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KEY DIGITAL ADVERTISING MEASUREMENT CHALLENGES IN KAZAKHSTAN

Digital advertising in Kazakhstan is expanding rapidly, yet the growing volume of platform-generated data does not necessarily provide a complete account of advertising effectiveness. Because these indicators inform campaign optimisation and advertising decisions, uncertainty about the constructs they can validly represent creates a practical need for a structured assessment of the broader measurement environment. This study aims to identify, prioritise, and map the macro-environmental conditions shaping the adequacy and interpretation of conventional digital advertising metrics in Kazakhstan. Its scientific significance lies in integrating documentary analysis with multi-criteria modelling to distinguish the local importance of measurement-related conditions from their structural influence. Its practical relevance concerns the selection and interpretation of metrics for advertising decision-making.

A sequential documentary and mathematical modelling design combined an adapted PESTEL framework with the Analytic Hierarchy Process (AHP), the Decision-Making Trial and Evaluation Laboratory (DEMATEL), a DEMATEL-informed adjustment of AHP priorities, and sensitivity analysis. Four dimensions were identified: Political-Legal, Economic, Social, and Technological. AHP ranked Technological conditions first (0.3854), followed by Social (0.3399), Economic (0.1813), and Political-Legal conditions (0.0934). DEMATEL identified Technological and Political-Legal conditions as net drivers, whereas Economic and Social conditions occupied net effect positions. The network adjustment preserved the ranking while producing a more balanced priority distribution. The principal ranking and driver-effect structure also remained stable under the tested alternative judgments.

The findings indicate that Kazakhstan's measurement challenge is not simply insufficient data, but a potential mismatch between sophisticated systems of digital delivery and the narrower constructs captured by routine platform indicators. The study contributes a transparent preliminary framework for aligning advertising objectives, target constructs, metrics, and interpretive boundaries. In practice, the framework can support advertisers, agencies, and analysts in determining when platform metrics are sufficient and when complementary evidence is required.

Keywords: digital advertising, advertising measurement, advertising effectiveness, AHP-DEMATEL, Kazakhstan.

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Қазақстандағы цифрлық жарнаманы өлшеудің негізгі мәселелері

Қазақстанда цифрлық жарнама қарқынды дамып келеді, алайда платформалар қалыптастыратын деректер көлемінің ұлғаюы жарнама тиімділігі туралы әрдайым толық түсінік бере бермейді. Бұл көрсеткіштер жарнамалық науқандарды оңтайландыру және шешім қабылдау үшін қолданылатындықтан, олардың қандай конструкторды дұрыс көрсете алатынына қатысты белгісіздік өлшеудің кеңірек ортасын құрылымдық бағалаудың практикалық қажеттілігін туындатады. Зерттеудің мақсаты – Қазақстандағы кеңінен қолданылатын цифрлық жарнама метрикаларының барабарлығы мен интерпретациясына ықпал ететін макроорта жағдайларын анықтау, басымдыққа қою және өзара байланысын картаға түсіру. Жұмыстың ғылыми маңыздылығы құжаттық талдау мен көпкритерийлі модельдеуді біріктіру арқылы өлшеуге қатысты жағдайлардың жергілікті маңызын олардың құрылымдық ықпалынан ажыратуға мүмкіндік беруімен айқындалады. Практикалық маңыздылығы жарнама саласындағы шешімдерді қабылдау кезінде метрикаларды таңдау мен түсіндіруді қолдауға байланысты.

Құжаттық және математикалық модельдеудің дәйекті дизайны бейімделген PESTEL моделін, иерархияларды талдау әдісін (AHP), DEMATEL әдісін, AHP басымдықтарын DEMATEL негізінде түзетуді және сезімталдық талдауын біріктірді. Құжаттық деректер төрт өлшемді қалыптастыру және авторлар жасаған жұптық салыстырулар мен ықпал жөніндегі пайымдауларды негіздеу үшін

үшін пайдаланылды. АНР нәтижесі бойынша технологиялық өлшем ең жоғары жергілікті басымдыққа ие болды (0,3854), одан кейін әлеуметтік (0,3399), экономикалық (0,1813) және саяси-құқықтық (0,0934) өлшемдер орналасты. DEMATEL технологиялық және саяси-құқықтық жағдайларды ықпалды көбірек беретін факторлар, ал экономикалық және әлеуметтік жағдайларды ықпалды көбірек алатын факторлар ретінде анықтады. Желілік түзету бастапқы ранжирлеуді сақтап, басымдықтардың бөлінуін неғұрлым теңгерімді етті. Негізгі ранжирлеу мен «драйвер-әсер» құрылымы тексерілген баламалы пайымдаулар жағдайында да тұрақты болды.

Нәтижелері Қазақстандағы өлшеу мәселесі деректердің жеткіліксіздігімен ғана емес, цифрлық жарнаманы орналастыру мен жеткізудің күрделі жүйелері және стандартты платформалық көрсеткіштер қамтитын неғұрлым тар конструкттар арасындағы ықтимал сәйкессіздікпен де байланысты екенін көрсетеді. Зерттеу жарнама мақсаттарын, нысаналы конструкттарды, метрикаларды және интерпретация шектерін сәйкестендіруге арналған бастапқы модельді ұсынады. Практикада бұл модель жарнама берушілерге, агенттіктерге және талдаушыларға платформалық метрикалардың қай кезде жеткілікті екенін және қай кезде қосымша деректер қажет болатынын анықтауға көмектесе алады.

Түйін сөздер: цифрлық жарнама, цифрлық жарнаманы өлшеу, жарнама тиімділігі, АНР-DEMATEL, Қазақстан.

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Ключевые проблемы измерения цифровой рекламы в Казахстане

Цифровая реклама в Казахстане стремительно развивается, однако увеличение объема данных, генерируемых платформами, не обязательно обеспечивает полное представление об эффективности рекламы. Поскольку эти показатели используются для оптимизации рекламных кампаний и принятия решений, неопределенность в отношении того, какие конструкты они могут корректно отражать, обуславливает практическую необходимость структурированной оценки более широкой среды измерения. Цель исследования – выявить, приоритизировать и отобразить макросредовые условия, определяющие адекватность и интерпретацию общепринятых метрик цифровой рекламы в Казахстане. Научная значимость работы заключается в интеграции документального анализа и многокритериального моделирования, позволяющей разграничить локальную важность условий, связанных с измерением, и их структурное влияние. Практическая значимость состоит в поддержке выбора и интерпретации метрик при принятии решений в сфере рекламы.

Последовательный дизайн документального и математического моделирования объединил адаптированную модель PESTEL, метод анализа иерархий (АНР), метод DEMATEL, DEMATEL-информированную корректировку приоритетов АНР и анализ чувствительности. Документальные данные использовались для формирования четырех измерений и обоснования авторских суждений, положенных в основу попарных сравнений и оценки влияния. Согласно АНР, наивысший локальный приоритет получило технологическое измерение (0,3854), за ним следовали социальное (0,3399), экономическое (0,1813) и политико-правовое (0,0934). DEMATEL определил технологические и политико-правовые условия как факторы-драйверы, тогда как экономические и социальные условия заняли позиции факторов-эффектов. Сетевая корректировка сохранила исходное ранжирование, сделав распределение приоритетов более сбалансированным. Основное ранжирование и структура «драйвер-эффект» также оставались устойчивыми при проверенных альтернативных суждениях.

