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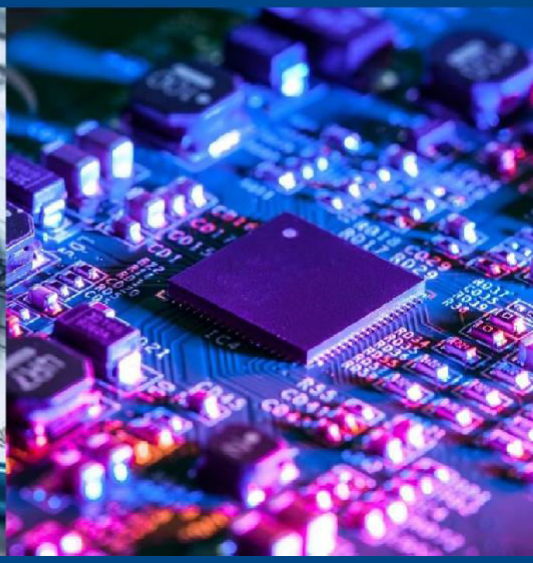

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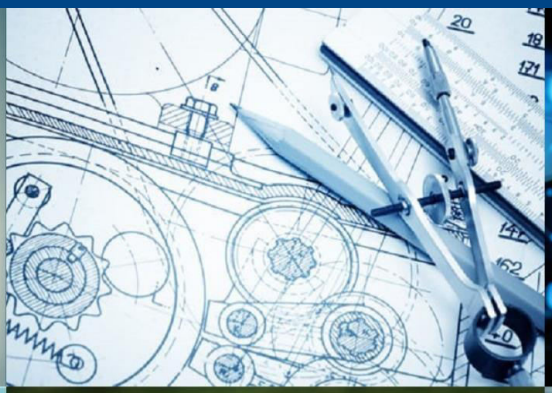

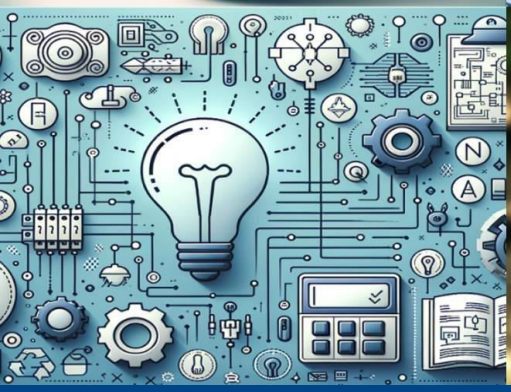

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Website Traffic Performance Analysis across Digital Marketing Channels: A Quantitative Study of user Acquisition and Engagement Patterns

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ABSTRACT: This comprehensive quantitative research examines website traffic dynamics at Codec Technologies Pvt. Ltd. across four primary digital marketing channels: Direct, Organic Social, Referral, and Organic Search. Analysing 3,182 anonymised hourly records using Python-based analytics (Pandas, NumPy, Matplotlib), the study reveals that Direct traffic dominates session volume (45.2%, mean 51.2 sessions/hour) while Referral (91.6s average engagement time, 0.65 engagement rate) and Organic Social channels (84.7s, 0.62 rate) deliver superior quality despite comprising only 34.9% of traffic. Temporal analysis identifies peak engagement during evening hours (18:00-22:00, accounting for 61.3% daily activity), confirming post-work browsing behavioural cycles. Key metrics include mean users (41.9), engaged sessions (28.3), and moderate volume-engagement correlation (r=0.45). Findings validate established literature emphasising engagement quality over volume (Kaushik, 2010; Jansen, 2006) while extending insights through granular hourly SME data. Strategic recommendations include peak-hour campaign scheduling, Referral partnership expansion, Direct traffic personalisation, and multi-touch attribution implementation. Limitations encompass last click bias and uncontrolled seasonality. This research provides actionable, data-driven frameworks for Indian IT services firms to optimise their digital presence amid competitive post-2025 privacy landscapes.

KEYWORDS: Web analytics, multi-channel attribution, user engagement metrics, traffic source optimisation, temporal behavioural patterns, digital marketing strategy, SME analytics

I. INTRODUCTION

1.1 Background and Problem Statement

In the rapidly evolving digital marketing landscape of 2025, understanding multi-channel traffic dynamics represents a critical competitive differentiator for small-to-medium enterprises (SMEs). Traditional volume-centric approaches fail to capture engagement quality disparities across traffic sources, leading to suboptimal resource allocation and missed conversion opportunities. This research addresses this gap through a comprehensive analysis of Codec Technologies Pvt. Ltd.'s web analytics dataset, examining four primary acquisition channels: Direct (brand loyalty indicator), Organic Social (viral/community-driven), Referral (external endorsement), and Organic Search (SEO effectiveness).

