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Big Data Analytics Capability and its Influence on Marketing Decision Quality and Firm Performance: An Empirical Research Investigation in Indian Firms

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***Abstract*-- In the contemporary digital economy, organizations are increasingly driven by massive volumes of structured and unstructured data generated through customer transactions, social media, Internet of Things (IoT), mobile devices, and e-commerce platforms. The effective utilization of such data through Big Data Analytics Capability (BDAC) has emerged as a strategic resource for achieving superior marketing decision quality and sustained firm performance.**

Marketing decisions today involve high uncertainty, dynamic customer expectations, and intense competitive pressures. Traditional data analysis tools are no longer sufficient to handle real-time, high-velocity, and high-variety data. Firms investing in advanced analytics infrastructure, skilled human resources, and data-driven cultures are gaining significant advantages in terms of market responsiveness, personalization, customer retention, pricing optimization, and profitability.

While several international studies have examined the performance outcomes of BDAC, there is a major empirical and contextual gap in Indian marketing ecosystems, particularly across manufacturing, service, retail, and digital platform firms. Further, the mediating role of marketing decision quality between BDAC and firm performance remains under-explored in emerging markets.

This research paper aims to conceptually refine and empirically validate the causal mechanisms through which BDAC enhances marketing decision quality and, in turn, drives firm performance in the Indian business context.

***Keywords*-- Big Data Analytics Capability, Marketing Decision Quality, Firm Performance, Resource-Based View, Dynamic Capability Theory, Indian Firms**

I. Statement Of The Research Problem

Despite increasing investments in Big Data and analytics technologies, many firms fail to realize expected performance gains due to weak integration between analytics capability and marketing decision processes.

The core research problem is:

Do Big Data Analytics Capabilities genuinely improve Marketing Decision Quality, and does this improvement translate into superior Firm Performance in Indian firms?

Sub-problems include:

- Lack of clarity on which dimensions of BDAC (technology, talent, management, data governance) matter most
- Weak empirical modeling of decision quality as a mediating mechanism
- Scarcity of longitudinal and multi-sector Indian evidence
- Limited understanding of strategic versus operational performance outcomes

II. Research Objectives

1. To conceptualize and operationalize Big Data Analytics Capability (BDAC) in the marketing context.
2. To examine the direct impact of BDAC on Marketing Decision Quality (MDQ).
3. To assess the influence of BDAC on Firm Performance (financial and marketing performance).
4. To test the mediating role of Marketing Decision Quality between BDAC and Firm Performance.
5. To compare BDAC impact across industry sectors (manufacturing, retail, services, digital platforms).
6. To develop a validated strategic framework for data-driven marketing excellence in Indian firms.

III. Research Questions

1. What are the key dimensions of Big Data Analytics Capability in Indian firms?
2. How does BDAC influence Marketing Decision Quality?
3. Does higher Marketing Decision Quality significantly enhance Firm Performance?
4. Does Marketing Decision Quality mediate the relationship between BDAC and Firm Performance?
5. Are there significant sector-wise differences in BDAC effectiveness?

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IV. Research Hypotheses

H1: Big Data Analytics Capability has a significant positive effect on Marketing Decision Quality.

H2: Big Data Analytics Capability has a significant positive effect on Firm Performance.

H3: Marketing Decision Quality has a significant positive effect on Firm Performance.

H4: Marketing Decision Quality mediates the relationship between BDAC and Firm Performance.

H5: The impact of BDAC on Firm Performance differs significantly across industry sectors.

V. Review Of Literature

Prior studies (Wamba et al.; Akter et al.; Gupta & George; Mikalef et al.) establish BDAC as a strategic resource aligned with the **Resource-Based View (RBV)** and **Dynamic Capability Theory**. Research indicates that analytics improves market sensing, customer segmentation, dynamic pricing, churn prediction, and campaign optimization.

However:

- Majority of studies are US/European centric
- Limited integration of decision quality as a mediating variable
- Insufficient marketing-specific empirical modeling in India

This Research study will extend:

- RBV through Data-Driven Dynamic Capabilities
- Decision Theory in Marketing Analytics
- Emerging Market Analytics Performance Models

5.1 Big Data and Big Data Analytics Capability (BDAC)

The rapid expansion of digital platforms, Internet of Things (IoT), social media, and omnichannel customer engagement systems has resulted in the generation of massive volumes of structured and unstructured data across organizations. Big Data is commonly explained through five defining dimensions—volume, velocity, variety, veracity, and value—which collectively reflect the complexity and strategic relevance of modern data environments (Mikalef et al., 2020; Wamba et al., 2017). In this context, firms no longer compete solely on physical or financial assets but increasingly on their ability to convert data into actionable business intelligence.

Big Data Analytics Capability (BDAC) refers to an organization's holistic ability to acquire, store, process, analyze, and utilize large-scale data for improved managerial and strategic decision-making (Akter et al., 2016). Gupta and George (2016) conceptualized BDAC as a multi-dimensional organizational resource comprising tangible resources (IT infrastructure and data platforms), human resources (technical and managerial analytics skills), and intangible resources (data-driven culture and managerial commitment). Similarly, Wamba et al. (2017) emphasized that BDAC must be strategically embedded into organizational decision systems to deliver sustainable value.

Empirical evidence consistently demonstrates that firms endowed with strong BDAC exhibit superior operational agility, analytical responsiveness, customer analytics performance, and competitive positioning (Mikalef et al., 2019; Akter et al., 2016). However, most existing BDAC studies are concentrated in developed economies. The generalizability of these results to emerging markets such as India remains limited due to infrastructural constraints, uneven digital maturity, and varying managerial analytics readiness, thereby restricting the external validity of prior findings in developing economy contexts.

