“Digitalization – CSR integration in transitional banking: Evidence from Ukraine and Kazakhstan”

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DIGITALIZATION – CSR INTEGRATION IN TRANSITIONAL BANKING: EVIDENCE FROM UKRAINE AND KAZAKHSTAN

Abstract

Transitional banking systems increasingly rely on both digitalization and corporate social responsibility (CSR) to sustain resilience and public trust. This study evaluates whether the integration of digital capabilities and CSR relates to bank-level trust and reputation in Ukraine and Kazakhstan. The study assembled 2019–2023 indicators for four banks – PrivatBank, Monobank (Ukraine), Kaspi.kz, and Halyk Bank (Kazakhstan) – based on publicly available information. All measures were standardized, and Principal Component Analysis (PCA) was used to construct a Digital-CSR Index (DCSI). The first principal component (PC1), which jointly loads on digital innovation, CSR, and sustainability variables, explains 54.5% of total variance and serves as the composite index; document coding achieved Krippendorff's α = 0.82. Results show a clear rank order: Kaspi.kz = 4.48, PrivatBank = 0.88, Monobank = −0.27, and Halyk Bank = −4.07. Higher DCSI values are associated with stronger outcomes in customer trust and reputation across cases (e.g., trust levels up to 8.5/10), and descriptive fits suggest that the integrated index captures more cross-sectional variation in these outcomes than single-domain proxies. Robustness checks excluding one indicator at a time and restricting Ukrainian observations to the post-2022 period preserve the loading structure and rank order. The study concludes that integration, rather than parallel pursuit, of digitalization and CSR is associated with superior legitimacy outcomes in transitional contexts. Country conditions shape this relationship: Ukraine's crisis-driven digital expansion is tempered by disclosure volatility, whereas Kazakhstan's steadier assurance environment favors platformized integration. The DCSI provides a transparent, replicable benchmark to guide managerial strategy and regulatory design in comparable financial systems.

Keywords digitalization, banking, CSR, ESG, fintech, trust, reputation, transition

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INTRODUCTION

The COVID-19 pandemic reshaped banking everywhere, but its imprint on transitional systems has been especially sharp. Rapid digitization and a newer interest in corporate social responsibility have become part of the two significant strategic responses in this environment that have ceased being an alternative activity but have become a requirement for sustainable growth and reasonable engagement with customers (Nanda et al., 2021; Theiri & Alareeni, 2023). It is self-explanatory: as shocks multiply and rules change, banks must provide ways of multiplying channels and finding trustworthy behaviors.

The stakes are higher in Kazakhstan and Ukraine since the institutions themselves have yet to come to terms with the situation. Digital tools, platform banking, data rails, and, more and more, AI would offer reach and efficiency; CSR and the wider ESG frame would address the question of legitimacy and social license. Such tracks tend to run

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concurrently and, at their finest, complement each other: technology increases access and reduction of friction, whereas responsibility norms embedded fairness, disclosure, and accommodating externalities. The conflict is evident in the case of Ukraine. Wartime crisis and reforms led by donors have increased the speed of regulatory turnover and the implementation of digital public goods, which, in practice, have elevated expectations on consistency, prudence, and stakeholder disclosure on banks that carry on working in an ever-changing rulebook (Pellicciari, 2022). The rhythm is different in Kazakhstan. Retail finance based on platforms has grown under relatively stable supervision by the state, a market where innovation can be ordered, not reflexive (Kulikov et al., 2022). But the issue is the same. It is not only to digitalize more transactions, but to make sure that the digital proliferation enriches accountability and transparency, but not to make them thinner. In other words, these two systems are striving to transform technical adoption, to sustain over time the confidence of institutions that are in a state of flux. It demands governance options, transparent disclosures, audit control, and plausible social commitments that the productivity gain of digitalization would be aligned with the longer horizon of social trust.

The scholarly gap is equally clear. Existing work richly documents the adoption of mobile channels, data-driven services, and ecosystem strategies, and separately maps the diffusion of CSR/ESG standards in finance. What is missing is an integrative, bank-level lens that captures how digital capability and CSR assurance interact in shaping perceived legitimacy, reputational capital, and resilience. Three obstacles have impeded such analysis: first, measurement fragmentation, whereby digital and CSR indicators are reported in incompatible formats; second, contextual confounding, as conflict exposure, regulatory stability, and disclosure quality vary sharply across post-Soviet settings; and third, construct slippage, where studies proxy "responsibility" with disclosure volume rather than assured practices embedded in customer journeys. As a result, the field lacks a systematic way to distinguish digital scale without legitimacy from digitally enabled, responsibility-anchored banking. Therefore, the scientific problem is to identify and quantify the integration of digital transformation and CSR at the bank level and to determine whether this integration, rather than either domain in isolation, is the principal driver of observed differences in trust and reputational standing within transitional financial systems.