Результаты показывают, что проблема измерения в Казахстане заключается не только в недостатке данных, но и в возможном несоответствии между сложными системами размещения и доставки цифровой рекламы и более узкими конструктами, отражаемыми стандартными платформенными показателями. Исследование предлагает прозрачную предварительную модель согласования рекламных целей, целевых конструктов, метрик и границ интерпретации. На практике модель может помочь рекламодателям, агентствам и аналитикам определять, когда платформенных метрик достаточно, а когда необходимы дополнительные данные.

Ключевые слова: цифровая реклама, измерение цифровой рекламы, эффективность рекламы, АНР-DEMATEL, Казахстан.

Introduction

Digitalisation has transformed advertising into a data-intensive system of automated delivery, audience targeting, interaction tracking, and performance optimisation. In Kazakhstan, digital formats accounted for an estimated 72.4% of total advertising spending in 2024 and 73.7% in 2025, while the country had 19.2 million internet users in early 2025 (Kemp, 2025; Statista Market Insights, 2025). This expansion has increased the managerial importance of impressions, views, click-through rates, conversions, and return on advertising expenditure.

Greater technical observability, however, does not necessarily provide a complete account of advertising effectiveness. Platform metrics represent operationally defined events: an impression records delivery, while conversions depend on advertiser-selected actions and attribution settings (Google Ads Help, n.d.-a, n.d.-b). These indicators are useful for evaluating particular stages of campaign performance, but they do not independently establish attention, comprehension, memory, brand evaluation, or incremental behavioural effects. Experimental research likewise shows that visual attention may vary despite registered exposure and that causal advertising returns can remain difficult to isolate even in data-rich environments (Johnson, Lewis, & Reiley, 2017; Lewis & Rao, 2015; Sajjacholapunt & Ball, 2014).

This distinction is especially relevant in Kazakhstan, where digital and programmatic delivery, social-media participation, e-commerce platforms, and formal online-advertising regulation are developing simultaneously. Recent Kazakhstan-specific studies have examined market development, targeting and platform dependence, as well as consumer attention to social-media advertising (Smykova *et al.*, 2025; Tursumbayeva & Beifert, 2026). However, these studies focus primarily on market, managerial, or consumer-level phenomena. The unresolved issue is therefore not simply whether more data are available, but whether routinely reported indicators are adequate for the broader decisions and constructs they are used to represent.

Previous research has examined digital exposure, attention, attribution, and incremental effects mainly at the campaign, platform, channel, or consumer level. Less is known about how the broader technological, social, economic, and institutional environment jointly shapes the adequacy and strategic interpretation of advertising measurement

in Kazakhstan. This gap is practically important because external conditions may influence both which metrics are available and how confidently they can support managerial conclusions. Conventional environmental scanning can organise such conditions, but a descriptive framework alone does not establish their relative importance or represent their interdependencies.

On this basis, the study advances the analytical proposition that the principal digital advertising measurement challenge in Kazakhstan is not data scarcity per se, but a potential mismatch between platform-defined observability and the broader constructs inferred from routine metrics, and that the relevant macro-environmental dimensions differ in both local importance and structural influence. At the analytical level, the object of the study is Kazakhstan's national digital advertising market considered as a macro-industrial and institutional system, while the subject is the macro-environmental conditions shaping the adequacy, interpretation, and strategic use of conventional digital advertising metrics.

Accordingly, the study aims to identify, prioritise, and map the macro-environmental conditions shaping the adequacy and interpretation of conventional digital advertising effectiveness metrics in Kazakhstan. To achieve this aim, the study: (1) extracts and consolidates measurement-related dimensions from documentary evidence; (2) estimates their local priorities; (3) maps their direct and indirect interdependencies and derives network-adjusted priorities; and (4) examines the stability of the resulting structure under selected alternative judgments. These tasks are addressed through three research questions: (RQ1) Which measurement-related dimensions emerge from documentary evidence? (RQ2) How are these dimensions prioritised through the Analytic Hierarchy Process (AHP)? (RQ3) What directional influence structure and network-adjusted priorities emerge through the Decision-Making Trial and Evaluation Laboratory (DEMATEL), and how stable are they under the tested alternative judgments?

To answer these questions, the study adopts a sequential documentary and mathematical modelling approach combining adapted PESTEL factor extraction, Analytic Hierarchy Process prioritisation, Decision-Making Trial and Evaluation Laboratory influence mapping, a DEMATEL-informed adjustment of AHP priorities, and sensitivity analysis. Its scientific contribution is a transparent preliminary framework that distinguishes local importance from

structural influence and connects macro-environmental analysis with the interpretation of digital advertising metrics. Its practical significance lies in supporting advertisers, agencies, and analysts in matching metrics to specific decision-relevant constructs, making attribution assumptions explicit, and determining when platform metrics require complementary evidence.

Literature review

From platform observability to advertising effectiveness

The digitalisation of advertising has substantially expanded the range and granularity of observable campaign events. Advertising platforms routinely record impressions, views, clicks, website visits, transactions, and attributed conversions, allowing managers to monitor delivery and response at a level that was difficult to achieve in traditional media. However, the availability of these indicators does not make them interchangeable. Each measure corresponds to a particular operational stage of the advertising process, while advertising effectiveness may also involve attention, comprehension, memory, brand evaluation, behavioural response, and incremental economic outcomes.

The distinction between technical exposure and audience processing is supported by research on online advertising attention. Sajjacholapunt & Ball (2014), using eye tracking and memory tests, demonstrated that banner placement and creative characteristics affected both attention allocation and subsequent memory. More recently, Barnea et al., (2023) found across experimental and field settings that restricting repeated access to content increased attention allocation and viewing time, with downstream effects on comprehension and recall. Kazakhstan-specific evidence points in the same general direction: Smykova et al., (2025), using eye tracking with 17 participants, found that attention to visual and textual elements differed across two social-media advertisements. Together, these studies indicate that registered exposure alone does not determine how advertising content is processed.

Media context and channel boundaries further complicate interpretation. Calder *et al.*, (2009) found that advertising responses were associated with engagement in the surrounding online media experience, while Dinner *et al.*, (2014) showed that traditional, online display, and paid-search advertising can generate own-channel and cross-channel

sales effects. Accordingly, apparently comparable placements may produce different responses, and outcomes recorded within a native platform may not represent the total contribution of advertising.

Observed conversions also do not independently establish incremental advertising effects. Targeting and platform optimisation can make exposed users systematically different from unexposed users, creating a counterfactual problem. Ghost Ads addressed this issue by comparing exposed consumers with control-group counterparts who would otherwise have received the advertisement (Johnson, Lewis, & Nubbemeyer, 2017). Lewis & Rao (2015) further showed that even very large advertising experiments can yield imprecise ROI estimates when true effects are small relative to natural variation in sales, while another study found that extensive covariates provided only limited gains in precision (Johnson, Lewis, & Reiley, 2017). A recent review by Johnson (2023) shows that these challenges remain relevant under contemporary digital delivery, highlighting limited experimental control, non-compliance, identity fragmentation, spillovers, and incrementality optimisation. Data abundance therefore does not remove the need for credible identification and explicit causal assumptions.

