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Framework for Aligning Digital Advertising Spend with ROI Benchmarks in Niche Markets

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ABSTRACT

Niche markets present unique challenges and opportunities for digital advertisers seeking to align spending with return on investment (ROI) benchmarks. Unlike mass markets, niche segments demand precise targeting, personalized messaging, and efficient media allocation strategies. This paper proposes a comprehensive framework to optimize digital advertising spend by aligning it with ROI benchmarks tailored to niche market dynamics. By synthesizing insights from econometrics, digital analytics, and strategic marketing, the study introduces a model that integrates channel-specific performance data, audience engagement metrics, and conversion attribution. The methodology incorporates multivariate regression, machine learning, and scenario analysis to evaluate spending effectiveness across search, social, display, and programmatic channels. Empirical validation using case data from high-tech B2B and premium lifestyle brands illustrates how the framework enhances budget allocation efficiency and performance accountability. Findings demonstrate that tailored ROI benchmarks in niche markets lead to significantly improved campaign outcomes, validating the necessity of specialized media strategies for high-value audience segments. The proposed framework equips marketers with actionable tools to navigate fragmented digital environments and maximize impact within constrained media budgets.

Keywords : Niche Markets, Digital Advertising, ROI Benchmarks, Media Optimization, Audience Targeting, Campaign Analytics

Introduction

Digital advertising has become an indispensable component of modern marketing strategies, with annual global spend reaching over $600 billion in 2023 [1], [2]. While mainstream markets benefit from economies of scale and broad reach, niche markets

present more nuanced and targeted challenges. These markets often represent specialized consumer segments with distinct behavioral, demographic, or psychographic characteristics [3], [4]. Aligning digital advertising expenditures with return on investment (ROI) benchmarks in such contexts is essential for efficient budget utilization and measurable campaign success.

Historically, digital advertising strategies have prioritized gross impressions, click-through rates, and conversion volumes. However, in niche markets, where target audiences are smaller and more specialized, traditional metrics often fail to capture the depth of engagement and quality of conversions [5], [6]. This misalignment creates a significant challenge for marketers attempting to justify ad spend and optimize performance within constrained media budgets.

The rise of data-driven marketing has enabled more granular analysis of campaign performance, yet a standardized framework for ROI alignment in niche contexts remains underdeveloped [7], [8]. Emerging analytics tools allow for better tracking of customer journeys, behavioral patterns, and cross-channel interactions, offering an opportunity to refine media strategies and ROI benchmarks accordingly.

This paper proposes a novel framework designed to align digital advertising spend with ROI benchmarks specifically tailored for niche markets. The model incorporates key performance indicators (KPIs), media channel dynamics, consumer behavior data, and predictive analytics to improve spend efficiency and accountability. The proposed framework is informed by both academic literature and real-world campaign data, enabling a practical and theoretically robust solution for digital marketers.

In the sections that follow, we review the relevant literature, outline the methodological approach, present empirical results, and discuss the implications of the proposed framework. The objective is to provide a scalable, adaptable model that empowers marketers operating in niche segments to make data-driven decisions and achieve superior campaign outcomes.

Literature Review

The field of digital marketing has witnessed an exponential increase in research on advertising performance, yet few studies address the unique needs of niche markets. Niche marketing focuses on highly segmented consumer groups characterized by specific interests, needs, or preferences [9], [10]. These segments often exhibit high engagement potential but low overall reach, necessitating targeted media strategies and customized ROI metrics [11], [12].

Several scholars have explored the general relationship between advertising spend and performance outcomes. Traditional media mix modeling (MMM) techniques have relied on linear regression and time series models to estimate the contribution of different channels to sales or conversions [13], [14]. However, these approaches often assume homogeneity in consumer behavior, which is not applicable in niche environments [15], [16].

The literature increasingly points to the value of personalized messaging and audience segmentation in enhancing advertising effectiveness. Studies have shown that ad relevance and contextual targeting significantly influence click-through and conversion rates in niche campaigns [17], [18]. Psychographic profiling and behavioral analytics are frequently cited as critical tools for refining audience targeting and improving ROI [19], [20].

Advancements in marketing technology have enabled real-time data collection and adaptive campaign optimization. Dynamic creative optimization (DCO), for instance, allows for message variation based on user behavior and preferences, which is particularly useful in narrow market segments [21], [22]. Nevertheless, the integration of such technologies into a cohesive ROI framework remains limited.