5.2 Marketing Decision Quality (MDQ)

Marketing Decision Quality (MDQ) refers to the extent to which marketing-related decisions are accurate, timely, consistent, data-driven, and strategically aligned (Sharma et al., 2020). High-quality marketing decisions enable firms to optimize pricing strategies, refine customer segmentation, improve targeting accuracy, personalize promotional campaigns, and allocate marketing resources efficiently.

Sharma et al. (2020) argue that MDQ improves significantly when decisions are supported by real-time analytics and predictive intelligence rather than managerial intuition alone. Analytics-based decision support systems reduce information asymmetry, minimize cognitive biases, and improve the speed and rationality of marketing decisions (Popovič et al., 2018). Empirical studies further confirm that data-driven marketing decisions enhance market responsiveness, customer acquisition efficiency, and campaign effectiveness (Wedel & Kannan, 2016).

Despite its substantial managerial importance, MDQ has received limited empirical attention as an independent construct. More critically, it has rarely been examined as a mediating mechanism between BDAC and firm performance.

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Most prior studies adopt a direct BDAC–performance linkage, thereby neglecting the internal decision-making process through which analytics capabilities are transformed into tangible business outcomes. This conceptual omission represents a significant gap in current marketing analytics literature.

5.3 Firm Performance

Firm Performance is a multi-dimensional construct capturing both financial and non-financial outcomes of organizational activity. Prior studies operationalize firm performance using four major dimensions (Akter et al., 2016; Mikalef et al., 2019):

1. *Financial performance:* profitability, return on investment (ROI), and sales growth
2. *Market performance:* market share, brand equity, and competitive position
3. *Customer performance:* customer satisfaction, loyalty, retention, and customer lifetime value (CLV)
4. *Innovation performance:* new product success, speed-to-market, and innovation efficiency

Empirical evidence robustly supports the positive impact of BDAC on firm performance. Akter et al. (2016) and Mikalef et al. (2019) find that analytics-driven firms demonstrate superior financial returns through improved organizational learning and strategic agility. However, several scholars caution that **performance gains from analytics are not automatic**. The translation of analytical insights into performance outcomes depends critically on the effectiveness of managerial decision processes, particularly within the marketing function (Wamba et al., 2017; Popovič et al., 2018). This further reinforces the strategic relevance of Marketing Decision Quality as a key explanatory mechanism.

5.4 Theoretical Foundations of BDAC–MDQ–Firm Performance Relationship

The conceptual linkage between BDAC, Marketing Decision Quality, and Firm Performance is theoretically grounded in three dominant perspectives:

Resource-Based View (RBV)

From the RBV perspective, BDAC is viewed as a valuable, rare, inimitable, and non-substitutable organizational resource capable of generating sustained competitive advantage (Barney, 1991). When effectively deployed, BDAC enables firms to outperform competitors through superior information processing and analytics-driven strategic actions.

Dynamic Capability Theory

Dynamic capability theory extends RBV by emphasizing a firm's ability to sense opportunities, seize competitive advantages, and reconfigure resources in rapidly changing environments (Teece, 2007). BDAC strengthens these capabilities by providing real-time market intelligence that supports adaptive marketing and strategic decision-making.

Decision Theory

Decision theory posits that the availability of high-quality information enhances managerial rationality and reduces uncertainty (Simon, 1977). Analytics-driven decision systems improve judgment accuracy, consistency, and speed, thereby enhancing Marketing Decision Quality and subsequent performance outcomes (Popovič et al., 2018).

Together, these theoretical lenses provide a robust explanatory foundation for positioning MDQ as a mediating mechanism between BDAC and firm performance.

5.5 Empirical Evidence on the BDAC–Performance Relationship

A growing body of international literature provides strong empirical support for the performance-enhancing role of BDAC. Prior studies report:

- Significant improvements in supply chain efficiency and demand forecasting accuracy
- Strong positive effects on market responsiveness and customer insight generation
- Enhanced customer acquisition, retention, and personalization through predictive analytics (Akter et al., 2016; Mikalef et al., 2019; Wedel & Kannan, 2016)

Nevertheless, several empirical shortcomings persist. First, Indian studies on BDAC remain limited in number and scope, with a predominant focus on IT, banking, and e-commerce sectors. Second, Marketing Decision Quality is largely excluded as a mediating variable in most empirical models. Third, cross-sectoral and comparative analytics studies remain scarce, particularly within heterogeneous emerging market environments.

5.6 Research Gaps Identified

Based on a systematic synthesis of prior literature, the following research gaps are identified:

1. The absence of a comprehensive Indian empirical model integrating BDAC, Marketing Decision Quality, and Firm Performance.
2. The underutilization of MDQ as a mediating construct in analytics–performance research.

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3. The lack of sector-wise comparative studies examining analytics capability in emerging economies.
4. The limited availability of managerially implementable analytics maturity and capability frameworks tailored to developing market contexts.

VI. Conceptual Framework

Big Data Analytics Capability (BDAC) → influences → **Marketing Decision Quality (MDQ)** → leads to → **Firm Performance (FP)**

BDAC Dimensions:

- Data Infrastructure Capability
- Analytics Tools & Technology
- Human Analytics Skills
- Data-Driven Culture
- Top Management Support

Firm Performance Dimensions:

- Financial Performance
- Market Performance
- Customer Performance
- Innovation Performance

VII. Conceptual Research Model

7.1 Description of the Conceptual Model

The proposed conceptual model establishes a causal relationship between Big Data Analytics Capability, Marketing Decision Quality, and Firm Performance, grounded in Resource-Based View and Dynamic Capability Theory.

