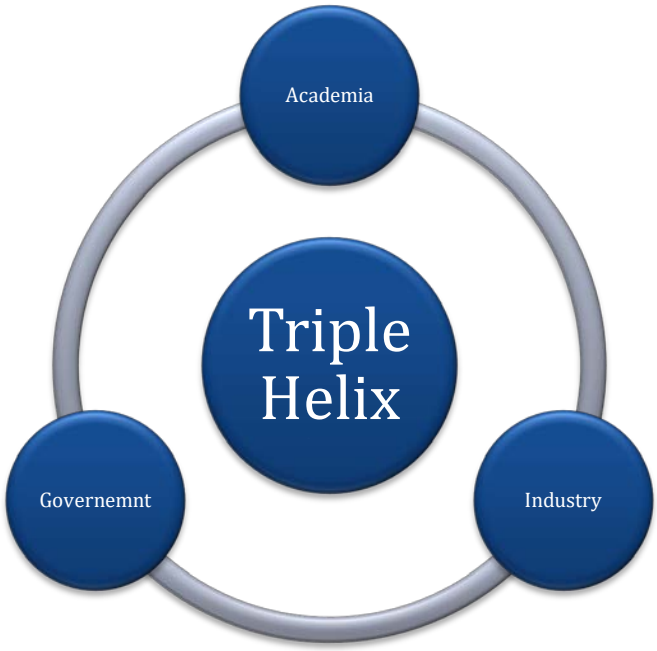
FDI flows	2017	2018	2019	2020	2021	2020-2021 Growth rate %	As a percentage of gross fixed capital formation 2017	2018	2019	2020	2021
India											
Inward	**39 904**	**42 156**	**50 558**	**64 072**	**44 735**	**-30.2**	**5.3**	**5.3**	**6.2**	**9.0**	**5.0**
Outward	**11 141**	**11 447**	**13 144**	**11 109**	**15 522**	**39.7**	**1.5**	**1.4**	**1.6**	**1.6**	**1.7**
Memorandum											
China											
Inward	136 315	138 305	141 225	149 342	180 957	21.2	2.6	2.3	2.3	2.4	2.5
Outward	158 288	143 037	136 905	153 710	145 190	-5.5	3.1	2.4	2.2	2.5	2.0
Pakistan											
Inward	2 496	1 737	2 234	2 057	2 102	2.2	5.0	3.2	5.1	5.2	4.7
Outward	52	- 21	- 85	- 45	242	..	0.1	-	-0.2	-0.1	0.5
South Asia											
Inward	51 640	52 262	59 086	70 957	52 417	-26.1	5.1	4.8	5.2	6.2	3.5
Outward	11 493	11 630	13 275	11 206	15 986	42.7	1.1	1.1	1.2	1.0	1.1
Developing Asia											
Inward	501 382	496 898	511 632	518 893	618 983	19.3	6.3	5.6	5.7	5.7	5.9
Outward	400 135	360 653	336 213	378 382	394 118	4.2	5.1	4.1	3.7	4.2	3.8
Developing economies*											
Inward	694 955	694 956	716 170	643 949	836 571	29.9	7.4	6.7	6.8	6.2	6.9
Outward	447 866	376 093	387 054	372 284	438 382	17.8	4.8	3.6	3.7	3.6	3.7
World*											
Inward	1 632 639	1 448 276	1 480 626	963 139	1 582 310	64.3	8.1	6.6	6.6	4.4	6.4
Outward	1 610 113	941 293	1 123 894	780 480	1 707 594	118.8	8.0	4.3	5.0	3.6	6.9

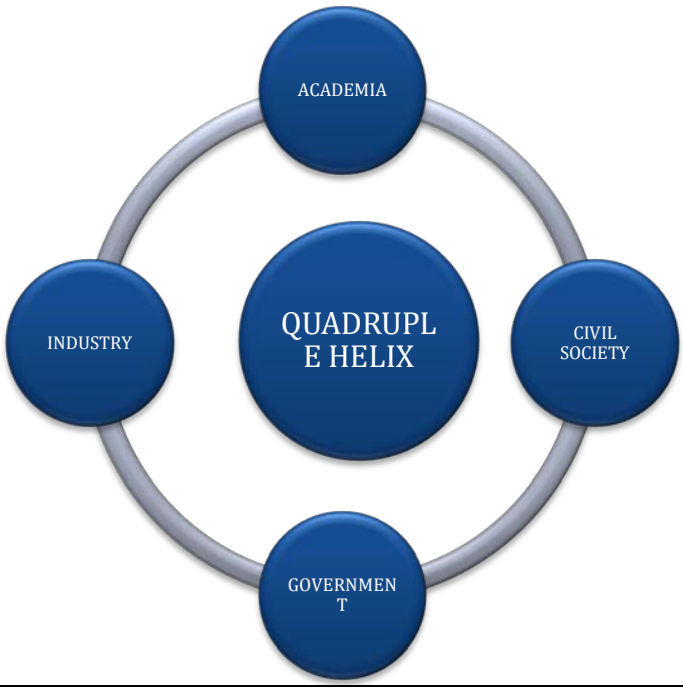


Source: UNCTAD World Investment Report 2022

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Appendix 5: Triple and Quadruple Helix Model (Carayannis and Campbell, 2009)