Attribution modeling has also evolved, with multitouch attribution (MTA) gaining popularity over traditional last-click models. MTA offers a more

comprehensive view of the customer journey by assigning fractional credit to various touchpoints [23], [24]. In niche markets, where decision cycles may be longer and involve more interactions, MTA provides a more accurate assessment of campaign performance [25].

Econometric research has highlighted the role of elasticity in measuring media performance. Media elasticity quantifies the responsiveness of an outcome variable (e.g., conversions) to changes in media input (e.g., spend) [26]. While commonly used in mass-market models, applying elasticity to niche segments requires contextual calibration due to differing consumer behaviors and market dynamics [27], [28].

The intersection of machine learning and digital advertising has opened new avenues for predictive modeling and ROI estimation. Algorithms such as random forests, support vector machines (SVM), and gradient boosting machines (GBM) have been employed to uncover non-linear relationships between media variables and performance metrics [29], [30]. These tools are particularly useful in high-dimensional data environments typical of digital campaigns.

Recent literature has also addressed the importance of campaign granularity and data fidelity. High-resolution temporal data allows for better tracking of lag effects and diminishing returns, which are crucial for optimizing media allocation in niche contexts [31], [32]. Researchers have advocated for the inclusion of lagged variables, control factors (e.g., seasonality, macroeconomic trends), and interaction terms to improve model robustness [33], [34].

Despite these advancements, a gap persists in frameworks specifically designed to align digital advertising spend with ROI in niche markets. Most existing models are generalized, focusing on volume metrics and broad market trends. This paper contributes to filling that gap by synthesizing best practices in media analytics, econometrics, and strategic planning into a focused framework for niche market applications.

Methodology

This section details the methodological approach undertaken to construct and validate the proposed framework for aligning digital advertising spend with ROI benchmarks in niche markets. The methodology integrates a multi-phase design combining qualitative discovery, quantitative model development, and validation through case-based application. Each phase builds upon core research principles in digital marketing analytics, behavioral modeling, and econometric validation to ensure robust and generalizable insights.

Phase I: Market and Channel Diagnostic

The research began with an extensive market and channel diagnostic to contextualize digital media dynamics within niche sectors. This involved mapping consumer personas, evaluating competitor spend behaviors, and profiling channel efficiencies using aggregated media performance datasets. The sample included 35 niche industry campaigns from sectors such as specialty healthcare, eco-tourism, artisanal food products, and enterprise SaaS verticals. Channel attributes such as average CPM, CPC, CTR, conversion rate, and dwell time were extracted from DSPs, ad exchanges, and client-side CRM logs [35], [36]. The goal was to delineate patterns of media consumption and ROI differentials across platforms including paid social, programmatic display, search engine marketing, influencer integrations, and email marketing [37], [38].

Cluster analysis was applied to segment markets based on ad response variance and media intensity using k-means and DBSCAN algorithms [39], [40]. This classification guided subsequent model customization for each niche group, ensuring contextual sensitivity and strategic alignment.

Phase II: Qualitative Input Gathering

To augment the quantitative models with real-world insights, semi-structured interviews were conducted with 42 digital marketers, media buyers, and agency strategists operating in niche markets [41], [42]. Interview questions centered on campaign planning,

budget constraints, ROI expectations, and adaptive optimization strategies. Thematic analysis using NVivo 14 was conducted to identify key operational themes such as creative testing cycles, budget elasticity thresholds, and lead quality feedback loops [43], [44].

Insights from this phase informed the definition of operational variables within the modeling framework, such as cost tolerance, time-to-impact, and attribution reliability, which are not typically captured in traditional MMMs or ROI models.

Phase III: ROI Benchmark Construction

A core innovation of the methodology is the construction of contextual ROI benchmarks tailored to niche conditions. Traditional ROI models (ROI = Net Return / Ad Spend) were enriched with weighted KPIs that reflect niche-specific outcomes, such as customer lifetime value (CLV), engagement depth, and repeat transaction rates [[45], [46].

These benchmarks were constructed using a combination of regression-based normalization, industry meta-analysis, and expert-sourced weight calibrations. A constrained optimization algorithm based on Lagrange multipliers was employed to balance competing priorities e.g., cost efficiency vs. branding reach within defined spend thresholds [47], [48].

Phase IV: Predictive Model Development

The predictive model was constructed using supervised machine learning techniques aimed at simulating and forecasting campaign outcomes under varying budget scenarios. The training dataset included over 1.2 million ad impressions, and 96,000 conversion events aggregated from multiple campaigns across four niche verticals. Features engineered for model training included media type, ad format, frequency cap, time-of-day, geo-targeting intensity, device type, audience segment ID, and prior engagement score [49], [50].

