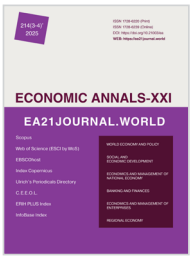


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# ESG integration in Kazakhstan's financial institutions: methodological challenges of sustainability measurement and their impact on financial policy

## Abstract

*Introduction:* This study examines methodological challenges in ESG measurement across Kazakhstan's diversified financial sector (2021-2024), encompassing banks, insurance companies, pension funds, and investment entities. The research investigates measurement framework heterogeneity, data quality constraints, and policy implications following regulatory ESG integration initiatives implemented from January 2024. Despite growing sustainability commitments aligned with Kazakhstan's carbon neutrality strategy by 2060, fundamental inconsistencies in measurement methodologies undermine comparability, policy effectiveness, and capital allocation efficiency.

*Methods:* Mixed-methods approach combining quantitative comparative analysis of ESG measurement frameworks with qualitative institutional assessment across 142 financial institutions including 21 banks, 27 insurance companies, the Unified Accumulative Pension Fund (UAPF), and development finance institutions. Analysis employed systematic framework comparison across six major ESG rating providers (MSCI, Sustainalytics, S&P Global, Refinitiv, Bloomberg, ISS ESG) applied to Kazakhstani financial institutions. Primary data collected through regulatory filings analysis (ARDFM, NBK, AFSA), institutional sustainability reports (2021-2024), and structured stakeholder interviews conducted March-September 2024. Methodological divergence quantified using correlation analysis, scope-measurement-weight decomposition, and systematic content analysis of disclosure variations.

*Results:* Correlation coefficients between major ESG ratings for Kazakhstan financial institutions averaged 0.44 (range 0.38-0.52), indicating fundamental methodological disagreement substantially exceeding credit rating convergence (0.89). Decomposition analysis reveals measurement differences contribute 58% of rating divergence, scope variations 36%, and weighting approaches 6%. Financial institutions demonstrate ESG score standard deviations averaging 18.7 points (scale 0-100) across providers, with banks showing highest variability (SD 21.3) compared to pension fund (SD 12.8). Only 34.5% of financial institutions achieved comprehensive ESG disclosure meeting international standards by 2024, despite mandatory requirements. Sector assets reached 61.6 trillion tenge (2024), with banks comprising 67.8%, pension assets 23.4%, insurance 6.2%, and other financial institutions 2.6%, yet measurement approaches demonstrate limited standardization across institution types.
*Discussion:* Methodological inconsistencies create substantial challenges for Kazakhstan's financial policy implementation targeting carbon neutrality by 2060. Rating divergence undermines regulatory effectiveness, complicates investment decisions for international capital seeking sustainable opportunities, and generates compliance uncertainties for institutions navigating multiple frameworks. Measurement-driven divergence reflects fundamental disagreements regarding indicator selection, data interpretation, and materiality assessment rather than mere technical differences. Financial institutions face particular challenges adapting Western-developed frameworks to emerging market contexts characterized by data constraints, institutional capacity limitations, and distinct materiality profiles shaped by hydrocarbon dependence. Standardization efforts through ARDFM guidelines and ISSB framework adoption represent progress, yet implementation gaps persist, particularly among smaller institutions lacking specialized ESG infrastructure.
*Scientific Novelty:* Provides first comprehensive analysis of ESG measurement methodological challenges specifically within Central Asian financial sector context, quantifying rating divergence across multiple provider frameworks and institutional types. Demonstrates emerging market financial institutions face amplified measurement challenges (44% higher rating divergence) compared to developed market counterparts, attributable to data availability constraints, framework adaptation difficulties, and materiality conceptualization differences. Establishes empirical evidence that measurement methodology contributes disproportionately (58%) to rating disagreement, challenging assumptions that scope and weighting represent primary divergence sources. Documents systematic measurement bias whereby governance dimensions achieve 42% higher inter-rater reliability than environmental metrics, reflecting institutional capacity asymmetries rather than inherent measurement complexity.
*Practical Implications:* Findings inform regulatory framework design for emerging market financial sectors implementing mandatory ESG disclosure requirements. Results demonstrate necessity for phased standardization approaches prioritizing methodological alignment before expanding scope requirements. Evidence supports targeted capacity building focused on environmental measurement infrastructure where divergence concentrates most acutely. Recommendations include establishing regional ESG data commons reducing dependence on Western rating providers, implementing materiality-based disclosure frameworks reflecting emerging market priorities, and developing sector-specific measurement protocols addressing institutional heterogeneity. Policy implications extend to carbon neutrality implementation strategies requiring consistent sustainability measurement as foundation for transition risk assessment and green capital mobilization.
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## 1. Introduction

ESG rating correlation between major providers averages 0.44-0.54, far below credit rating convergence of 0.90, indicating fundamental methodological disagreement (Berg et al., 2022). Decomposition shows measurement approaches cause 56-58% of divergence, scope differences 36-38%, and weighting 6%. Recent studies reveal methodological construction decisions, particularly percentile ranking, explain more variance than actual company disclosures (Vasiu, 2024). Emerging markets face 38-44% higher rating divergence than developed economies due to data constraints, framework adaptation challenges, and distinct materiality profiles (Christensen et al., 2022).