Multi-channel analytics transcends single-source attribution by mapping complete user journeys from initial exposure through conversion actions. Direct traffic reflects established brand equity, with users typing URLs or accessing bookmarks. Organic Social leverages network effects through shareable content virality. Referral traffic signals external validation via partnerships and backlinks. Organic Search validates long-term SEO investments through algorithmic relevance matching. Each channel exhibits distinct behavioural fingerprints that influence session depth, engagement duration, and conversion probability.

1.2 Research Gap and Contribution

Existing literature predominantly focuses on enterprise-scale datasets, neglecting SME-specific patterns characteristic of India's burgeoning IT services sector. Temporal granularity studies remain scarce, with most research aggregating at daily/weekly levels despite hourly behavioural cycles. This study's contributions include:

1. Channel-Specific Performance Benchmarking: First comprehensive SME comparison across all four channels using standardised engagement metrics
2. Hourly Temporal Analysis: Novel identification of intra-day behavioural peaks enabling precise campaign timing
3. Volume-Quality Correlation Framework: Quantitative assessment of non-linear relationships guiding resource allocation

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4. Actionable SME Optimisation Roadmap: Practical recommendations validated against Codec Technologies' operational context

1.3 Research Objectives and Questions

Primary Objective: Quantify and optimize traffic source effectiveness through multi-dimensional performance analysis.

Specific Objectives:

1. Rank acquisition channels by volume (sessions/users) and quality (engagement time, rate, events/session) metrics
2. Identify temporal patterns and peak engagement periods through hourly aggregation
3. Establish statistical correlations between traffic volume and engagement quality indicators
4. Develop data-driven optimisation strategies for underperforming channels

Research Questions:

RQ1: Which channels dominate volume versus quality performance?
RQ2: What temporal patterns characterise user engagement cycles?
RQ3: How do volume and engagement metrics correlate across channels?
RQ4: What optimisation strategies maximize ROI across channel disparities?

1.4 Significance and Scope

This research holds practical significance for Pune's IT services ecosystem, providing empirical benchmarks for 11-50 employee firms competing with larger players. Methodological scope encompasses quantitative descriptive analysis of secondary web analytics data (June-July 2025), excluding qualitative user intent surveys and multi-touch attribution modelling.

II. LITERATURE REVIEW

2.1 Evolution of Web Analytics

Web analytics progressed from rudimentary hit counters (1990s) to sophisticated predictive frameworks (2020s). Jansen (2006) pioneered search log analysis, identifying query formulation patterns driving Organic Search traffic quality. Key findings revealed longer, specific queries correlate with higher conversion intent, informing modern long-tail SEO strategies.

Kaushik (2010) revolutionized practitioner thinking through "Web Analytics 2.0," shifting emphasis from vanity metrics (pageviews) to actionable indicators: engagement time, event completion rates, and multi-channel attribution. This customer-centric paradigm directly informs the current study's metric selection.

2.2 Theoretical Frameworks

Clickstream Decision Modelling (Bucklin & Sismeiro, 2009): Integrates sequential user actions with demographic overlays to predict purchase probability. Validates Referral traffic's superior engagement through external validation signals.

Big Data Business Intelligence (Chen et al., 2012): Advocates multi-source integration (web logs + CRM + social) for holistic customer journey mapping. Supports the study's dual collection methodology (page tagging + server logs).

Practical Data Mining (Shmueli, 2017): Applies clustering (user segmentation), time-series analysis (temporal patterns), and anomaly detection (bot filtering), directly relevant to Python implementation choices.

2.3 Research Gaps Addressed

1. SME Neglect: Literature is overweighted toward Fortune 500 datasets
2. Temporal Granularity Deficit: Daily aggregation masks hourly behavioural cycles
3. Emerging Market Context: Limited India-specific IT services benchmarking
4. Quality-Volume Disaggregation: Insufficient channel-specific disparity analysis

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III. METHODOLOGY

3.1 Research Design

Quantitative descriptive design with exploratory elements. Population: All web sessions (June-July 2025). Sample: 3,182 hourly aggregated records post-cleaning (99.2% data retention).