Gradient boosting machines (GBMs) and Lasso regression were chosen for their high accuracy and interpretability, respectively [51], [52]. Hyperparameter tuning was performed via grid search and cross-validation to minimize overfitting. The models predicted both ROI uplift and marginal cost efficiency (MCE) at incremental spend levels [53], [54].

Model accuracy was evaluated using RMSE, MAE, and R^2 metrics, with performance thresholds defined by domain-specific tolerances. Feature importance analysis further revealed key drivers of spend-to-performance alignment, such as creative relevance, channel saturation, and audience engagement latency [55], [56].

Phase V: Decision Support System (DSS) Design

To operationalize the predictive insights, a decision support system was developed using Python Dash for visualization and SQL-based backend integration. The DSS interface allows media planners to simulate budget shifts, view predicted ROI impacts, and compare scenario-based spend allocations [57], [58].

Functional modules included:

1. ROI Simulator – Visualizes expected ROI changes across media channels under budget reallocation scenarios.
2. Benchmark Validator – Compares predicted campaign outcomes against contextual ROI benchmarks.
3. Budget Optimizer – Suggests optimal spend configuration using a greedy algorithm approach for real-time planning.

User testing with 18 campaign managers resulted in UI/UX enhancements and confirmed the system's utility in guiding budgetary decisions [59], [60].

Phase VI: Framework Validation and Refinement

To test framework efficacy, it was applied retrospectively to five completed campaigns across different niche sectors. Pre-post comparisons of ROI realized vs. predicted showed alignment within a 5% margin of error, validating model accuracy [61]. Follow-up surveys with campaign stakeholders indicated improved confidence in budget decisions

and heightened ability to rationalize spend allocations to executive teams.

Limitations included sensitivity to data granularity, especially in low-frequency campaign environments, and dependency on high-quality CRM integration for lead tracking accuracy. These challenges were mitigated through Bayesian priors in regression modeling and imputation techniques for missing values [62], [63].

Ethical Considerations

All data used in the study were anonymized and complied with GDPR and CCPA standards. Informed consent was obtained from all interview participants, and data sharing agreements were signed with participating brands [64], [65].

Summary

The methodological architecture deployed in this study ensures that the proposed framework is grounded in empirical rigor and operational realism. It captures the nuances of digital spend behavior in niche markets while offering predictive power and actionable insights for ROI benchmarking. This prepares the ground for an evidence-based analysis in the results section, which explores real-world application outcomes and quantifies performance improvements enabled by the framework.

Results

This section presents the empirical findings derived from the application of the digital advertising spend alignment framework across five campaigns representing distinct niche market verticals. Each campaign was selected based on its unique market constraints, budget dynamics, and performance objectives. The verticals included: (1) holistic wellness services, (2) ethical fashion e-commerce, (3) organic skincare for sensitive demographics, (4) B2B productivity software for nonprofit organizations, and (5) gourmet pet food subscription services. The results detail improvements in ROI realization, efficiency gains, audience reach quality, and operational decision-making facilitated by the implementation of the predictive models and ROI benchmarks introduced earlier.

Campaign Performance Evaluation

Each of the five campaigns underwent a three-stage performance evaluation: baseline (pre-framework), simulation (framework projections), and implementation (post-framework deployment). For baseline comparisons, historical performance data for a 6-month period was normalized and indexed across standardized KPIs—CPC, CTR, CPM, ROAS, and engagement duration. Using model-generated benchmarks, simulations were run to forecast expected outcomes from optimized budget configurations.

In the post-implementation stage, ROI uplift averaged 18.7% across campaigns, with the most significant improvement observed in the B2B software case, which experienced a 23.4% increase in cost efficiency [66]. This was attributed to better retargeting strategies, dynamic creative versioning, and strategic narrowing of geo-targeted placements.

The ethical fashion campaign showed a lower uplift (11.3%) due to limited variation in consumer behavior and a heavily saturated influencer marketing segment. However, the ROI benchmark model accurately projected campaign fatigue onset and suggested pivoting to paid search, which sustained performance [67], [68].

Budget Allocation Shifts and Efficiency Gains

Pre-framework budget allocations were often intuition-driven, with disproportionate emphasis on channels lacking cost-performance justification. Post-framework reallocation led to an average 24% reduction in wasteful spend, as measured by cost per non-converting impression [69], [70]. Spend shifted away from low-engagement platforms (e.g., static display) toward higher-performing environments such as video pre-roll and contextual programmatic placements.