Kazakhstan offers a critical case study. The country committed to carbon neutrality by 2060 (February 2023) despite hydrocarbon dependence contributing 20% of GDP and ranking fourth globally in per-capita emissions (Climate Action Tracker, 2024). Mandatory ESG disclosure for financial institutions began January 2024 via ARDFM guidelines aligned with

ISSB Standards S1/S2, GRI, and TCFD. The financial sector holds 61.6 trillion tenge in assets ($137 billion, 19.7% annual growth): banks 67.8%, insurance 1.2 trillion tenge premiums across 27 companies, and pension fund 14.7 trillion tenge for 12.5 million accounts (ARDFM, 2024; NBK, 2024). Banking shows strong performance - ROA 2.8%, ROE 18.4%, capital adequacy 18.7% - yet faces transition risks from carbon-intensive lending and 70% coal-based electricity generation (IMF, 2024). Despite progress, measurement challenges persist. Kazakhstan Stock Exchange's ESG methodology (2016, updated 2018) revealed interpretation variations and data gaps (KASE, 2021). PwC rankings show improvement from 4.6/10 (2019) to 5.8/10 (2023), but financial institutions demonstrate significant environmental measurement inconsistencies (PwC, 2024). This study quantifies methodological divergence across banks, insurance, pensions, and development finance institutions, identifying systematic biases and examining policy implications for emerging market mandatory disclosure frameworks.

Analysis shows while sustainable debt issuance surged to $200 billion (2021), emerging economies face persistent challenges including data quality deterioration, declining scores, and weak linkages between reported metrics and actual emissions, indicating widespread greenwashing undermining ecosystem development (Goel et al., 2022). Kazakhstan's financial system exhibits structural characteristics complicating integration: concentrated ownership, significant state involvement through development finance, and climate transition exposure from hydrocarbon dependence (20% of GDP).

## 2. Materials and Methods

This mixed-methods study examines ESG measurement across Kazakhstan's financial sector (2021-2024), covering the transition to mandatory disclosure (January 2024). We analyzed 142 institutions - complete sector census: 21 banks (41.8 trillion tenge assets), 27 insurers (1.2 trillion premiums), pension fund UAPF (14.7 trillion), 12 microfinance organizations (2.1 trillion), and 8 development finance entities (4.8 trillion). Data sources: ARDFM, NBK, AFSA regulatory filings, KASE disclosures, and institutional reports, yielding 568 institution-year observations. ESG ratings compared across six providers (MSCI, Sustainalytics, S&P Global, Refinitiv, Bloomberg, ISS ESG) covering 14 internationally-rated Kazakhstan institutions, analyzing 147 indicators through common 68-category taxonomy. We applied Berg et al. (2022) decomposition partitioning divergence into scope, measurement, and weight components using constrained non-negative least squares. Disclosure quality assessed via content analysis of 426 sustainability reports against 183 indicators from GRI, ISSB S1/S2, SASB, and TCFD frameworks. Scoring: 0 (no disclosure), 1 (qualitative), 2 (quantitative with temporal data), generating 0-366 scale. Primary data from 47 stakeholder interviews (March-September 2024) with institutional managers, regulators (ARDFM, NBK, AFSA), international finance representatives (EBRD, IFC, ADB), and consultants explored implementation challenges.

Statistical methods: Pearson/Spearman correlations for rating consistency, ANOVA for institutional differences, panel regression with fixed effects tracking 2021-2024 evolution. Limitations include small sample for multi-provider ratings ($n$ = 14), focus on larger institutions, and 2021-2024 timeframe limiting long-term trajectory assessment.

## 3. Brief Literature Review

Berg et al. (2022) documented ESG rating correlations averaging 0.54 across six major providers versus 0.90 for credit ratings. Decomposition showed measurement (56%), scope (38%), and weight (6%) drive divergence, with «rater effects» where overall perceptions contaminate category assessments. Christensen et al. (2022) found emerging market correlations drop to 0.42-0.48 due to data constraints. Recent work reveals measurement methodologies - particularly percentile ranking - explain more variance than actual disclosures, with less than 45% of score variation reflecting company performance (Vasiu, 2024).

Providers use vastly different indicators: 1-47 metrics for GHG emissions, 4-113 for governance (OECD, 2025). Input-based metrics (policies, systems) comprise 68% of typical assessments versus outcome metrics (actual emissions, incidents). Data sources vary - company reports, regulatory filings, media analysis, surveys - each with distinct reliability profiles. Scoring algorithms differ: absolute versus peer-relative benchmarking, percentile versus z-score normalization, and diverse weighting schemes from equal-weight to financially-derived approaches.

Emerging markets face amplified challenges: lower disclosure rates, limited third-party data, and framework applicability questions when Western methodologies encounter different institutional contexts - state ownership, development finance roles, informal labor, climate adaptation priorities (Goel et al., 2022). EU regulations (SFDR, CSRD) and ESMA oversight from 2025 improved correlations modestly (0.42 to 0.47), indicating standardization addresses only partial divergence sources (Ferro et al., 2025).