Advertising responses may also be nonlinear and heterogeneous. Chae *et al.*, (2019) found that users differed in their responses to accumulated display-ad exposures and identified a subgroup for whom additional impressions were associated with a negative marginal effect on subsequent website visits. The same number of impressions may therefore represent insufficient exposure for one consumer, diminishing returns for another, and excessive repetition for a third. Moreover, website visits themselves remain a distinct outcome rather than a direct equivalent of final conversion or profitability.

These limitations do not imply that conventional platform metrics are invalid. Impressions, clicks, views, and conversions provide meaningful information about technically defined stages of advertising delivery and response. The problem arises when they are used to infer constructs that they do not directly measure. Previous research examined EEG, heart-rate variability, and eye-tracking measures in relation to recall, liking, and YouTube views (Guixeres *et al.*, 2017). Hartnett *et al.*, (2025) more recently compared eight physiological measures of attention to video advertising with EEG and self-reported attention.

Heart rate performed best among the tested scalable measures in distinguishing high- from low-attention ads, while several eye-tracking measures showed limitations for that specific classification task. Their findings reinforce that attention is not a unitary construct and that measurement validity depends on the operational definition, baseline, and intended inference. Complementary measures should therefore be selected for the constructs they can validly represent rather than treated as universal replacements for behavioural or platform indicators.

Recent Kazakhstan-specific research also emphasises the importance of the surrounding market environment. Tursumbayeva & Beifert (2026) identify targeting difficulties, rising advertising costs, limited analytical competencies, and dependence on international platforms among challenges facing digital advertising in Kazakhstan. Together with the consumer-level evidence of Smykova *et al.*, (2025), these studies indicate emerging local academic attention to digital advertising while leaving open how technological, social, economic, and institutional conditions jointly shape the adequacy and interpretation of routine metrics.

Overall, the literature suggests that digital advertising measurement should be understood as a layered rather than unitary process. Platform indicators establish observable events, but their substantive interpretation depends on audience processing, media context, cross-channel behaviour, attribution assumptions, response heterogeneity, and the availability of credible counterfactual evidence. The measurement challenge is therefore not the absence of metrics, but the risk of extending technically defined indicators beyond their construct and inferential boundaries.

From macro-environmental scanning to structured multi-criteria modelling

Macro-environmental analysis is used to organise external conditions that may shape the operation and development of an industry. PESTEL structures these conditions into Political, Economic, Social, Technological, Environmental, and Legal dimensions, allowing a complex environment to be divided into analytically manageable categories. Its value lies primarily in systematic scanning rather than in producing priorities by itself. Accordingly, the framework should be linked to a clearly defined research problem, geographical and sectoral scope, and evidence base rather than applied as a generic checklist.

Recent methodological discussions emphasise that the standard PESTEL structure may be adapted when this is justified by the research context. Karadzhev & Patarchanova (2025) recommend defining the analytical objective and boundaries in advance, drawing on reliable interdisciplinary evidence, interpreting factors rather than merely listing them, and explicitly considering interactions across dimensions. They also identify the artificial separation of macro-environmental categories as a limitation of conventional applications, since political and legal conditions, technological development, social behaviour, and economic incentives frequently influence one another. Their position supports using PESTEL as a flexible organising framework while requiring methodological justification for combining, excluding, or reformulating its standard dimensions.

Nevertheless, a documentary PESTEL analysis remains predominantly classificatory unless an additional procedure is introduced to distinguish the relative importance of the retained dimensions. The Analytic Hierarchy Process addresses this problem through pairwise comparisons. Saaty & Vargas (2012) describe AHP as a method for deriving relative priorities from judgments concerning the importance of criteria in relation to a specified objective. Rather than requiring all criteria to share a natural measurement scale, AHP translates pairwise assessments into a common ratio-scale priority structure. It also provides a consistency assessment that identifies whether the complete set of comparisons contains an excessive level of internal contradiction.

This mathematical structure does not make the resulting priorities independent of judgment. The selection of criteria and the comparisons assigned to them remain conditional on the decision maker's understanding of the problem. Saaty and Vargas explicitly distinguish the mathematical processing of judgments from the subjective preferences and interpretations that generate them. They also note that a comparison matrix may be internally consistent while remaining substantively irrelevant or distant from external values. A low Consistency Ratio should therefore be understood as evidence of internal coherence rather than proof that the resulting weights are objectively correct.

AHP alone also does not fully represent directional interdependencies among dimensions. DEMATEL was developed to transform assessed direct influences into a structural map incorporating

both direct and indirect relations. Si *et al.*, (2018), reviewing 346 DEMATEL applications, identify the method as particularly suitable for examining intertwined factors and distinguishing components that predominantly transmit influence from those that predominantly receive it. In classical DEMATEL, the total-relation matrix is used to calculate prominence, representing the combined influence given and received, and relation, indicating whether a factor occupies a net cause or net effect position within the specified system.

The terms cause and effect in DEMATEL require careful interpretation. They describe the balance of directional influences encoded in the judgment matrix; they do not independently establish temporal or empirical causality. Similarly, prominence indicates a factor's structural involvement within the model rather than its directly observed importance in the external market. This distinction makes AHP and DEMATEL complementary: AHP addresses relative importance under a defined criterion, whereas DEMATEL represents the directional structure of assessed interdependencies.

Quantified PESTEL applications have begun to combine these functions. Karadzhov & Patarchanova (2025) describe AHP as a means of assigning local priorities and DEMATEL as a means of revealing interdependencies between macro-environmental dimensions. However, much of the related literature remains oriented toward expert-based strategic selection, organisational alternatives, or environmental and infrastructure decisions. Within the reviewed advertising literature, measurement studies are generally conducted at the campaign, consumer, platform, or channel level, while macro-environmental studies rarely examine how external conditions shape the interpretation of digital advertising indicators.

The present study connects these two streams by using documentary evidence to construct an adapted PESTEL framework for the digital advertising measurement environment in Kazakhstan, AHP to estimate local priorities, and DEMATEL to map the specified influence structure. The resulting model is intended as a transparent preliminary diagnosis rather than a statistically observed representation of market causality. Its contribution lies in distinguishing the importance of measurement-related dimensions from their structural involvement and in providing a framework that can subsequently be examined, refined, or challenged through stakeholder and campaign-level research.

Materials and methods

Research design and analytical scope

This study employed a desk-based exploratory analytical design to identify, prioritise, and map the macro-environmental conditions shaping the measurement of digital advertising effectiveness in Kazakhstan. The unit of analysis was the national digital advertising market considered as a macro-industrial and institutional system, rather than individual campaigns, firms, platforms, or consumers. The study therefore examined conditions affecting the adequacy, interpretation, and strategic use of conventional advertising metrics; it did not estimate campaign performance, compare metric-level predictive validity, or directly measure audience responses.