The ROI Simulator module proved instrumental in reallocating spend in real-time during the campaign window. For instance, the organic skincare brand

redirected 37% of its display budget mid-campaign to native content channels, resulting in a 2.1x lift in average time-on-page and a 16.9% drop in bounce rate [71], [72].

Attribution Accuracy and KPI Refinement

The inclusion of behavioral proxies (scroll depth, interaction dwell time, and sequential visit analysis) into the predictive framework improved multi-touch attribution accuracy. Standard last-click models were compared against the framework's regression-weighted attribution scheme. The latter produced a 12.4% higher correlation with verified sales data and enabled more precise channel ROI calculations [73], [74].

Refinements in KPI prioritization were observed. Stakeholders began to emphasize metrics such as customer LTV, conversion quality, and post-click engagement scores over vanity metrics like impressions and superficial reach. This shift resulted in a 28% greater alignment between campaign objectives and actual media performance [75], [76].

Qualitative Feedback and Organizational Outcomes

Interviews with media teams post-deployment indicated improved confidence in budget decisions and reduced internal friction during performance reviews. Teams cited the DSS's ability to justify spend in board meetings and its facilitation of more informed cross-functional discussions [77], [78].

Additionally, campaign cycles shortened by 11.5% due to more efficient testing and optimization. Instead of running redundant A/B tests, the predictive model's outputs allowed for more focused creative iterations, reducing turnaround times for asset deployment [79].

Validation Metrics

Model accuracy metrics across all five campaigns consistently outperformed baseline expectations. RMSE values averaged 0.042 on normalized ROI scales, and R^2 scores exceeded 0.87 in all cases [80], [81].

Feature importance analysis reaffirmed earlier hypotheses: the top five contributors to ROI accuracy included creative relevance score (22.6%), audience match index (18.1%), frequency-to-engagement ratio (16.3%), platform trust rating (14.7%), and contextual fit score (13.9%) [82], [83].

Cross-Campaign Insights and Transferability

Despite vertical specificity, several patterns emerged that suggest cross-niche transferability. First, platform trust ratings measured through brand safety, ad fraud exposure, and consumer sentiment consistently moderated ROI outcomes. Second, alignment between content style and channel format (e.g., story-format video on Instagram vs. blog-style content on Pinterest) yielded stronger cost-performance ratios [84], [85].

Furthermore, DSS-enabled budget simulations allowed smaller marketing teams to compete with larger competitors by making more data-informed decisions. The gourmet pet food brand, with only two full-time marketing staff, achieved a 21.5% ROI increase without expanding its team or increasing spend [86], [87].

Limitations and Data Constraints

Some limitations were observed, particularly concerning data fidelity in CRM systems, especially for campaigns with fragmented customer touchpoints. Missing attribution links led to underrepresented conversion paths, requiring imputation and Bayesian corrections [88], [89]. In addition, newer platforms such as TikTok and Threads posed challenges due to limited historical data and less mature ad APIs.

Nevertheless, when adjusted for these anomalies, the framework continued to yield stable and reliable performance insights, particularly in environments where media tracking was fully integrated with downstream CRM and POS systems [90], [91].

Summary

The results demonstrate that aligning digital advertising spend with ROI benchmarks through the proposed framework leads to measurable performance gains in niche markets. With an average ROI uplift nearing 19%, enhanced attribution granularity, and increased stakeholder confidence in spend decisions, the framework shows strong empirical validity. The

next section will interpret these findings in the broader context of digital advertising strategy, technology integration, and evolving ROI expectations in niche sectors.

Discussion

The empirical findings derived from the application of the proposed digital advertising spend alignment framework affirm its capacity to deliver substantial value in niche marketing contexts. This discussion section contextualizes these results by examining their implications for digital strategy, campaign management, predictive modeling, and organizational decision-making. It also explores theoretical alignments and practical divergences with existing literature, reflecting on how the framework redefines performance measurement and resource allocation in micro-targeted advertising ecosystems.

A New Paradigm for ROI-Driven Budgeting in Niche Markets

Traditional advertising models often fail to accommodate the complexity of niche market dynamics, where smaller audiences require more precision, higher relevance, and a nuanced understanding of behavioral motivators. The observed average ROI uplift of 18.7% post-framework implementation underscores the value of a predictive, benchmark-driven approach in optimizing ad spend efficiency. Unlike mass-market strategies that leverage economies of scale, niche markets benefit more from intelligent targeting and refined attribution modeling both of which are central to this framework.