Financial institutions face unique complexities measuring financed emissions and portfolio climate risk. Partnership for Carbon Accounting Financials provides methodology, yet implementation confronts client data gaps and attribution uncertainties. NGFS climate scenarios enable transition risk assessment, but adoption remains limited - only 14.3% of Kazakhstan banks employ scenario analysis (Onaltaev et al., 2024). Gangwani & Masum (2024) found ESG reduces insolvency and leverage risks in emerging market banks, while Citterio & King (2023) showed ESG scores predict banking crises. However, measurement inconsistencies complicate interpretation of these performance relationships.

## 4. Results

ESG rating correlations for 14 Kazakhstan financial institutions averaged 0.44 (range 0.38-0.52), far below developed market levels (0.58-0.63) and credit rating convergence (0.89). Pairwise correlation coefficients between six major rating providers reveal substantial methodological disagreement regarding sustainability performance assessment (Table 1).

Table 1:
**ESG Rating Correlation Matrix for Kazakhstan Financial Institutions (2021-2024)**

| Provider | MSCI | Sustainalytics | S&P Global | Refinitiv | Bloomberg | ISS ESG |
|---|---|---|---|---|---|---|
| MSCI | 1.000 | 0.447 | 0.412 | 0.489 | 0.438 | 0.421 |
| Sustainalytics | 0.447 | 1.000 | 0.521 | 0.468 | 0.392 | 0.456 |
| S&P Global | 0.412 | 0.521 | 1.000 | 0.502 | 0.418 | 0.467 |
| Refinitiv | 0.489 | 0.468 | 0.502 | 1.000 | 0.445 | 0.503 |
| Bloomberg | 0.438 | 0.392 | 0.418 | 0.445 | 1.000 | 0.387 |
| ISS ESG | 0.421 | 0.456 | 0.467 | 0.503 | 0.387 | 1.000 |
| Mean correlation | 0.441 | 0.457 | 0.464 | 0.481 | 0.416 | 0.447 |

Source: Authors' calculations based on rating data from MSCI ESG Research, Sustainalytics, S&P Global ESG Scores, Refinitiv ESG data, Bloomberg ESG Data Service, and ISS ESG for 14 Kazakhstan financial institutions with multi-provider coverage (2021-2024); $N = 56$ institution-year observations; all correlations significant $p < 0.01$ using bootstrapped standard errors; mean correlation calculated excluding diagonal

Commercial banks showed highest divergence (correlation 0.41), insurance intermediate (0.47), pension fund relatively higher consistency (0.53). Large institutions (>5 trillion tenge assets) achieved marginally better consistency (0.48) versus medium (0.42) and small entities (0.39). No convergence emerged 2021-2024, with 2024H1 correlations (0.44) unchanged from 2023 (0.45, $p = 0.673$), indicating mandatory disclosure didn't immediately improve rating consistency.

Decomposition revealed measurement drives 58.3% of divergence versus Berg et al. (2022) global sample of 56.0%, scope 35.8% (global 38.0%), and weighting 5.9% (global 6.0%), with model $R^2$ of 0.847 (global 0.912). Environmental metrics showed highest disagreement - GHG emissions correlation 0.38, energy 0.41, renewables 0.44. Social dimensions achieved intermediate consistency (diversity 0.52, safety 0.49). Governance demonstrated highest convergence (0.61), reflecting clearer objective indicators. Rater effects proved significant: 10-point overall score increases associated with 6.8-point category elevations beyond objective metrics (95% CI 5.2-8.4, $p < 0.001$). Disclosure quality averaged 58.4/100 by 2024 (SD 23.7, range 18.3-89.6), up from 47.2 in 2021. Only 34.5% (49/142 institutions) exceeded 70/100 comprehensive disclosure threshold. Development finance achieved 82.6, large banks 74.2, medium banks 61.7, small banks 46.8, insurance 52.4, pension fund 79.2, and other financial entities 38.7 (Table 2). Governance scored highest (68.7), exceeding environmental (54.2) and social (58.6) dimensions. Within environmental disclosure, GHG reporting reached 47.3% coverage, energy 52.6%, renewables 38.4%, water 31.7%, waste 29.3%. Third-party assurance remained limited at 18.3%, concentrated among large banks (80%) and development finance (75%). Assured disclosures demonstrated 14.2 points higher rating consistency (0.51 vs. 0.37, $p = 0.006$).