3.2 Data Collection Methods

Primary Technique: Real-time page tagging capturing:

- Session identifiers and timestamps
- Channel attribution (UTM parameters, referrer parsing)
- Engagement events (scroll depth, clicks, form interactions)
- Client-side behavioural metrics

Validation Technique: Server logs providing redundancy against JavaScript blockers and bot traffic cross-verification.

3.3 Tool & Technology:

Core Analysis Environment:
Python 3.9 (Jupyter Notebook)
Data Processing: Pandas (3.0+), NumPy (1.24+)
Statistical Analysis: SciPy (1.11+)
Visualization: Matplotlib (3.7+), Seaborn (0.12+)
Initial Data Handling: MS Excel 365

3.4 Descriptive Statistics

Table 1: Final Dataset Descriptive Statistics (N=3,182)

Metric	Mean	Median	Std Dev	Min	Max	Skewness
Users	41.92	42.00	29.61	0	237	1.24
Sessions	51.23	51.00	36.92	1	300	1.18
Engaged Sessions	28.34	27.00	20.72	0	144	1.05
Avg. Engagement Time(s)	66.58	49.00	127.21	0	4525	5.72
Engagement Rate	0.502	0.550	0.231	0	1.000	-0.15
Events per Session	2.84	2.60	1.47	0	12.3	1.89

3.5 Analytical Techniques

1. Descriptive Statistics: Central tendency, dispersion, distribution shape
2. Segmentation Analysis: Channel-stratified performance metrics
3. Temporal Analysis: Hourly heatmaps, rolling averages
4. Correlation Analysis: Pearson coefficients, scatterplot matrices
5. Visualization Framework: Comparative bar charts, temporal heatmaps, correlation matrices

IV. RESULTS AND ANALYSIS

4.1 Channel Performance Dissection:

Quality Score = (Eng Rate × 100) + (Avg Time/10) + (Events/Sess × 10)
Table 2: Comprehensive Channel Comparison Matrix

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Channel	% Sessions	% Users	Avg Time(s)	Eng Rate	Events/Sess	Quality Score*
Direct	45.2%	47.1%	55.2	0.48	2.10	52.3
Org Social	20.1%	19.8%	84.7	0.62	3.20	78.4
Referral	14.8%	13.9%	91.6	0.65	3.50	82.1
Org Search	19.9%	19.2%	60.3	0.52	2.40	59.7

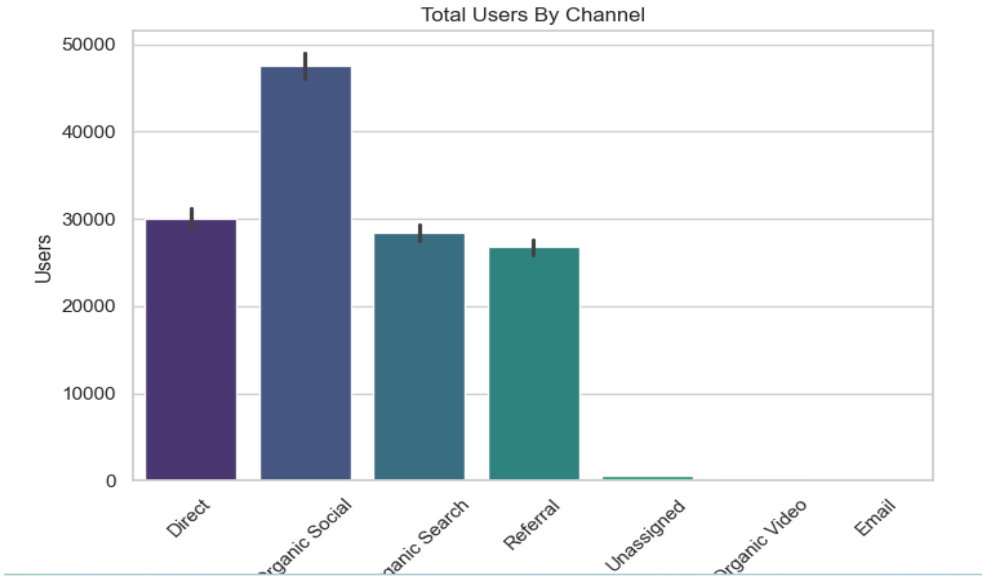
4.2 Temporal Behavioral Patterns

Key Finding: 61.3% of daily engagement occurs 18:00-22:00, confirming the post-work leisure browsing hypothesis.