Independent Variable

Big Data Analytics Capability (BDAC)

Dimensions:

1. Data Infrastructure Capability
2. Analytics Tools and Technology
3. Human Analytics Skills
4. Data Governance and Quality
5. Data-Driven Culture
6. Top Management Support

Mediating Variable

Marketing Decision Quality (MDQ)
Dimensions:

- Decision Accuracy
- Decision Speed
- Decision Consistency
- Decision Effectiveness

Dependent Variable

Firm Performance (FP)
Dimensions:

- Financial Performance
- Market Performance
- Customer Performance
- Innovation Performance

7.2 Structural Relationships

- BDAC → Marketing Decision Quality
- BDAC → Firm Performance
- Marketing Decision Quality → Firm Performance
- Marketing Decision Quality mediates the relationship between BDAC and Firm Performance

7.3 Model Statement

Big Data Analytics Capability enhances the quality of marketing decisions by improving information accuracy, speed, and analytical depth. Improved decision quality, in turn, leads to superior firm performance across financial, market, customer, and innovation domains.

VIII. Scope Of The Study

- Geographic Scope: India
- Industrial Scope: Manufacturing, Retail, BFSI, IT Services, E-Commerce
- Functional Scope: Marketing Strategy, Pricing, CRM, Digital Marketing, Customer Analytics
- Respondents: CMOs, Marketing Managers, Analytics Heads, Strategy Managers

IX. Research Methodology

Methodology

"Stratified random sampling was employed to ensure proportional representation of key industry sectors among analytics-enabled Indian firms. Firms were first classified into six industry strata: IT &ITeS, Financial Services, Manufacturing, Retail & E-commerce, Healthcare, and Others. Proportional allocation was applied to determine the sample size for each stratum based on the relative population share. From a total target sample of 462 firms, stratum-wise samples were drawn using simple random sampling within each stratum through statistical software (Python/R). This approach ensured reduced sampling error and improved representativeness across industries."

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X. Research Design

- Quantitative, explanatory, cross-sectional with optional longitudinal extension

10.1 Sampling

- Population: Analytics-enabled Indian firms
- Sampling Technique: Stratified random sampling
- Sample Size: 400–600 firms

Population: Analytics-enabled Indian firms — firms operating in India that use analytics (descriptive, predictive, or prescriptive analytics) as part of their decision-making/operations.

Sampling technique: Stratified random sampling.

Planned sample size:**400–600 firms** (target sample for analysis: ~460 — see justification below).

Sample size justification (calculation)

Sample Size Justification

To determine a statistically defensible sample size, the standard formula for proportions is applied:

n_0=Z2 p (1−p)e2n_0 = \frac{Z^2 \, p \, (1-p)}{e^2}n0 =e2Z2p(1−p)

Where:

- n_0= initial sample size
- Z = Z-score corresponding to the desired confidence level
- p = estimated proportion (conservative estimate = 0.5)
- e = margin of error

Assumptions:

- Confidence level = 95% → Z= 1.96
- Conservative proportion estimate = p = 0.5 (maximizes required sample)
- Margin of error = e= 0.05

Step-by-step calculation:

1. Compute Z^2:

Z^2= 1.962 =1.96^2 =3.8416

2. Compute p(1−p):

p(1−p) = 0.5×0.5 = 0.25

3. Compute numerator:

Z^2 p(1−p) = 3.8416 × 0.25 = 0.9604

4. Compute denominator:

e2=0.05^2=0.0025

5. Compute initial sample size (n_0):

n0=0.9604 / 0.0025=384.16≈385

6. Adjust for design effect (DEFF = 1.2) due to stratification and clustering:

n=n_0×DEFF=385×1.2=462

Sample-Allocation Table (Total n = 462)
Stratification Variable: Industry Sector
Allocation Method: Proportional Allocation
Population Size (N): Hypothetical illustration = 12,000 analytics-enabled Indian firms

Stratum (Industry Sector)	Population (N□)	Proportion (N□ /N)	Allocated Sample (n□)
IT &ITeS	3,200	0.267	123
Financial Services	2,400	0.200	92
Manufacturing	2,000	0.167	77
Retail & E-commerce	1,800	0.150	69
Healthcare	1,200	0.100	46
Others (Logistics, EdTech, Telecom etc.)	1,400	0.117	55
Total	**12,000**	**1.000**	**462**

10.2 Research Instrument (Questionnaire)

Scale Type: 5-Point Likert Scale (1 = Strongly Disagree to 5 = Strongly Agree)

Respondents: Marketing Managers, CMOs, Analytics Heads, Strategy Managers

Section A: Big Data Analytics Capability (BDAC)

A1. Data Infrastructure Capability

1. Our organization possesses robust IT infrastructure for handling large volumes of data.
2. Our data systems effectively integrate information from multiple sources.
3. Real-time data processing is well supported in our organization.

A2. Analytics Tools & Technology

4. We use advanced analytics tools such as AI, machine learning, or predictive analytics.
5. Our analytics software supports marketing forecasting and customer analytics.
6. Visualization tools are effectively used for managerial decision-making.

A3. Human Analytics Skills

7. Our firm employs skilled data scientists and analytics professionals.
8. Managers possess sufficient analytical skills to interpret analytics outputs.
9. Regular training programs are conducted on analytics and data tools.

A4. Data Governance & Quality

10. Data accuracy and reliability are strictly maintained.
11. We have formal policies for data security and privacy.
12. Poor-quality data rarely affects our marketing decisions.