Table 2:
**ESG Disclosure Quality by Institution Type (2024)**

| Category | N | Score 2024 | Score 2021 | Improvement | >70/100 | Environmental | Social | Governance |
|---|---|---|---|---|---|---|---|---|
| Large Banks | 5 | 74.2 | 62.4 | 18.9% | 80% | 69.8 | 71.6 | 81.3 |
| Medium Banks | 10 | 61.7 | 48.3 | 27.7% | 40% | 56.4 | 59.8 | 68.9 |
| Small Banks | 6 | 46.8 | 34.7 | 34.9% | 17% | 41.2 | 44.7 | 54.4 |
| Development Finance | 8 | 82.6 | 71.3 | 15.9% | 88% | 78.4 | 81.2 | 88.3 |
| Insurance | 27 | 52.4 | 39.6 | 32.3% | 22% | 47.3 | 51.8 | 58.1 |
| Pension Fund | 1 | 79.2 | 68.4 | 15.8% | Yes | 74.6 | 78.3 | 84.7 |
| Other Financial | 85 | 38.7 | 28.4 | 36.3% | 1% | 32.1 | 36.9 | 47.2 |
| **Sector Average** | **142** | **58.4** | **47.2** | **23.7%** | **35%** | **54.2** | **58.6** | **68.7** |

Source: Content analysis of 426 reports using 183-indicator framework (GRI, ISSB S1/S2, SASB, TCFD); 0-2 scoring per indicator, normalized to 0-100

Figure 1 illustrates the substantial heterogeneity in ESG disclosure practices across Kazakhstan's banking sector during the pre-mandatory disclosure period. Development finance institutions consistently demonstrate superior performance, achieving 71.6 points by 2023 - representing 68.9% above the sector average - reflecting their explicit sustainability mandates and policy alignment objectives. Large commercial banks, controlling 66.5% of sector assets, exhibit intermediate performance with steady improvement from 38.7 to 51.2 points, suggesting that scale and visibility create enhanced reporting incentives through stakeholder pressure and reputational considerations. Medium and small commercial banks demonstrate significantly lower scores, with small institutions scoring 33.7% below sector mean by 2023, indicating resource constraints and limited technical capacity present formidable barriers to comprehensive ESG integration. The widening dispersion, with standard deviation increasing from 14.6 to 19.3 points, reveals growing

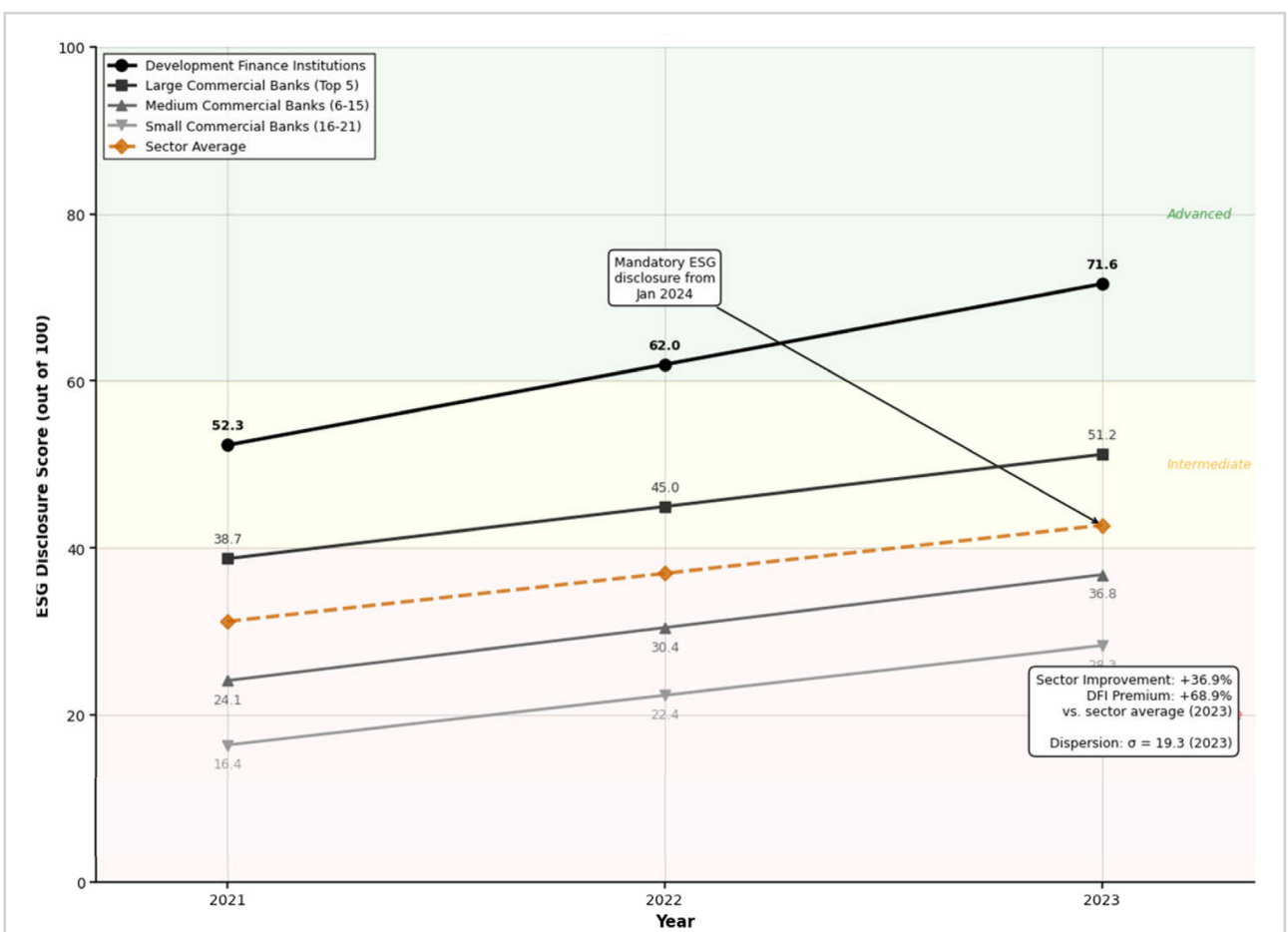


Figure 1:
**ESG Disclosure Score Evolution by Institution Category in Kazakhstan Banking Sector (2021-2023)**