As civic society was included in the innovation hypothesis, the triple helix was expanded into the quadruple helix. It claims that the four helices are connected to innovation in an economy. Civil Society is involved in innovation and production, and it also plays a demanding role in our economy's consumption sector, where citizens (Civil Society) want to buy cutting-edge goods and services combined into a single, overall good. (Afonso et al., 2012).

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Appendix 7: Ease of Doing Business Index (World Bank, 2020)

An economy's ease of doing business score ranges from 0 to 100, where 0 represents the lowest and 100 represents the best performance. A score of 80 in Doing Business 2020 would indicate that the economy is improving.

Economy	DB 2019	DB 2020
India	81	81.6
India - Delhi	81.3	82
India - Mumbai	80.5	81.2

World Bank. 2020. Doing Business 2020. Washington, DC: World Bank. DOI: 10.1596/978-1-4648-1440-2. License: Creative Commons Attribution CC BY 3.0 IGO

Appendix 8: Market Potential Index (Global Edge, 2022) (2016)

Rank	Country	Market Size	Market Growth Rate	Market Intensity	Market Consumption Capacity	Commercial Infrastructure	Market Receptivity	Economic Freedom	Country Risk	Overall Score
1	China	100	95	1	93	63	7	23	79	100
2	Hong Kong	2	59	100	44	100	100	100	100	57
3	Singapore	2	76	76	44	84	89	71	93	50
4	India	37	79	32	67	28	8	45	67	49
5	Japan	19	39	71	100	71	10	71	93	48
6	Canada	9	50	67	74	56	68	76	93	48
7	Germany	11	44	69	92	77	17	71	93	44
8	United Kingdom	8	42	78	87	79	16	73	85	41
9	Qatar	1	100	95	54	54	27	45	84	40
10	Switzerland	2	45	80	72	68	38	78	93	39

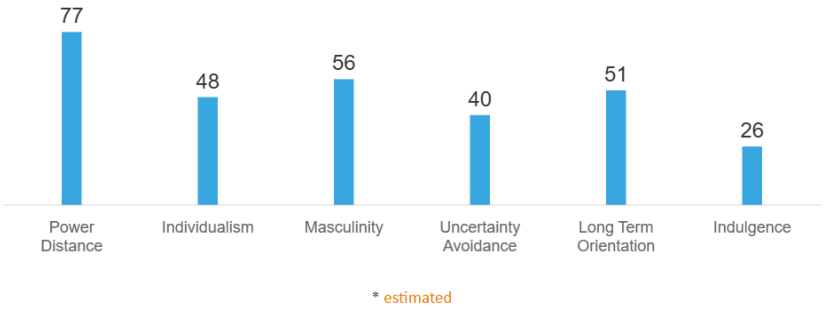
(2022)

Rank	Country	Market Size	Market Growth Rate	Market Intensity	Market Consumption Capacity	Commercial Infrastructure	Market Receptivity	Economic Freedom	Country Risk	Overall Score
1	China	100	87	1	100	100	10	27	66	100
2	Singapore	2	52	60	59	79	100	82	94	51
3	Hong Kong	2	40	89	58	85	86	42	78	46
4	India	37	67	22	39	46	10	54	51	45
5	Canada	6	40	57	63	52	54	92	94	42
6	Ireland	1	88	37	52	47	42	98	82	40
7	Japan	13	29	49	77	72	14	84	94	40
8	Switzerland	2	42	66	68	61	40	100	77	39
9	Netherlands	3	42	44	56	69	44	95	94	38
10	Germany	8	32	55	69	60	23	91	88	37

According to an examination of the market potential index, India is ranked fourth with a significant prospective market for launching a firm. India scored 49 overall in 2016, but when compared to 2022, the score dropped to 45, indicating a sluggish increase in market potential. Additionally, it demonstrates the potential for the car industry to boost consumer spending. However, due to the pandemic in 2020, the Indian economy's market growth rate dropped.

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Appendix 9: Assessing Cultural Fit (Hofstede, 1993)



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3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of management and business then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.
Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.



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- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.



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Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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