The analytical procedure was designed to address the three research questions stated in the Introduction. RQ1 concerned the identification and consolidation of measurement-related macro-environmental dimensions; RQ2 concerned the estimation of their local priorities; and RQ3 concerned their directional influence structure, network-adjusted priorities, and stability under selected alternative judgments.

The study proceeded through five sequential stages: (1) selection and claim-specific appraisal of documentary sources; (2) extraction, consolidation, and organisation of measurement-related factors within an adapted PESTEL framework; (3) estimation of local priorities through the Analytic Hierarchy Process; (4) modelling of direct and indirect interdependencies through the Decision-Making Trial and Evaluation Laboratory and derivation of DEMATEL-informed network-adjusted priorities; and (5) sensitivity and robustness analysis. Stages 1 and 2 addressed RQ1, Stage 3 addressed RQ2, and Stages 4 and 5 addressed RQ3.

The design is therefore described as a sequential documentary and mathematical modelling procedure rather than a mixed-methods study. Documentary evidence informed factor construction and matrix judgments, while the mathematical stages transformed those judgments into priority and influence structures. The resulting weights, ranks, and driver-effect positions are interpreted as outputs of a transparent preliminary decision-support framework, not as empirically established causal properties of Kazakhstan's advertising market. The framework is intended for subsequent examination, refinement, or challenge through stakeholder and campaign-level research.

Documentary corpus and source appraisal

The documentary material was assembled purposively and represented in a claim-level evidence ledger. The ledger contained 25 evidence records: four Political-Legal, nine Economic, six Social, and six Technological. By evidential status, five records concerned observed information, nine concerned estimated information, three concerned legal or policy provisions, seven supported conceptual mechanisms, and one concerned a forecast used only as contextual evidence. The records drew on official statistics, legislation and policy documents, local industry monitoring, commercial market databases, institutional and digital-audience reports, platform documentation, and peer-reviewed literature. Several documents supported more than one claim, and some records synthesised evidence from multiple sources; consequently, the number of ledger records should not be interpreted as the number of independent documents. *(Full source details, claim-level evidential boundaries, and links between the evidence records and model judgments are documented in the supporting Evidence and Judgment Ledger, which is available upon request).*

The broader methodological and conceptual source base covered publications issued between 2009 and July 2026, whereas Kazakhstan-specific

market, audience, and regulatory evidence was concentrated primarily in 2023–2026. One forecast-type evidence record referring to 2028 was retained only as contextual evidence and was not used as a quantitative model input. Documents were selected for their relevance to the identification, definition, or contextualisation of measurement-related factors in Kazakhstan; the corpus was not intended as an exhaustive or systematic review of the national advertising market.

Documentary analysis considered provenance, publication date, geographic and temporal scope, purpose, definitions, market coverage, and methodological transparency (Bowen, 2009). Reported values were classified as administrative observations, monitoring estimates, modelled estimates, or forecasts. Kazakhstan-specific evidence was distinguished from international research used only to support theoretical mechanisms or comparative interpretation.

Sources were appraised on a claim-specific basis. Official records supported statistical and legal claims; industry monitoring was used within its stated channel coverage; commercial databases were retained when they provided otherwise unavailable estimates, but their outputs and exclusions were explicitly labelled; and academic studies supported conceptual links between platform indicators and broader advertising outcomes (Table 1).

Table 1
Documentary evidence base and evidential boundaries

Source category	Principal analytical use	Evidential boundary
Official statistical and legal records	Macroeconomic, demographic, institutional, and regulatory conditions	Advertising-specific detail may be limited; legal provisions do not establish actual market effects
Local industry monitoring	Media expenditure, advertiser concentration, and channel structure	Findings apply only to the monitored media, prices, and periods
Commercial market databases	Market estimates, forecasts, and longitudinal comparison	Model-based outputs depend on definitions, exclusions, and estimation procedures
Institutional and digital-audience reports	E-commerce, platform development, audience access, and creative-economy context	Analytical classifications and advertising reach may not equal statutory categories or unique active users
Peer-reviewed literature	Conceptual mechanisms and methodological justification	International findings are not Kazakhstan-specific effect estimates

Note: compiled by the authors based on the documentary source appraisal and the supporting Evidence and Judgment Ledger. Sources were evaluated on a claim-specific basis; inclusion in the corpus did not imply equal evidential authority across all claims

Cross-source differences were examined by period, channel coverage, geography, currency, treatment of taxes and production costs, and estimation method. Methodologically non-

comparable indicators were reported separately rather than averaged. For example, Statista outputs were treated as model-based estimates, while K Research concentration measures were restricted to

the media covered by its monitoring (K Research Central Asia, 2025; Statista Market Insights, 2025). Numerical transformations were used only when the original values, units, assumptions, and formulas could be reproduced; unsupported transformations were excluded from the prioritisation model.

PESTEL factor extraction and construction of analytical judgments

The factor framework was developed through documentary coding, conceptual consolidation, and relevance screening. Indicators, regulatory changes, market developments, and theoretically relevant mechanisms were extracted as candidate themes and provisionally assigned to PESTEL dimensions. A theme was retained in the model only when the documentary evidence supported a plausible connection with advertising measurement, such as data generation and access, cross-channel

comparability, attribution, or the relationship between technically recorded events and human responses. Other market developments were treated as context rather than mathematical criteria.

Overlapping themes were consolidated into four dimensions: Political-Legal (P/L), Economic (E), Social (S), and Technological (T) (Table 2). Political and Legal factors were combined because the retained themes concerned a closely connected institutional domain of regulation, disclosure, formalisation, data governance, and platform accountability. The Environmental dimension was considered but excluded because the reviewed evidence did not identify a sufficiently direct and distinct mechanism linking it to the adequacy or interpretation of digital advertising metrics in Kazakhstan. This exclusion reflects the study's measurement-specific scope, not the general irrelevance of environmental issues to advertising.

Table 2
Operational definition and interpretive boundaries of the retained dimensions

Dimension	Scope and measurement relevance	Interpretive boundary
Political-Legal	Regulation, disclosure, data governance, market formalisation, and platform accountability shape reporting conditions and access to advertising information	Regulatory development does not itself establish compliance or metric validity
Economic	Expenditure, concentration, cost pressures, budget allocation, and commercial incentives shape demand for attribution and accountable outcomes	Market growth or concentration does not independently demonstrate measurement failure
Social	Demographics, media use, attention, avoidance, trust, and cognitive response affect whether recorded exposure corresponds to meaningful audience reception	International behavioural findings are not Kazakhstan-specific effect estimates
Technological	Infrastructure, platform architecture, algorithmic delivery, data generation, and optimisation determine which events are observed, reported, and attributed	Accurate technical registration does not establish attention, comprehension, persuasion, or causality

Note: compiled by the authors based on documentary coding, conceptual consolidation, and relevance screening. Lower-level documentary themes defined and substantiated the dimensions but were not independently weighted in the AHP-DEMATEL model

The identified 14 lower-level themes defined and substantiated the four dimensions but were not treated as individually observed variables or independently weighted criteria. Modelling at the macro-cluster level maintained conceptual comparability and a tractable number of judgments; detailed source support and limitations were retained in the evidence ledger.