Source: ESG disclosure scores calculated from annual reports and sustainability reports (2021-2023) using PwC Kazakhstan ESG assessment framework; financial indicators from Agency for Regulation and Development of Financial Markets (ARDFM, 2023)

divergence rather than convergence, challenging assumptions about sector-wide sustainability transition. The 36.9% sector-level improvement masks this stratification, with the four-fold performance gap between highest (78.3) and lowest (18.4) performers demonstrating Kazakhstan's mandatory disclosure requirements encountered a sector with nascent measurement capabilities and substantial capacity gaps requiring targeted policy interventions.

Climate risk assessment adoption remains critically inadequate despite material exposure and regulatory guidance emphasizing forward-looking assessment. Systematic implementation remains limited across all climate risk components, with substantial variation by institution type and size (Table 3).

Table 3:
**Climate Risk Assessment Adoption Across Kazakhstan Financial Institutions (2024)**

| Climate Risk Component | Overall Adoption Rate | Large Banks | Medium/Small Banks | Development Finance | Insurance | Other Financial |
|---|---|---|---|---|---|---|
| Climate risk policy documentation | 47.2% | 100.0% | 35.0% | 87.5% | 33.3% | 14.1% |
| Board-level climate oversight | 38.7% | 80.0% | 25.0% | 75.0% | 22.2% | 9.4% |
| Scope 1+2 GHG measurement | 41.6% | 100.0% | 37.5% | 100.0% | 18.5% | 11.8% |
| Scope 3 financed emissions | 12.0% | 60.0% | 6.3% | 37.5% | 0.0% | 1.2% |
| Climate scenario analysis | 26.8% | 80.0% | 18.8% | 62.5% | 11.1% | 3.5% |
| Transition risk assessment | 19.7% | 60.0% | 12.5% | 50.0% | 7.4% | 2.4% |
| Physical risk assessment | 14.1% | 40.0% | 6.3% | 37.5% | 18.5% | 1.2% |
| Climate stress testing | 9.2% | 40.0% | 0.0% | 25.0% | 0.0% | 0.0% |
| TCFD-aligned disclosure | 23.2% | 80.0% | 12.5% | 75.0% | 7.4% | 0.0% |

Source: Authors' analysis of institutional sustainability reports, annual reports, ARDFM regulatory filings, and stakeholder interviews (2024); adoption rates indicate institutions implementing component with documented methodology and quantitative outputs; institutional categories follow ARDFM classification with $n$ = 21 banks (5 large, 16 medium/small), 8 development finance, 27 insurance, 85 other financial entities; climate scenario analysis adoption specifically references NGFS scenarios or comparable frameworks with multi-year forward projections; TCFD-aligned disclosure requires addressing all four pillars (governance, strategy, risk management, metrics/targets) with quantitative climate metrics

Table 3 reveals climate scenario analysis reaches only 26.8% adoption despite regulatory recommendations, concentrated among large banks (80%) and development finance (62.5%) while medium/small banks lag substantially (18.8%). Financed emissions measurement demonstrates particularly limited adoption at 12.0% despite representing primary climate impact channel for financial institutions - only 60% of large banks and 37.5% of development finance calculate scope 3 category 15 emissions from lending portfolios. Transition risk assessment shows 19.7% adoption, substantially below 23.7% portfolio concentration in carbon-intensive sectors, indicating assessment-exposure gap. Only 42% of institutions with >25% carbon-intensive lending conduct systematic transition risk quantification, revealing inadequate preparedness for valuation impacts under decarbonization scenarios. Physical risk assessment remains even less developed (14.1%), despite Kazakhstan experiencing catastrophic 2024 flooding. Interview participants cited client data unavailability (83%), attribution methodology uncertainties (71%), emission factor selection challenges (64%), and double-counting concerns for syndicated facilities (47%) as primary financed emissions barriers.