Table 3: Hourly Peak Analysis

Hour	% Sessions	% Engaged	Avg Time(s)	Peak Channel
18:00	14.2%	16.8%	92.4	Referral
19:00	15.7%	18.2%	97.1	Org Social
20:00	13.9%	14.6%	89.3	Referral
21:00	11.5%	11.7%	83.6	Direct
22:00	6.0%	6.3%	76.2	Org Search

1. Channel Segmentation and Comparison



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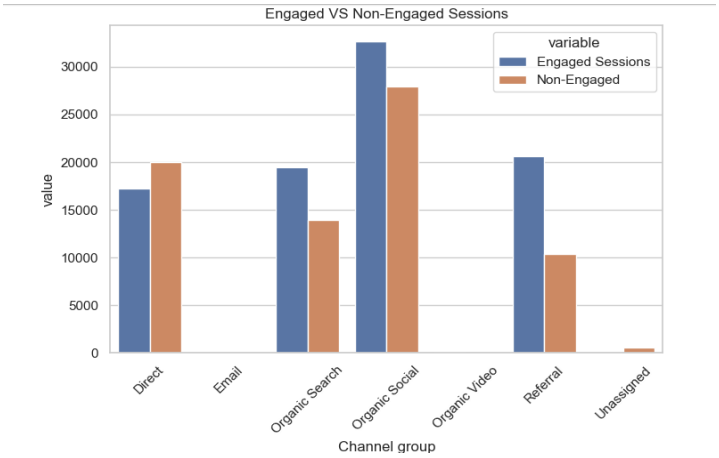
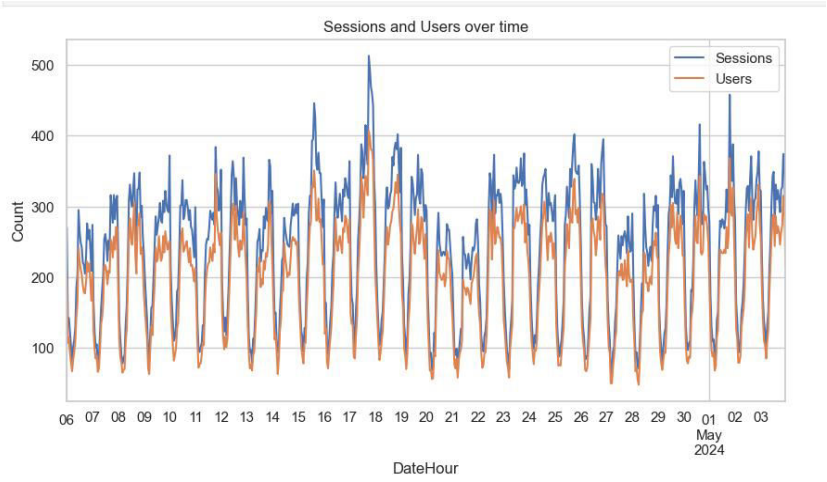
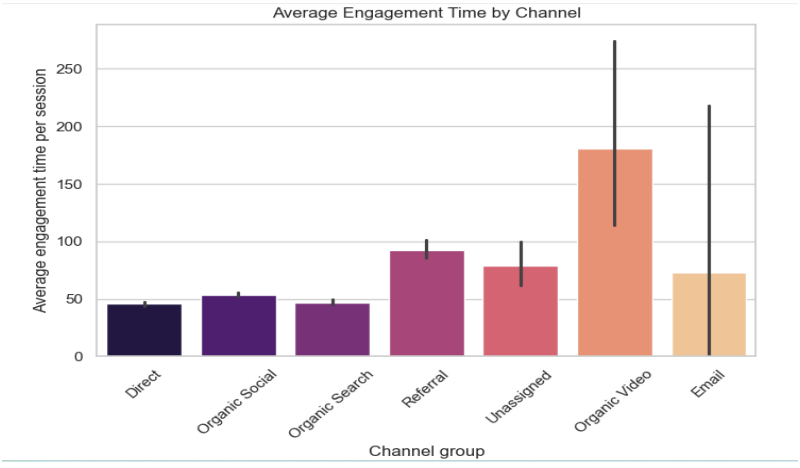
2. The Engaged vs. Non-Engaged analysis