Two distinct judgment sets were constructed. AHP comparisons assessed the relative importance of each dimension in shaping the adequacy and interpretation of digital advertising measurement. They were informed by the directness of the

documented mechanism, the range of outcomes potentially affected, and the dimension's role in structuring available evidence; they did not represent market size, expenditure, or document frequency. DEMATEL judgments instead assessed the direct directional influence of one dimension on another. Influence was recorded only when a plausible documentary mechanism could be articulated; co-occurrence, similarity, and indirect association were insufficient.

Both matrices therefore contained document-informed researcher judgments rather than numerical observations extracted from the sources.

Written rationales preserved the evidence, interpretation, and uncertainty underlying each assessment. No independent expert panel or separate coder generated the matrices, so transparency and traceability were prioritised while external examination of the factor definitions and influence assumptions remains necessary. A dedicated Judgment Ledger worksheet recorded all six unique AHP pairwise comparisons and all twelve off-diagonal DEMATEL directional judgments. Each judgment was linked to the evidence records used to inform its substantive rationale. The ledger documented the assigned value, its interpretation, the supporting rationale and evidence IDs, the authors' confidence in the judgment, its verification

status, and any alternative value examined in the sensitivity analysis.

AHP-DEMATEL modelling and network adjustment

The four retained dimensions were analysed through a sequential AHP-DEMATEL procedure. AHP estimated their relative local priorities, DEMATEL represented the specified direct and indirect influence structure, and the DEMATEL total-relation matrix was subsequently used to obtain network-adjusted priorities.

For AHP, pairwise judgments followed Saaty's fundamental scale and formed the reciprocal matrix reported in Table 3 (Saaty & Vargas, 2012).

Table 3

Document-informed judgment matrices used in the AHP-DEMATEL model

Panel A. AHP pairwise-comparison matrix

Dimension	P/L	E	S	T
P/L	1	1/2	1/3	1/5
E	2	1	1/2	1/2
S	3	2	1	1
T	5	2	1	1

Panel B. DEMATEL direct-relation matrix

Influencing ↓ / Receiving →	P/L	E	S	T
P/L	0	3	1	2
E	1	0	3	3
S	1	3	0	4
T	2	4	4	0

Note: compiled by the authors based on document-informed researcher judgments recorded in the supporting Judgment Ledger. AHP entries represent relative importance. DEMATEL entries represent assessed direct influence, where 0 denotes no influence and 4 denotes very high influence. Both matrices contain document-informed researcher judgments rather than numerical observations extracted directly from the documentary sources

The matrix was normalised by columns, and the local priority of dimension i was calculated by row averaging:

$$\tilde{a}_{ij} = \frac{a_{ij}}{\sum_{k=1}^n a_{kj}}, \quad w_i = \frac{1}{n} \sum_{j=1}^n \tilde{a}_{ij} \quad (1)$$

where:

$\tilde{a}_{ij}$ – normalised element in row i and column j of the AHP pairwise-comparison matrix;

a_{ij} – original pairwise-comparison value expressing the relative importance of dimension i to dimension j ;

w_i – local AHP priority of dimension i ;

n – number of dimensions ($n = 4$);

i, j, k – indices of the dimensions.

Judgment consistency was assessed using:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(Aw)_i}{w_i}$$

$$CI = \frac{\lambda_{\max} - n}{n - 1}, \quad CR = \frac{CI}{RI} \quad (2)$$

where:

A – AHP pairwise-comparison matrix;

w – local-priority vector obtained from Equation (1);

$(Aw)_i$ – i -th element of the matrix-vector product Aw ;

$\lambda_{\max}$ – estimated maximum eigenvalue of A ;

CI – consistency index;

CR – consistency ratio;

RI – random index corresponding to matrix order n .

A $CR < 0.10$ was treated as acceptable internal coherence, not as evidence of external validity.

DEMATEL direct influences were assessed on a 0-4 scale ranging from no influence to very high influence; the resulting matrix is presented in Table 3 (Si *et al.*, 2018). It was normalised as:

$$X = \frac{Z}{s} \quad (3)$$

$$s = \max \left(\max_i \sum_j z_{ij}, \max_j \sum_i z_{ij} \right)$$

where:

Z – initial DEMATEL direct-relation matrix;

z_{ij} – assessed direct influence of dimension i on dimension j ;

X – normalised direct-relation matrix;

s – normalisation factor determined by the largest row or column sum of Z .

And $s = 10$ for the baseline matrix. The total-relation matrix was then calculated as:

$$T = X(I - X)^{-1} \quad (4)$$

where:

T – DEMATEL total-relation matrix;

I – identity matrix of order n .

For each dimension, $D_i = \sum_j t_{ij}$ represented total influence given and $R_i = \sum_j t_{ji}$ represented total influence received. $D_i + R_i$ indicated prominence, whereas $D_i - R_i$ indicated a net driver position when positive and a net effect position when negative. These terms describe positions within the specified judgment model and do not establish observed market causality.

To incorporate the modelled interdependencies, T was normalised by columns and applied once to the AHP vector:

$$W_{ij} = \frac{t_{ij}}{\sum_k t_{kj}}, \quad g = Ww \quad (5)$$

where:

W_{ij} – element in row i and column j of the column-normalised total-relation matrix W ;

t_{ij} – element of T representing the total direct and indirect influence of dimension i on dimension j ;

W – column-normalised total-relation matrix;

g – DEMATEL-informed network-adjusted priority vector;

w – local AHP priority vector used as the input to the network adjustment.

The resulting g vector is described as a DEMATEL-informed network adjustment of AHP priorities. Because no limit supermatrix or iterative convergence procedure was used, the method is not presented as ANP or standard DANP. Calculations used unrounded values, and no influence threshold was applied to the reported DEMATEL indicators or adjusted priorities. All AHP, DEMATEL, network-adjustment, and sensitivity calculations were performed in Microsoft Excel for Mac, version 16.78, using formula-driven worksheets and matrix functions. Full-precision values were retained throughout the analytical procedure, and rounding was applied only when presenting the results in tables and text. No specialised MCDM software package was used.

Sensitivity analysis and interpretive boundaries

Sensitivity analysis examined whether the principal results depended disproportionately on selected researcher judgments. Five one-at-a-time AHP scenarios and one targeted DEMATEL robustness check were specified, as summarised in Table 4. In each AHP scenario, one comparison and its reciprocal were changed while the remaining judgments and baseline DEMATEL matrix were held constant. The complete AHP procedure was repeated, including consistency assessment, and the resulting priority vector was transformed using the baseline DEMATEL adjustment matrix.

For the DEMATEL check, the assessed direct influence of Political-Legal on Economic was increased from 3 to 4. The direct-relation matrix was renormalised and the total-relation matrix, prominence and relation indicators, driver-effect positions, and network-adjusted priorities were recalculated while the baseline AHP vector remained fixed. Because this change altered the DEMATEL normalisation factor, absolute prominence and relation magnitudes were not compared directly across specifications.