1. LITERATURE REVIEW

Contemporary banking sits at the intersection of two powerful currents: rapid digital transformation and the steady institutionalization of corporate social responsibility (CSR). Over the past two decades, scholars have traced how ecosystem-based models, mobile platforms, blockchain, and artificial intelligence are reshaping financial services and redefining competitive advantage (Nanda et al., 2021; Theiri & Alareeni, 2023; Kaluarachchi & Sedera, 2024). In parallel, a growing literature shows that CSR and ESG frameworks underpin legitimacy, trust, and long-horizon accountability within financial institutions (Giannopoulos et al., 2024; Liang et al., 2025). The one thing we lack a clear understanding of is the fit on the ground of how digital muscle and responsibility practice are acquired. They can sometimes march in step (accelerated onboarding and clean audit trails); they can sometimes drag apart (opaque scoring models that scale better than fairness checks). It becomes an even more painful question in the in-between systems, where institutions are still trying to figure them out, and shocks strike halfway through the reform: banks are requested to demonstrate that they can scale services and data processing and keep commitments to transparency, inclusion, and community responsibility simultaneously (Pellicciari, 2022; Kulikov et al., 2022). Stated differently, could the same technology that reduced friction also be used to automate KYC, platform lending, and AI triage, at the same time, further enhancing explainability, disclosure, and recourse? Or shall speed, as is too often the case, accountability follow behind?

Ukraine and Kazakhstan have some lessons that are similar to each other, although they move on different routes. War and the inconsistent march of the rebuilding process, as well as reforms at the donor expense and alignment, have shocked banks in Ukraine directly into a rash of overhaul: faster digitization, playbooks of continuity that are more

demanding, and an overall increase in the resilience of operations (Maranzano & Romano, 2025; Kolodii, 2024). Kazakhstan has its way, which is not inactive. Policy has become more consistent, where state-managed modernization and ecosystem trials incorporate new finance instruments of retailing and do not attempt to substitute the current market structures in a single step (Omarini, 2023; Shah, 2024). The two experiences are educative. The only thing still missing in the literature is a compelling yardstick of when digitization and CSR meet or not, the shifts in sustainability outcomes, and, most crucially, whether the convergence generates consumer trust. To further that discussion, this review cuts across three major fields, namely, digital change in banking, CSR/ESG in finance, and comparative analysis of transitional systems. The aim is deliberately modest and yet practical: to sort the things which we can measure out of those which we can just conjecture about, and to state the ways by which such a gap must be bridged.

1.1. Digital transformation in banking

Digital transformation is often seen as the key to banks' increased innovation, efficiency, and ability to compete. Two common and useful frameworks help explain why uptake varies. First, the Technology–Organization–Environment (TOE) model focuses on the foundations: how ready institutions are, how strong the technology infrastructure is, and the rules that either speed up or slow down uptake (Malik et al., 2021; S. Shah & T. Shah, 2023). Second, the Diffusion of Innovation (DOI) theory explains how features like relative advantage, compatibility, trialability, and observability affect how companies and end users ponder new tools (Attié & Meyer-Waarden, 2022; Mbatha, 2024; Artemchuk et al., 2024). Basically, TOE tells you if a system can be adopted, while DOI tells you how and how fast people adopt. All these points of view agree that for digital transformation to be a success, internal resources, customer habits, and external incentives must all be in harmony. Despite the lack of proof of a direct relationship, Bezrukova et al. (2022) demonstrate a strong correlation between consumer e-commerce uptake and enterprises' ICT upskilling in several countries, including Sweden, Malta, and Estonia. This suggests that human-capital investment is an important complement to digital adoption. Translation of infrastructure investments into widespread, innovation-driven growth can be achieved soon through the potential highlighted by Sucre et al. (2025) in the areas of labor upskilling, interoperable digital ID/payments, and updated fintech/data protection regulations. Amidst European integration, extending market access, and aligning with global trends, Verbivska et al. (2023) argue that e-commerce functions as a catalyst for creative business development. It also highlights gaps that founders can use to focus their strategy and drive growth.

The developments of online shopping and more integration of e-commerce are expected to define the new era of internet banking (Prokopenko, 2021). Omarini (2023) goes further, taking the view that banks are digital platforms in connected ecosystems to provide bundles of both financial and non-financial services and not a line of products. The most obvious example is the Kaspi.kz of Kazakhstan, which merges credit, retail, and payments into a single platform and, in the process, offers a new layer of evidence, owing to its experience with the war in Ukraine. PrivatBank relied on the existence of state-subsidized digital rails to continue with core services under pressure as Monobank moved to the pure neobank model of smartphone-first, branchless, and designed to roll out quickly (Kolodii, 2024).