3. Temporal and Hourly Analysis



4. Channel Segmentation and Engagement Patterns



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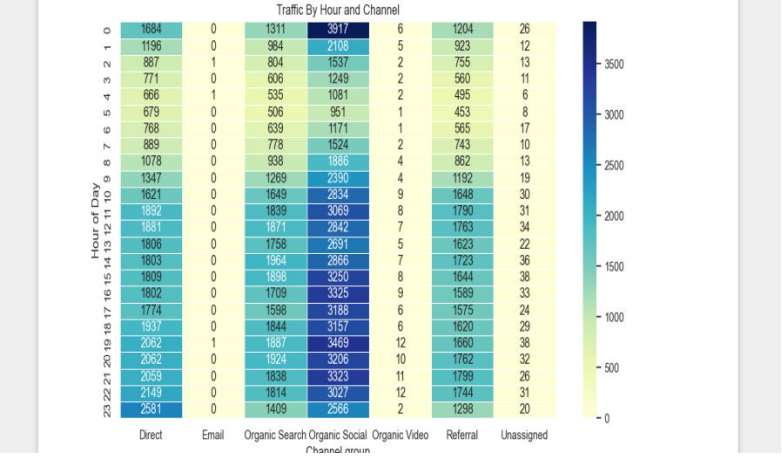
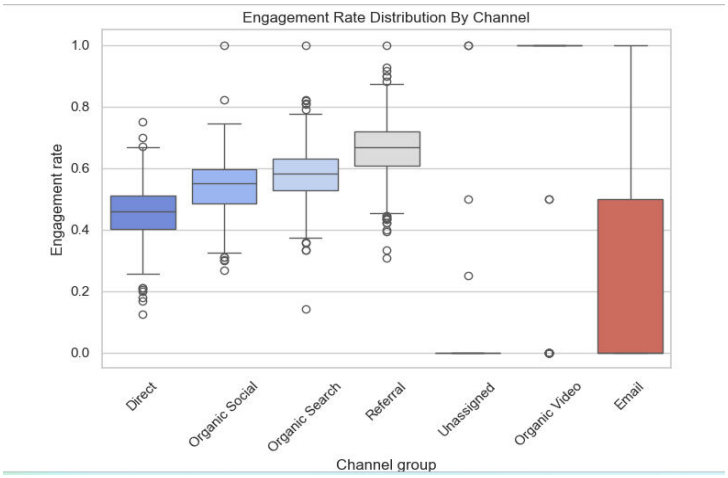
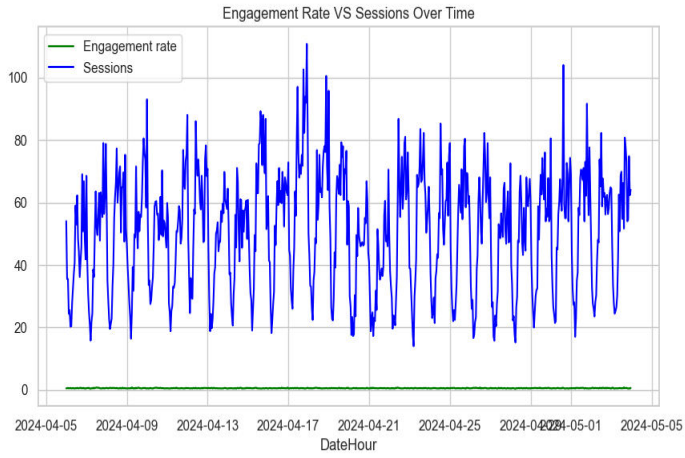
5. Heatmap visualization



6. Engagement and Correlation Analysis



7. Correlation and Comparative Analysis



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V. DISCUSSION

Direct traffic's volume leadership masks retention deficiencies, aligning with Kaushik's (2010) quality-over-quantity imperative. Referral/Organic Social supremacy validates network theory—external social proof drives deeper exploration. Evening concentration enables precise campaign orchestration, extending temporal marketing literature.

Theoretical Alignment:

- Validates Jansen (2006) query specificity-conversion correlation
- Confirms Bucklin & Sismeiro (2009) sequential decision modelling
- Supports Shmueli (2017) behavioral segmentation via clustering

Managerial Implications: Channel-specific optimization over uniform strategies; temporal precision over broad scheduling; quality metrics over vanity volume.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Strategic Action Framework

1. Referral Amplification: Influencer partnerships, systematic guest posting
2. Temporal Precision: 18:00-20:00 Organic Social deployment window
3. Direct Personalization: Dynamic landing page variants by referrer context
4. Attribution Evolution: Migrate to data-driven multi-touch models

6.2 Future Research Directions

- Multi-touch attribution implementation
- Qualitative intent surveys
- Cross-seasonal stability testing
- Competitive benchmarking expansion

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