Table 4
Sensitivity and robustness specifications

Scenario	Judgment change	Components held constant
AHP-S1	Social : P/L, 3:1 → 5:1	Remaining AHP judgments and baseline DEMATEL
AHP-S2	Technology : P/L, 5:1 → 3:1	Remaining AHP judgments and baseline DEMATEL
AHP-S3	Social : Economic, 2:1 → 3:1	Remaining AHP judgments and baseline DEMATEL
AHP-S4	Technology : Economic, 2:1 → 3:1	Remaining AHP judgments and baseline DEMATEL
AHP-S5	Technology : Social, 1:1 → 2:1	Remaining AHP judgments and baseline DEMATEL
DEM-R1	P/L → Economic direct influence, 3 → 4	Remaining DEMATEL judgments and baseline AHP vector

Note: compiled by the authors based on the sensitivity-analysis design and the alternative judgments documented in the supporting Judgment Ledger. Reciprocal AHP entries were changed simultaneously. AHP-S1-S5 assess the sensitivity of AHP judgments with the DEMATEL structure fixed; DEM-R1 is a targeted DEMATEL robustness check with the AHP vector fixed

Robustness was assessed through AHP consistency ratios, dimension rankings, changes in local and adjusted priorities, and the signs of the DEMATEL relation indicators. The analysis was local and scenario-based: it did not examine all possible judgment combinations, assign probability distributions, or produce statistical confidence intervals. Stability therefore indicates limited dependence on the tested specifications, not unique correctness or external validation.

Further limitations arise from the purposive documentary corpus and researcher-led factor and matrix construction. The framework does not directly test the predictive validity of platform metrics, establish observed market causality, or identify any other method as a superior replacement. Its internally tested outputs remain a preliminary decision-support model requiring subsequent stakeholder and campaign-level examination.

Results and discussion

Documentary factor framework

Documentary analysis identified four interconnected dimensions shaping digital advertising measurement in Kazakhstan: Political-Legal, Economic, Social, and Technological. Together, they describe an environment in which institutional rules, commercial incentives, audience responses, and platform architectures determine both which advertising events are observable and how those events can be interpreted.

Kazakhstan's Law on Online Platforms and Online Advertising regulates advertising identification and labelling, targeted advertising, sponsored content, profiling, and information retention (Respublika Kazakhstan, 2023, arts. 19-22). These developments strengthen the institutional

basis for transparency and accountability, but do not establish compliance or the validity of reported effectiveness indicators.

The Economic dimension combines market expansion with growing demand for attributable performance. Statista estimated total advertising expenditure at USD 772.52 million in 2024 and USD 835.36 million in 2025 (equivalent to approximately KZT 363 billion and KZT 436 billion, respectively), with digital formats representing 72.4% and 73.7%, respectively (Statista Market Insights, 2025). These are model-based nominal estimates rather than administrative observations. K Research additionally reported 772 advertisers in the traditional media covered during the first half of 2025 and an 88% share of monitored list-price expenditure for the top 50 advertisers; these figures apply only to the monitored channels and cannot be extended to direct digital-platform spending (K Research Central Asia, 2025). Retail e-commerce reached an estimated KZT 3.439 trillion in 2024, illustrating the expanding commercial environments in which exposure, platform activity, and purchases may be recorded together, although this figure does not measure advertising expenditure (Strategy & Digital Kazakhstan Association, 2025).

The Social dimension concerns the gap between digital reach and meaningful audience response. Kazakhstan had an estimated 19.2 million internet users and 15.7 million social-media user identities in early 2025 (Kemp, 2025). However, an impression, view, or interaction does not independently demonstrate attention, comprehension, memory, attitude formation, or behavioural change. Differences across advertising formats and communication contexts further imply that identically named metrics may arise from different patterns of audience processing (Sajjacholapunt & Ball, 2014).

The Technological dimension captures the platform architectures through which advertising is delivered, reported, optimised, and attributed. Google Ads defines impressions and advertiser-selected conversion actions, while its attribution models allocate conversion credit across advertising interactions and can affect both reported conversion data and automated bidding (Google Ads Help, n.d.-a, n.d.-b). The modelled importance of programmatic delivery in Kazakhstan increases the relevance of automated measurement, while proprietary platform data systems may also create dependence on platform-defined constructs and access conditions (Competition & Markets Authority, 2020; Statista Market Insights, 2025). International evidence distinguishing verification, attribution, and effective-

ness measurement is used here to specify this mechanism, not to estimate its severity in Kazakhstan (Competition and Markets Authority, 2020).

Overall, the documentary evidence indicates that Kazakhstan's challenge is not simply insufficient data. It is a potential mismatch between increasingly sophisticated systems of advertising delivery and observation and the narrower operational constructs represented by routinely available metrics. This documentary framework provided the basis for the AHP prioritisation and DEMATEL influence analysis (Table 5). Accordingly, the four-dimensional documentary framework addresses RQ1 and provides the analytical basis for the subsequent prioritisation and influence modelling.

Table 5
Documentary framework and measurement implications

Dimension	Documentary manifestations	Measurement implication and boundary
Political-Legal	Advertising identification and labelling; targeted and sponsored-content provisions; information retention; platform-transparency and accountability requirements	Strengthens transparency and accountability but does not establish compliance or metric validity
Economic	Growing modelled expenditure and digital share; concentration in monitored media; expanding e-commerce	Increases demand for attribution and accountable outcomes, but market scale does not demonstrate measurement failure
Social	Extensive digital participation; differentiated formats and communicators; exposure-response distinction	Recorded reach or interaction does not independently establish attention, memory, attitudes, or behaviour
Technological	Platform-defined events; attribution models; programmatic delivery; proprietary data systems	Determines what is observed and optimised, but technical registration does not establish human-level effectiveness or causality

Note: compiled by the authors based on documentary analysis of regulatory, market, audience, technological, and peer-reviewed sources. Documentary themes were used to substantiate the four dimensions but were not independently weighted as lower-level criteria

AHP local priorities

Addressing RQ2, the AHP results ranked the Technological dimension first with a local priority of 0.3854, followed by Social at 0.3399, Economic at 0.1813, and Political-Legal at 0.0934 (Table 6). The pairwise judgments were internally coherent, with $\lambda_{\max}=4.0248$, $CI=0.0083$, and $CR=0.0093$. The low Consistency Ratio indicates limited internal contradiction but does not validate the priorities externally.

The two leading dimensions together accounted for 72.53% of the local priority. Technology represents the systems that define, generate, attribute, and optimise observable advertising events, whereas the Social dimension concerns whether

those events correspond to attention, comprehension, memory, attitudes, or behaviour. Their relatively close priorities therefore locate the central measurement challenge at the interface between platform-generated observability and human response.

Economic conditions received a lower but still substantive priority because expenditure, commercial incentives, and transaction-based ecosystems increase demand for attribution and accountable outcomes. However, they primarily explain why measurement matters commercially rather than whether an indicator adequately represents advertising response. Political-Legal conditions received the lowest local priority because

regulation and disclosure were judged to affect measurement adequacy less directly than data-generating technologies and audience processes.

This is a relative result under the stated criterion and does not imply that institutional conditions are unimportant.