Previous studies have noted the limitations of general-purpose ad optimization tools in addressing the idiosyncrasies of niche segments. By contrast, our framework's use of vertical-specific inputs and contextual engagement metrics offers a tailored alternative, substantiating claims that precision-based modeling yields higher marginal returns on ad investments in such markets [92], [93].

Insights on Behavioral Segmentation and Predictive Attribution

One of the most significant innovations presented by the framework is its integration of behavioral proxies such as scroll depth, interaction dwell time, and sequential visit analysis into the attribution model. This goes beyond the conventional "last-click" or "linear" models that have dominated digital analytics for the past decade. The improvement in attribution accuracy by 12.4% provides a compelling case for the broader adoption of such advanced behavioral segmentation techniques.

Furthermore, the feature importance analysis revealed that factors like creative relevance score (22.6%) and audience match index (18.1%) had greater predictive weight than mere frequency or CPM. This confirms emerging literature advocating for relevance-first advertising strategies, especially in consumer journeys with higher consideration cycles [94], [95]. Platforms such as Meta and TikTok have started to embed these considerations into their native ad tools, but our findings demonstrate that third-party predictive overlays can further enhance these capabilities, particularly when tailored to niche market idiosyncrasies.

Cross-Channel Synergy and Content-Platform Fit

The observed success of channel reallocation particularly the shift from static display to native and video-based formats aligns with recent trends in content consumption behavior. As seen in the organic skincare and ethical fashion campaigns, higher engagement and conversion rates were correlated with better alignment between content type and platform architecture. This confirms findings by Kumar et al. [96], who emphasized that "channel congruence" significantly impacts campaign efficacy in segmented digital ecosystems.

Moreover, the platform trust rating emerged as a critical predictor of ROI. This insight adds weight to ongoing debates around brand safety and consumer data ethics in programmatic environments [97]. In an age of increasing consumer scrutiny and ad fatigue,

placing budgetary emphasis on trusted platforms not only drives performance but also fosters longer-term brand loyalty an especially vital consideration in mission-driven niche verticals like ethical fashion and wellness.

Operational Impacts and Organizational Learning

One of the more unexpected but valuable findings pertains to organizational dynamics. The qualitative data indicated a noticeable shift in how internal teams approached media planning and reporting. Enhanced trust in the decision support system (DSS) led to more informed, collaborative budgetary discussions and reduced friction in justifying ad spend to stakeholders. This reinforces the importance of transparent analytics tools that democratize data access and interpretation across non-technical marketing personnel [98].

The reduction in campaign cycle time by 11.5% further demonstrates the operational efficiency gains afforded by predictive modeling. Traditionally, A/B testing and creative rotation are resource-intensive processes, particularly in small marketing teams. By pre-modeling likely outcomes, teams were able to iterate faster and reallocate resources more effectively—an advantage that could scale significantly across portfolios of micro-campaigns or product line variants [99].

Strategic Implications for Micro-Targeting and Competitive Positioning

An important strategic implication from the gourmet pet food case was that smaller organizations, when armed with robust predictive tools, can compete with significantly larger players. This democratization of advertising intelligence reconfigures the competitive landscape of niche markets, enabling lean teams to punch above their weight. It aligns with Christensen's theory of "disruptive innovation," wherein incumbents are challenged not by sheer spend but by smarter operational models and better data utilization [100].

By enabling more granular control of budget across micro-segments, the framework supports "micro-market domination" rather than broad-based visibility. This shift is particularly useful in sectors where consumer loyalty and lifetime value outweigh mass reach metrics a pattern seen in direct-to-consumer (DTC) brands that rely on recurring revenue from highly engaged customer bases [101].

The Role of CRM-Integrated Campaign Design

A recurring constraint encountered during the study was the integrity and completeness of CRM data. Campaigns with robust CRM-POS integration showed the strongest predictive correlations and ROI optimization outcomes. This finding supports the position that closed-loop marketing systems where ad engagement data flows into customer relationship databases and back into campaign design are essential for full-funnel performance measurement.

Organizations that fail to integrate these systems will face a "data loss chasm," whereby ad spend cannot be adequately tied to business outcomes. The implication for digital strategy is clear: investing in CRM interoperability is not a back-office concern, but a front-line requirement for advertising effectiveness [102].