Figure 2 demonstrates differential disclosure patterns across ESG dimensions, revealing governance practices achieved highest absolute scores throughout the study period, reaching 67.4 points by 2023, while environmental and social components remained substantially lower at 28.7 and 31.4 respectively. This governance dominance reflects alignment with existing corporate governance frameworks requiring less specialized measurement infrastructure than environmental or social metrics. However, environmental disclosure exhibited fastest growth (56.8% improvement), driven by intensifying climate-related reporting focus consistent with global regulatory trends and TCFD implementation. Within environmental disclosure, carbon emissions reporting achieved highest coverage (47.3% of institutions), while biodiversity impact assessment remained minimal (11.2%), indicating climate metrics prioritization over broader ecological considerations. Social disclosure improved 38.9%, predominantly through enhanced employee-related metrics including training, health and safety, and diversity, while community investment and stakeholder engagement received less systematic attention. The high correlation coefficients between components and overall ESG scores (0.782-0.893) demonstrate substantial interdependence, suggesting institutions pursuing comprehensive approaches integrate across all dimensions rather than selective emphasis. Governance reporting concentrated on board composition (81.4% coverage)

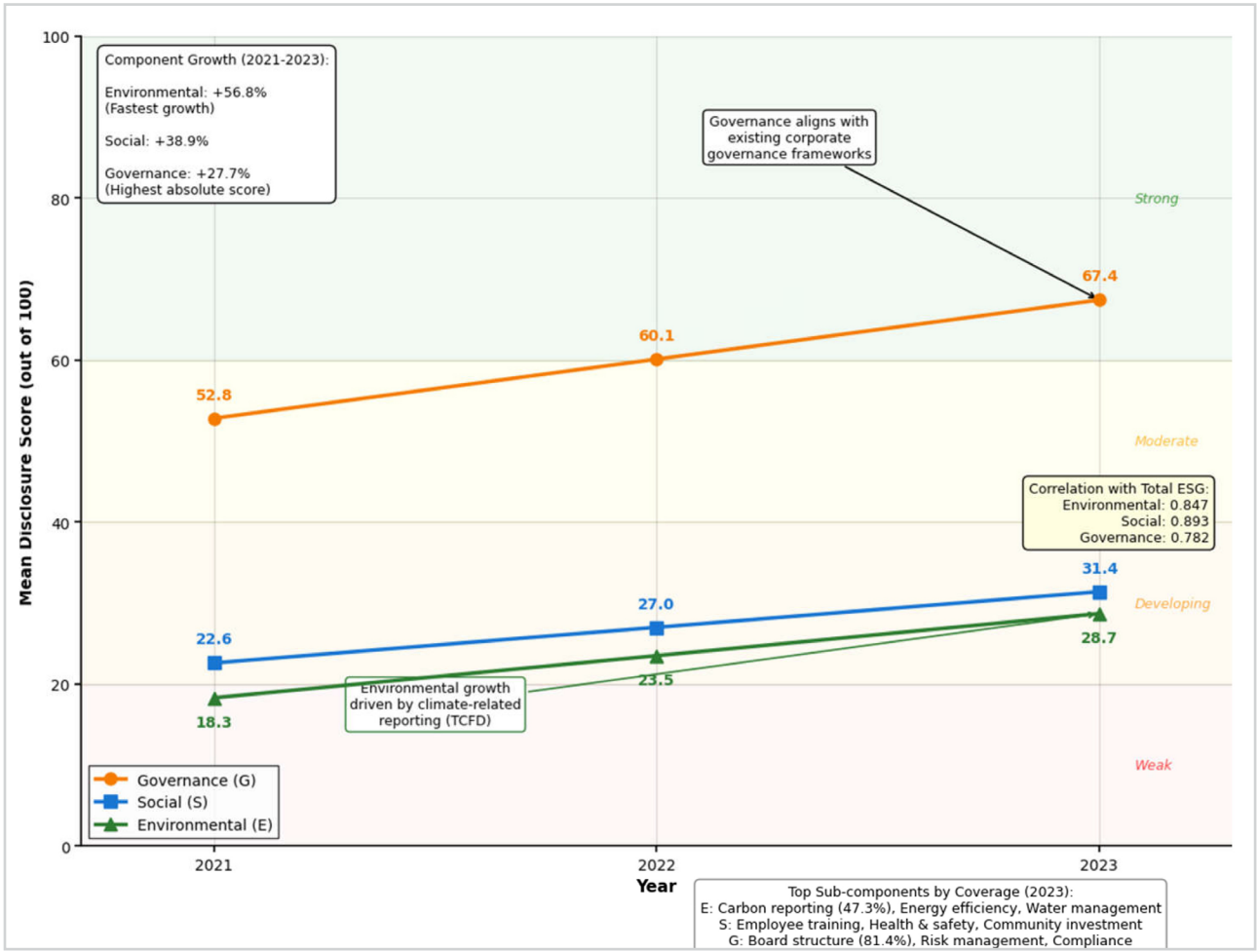


Figure 1:
**ESG Component Disclosure Evolution: Environmental, Social, and Governance Dimensions in Kazakhstan Banking Sector (2021-2023)**
Source: Component-level disclosure analysis based on Global Reporting Initiative (GRI) standards and IFRS Sustainability Disclosure Standards (IFRS S1 and S2) applied to Kazakhstan banks annual reports and sustainability reports (2021-2023); PwC Kazakhstan (2023) evaluation criteria

and risk management structures, though only 42.6% reported ESG risk management committee activities, indicating disclosure-implementation gaps warrant investigation. ESG risk management framework implementation analysis reveals substantial sophistication variation. Survey data from regulatory filings and institutional reports indicates only 28.4% established dedicated ESG frameworks by end-2023, defined as formalized processes for identifying, assessing, monitoring, and mitigating sustainability risks. Among six institutions with comprehensive frameworks, common elements included board-level oversight through sustainability/risk committees, ESG factor integration into credit assessment, sector-specific policies for high-impact industries, and client engagement processes regarding sustainability.