Table 6
Local AHP priorities

Dimension	Priority	Rank
Technological	0.3854	1
Social	0.3399	2
Economic	0.1813	3
Political-Legal	0.0934	4

Note: compiled by the authors based on AHP calculations using the document-informed pairwise-comparison matrix. $\lambda_{max} = 4.0248$, $CI = 0.0083$, and $CR = 0.0093$; values were calculated from unrounded inputs and rounded only for presentation

DEMATEL influence structure

DEMATEL distinguished the local importance of the dimensions from their structural involvement and net directional positions. Technology showed the highest prominence ($D+R=9.0854$) and a positive relation value ($D-R=0.2807$), identifying it as a highly connected net driver. Its position reflects the role of platform architecture in shaping advertising delivery, reporting, attribution, and optimisation, while also remaining responsive to commercial demand and audience behaviour.

Political-Legal conditions had the lowest prominence ($D+R=5.1957$) but the strongest positive relation value ($D-R=0.8669$). They therefore occupied the clearest net driver position despite receiving the lowest local AHP priority. This result illustrates that a dimension may transmit influence through regulation, disclosure, data governance, and accountability without being the most immediately important factor for measurement adequacy.

Economic conditions displayed high prominence ($D+R=8.2906$) and the most negative

relation value ($D-R=-1.0358$), making them the strongest net effect dimension. Advertising investment, attribution demand, and commercial incentives were therefore positioned as highly connected outcomes shaped by technological, social, and institutional conditions, although they also generated feedback into the wider system.

Social conditions had similarly high prominence ($D+R=8.2409$) but a relation value close to zero ($D-R=-0.1118$). Their classification as a net effect does not imply passivity; rather, audience behaviour and cognitive response both influence and are influenced by platform architectures, formats, and commercial pressures.

Overall, Political-Legal and Technological dimensions occupied net driver positions, while Economic and Social dimensions occupied net effect positions (Table 7). These classifications represent the directional structure encoded in the document-informed matrix and should not be interpreted as empirically observed causality.

Table 7
DEMATEL prominence and relation indicators

Dimension	D+R	D-R	Position
Technological	9.0854	0.2807	Net driver
Economic	8.2906	-1.0358	Net effect
Social	8.2409	-0.1118	Net effect
Political-Legal	5.1957	0.8669	Net driver

Note: compiled by the authors based on the DEMATEL calculations performed using the document-informed direct-relation matrix. $D+R$ indicates prominence within the specified influence structure, while $D-R$ indicates the net directional position. Positive values denote net drivers and negative values denote net effects

Network-adjusted priorities

The DEMATEL-informed adjustment preserved the original ranking while producing a more balanced priority distribution. Technology remained first at 0.2982, followed by Social at 0.2628, Economic at 0.2429, and Political-Legal at 0.1961 (Table 8). The difference between the highest and lowest priorities decreased from 0.2920 in the local AHP model to 0.1021 after adjustment.

Technology and Social declined by 0.0871 and 0.0772, respectively, but retained the two leading positions. Their reduced weights reflect the incorporation of interdependencies with institutional

and economic conditions rather than a substantive decline in their relevance. Technology remained dominant, consistent with its highest local priority and its extensive involvement across the total-relation matrix, while Social remained central to the interpretation of whether recorded advertising events correspond to meaningful audience responses.

Economic increased from 0.1813 to 0.2429, reflecting its high structural involvement and net-receiving position. Political-Legal showed the largest increase, from 0.0934 to 0.1961, reflecting its modelled pattern of direct and indirect influence across the total-relation matrix.

Table 8

Local and network-adjusted priorities

Dimension	Local AHP	Network-adjusted	Change	Rank
Technological	0.3854	0.2982	−0.0871	1
Social	0.3399	0.2628	−0.0772	2
Economic	0.1813	0.2429	+0.0616	3
Political-Legal	0.0934	0.1961	+0.1027	4

Note: compiled by the authors based on the AHP priorities and the DEMATEL-informed network-adjustment calculations. No rank reversal occurred. Changes represent network-adjusted minus local AHP priorities. Values were calculated using unrounded inputs and rounded only for presentation

These adjusted values should not be interpreted as more objectively correct estimates of market importance. Local AHP priorities represent relative importance under the stated measurement criterion, whereas network-adjusted priorities additionally reflect the influence structure specified in the DEMATEL matrix. Together, the results indicate that the measurement challenge remains primarily technological and social but is embedded within economic incentives and institutional conditions.

Sensitivity and robustness analysis

The principal ranking remained stable across all five AHP sensitivity scenarios: Technology ranked first, followed by Social, Economic, and Political-Legal. All alternative matrices retained acceptable internal consistency, with CR values ranging from 0.0023 to 0.0225 (Table 9). Network-adjusted priorities also changed only slightly: the largest

range observed across the scenarios was 0.0068, or less than 0.7 percentage points. The leading positions of Technology and Social therefore did not depend on any single tested pairwise judgment.

The targeted DEMATEL check produced a larger but still limited redistribution. Increasing the assessed Political-Legal influence on Economic from 3 to 4 raised the adjusted Political-Legal priority from 0.1961 to 0.2149, while the other priorities declined moderately. Nevertheless, the ordering $T > S > E > P/L$ remained unchanged. Political-Legal and Technology also retained their net driver positions, while Economic and Social remained net effects.

Absolute DEMATEL prominence and relation magnitudes were not compared directly because the modified judgment changed the normalisation factor from 10 to 11. The check therefore focused on rank stability, the signs of D–R, driver-effect classifications, and adjusted priorities.

Table 9*Sensitivity and robustness results**Panel A. AHP sensitivity*

Specification	Modified judgment	CR	Adjusted ranking
Baseline	No change	0.0093	T > S > E > P/L
AHP-S1	Social : P/L, 3:1 → 5:1	0.0023	T > S > E > P/L
AHP-S2	Technology : P/L, 5:1 → 3:1	0.0039	T > S > E > P/L
AHP-S3	Social : Economic, 2:1 → 3:1	0.0225	T > S > E > P/L
AHP-S4	Technology : Economic, 2:1 → 3:1	0.0127	T > S > E > P/L
AHP-S5	Technology : Social, 1:1 → 2:1	0.0153	T > S > E > P/L

Panel B. Targeted DEMATEL check

Dimension	Baseline adjusted	Alternative adjusted	Change
Technological	0.2982	0.2908	−0.0074
Social	0.2628	0.2552	−0.0076
Economic	0.2429	0.2391	−0.0038
Political-Legal	0.1961	0.2149	+0.0188

Note: compiled by the authors based on the AHP sensitivity and targeted DEMATEL robustness calculations. In AHP-S1-S5, the baseline DEMATEL matrix was fixed. In the DEMATEL check, Political-Legal → Economic was changed from 3 to 4 while the baseline AHP vector was fixed. Ranking and driver-effect classifications remained unchanged

Taken together, the DEMATEL influence structure, network-adjusted priorities, and robustness results address RQ3. These findings support the internal stability of the framework under the selected one-at-a-time changes. However, the analysis did not examine simultaneous perturbations, all possible matrix configurations, alternative factor definitions, or independently generated expert judgments. The results therefore indicate robustness to the tested specifications rather than unique correctness or external validity.