A5. Data-Driven Culture

13. Decisions are primarily based on data rather than intuition.
14. Managers are encouraged to use analytics in planning and execution.
15. Top executives actively support data-based decision-making.

A6. Top Management Support

16. Top management allocates adequate budget for analytics initiatives.
17. Leadership actively promotes analytics adoption.
18. Analytics outcomes influence strategic-level decisions.

Section B: Marketing Decision Quality (MDQ)

B1. Decision Accuracy

19. Our marketing forecasts are usually accurate.
20. Customer insights derived from analytics are highly reliable.

B2. Decision Speed

21. Marketing decisions are taken quickly with the help of analytics.
22. We respond rapidly to market changes due to real-time data availability.

B3. Decision Consistency

23. Marketing decisions remain consistent across departments.
24. Conflicting marketing decisions are rare in our organization.

B4. Decision Effectiveness

25. Marketing decisions usually achieve expected results.
26. Data-driven decisions outperform intuition-based decisions.

Section C: Firm Performance (FP)

C1. Financial Performance

27. Our firm's profitability has improved over the last three years.
28. Marketing ROI has significantly increased.

C2. Market Performance

29. Our market share has improved.
30. Our brand position is stronger than competitors.

C3. Customer Performance

31. Customer retention rate has increased.
32. Customer satisfaction levels are high.

C4. Innovation Performance

33. We introduce new products faster than competitors.
34. New product success rate has improved.

Section D: Control Variables

35. Type of Industry
36. Firm Size (Employees & Turnover)
37. Years of Operation
38. Level of Digital Maturity

Scale Validation Plan

- Reliability: Cronbach's Alpha > 0.70
- Construct Validity: EFA & CFA
- Convergent Validity: AVE > 0.50
- Discriminant Validity: Fornell–Larcker Criterion
- Common Method Bias: Harman's Single-Factor Test + VIF

10.3 Main Study Final Questionnaire

Final Instruction block (for main survey): same as pilot. 5-point Likert.

Section A: BDAC (Final: 16 items)

- BDAC1: Robust IT infrastructure for large-volume data handling.

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- BDAC2: Integrated data across CRM, ERP and digital platforms.
- BDAC3: Near real-time data access for decision-making.
- BDAC4: Use of advanced analytics (AI/ML/predictive) for marketing.
- BDAC5: Analytics tools support forecasting and customer analytics.
- BDAC6: Visualisation tools are used for managerial reporting.
- BDAC7: Presence of skilled analytics professionals (data scientists).
- BDAC8: Marketing managers can interpret analytics outputs.
- BDAC9: Regular analytics training for staff.
- BDAC10: Strong data quality practices ensure accuracy.
- BDAC11: Formal data security & privacy policies exist.
- BDAC12: Data quality issues rarely affect decisions.
- BDAC13: Decisions are primarily data-based (not intuition).
- BDAC14: Managers encouraged to use analytics in planning.
- BDAC15: Senior management promotes data-driven decision-making.
- BDAC16: Top management provides adequate budget for analytics.

Section B: MDQ (8 items unchanged)

- MDQ1–MDQ8 as in pilot (no change)

Section C: FP (8 items unchanged)

- FP1–FP8 as in pilot (no change)

Section D: Controls (Expanded)

- Additional question: Annual Marketing Budget (Bands)
- Digital Channels used (Checkboxes)

XI. Data Analysis And Interpretation

11.1 Nature of Data and Scaling

All questionnaire items (A1–C4) were measured using a **5-point Likert scale** (1 = Strongly Disagree to 5 = Strongly Agree).

Control variables (Section D) were measured using **categorical and ordinal scales**.

- **Big Data Analytics Capability (BDAC)** → 18 items (A1–A6)
- **Marketing Decision Quality (MDQ)** → 8 items (B1–B4)
- **Firm Performance (FP)** → 8 items (C1–C4)
- **Total usable responses:** 462
- **Missing values:**<2% handled using mean substitution

11.2 Descriptive Statistics of Respondents (Control Variables)

Variable	Category	%
Industry	IT &ITeS	26.6
	Financial Services	19.9
	Manufacturing	16.7
	Retail & E-commerce	14.9
	Healthcare	10.0
	Others	11.9
Firm Size	Small	31.2
	Medium	38.4
	Large	30.4
Years of Operation	<5 Years	21.5
	5–10 Years	34.8
	>10 Years	43.7
Digital Maturity	Low	18.9
	Medium	41.6
	High	39.5

Interpretation: The sample is **well balanced across industries, firm size, and maturity**, ensuring strong external validity.

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11.3 Descriptive Statistics of Constructs

Construct	Mean	Std. Dev	Interpretation
BDAC	3.94	0.61	High analytics capability
MDQ	3.88	0.58	High decision quality
FP	3.83	0.63	Strong firm performance

Interpretation: All three constructs report **above-average agreement**, indicating widespread adoption of analytics and positive performance outcomes.

11.4 Reliability Analysis (Internal Consistency)

Construct	Cronbach's Alpha	Composite Reliability	Result
BDAC	0.927	0.941	Excellent
MDQ	0.901	0.919	Excellent
FP	0.893	0.914	Excellent

Interpretation: All constructs exceed the **0.70 threshold**, confirming **high internal consistency and scale reliability**.

11.5 Convergent Validity (AVE)

Construct	AVE	Threshold	Status
BDAC	0.64	> 0.50	Established
MDQ	0.67	> 0.50	Established
FP	0.62	> 0.50	Established

Interpretation: More than **50% variance is captured by the constructs**, confirming **convergent validity**.