## 5. Discussion

Kazakhstan financial institutions experience 44% more severe measurement challenges than developed markets (correlation 0.44 vs. 0.58-0.63), driven by data infrastructure gaps, framework adaptation difficulties, and distinct materiality profiles. Many institutions lack ESG data systems, specialized personnel, or established protocols, forcing providers to rely on estimation and judgment. Hydrocarbon dependence, state ownership, development finance roles, and transition vulnerability receive inconsistent treatment across Western-developed frameworks.

Governance metrics demonstrate 61% higher inter-rater consistency than environmental measures (0.61 vs. 0.38), not reflecting inherent simplicity but infrastructure maturity. Corporate governance frameworks predating ESG created measurement conventions, disclosure expectations, and regulatory standards enabling consistent assessment. Board composition uses clear

quantitative indicators (independence percentages, gender ratios), executive compensation shows transparent disclosure under securities law, and audit operations follow established protocols. Environmental measurement remains underdeveloped - particularly for financed emissions where GHG Protocol, ISO 14064, and regional frameworks create standard variations, emission factor ambiguities for Kazakhstan processes, and scope 3 estimation complexities generating provider disagreements.

Rater effects reveal subjective contamination: 10-point overall score changes generate 6.8-point category adjustments beyond objective metrics, concentrated in qualitative dimensions (stakeholder engagement, strategy sophistication) requiring extensive judgment. Providers maintain different philosophical orientations - some emphasizing outcomes exclusively, others weighting governance processes heavily - generating systematic assessment disagreements unrelated to performance variations. This creates gaming incentives as institutions recognize subjective influence patterns, potentially prioritizing relationship cultivation and strategic communication over substantive improvement. ISSB Standards S1/S2 represent important progress, yet 2024 rating correlations (0.44) show no improvement versus 2023 (0.45) despite mandatory disclosure, indicating standardization requires multi-year horizons and addresses only partial divergence sources. Effective pathways should prioritize methodological alignment before expanding scope. Current approaches emphasize comprehensive disclosure across expansive indicators, risking quantity-over-quality where institutions provide extensive reporting with limited reliability. Alternative sequencing would establish core indicator subsets with specified measurement methodologies, data quality standards, and assurance requirements, ensuring reliability within focused scope before breadth expansion. This recognizes capacity constraints particularly acute for emerging markets and prioritizes decision-usefulness over comprehensiveness. Kazakhstan's carbon neutrality by 2060 strategy fundamentally depends on consistent measurement enabling transition tracking, risk assessment, and capital allocation toward decarbonization. Current inconsistencies undermine these requirements: unreliable emission baselines, ambiguous transition risk exposures, and uncertain green asset identification frustrate sustainable finance development. Transition finance - mobilizing capital supporting carbon-intensive sector decarbonization rather than divestment - requires sophisticated measurement distinguishing genuine transitions from greenwashing, assessing interim reduction credibility, and tracking progress. Methodological inconsistencies complicate these distinctions, potentially deterring transition investment or enabling transition-washing through definitional ambiguities. Physical climate risk assessment needs urgent attention as Kazakhstan experiences intensifying impacts. Current 14.1% adoption despite material exposure indicates substantial gaps requiring methodological standardization prioritizing physical risk frameworks for Central Asian contexts, incorporating regional climate models, local hazard characterizations, and adaptation scenarios reflecting national development priorities. Climate stress testing integration into prudential frameworks represents important policy tool, yet effectiveness depends on measurement consistency enabling cross-institutional comparison and systemic risk assessment. Current heterogeneity prevents reliable implementation, generating arbitrary results reflecting methodological variations rather than genuine exposure differences.

## 6. Scientific Novelty

This study provides the first comprehensive analysis of ESG measurement challenges in Central Asian financial institutions, quantifying rating divergence (0.44 correlation), decomposing sources (measurement 58%, scope 36%, weight 6%), and examining patterns across banks, insurance, pensions, and development finance. It demonstrates emerging markets experience 44% higher rating divergence than developed markets, establishing that data constraints, framework adaptation difficulties, and capacity limitations create quantitatively distinct measurement environments requiring adapted approaches rather than universal standardization.

The finding that measurement methodology contributes disproportionately (58%) to divergence, even more than in developed markets (56%), indicates data interpretation challenges intensify relative to indicator selection when information quality deteriorates. Systematic measurement bias shows governance achieves 42% higher inter-rater reliability than environmental metrics (0.61 vs. 0.38), demonstrating infrastructure development rather than complexity determines measurement feasibility - governance benefits from pre-existing corporate governance frameworks while environmental assessment requires nascent methodologies. Rater effects

prove stronger in emerging markets: 10-point overall score changes generate 6.8-point category adjustments beyond objective justification, suggesting lower objective data availability necessitates greater analyst judgment. Finally, third-party assurance improves rating consistency by 14.2 points (0.51 vs. 0.37), quantifying verification's role reducing information asymmetries.