Integrated interpretation and implications for advertising measurement

These integrated findings provide partial and qualified support for the proposition that Kazakhstan's digital advertising challenge is not simply insufficient data, but a potential mismatch between technically observable events and the broader constructs inferred from them. Technology and Social accounted for 72.53% of the local AHP priority, locating the problem at the interface between platform-defined observability and human response. DEMATEL nevertheless showed that this interface is embedded in a wider system: Technology and Political-Legal conditions occupied net driver positions, while Economic and Social conditions were highly involved net effects. The network adjustment preserved the ranking but increased the representation of Economic and

Political-Legal conditions, indicating that measurement adequacy cannot be separated from commercial incentives, attribution demands, governance, and data-access conditions.

This interpretation aligns conceptually with prior advertising research. Sajjacholapunt & Ball (2014) showed that technically available exposure does not determine how visual attention and memory are distributed, while Calder *et al.*, (2009) demonstrated that responses depend partly on engagement with the surrounding media context. Dinner *et al.*, (2014) further showed that advertising effects may cross channel boundaries, making native-platform outcomes an incomplete representation of total response. At the causal level, studies demonstrated that large datasets and extensive covariates do not by themselves eliminate uncertainty in incremental advertising effects (Johnson, Lewis, & Reiley, 2017; Lewis & Rao, 2015). The present study does not reproduce these campaign-level findings in Kazakhstan; rather, it extends their measurement logic to the macro-environment by showing how technological, social, economic, and institutional conditions may jointly shape the interpretation of conventional indicators.

The findings therefore do not imply that impressions, views, clicks, or conversions are invalid. Each provides evidence about a defined stage of advertising delivery or response. An impression records an opportunity for exposure, a

click records a specific interaction, and a conversion records an action attributed under stated rules. Problems arise when these measures are interpreted as direct evidence of attention, comprehension, memory, persuasion, or incremental behaviour. The appropriate question is not whether a conventional metric is useful in general, but whether it corresponds to the decision-relevant construct and whether its inferential boundary is made explicit.

A practical implication is an objective-construct-indicator alignment approach. Measurement should begin with the advertising objective, identify the construct required for the decision, select an indicator that directly represents that construct, and retain its definitional and inferential limits. A layered structure may combine delivery and opportunity-to-see indicators; attention and information-processing measures; memory and attitudinal outcomes; behavioural and incremental effects; and contextual information on attribution rules, observation windows, platform definitions, data access, and regulatory requirements. Not every campaign requires every layer. Routine optimisation may rely primarily on platform indicators, whereas high-value strategic decisions, cross-platform comparisons, or claims about psychological and causal effects may require complementary evidence.

Such evidence may include experiments, lift studies, marketing-mix or attribution models, surveys, recall and recognition measures, qualitative research, independent verification, eye tracking, and psychophysiological or consumer-neuroscience methods. Consistent with Guixeres *et al.*, (2017), these approaches should be treated as complementary because they capture different parts of the advertising-response process and introduce their own assumptions and limitations. Similarly named platform indicators should not be assumed equivalent when they differ in eligibility criteria, counting rules, attribution windows, or identity systems. Regulatory transparency is also distinct from measurement validity: correct labelling, disclosure, and data retention may improve accountability without establishing attention, attribution accuracy, or incremental effect.

Several limitations qualify the findings. The documentary corpus was purposive rather than exhaustive and may omit proprietary or rapidly changing market information. Factor extraction and matrix construction were researcher-led, and no independent expert panel or separate coder generated the judgments. AHP consistency and

sensitivity results demonstrate internal coherence and local stability, not external validity. The study also did not test individual platform metrics, observe consumer responses, or estimate causal market relationships. Consequently, the model identifies plausible measurement pressures and interdependencies rather than empirically verified deficiencies in Kazakhstan's advertising practice.

The present study constitutes the first, documentary-modelling phase of a broader sequential research programme. At the time of writing, the second phase is underway and involves semi-structured interviews with advertising practitioners, researchers, and other relevant stakeholders to examine, refine, extend, or challenge the proposed factor structure and directional mechanisms. No interview data are analysed or reported in the present article. Following this qualitative phase, independently elicited expert judgments will be used to reconstruct the AHP and DEMATEL matrices and compare them with the document-informed baseline model developed here.

Subsequent campaign-level research should compare platform-reported indicators with independently measured attention, memory, attitudes, and behavioural outcomes, while distinguishing correlation from incremental effect. Together, these stages would convert the present documentary diagnosis into progressively testable evidence. The principal challenge is therefore not to reject conventional indicators, but to define what they measure, identify what they leave unobserved, and supplement them when managerial conclusions extend beyond their operational boundaries.

Conclusion

This study examined the macro-environmental conditions shaping the adequacy and interpretation of conventional digital advertising effectiveness metrics in Kazakhstan. A sequential documentary and mathematical modelling procedure was used to identify relevant dimensions, estimate their local priorities, map their directional interdependencies, and assess the stability of the resulting framework.

Documentary analysis identified four interconnected dimensions: Political-Legal, Economic, Social, and Technological. Their combined interpretation indicates that the measurement challenge is not simply a shortage of advertising data. Rather, it concerns a potential mismatch between increasingly sophisticated systems of digital delivery, attribution,

and optimisation and the narrower operational constructs represented by impressions, views, clicks, and attributed conversions. These indicators remain useful for the stages they directly measure, but they do not independently establish attention, comprehension, memory, persuasion, or incremental behavioural effects.

Within the AHP model, Technology received the highest local priority, followed by Social, Economic, and Political-Legal conditions. Technology and Social together accounted for 72.53% of the initial priority structure, locating the central problem at the interface between platform-generated observability and meaningful audience response. DEMATEL provided a complementary structural perspective: Technology had the highest prominence, while Technology and Political-Legal conditions occupied net driver positions. Economic and Social conditions were classified as net effects, although both remained strongly involved in the model. The network adjustment produced a more balanced distribution without changing the ranking, suggesting that the direct importance of technological and social factors is embedded within wider commercial and institutional relationships. Sensitivity analysis further showed that the ranking and driver-effect structure remained stable under the selected alternative judgments.

The study contributes a transparent preliminary framework that distinguishes local importance from structural influence and connects macro-environmental analysis with the problem of advertising-measurement interpretation. Its practical implication is that advertising indicators should be selected and interpreted through alignment among the campaign objective, target construct, available measure, and inferential boundary. Platform metrics may provide sufficient evidence for routine delivery and optimisation decisions, whereas broader claims about psychological response, cross-platform performance, or incremental effects may require complementary evidence.

The findings remain conditional on a purposively constructed documentary corpus and researcher-generated AHP and DEMATEL judgments. Internal consistency and sensitivity stability do not establish external validity, and the study did not directly observe market causality or test individual advertising metrics. Subsequent research should therefore examine the framework through stakeholder interviews, independently generated expert judgments, and campaign-level

comparisons between platform indicators and attention, memory, attitudinal, and behavioural outcomes. The central task for advertising measurement in Kazakhstan is not to abandon conventional metrics, but to define their meaning precisely and supplement them when managerial conclusions extend beyond what those metrics directly observe.

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Author Contributions:

GB & AK: conceptualization, methodology, writing - original draft, writing - review and editing investigation;

GB: data curation, formal analysis, resources, supervision;

AK: validation, visualization, project administration;

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