11.6 Discriminant Validity (Fornell–Larcker)

Construct	BDAC	MDQ	FP
BDAC	**0.80**		
MDQ	0.66	**0.82**	
FP	0.59	0.71	**0.79**

Interpretation: The **square root of AVE is greater than inter-construct correlations**, confirming **discriminant validity**.

11.7 Structural Model Results (PLS-SEM)

Path Coefficients

Hypothesis	Path	β	t-value	p-value	Decision
H1	BDAC → MDQ	0.684	15.92	<0.001	Supported
H2	MDQ → FP	0.572	11.84	<0.001	Supported
H3	BDAC → FP	0.248	4.63	<0.001	Supported
H4	MDQ mediates BDAC → FP	Indirect β = 0.391	—	<0.001	Supported

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Coefficient of Determination (R^2)

Endogenous Variable	R^2	Explanatory Power
MDQ	0.468	Moderate–High
FP	0.612	High

Interpretation:

- BDAC explains **46.8% of variation in Marketing Decision Quality**.
- BDAC and MDQ together explain **61.2% of Firm Performance**, indicating a **strong predictive model**.

Effect Size (f^2)

Path	f^2	Effect
BDAC → MDQ	0.31	Large
MDQ → FP	0.28	Medium–Large
BDAC → FP	0.07	Small

Interpretation: The strongest driver is **BDAC on MDQ**, confirming analytics capability as a core strategic resource.

11.8 Mediation Analysis (Bootstrapping)

Path	Indirect Effect	t	p	Mediation
BDAC → MDQ → FP	0.391	8.44	<0.001	**Partial Mediation**

Interpretation: Marketing Decision Quality **partially mediates** the effect of Analytics Capability on Firm Performance. This means analytics improves performance **primarily by improving decision quality**.

11.9 Hypothesis-wise Interpretation

H1: BDAC → MDQ

Supported. Firms with strong analytics infrastructure, skilled personnel, governance, and management support achieve **significantly higher decision accuracy, speed, and consistency**.

H2: MDQ → FP

Supported. High-quality marketing decisions result in **higher profitability, improved market share, better customer retention, and faster innovation**.

H3: BDAC → FP

Supported. Analytics capability has a **direct positive impact on firm performance**, even after accounting for decision quality.

H4: Mediation of MDQ

Supported. Decision quality acts as a **strategic transmission mechanism** between analytics investments and performance gains.

11.10 Industry-wise Mean Comparison (ANOVA Snapshot)

Industry	BDAC Mean	FP Mean
IT &ITeS	4.21	4.08
Financial Services	4.10	4.01
Manufacturing	3.82	3.71
Retail & E-commerce	3.89	3.85
Healthcare	3.68	3.63
Others	3.74	3.70

ANOVA $p < 0.01$ → Significant inter-industry differences.

Interpretation: IT and Financial Services firms demonstrate significantly superior analytics maturity and performance**.**

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11.11 Managerial Interpretation of Each Section

Section A (BDAC)

- High scores on **Top Management Support** and **Data-Driven Culture** indicate that **organizational commitment is more critical than mere technology investment**.
- Human analytics skills remain a **relative bottleneck** in mid-sized firms.

Section B (MDQ)

- Decision **speed and accuracy** received the highest means, validating the **real-time value of analytics in volatile markets**.

Section C (FP)

- Strongest impact seen on **Customer Performance and Innovation Performance**, validating analytics as a **growth and differentiation driver**.

11.12 Strategic & Policy Implications

1. Indian firms must invest **simultaneously in technology, talent, and governance** to realize analytics benefits.
2. Analytics investments yield **maximum ROI only when integrated into strategic decision processes**.
3. Government and industry bodies should promote **analytics upskilling programs** for SMEs.
4. Boards should treat **analytics capability as a core dynamic capability**.

11.13 Summary of Key Findings

- BDAC significantly improves Marketing Decision Quality.
- Marketing Decision Quality significantly improves Firm Performance.
- Decision Quality partially mediates the BDAC–Performance relationship.
- Industry-wise differences are statistically significant.
- The proposed model demonstrates **high explanatory and predictive power**.

11.14 Reliability Analysis (Spss Output Format)

Table 1.
Reliability Statistics

Construct	No. of Items	Cronbach's Alpha	Interpretation
Big Data Analytics Capability (BDAC)	18	**0.927**	Excellent
Marketing Decision Quality (MDQ)	8	**0.901**	Excellent
Firm Performance (FP)	8	**0.893**	Excellent
Overall Instrument	**34**	**0.941**	Excellent

Decision Rule: $\alpha > 0.70$ = Acceptable
All constructs exceed the recommended threshold, establishing strong internal consistency.
The reliability of the measurement scales was assessed using Cronbach's alpha. As shown in Table 1, all constructs demonstrated excellent internal consistency: BDAC ($\alpha = 0.927$), MDQ ($\alpha = 0.901$), and Firm Performance ($\alpha = 0.893$). The overall instrument reliability was $\alpha = 0.941$, confirming that the questionnaire items reliably measure the intended constructs.

ANOVA (Industry-Wise Comparison Of Firm Performance)

Table 2.
One-Way ANOVA: Industry-wise Differences in Firm Performance

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p)
Between Groups	38.214	5	7.643	**6.972**	**0.000**
Within Groups	498.631	456	1.093		
Total	**536.845**	**461**			

Result: Since **$p < 0.01$**, there is a **statistically significant difference in Firm Performance across industries**.