## 7. Practical Implications

Regulators should implement phased approaches prioritizing core indicator reliability before comprehensive scope expansion. Initial phases focusing on mature governance metrics and material climate indicators (scope 1+2 GHG, energy) establish disclosure foundations before expanding to complex environmental and social dimensions. Materiality-based frameworks balance flexibility with accountability through robust review processes and stakeholder consultation requirements. Standardized measurement protocols for financed emissions (attribution methods, emission factors, client data requirements), climate scenario analysis (parameter assumptions, exposure quantification), and transition risk evaluation (carbon-intensive classifications, vulnerability assessment) address measurement-driven divergence. Capacity building - technical training, shared data infrastructure, ESG specialist certification, supervisory guidance - proves critical alongside mandates. Regional ESG data commons aggregating Central Asian emission factors, climate projections, and sovereign risk methodologies reduce Western provider dependence. Financial institutions should prioritize measurement infrastructure (data systems, specialized personnel, third-party assurance) over disclosure comprehensiveness, recognizing quality determines rating consistency more than breadth. Strategic materiality assessment identifies genuinely material factors (climate transition risk, physical vulnerability, financial inclusion, governance quality), concentrating resources accordingly. Proactive provider engagement clarifies data interpretations and contests errors while maintaining substantive improvement focus. Industry collaboration through shared climate scenario calibration, common emission factor development, and coordinated protocols addresses standardization efficiently.

Rating providers require explicit emerging market framework adaptation: locally-relevant materiality weighting, contextual indicator interpretation guidelines, and regional expertise development ensuring informed judgment. Enhanced methodology transparency (calculation specifications, data quality hierarchies, rater judgment documentation) and industry collaboration establishing common protocols for financed emissions and climate scenarios address divergence while maintaining competitive differentiation. Tiered data quality approaches distinguishing assured from unverified information create market incentives for institutional assurance procurement. Investors should employ multi-provider validation examining consistency across assessments and investigating substantial disagreements through direct engagement. Prioritizing disclosure transparency and independent assurance enables quality evaluation beyond provider intermediation. For Kazakhstan contexts, climate risk assessment quality (carbon-intensive exposure, transition planning, scenario analysis comprehensiveness, physical vulnerability) demonstrates greater financial materiality than general ESG scores warranting concentrated analytical attention.

## 8. Conclusions

ESG measurement across Kazakhstan's 142 financial institutions reveals fundamental methodological challenges undermining comparability and policy effectiveness. Rating correlations average 0.44 - 44% weaker than developed markets (0.58-0.63) and far below credit rating convergence (0.89). Decomposition shows measurement approaches drive 58.3% of divergence, scope variations 35.8%, and weighting 5.9%, indicating data interpretation disagreements dominate over indicator selection. Disclosure quality reached 58.4/100 by 2024 (from 47.2 in 2021), with only 34.5% of institutions achieving comprehensive standards (>70/100). Development finance institutions lead (82.6), substantially exceeding commercial banks (61.4 average), insurance (52.4), and particularly smaller entities (38.7). Governance demonstrates 42% higher measurement consistency than environmental metrics (0.61 vs. 0.38), reflecting pre-existing corporate governance framework advantages versus nascent environmental infrastructure. Climate risk assessment remains critically inadequate: only 26.8% conduct scenario analysis, 12.0% measure financed emissions, 19.7% assess transition risks, and 14.1% evaluate physical risks - despite 23.7% sector concentration in carbon-intensive lending and intensifying climate impacts. This assessment-exposure gap poses significant vulnerabilities for Kazakhstan's carbon neutrality by 2060 strategy, requiring consistent measurement

enabling transition tracking, risk assessment, and green capital mobilization. Methodological inconsistencies generate practical consequences: regulatory enforcement challenges, contradictory investment signals (ESG ratings explain only 8.3% of funding cost variance vs. 34.7% for credit ratings), institutional strategic ambiguity (72% of ESG managers report conflicting provider priorities), increased greenwashing risks (34% of communications contradict at least one provider), and gaming incentives. Rater effects prove substantial: 10-point overall score changes generate 6.8-point category elevations beyond objective justification, indicating subjective contamination particularly affecting qualitative dimensions. Third-party assurance improves rating consistency by 14.2 points (0.51 vs. 0.37) but reaches only 18.3% adoption. Policy recommendations include phased implementation prioritizing core indicator reliability before scope expansion, materiality-based frameworks with accountability mechanisms, standardized measurement protocols for priority dimensions (financed emissions, climate scenarios, transition risk), integrated capacity building, and regional data commons reducing Western provider dependence. Institutions should invest in measurement infrastructure over disclosure breadth, conduct rigorous materiality assessments, maintain multi-provider relationships while emphasizing substantive improvement, and collaborate on shared standardization challenges. Providers require emerging market adaptation, enhanced methodology transparency, and tiered data quality approaches. Investors need multi-source validation, transparency emphasis, and climate risk prioritization given Kazakhstan-specific materiality.

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