Evolving Definitions of Performance Metrics

Another critical insight from the Results section was the evolving emphasis on qualitative performance indicators such as customer lifetime value (LTV), post-click engagement, and conversion depth. These metrics increasingly replaced "vanity" indicators such as impressions and basic reach, signaling a maturation in how digital performance is evaluated in niche sectors.

This redefinition aligns with contemporary calls in marketing science to move toward multi-dimensional ROI frameworks that capture downstream and longitudinal impact. By helping organizations prioritize these deeper metrics, the framework serves both tactical and strategic roles optimizing immediate spend while also aligning with long-term brand objectives [103].

Limitations, Adaptability, and Future Research

While the framework proved robust across multiple verticals, certain limitations merit further exploration. Most notably, newer platforms like TikTok and Threads posed data acquisition challenges, limiting model reliability in these environments. As these platforms mature and open up richer APIs, future versions of the framework should incorporate their engagement variables to improve applicability.

Another limitation lies in the need for continuous data hygiene and updates to the benchmark library. ROI expectations and cost baselines are not static, and the models must evolve in tandem with consumer behavior and platform algorithm changes. This necessitates a hybrid governance model wherein human analysts continuously validate machine-generated projections, echoing the findings of hybrid intelligence literature.

Future research could explore the integration of real-time feedback loops via edge analytics, especially for mobile-first niche segments. Additionally, incorporating psychographic profiling and emotional sentiment analysis into the creative scoring module could enhance relevance estimation in high-empathy sectors like mental wellness or ethical consumption.

Summary

The discussion underscores that aligning digital advertising spend with ROI benchmarks through predictive analytics and behavioral modeling yields profound strategic and operational benefits in niche market contexts. By moving beyond intuition-based budgeting and adopting data-driven decision frameworks, organizations can unlock higher ROI, reduce waste, and build more resilient advertising ecosystems. While limitations remain particularly in CRM integration and emergent platforms the framework demonstrates significant potential as a foundational tool for future-facing digital marketing in constrained yet high-value environments [104].

Conclusion

This study has proposed and empirically validated a comprehensive framework for aligning digital advertising spend with ROI benchmarks in niche markets. Through a robust combination of predictive modeling, data segmentation, real-time simulation, and qualitative feedback loops, the framework delivers a multi-dimensional tool for optimizing advertising decisions in environments characterized by high specificity and constrained audience scale. The empirical evaluation across five distinct niche campaigns confirmed that strategic budget reallocation guided by data-informed benchmarks can yield significant ROI improvements, with average uplift approaching 19%. These findings affirm the practical viability of deploying advanced decision support systems (DSS) to overcome the limitations of intuition-driven advertising practices still prevalent in under-resourced or hyper-targeted segments.

Notably, the framework demonstrated cross-sector transferability, indicating that although each niche possesses unique behavioral and operational dynamics, the underlying mechanics of ROI optimization, audience precision, creative-context alignment, and channel trustworthiness remain consistently influential. The ability to integrate behavioral proxies into multi-touch attribution models contributed significantly to improved channel-level visibility and reduced performance blind spots, further strengthening the framework's value proposition. Furthermore, the qualitative insights captured from post-campaign stakeholder interviews underscore the framework's impact beyond mere metrics: fostering stronger organizational alignment, enhancing budget confidence, and streamlining operational workflows.

However, while the model's accuracy metrics were robust across test scenarios, limitations remain. Data incompleteness in CRM systems and immature API access on emerging platforms constrained the granularity of some predictions. Despite Bayesian correction methods, such data fidelity issues could compromise the accuracy of budget-to-performance mappings in real-time applications. Future iterations of the framework should prioritize enhanced integration with omnichannel CRM platforms and

pursue deeper interoperability with evolving ad ecosystems such as TikTok and Threads [105].

The implications of this research are far-reaching. For marketing practitioners in niche environments, the findings advocate for a strategic pivot toward analytics-driven budgeting mechanisms. For technology developers, the results highlight the value of modular DSS systems capable of ingesting and interpreting multifactorial media signals. For scholars, the work opens avenues for further exploration into ROI modeling in constrained digital ecosystems, particularly through the lens of algorithmic personalization, campaign lifecycle optimization, and audience micro-clustering [106].

In conclusion, as digital media channels continue to fragment and consumer behaviors grow increasingly nuanced, the necessity for intelligent, ROI-aligned advertising frameworks becomes ever more critical. The framework presented herein offers a structured, validated pathway for marketers to move beyond reactive strategies and adopt a proactive, performance-centric approach one that is not only measurable and accountable, but also adaptable to the unique challenges and opportunities inherent in niche digital markets.

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