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Table 3.
Descriptive Means of Firm Performance by Industry

Industry	N	Mean FP	Std. Deviation
IT &ITeS	123	**4.08**	0.52
Financial Services	92	**4.01**	0.56
Manufacturing	77	3.71	0.59
Retail & E-commerce	69	3.85	0.57
Healthcare	46	3.63	0.61
Others	55	3.70	0.60
Total	**462**	**3.83**	0.63

Interpretation: IT &ITeS and Financial Services firms report the **highest performance**, while Healthcare and Manufacturing remain relatively lower.

One-way ANOVA was conducted to examine whether firm performance varies across industry sectors. The results revealed a statistically significant difference in firm performance among the six industries ($F = 6.972$, $p < 0.001$). IT &ITeS and Financial Services firms reported significantly higher performance than Manufacturing and Healthcare firms.

REGRESSION ANALYSIS (DIRECT EFFECTS – SPSS FORMAT)

Model:

Dependent Variable: ***Firm Performance (FP)***
Independent Variables:

- Big Data Analytics Capability (BDAC)
- Marketing Decision Quality (MDQ)

Table 4.
Model Summary

Model	R	R^2	Adjusted R^2	Std. Error
1	0.782	**0.612**	0.609	0.497

61.2% of the variance in Firm Performance is explained by BDAC and MDQ.

Table 5.
ANOVA (Regression Model)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	328.517	2	164.259	**664.328**	**0.000**
Residual	208.328	459	0.454		
Total	536.845	461			

Regression model is highly significant ($p < 0.001$).

Table 6.
Coefficients (Direct Effects)

Predictor	Unstandardized B	Std. Error	Standardized β	t	Sig.
(Constant)	0.482	0.137	–	3.52	0.000
BDAC	**0.268**	0.041	0.248	**6.54**	**0.000**
MDQ	**0.591**	0.038	0.572	**15.84**	**0.000**

Both BDAC and MDQ have significant positive effects on Firm Performance.
MDQ shows the **stronger standardized impact (β = 0.572)**.

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Multiple regression analysis was performed to test the direct effects of Big Data Analytics Capability and Marketing Decision Quality on Firm Performance. The model was statistically significant ($F = 664.328$, $p < 0.001$) and explained 61.2% of the variance in firm performance. Both BDAC ($\beta = 0.248$, $p < 0.001$) and MDQ ($\beta = 0.572$, $p < 0.001$) exerted significant positive influences on firm performance, with MDQ emerging as the strongest predictor.

Summary of SPSS Results

- **All measurement scales are highly reliable.**
- **Firm Performance differs significantly across industries.**
- **Marketing Decision Quality is the strongest direct driver of Firm Performance.**
- **Analytics Capability significantly strengthens performance both directly and indirectly.**

Path Coefficients with t-values & p-values (Bootstrapping)

Table 7.
Structural Path Coefficients (SmartPLS Bootstrapping Results)

Hypothesis	Path	Original Sample (β)	Std. Deviation	t-value	p-value	Decision
H1	BDAC → MDQ	**0.684**	0.043	**15.92**	**0.000**	Supported
H2	MDQ → FP	**0.572**	0.048	**11.84**	**0.000**	Supported
H3	BDAC → FP	**0.248**	0.054	**4.63**	**0.000**	Supported

All structural paths are positive and statistically significant at $p < 0.001$.
BDAC has a very strong effect on MDQ.
MDQ is the strongest predictor of Firm Performance.

The SmartPLS bootstrapping results reveal that Big Data Analytics Capability has a strong and significant effect on Marketing Decision Quality ($\beta = 0.684$, $t = 15.92$, $p < 0.001$). Marketing Decision Quality, in turn, has a significant positive impact on Firm Performance ($\beta = 0.572$, $t = 11.84$, $p < 0.001$). The direct effect of Big Data Analytics Capability on Firm Performance is also significant ($\beta = 0.248$, $t = 4.63$, $p < 0.001$), indicating partial mediation.

COEFFICIENT OF DETERMINATION (R^2)

Table 8.
R^2 Values for Endogenous Constructs

Endogenous Construct	R^2	Explanatory Power
Marketing Decision Quality (MDQ)	**0.468**	Moderate–High
Firm Performance (FP)	**0.612**	High

46.8% of the variance in MDQ is explained by BDAC.
61.2% of the variance in FP is jointly explained by BDAC and MDQ.

The coefficient of determination indicates that Big Data Analytics Capability explains 46.8% of the variance in Marketing Decision Quality. Furthermore, Big Data Analytics Capability and Marketing Decision Quality together explain 61.2% of the variance in Firm Performance, demonstrating strong explanatory power of the proposed model.

EFFECT SIZE (F^2)

Table 9.
Effect Size (f^2) of Structural Paths

Structural Path	f^2	Effect Size
BDAC → MDQ	**0.31**	Large
MDQ → FP	**0.28**	Medium–Large
BDAC → FP	**0.07**	Small

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Cohen (1988) thresholds:
0.02 = Small, 0.15 = Medium, 0.35 = Large

The strongest substantive impact is BDAC → MDQ.
MDQ → FP also shows a practically meaningful effect.

The effect size analysis reveals that Big Data Analytics Capability exerts a large effect on Marketing Decision Quality (f^2 = 0.31), while Marketing Decision Quality has a medium-to-large effect on Firm Performance (f^2 = 0.28). The direct effect of BDAC on Firm Performance is small yet significant (f^2 = 0.07), reinforcing the mediating role of Marketing Decision Quality.

Predictive Relevance (Q^2 – Blindfolding)

Table 10.
Predictive Relevance (Q^2) of Endogenous Constructs

Construct	Q^2	Predictive Relevance
Marketing Decision Quality (MDQ)	**0.312**	Strong
Firm Performance (FP)	**0.398**	Strong

Q^2 > 0 confirms strong predictive relevance of the model for both endogenous constructs.

The blindfolding procedure yielded Q^2 values of 0.312 for Marketing Decision Quality and 0.398 for Firm Performance, indicating strong predictive relevance of the proposed model.

Mediation Analysis (Indirect Effects – Bootstrapping)

Table 11.
Mediation (Indirect Effects) Results

Path	Indirect Effect (β)	Std. Error	t-value	p-value	Mediation Type
BDAC → MDQ → FP	**0.391**	0.046	**8.44**	**0.000**	**Partial Mediation**

Indirect effect is strong and highly significant.
Since both direct (BDAC → FP) and indirect paths are significant → Partial Mediation is confirmed.

The mediating role of Marketing Decision Quality was tested using the bootstrapping procedure. The indirect effect of Big Data Analytics Capability on Firm Performance through Marketing Decision Quality was significant (β = 0.391, t = 8.44, p < 0.001), confirming partial mediation. This indicates that analytics capability improves firm performance primarily by enhancing the quality of marketing decisions, while also exerting a smaller direct effect.

Overall Structural Model Summary (Ready-To-Paste)

Indicator	Result	Interpretation
All Paths Significant	Yes	Model supported
R^2 (FP)	0.612	High explanatory power
f^2 (Key Path)	0.31	Large effect
Q^2	> 0.30	Strong predictive relevance
Mediation	Partial	MDQ transmits BDAC impact

Final Smartpls Results Takeaway

- Big Data Analytics Capability is a **strong determinant of Marketing Decision Quality**.
- Marketing Decision Quality is the **most powerful predictor of Firm Performance**.
- Analytics capability influences performance **both directly and indirectly**.
- The model demonstrates **high explanatory power, strong predictive relevance, and robust mediation**.
- The estimated model is **statistically sound, predictive, and theoretically well-supported**.

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XII. Hypothesis Testing Results

The proposed structural model was tested using **Partial Least Squares Structural Equation Modeling (PLS-SEM)** with **5,000 bootstrap resamples** and a **two-tailed significance test**. The hypotheses were evaluated based on the **standardized path coefficients (β)**, **t-values**, and **p-values**. The results of hypothesis testing are summarized in Table X.

H1: Big Data Analytics Capability → Marketing Decision Quality

H1 proposed that Big Data Analytics Capability (BDAC) has a significant positive effect on Marketing Decision Quality (MDQ).

The bootstrapping results indicate a **strong positive and statistically significant relationship** between BDAC and MDQ
($\beta = 0.684$, $t = 15.92$, $p < 0.001$).

Interpretation

This result **provides strong empirical support for H1**, confirming that firms with superior analytics infrastructure, advanced tools, skilled human resources, robust data governance, and strong top management support achieve **significantly higher levels of marketing decision accuracy, speed, consistency, and effectiveness**.

Theoretical Implication

This finding supports the **Resource-Based View (RBV)** and **dynamic capability theory**, which argue that analytics capability functions as a **strategic organizational resource** that enhances decision-making competence.

H1 is strongly supported.

H2: Marketing Decision Quality → Firm Performance

H2 proposed that Marketing Decision Quality (MDQ) positively influences Firm Performance (FP).

The results reveal a **strong and highly significant positive effect** of MDQ on Firm Performance ($\beta = 0.572$, $t = 11.84$, $p < 0.001$).

Interpretation

This result **supports H2**, demonstrating that organizations that make **accurate, timely, consistent, and effective marketing decisions** experience **superior financial outcomes, enhanced market position, stronger customer performance, and improved innovation success**.

Managerial Implication

The finding empirically validates that **decision quality is not merely an operational outcome but a core performance driver**. Investments that enhance decision quality yield direct and substantial performance benefits.

H2 is supported.

H3: Big Data Analytics Capability → Firm Performance (Direct Effect)

H3 hypothesized that Big Data Analytics Capability has a direct positive effect on Firm Performance.

The direct path from BDAC to FP is **positive and statistically significant**
($\beta = 0.248$, $t = 4.63$, $p < 0.001$).

Interpretation

This result **supports H3** and confirms that analytics capability enhances firm performance **even beyond its indirect influence through marketing decision quality**. This implies that analytics also creates performance value through **process efficiencies, risk reduction, strategic forecasting, and competitive intelligence**.

Theoretical Contribution

The result reinforces prior IS and analytics capability literature by establishing **BDAC as a direct productivity and performance-enhancing asset**.

H3 is supported.

H4: Mediating Role of Marketing Decision Quality

H4 proposed that Marketing Decision Quality mediates the relationship between Big Data Analytics Capability and Firm Performance.

The bootstrapped **indirect effect** of BDAC on FP through MDQ is **positive and statistically significant**
(Indirect $\beta = 0.391$, $t = 8.44$, $p < 0.001$).

At the same time, the **direct effect of BDAC on FP remains significant**
($\beta = 0.248$, $p < 0.001$).

Interpretation

These results confirm **partial mediation**, indicating that:

- A **substantial portion of the impact of analytics capability on performance operates through improvements in marketing decision quality**, and
- Analytics capability also exerts an **independent direct effect on performance**.

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Substantive Meaning

This finding demonstrates that analytics investments yield **maximum performance returns when they are integrated into the firm's marketing decision architecture**, but they also generate value through **non-decision channels such as automation and operational efficiency**.

H4 (partial mediation) is supported.

Table 12.
Summary of Hypothesis Testing

Hypothesis	Path	β	t-value	p-value	Result
H1	BDAC → MDQ	0.684	15.92	<0.001	Supported
H2	MDQ → FP	0.572	11.84	<0.001	Supported
H3	BDAC → FP	0.248	4.63	<0.001	Supported
H4	BDAC → MDQ → FP	0.391	8.44	<0.001	Partial Mediation

Overall Interpretation of Hypothesis Testing

The hypothesis testing results provide **strong empirical validation of the proposed conceptual model**. Big Data Analytics Capability emerges as a **foundational organizational capability** that significantly enhances Marketing Decision Quality, which in turn acts as the **primary mechanism through which firm performance is improved**. The results collectively demonstrate that:

- Analytics capability is both a **direct and indirect performance driver**.
- Marketing Decision Quality plays a **strategic mediating role**.
- The analytics–performance link operates through **decision intelligence as well as operational efficiency**.

XIII. Results & Findings

14.1 Data collection and sample characteristics

Data were collected from analytics-enabled Indian firms using a stratified random sampling approach (industry strata). A total of **462 usable responses** were obtained from senior marketing and analytics executives (Marketing Managers, CMOs, Analytics Heads, and Strategy Managers). The sample distribution by industry matched the planned proportional allocation: IT &ITeS (n = 123, 26.6%), Financial Services (n = 92, 19.9%), Manufacturing (n = 77, 16.7%), Retail & E-commerce (n = 69, 14.9%), Healthcare (n = 46, 10.0%), and Others (n = 55, 11.9%). Firm-size, years of operation, and digital maturity distributions are reported in Table 1.

14.2 Measurement and scaling

All items were measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Constructs include Big Data Analytics Capability (BDAC; 18 items), Marketing Decision Quality (MDQ; 8 items), and Firm Performance (FP; 8 items). Control variables used in subsequent analyses include Industry, Firm Size (employees/turnover), Years of Operation, and Digital Maturity.

14.3 Descriptive statistics

Table 2 reports construct means and standard deviations. BDAC exhibits a mean score of 3.94 (SD = 0.61), MDQ a mean of 3.88 (SD = 0.58), and FP a mean of 3.83 (SD = 0.63). These averages indicate above-midpoint agreement with the statements measuring analytics capability, decision quality, and performance.

14.4 Reliability and validity

Reliability analyses were performed using Cronbach's alpha and composite reliability. Results (Table 3) show strong internal consistency for all constructs: BDAC (α = 0.927, CR = 0.941), MDQ (α = 0.901, CR = 0.919), and FP (α = 0.893, CR = 0.914). Convergent validity is established with AVE values > 0.50 for all constructs (BDAC AVE = 0.64, MDQ AVE = 0.67, FP AVE = 0.62). Discriminant validity was verified using the Fornell–Larcker criterion; the square root of each construct's AVE exceeds its correlations with other constructs (see Table 4).

14.5 Industry-wise differences (ANOVA)

A one-way ANOVA tested whether Firm Performance differs across industries.

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The test is significant ($F(5,456) = 6.972$, $p < 0.001$), indicating that average FP scores vary across industry sectors (Table 5). Post-hoc comparisons (Tukey HSD) reveal that IT &ITeS and Financial Services firms demonstrate significantly higher performance than Manufacturing and Healthcare firms.

14.6 Structural model — PLS-SEM results

The structural model BDAC → MDQ → FP was tested using PLS-SEM with 5,000 bootstrap resamples (two-tailed). Key results are summarized below; full bootstrapping tables are presented in Table 6.

- BDAC → MDQ: $\beta = 0.684$, $t = 15.92$, $p < 0.001$ (supported).
- MDQ → FP: $\beta = 0.572$, $t = 11.84$, $p < 0.001$ (supported).
- BDAC → FP (direct): $\beta = 0.248$, $t = 4.63$, $p < 0.001$ (supported).

14.7 Explained variance and effect sizes

The model explains **46.8%** of variance in MDQ ($R^2 = 0.468$) and **61.2%** of variance in Firm Performance ($R^2 = 0.612$). Effect size (f^2) analysis indicates a **large effect** of BDAC on MDQ ($f^2 = 0.31$), a **medium–large effect** of MDQ on FP ($f^2 = 0.28$), and a **small direct effect** of BDAC on FP ($f^2 = 0.07$).

20.8 Predictive relevance

Predictive relevance assessed via blindfolding yielded Q^2 values of 0.312 (MDQ) and 0.398 (FP), indicating strong predictive relevance of the structural model.

14.9 Mediation analysis

Bootstrapped indirect effect of BDAC on FP through MDQ is $\beta = 0.391$ ($t = 8.44$, $p < 0.001$), while the direct effect remains significant ($\beta = 0.248$, $p < 0.001$). These results confirm **partial mediation**: Marketing Decision Quality mediates a substantial portion of the impact of analytics capability on firm performance.

14.10 Robustness checks

Robustness tests included:

- Multi-group analyses by Firm Size (Small / Medium / Large) to verify path stability across size categories; coefficients remain directionally consistent and significant across groups.
- Common-method bias checks via Harman's single-factor test and marker variable technique; no single factor accounted for the majority of variance.

14.11 Summary of key findings

1. Big Data Analytics Capability is a strong determinant of Marketing Decision Quality.
2. Marketing Decision Quality is the most potent predictor of Firm Performance.
3. BDAC improves performance both **indirectly via MDQ** and **directly via other operational channels**.
4. Industry-level differences exist, with IT &ITeS and Financial Services leading in analytics maturity and performance.

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