This skewed rush can be seen in the marketing technology picture. The transition by Ukraine to a global-type interactive ecosystem, yet characterized by unequal capacity, is described by Zozulov et al. (2023) as rapid adoption of social, mobile, e-commerce, CRM/automation, and data-driven tools and scarcities of skilled labor, fragile SME funding, unstable data quality and data governance, and unclear regulations that present firms with guesswork. Kobets et al. (2024) continue by clarifying that big data is now the focus of digital marketing enhanced by AI, and, in an upsurge, blockchain, since companies seek a more meaningful, targeted customer experience, enabled at a higher level of security, speed, and tailor-made interactions. The dilemma is quite clear: the same scale and accuracy increase privacy, ethical, and platform dynamics; it also exacerbates the digital divide when guardrails fall behind. In practice, it

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appears that to be competitive, it is necessary to act quickly and have a good level of control, plausible compliance, and further research to ensure that the technology is not going to device bravery.

Recent developments indicate the same trend: blockchain (Schinckus, 2021), AI and machine learning (Truby et al., 2020; Chen et al., 2021), and service automation (Kaluarachchi & Sedera, 2024) are shifting to the plumbing of finance. They are offering cheaper operations, customized offerings, and prediction tools, which are supposed to assist banks in predicting both risk and customer needs. The trade-off is not trivial. Zuboff (2019) provides the same data stream used for personalization, but with warnings: the active use of big data extended surveillance and left complex questions about consent and privacy, as well as who really owns the data. The financial institution of Western Europe is also able to count on strong collaborations with fintech and fairly uncomplicated regulations. By comparison, the transitional systems bang up against fuzzier law, smaller budgets, and more diverse customer bases, which precondition what can be meant by the concept of digital transformation in practice (Viardot et al., 2023). A large portion of the literature considers the positive aspect of technology, but strangely, it sees adoption as the endpoint. The connective tissue, however, is frequently wanting: how these instruments are imprinted on larger social and moral requirements, equity, explicability, redress, and whether there are plausible guardrails to those who incur the exposure.

1.2. Corporate social responsibility and ESG in banking

Banks are well aware of the CSR. A more demanding question is less complicated: in what ways do ethical, social and environmental issues manifest him or herself in the bank credit applications, product specifications, supplier selections, and not in smooth plans? According to Fatima and Elbanna (2023), it is reduced to community investment, environmental care, and responsible leadership. It is general, but practical when governance and incentives are on course. Furthermore, it is not only image management that has an upside. In the UK, the stronger the CSR is, the higher the financial performance (Giannopoulos et al., 2024). In a different perspective, Hanic and Smolo (2023) demonstrate that CSR is perfectly embedded in Islamic banking, demonstrating that, in fact, responsibility can be positioned on very different institutional and ethical backgrounds yet remain commercially rational.

ISO 26000 is a guideline on social responsibility, which does not impose certification (Bijlmakers, 2022). GRI has continued to be the engine material in sustainability reporting, and SASB has confined itself to what the investor can price in industry-specific measures of what is material in each individual sector (Liang et al., 2025). Practically, the templates of the ESG trace energy and emissions, workforce diversity, and even pay ratios, which are frequently approximate indicators of a bank's CSR system maturity (Ngamvilaikorn et al., 2024). Are companies in a similar manner adhering to these rules? Not really. Even compliance and comparability continue to stutter between countries and types of banks. According to Shapovalova et al. (2023), tax policy can push the systems in the right direction and increase revenue on the way, but the evidence produced is largely correlational in nature, which means that regulators need to be careful about cross-boundary imitation of models. CSR in Kazakhstan is a subsumed element of a larger, state-based modernization program, usually along with ecosystem finance and digital projects. After the cycles of shock, war, and reconstruction in Ukraine, CSR will adopt service continuity and accountability to the community. There is nothing better about one model. That measurement is behind the curve on both our side: we are yet to develop context-variable tools, capable of demonstrating whether (digital) and CSR do really promote sustainability performance and trust, and when they are merely paperwork.

The ratings seldom match between the providers and geography. Hmiden et al. (2024) and Hughes et al. (2021) attribute a major part of the spread to poor and disproportional underlying data. That rift, particularly, is disastrous to non-Western issuers, which are either over-represented or over-represented with paltry proxies, and their scores are heading in the wrong direction. In the meantime, less evidence is available on the direct control of leveraged firms. Kryvovyazyuk et al. (2020)

discovered that Slovak companies grew their profit margin through shaving export-import frictions; Indian companies grew their share but without making excessive expenditure. The do-not-resistant lesson is practically very close to boring and thus handy: fixing cross-border processes is likely to enhance performance.

Readings on a system level are colder. Basing their argument on IMF diagnostics, Adambekova et al. (2024) state that banks in Ukraine and Kazakhstan lag the rest of the global banking system in regard to compliance; the thin transparency trail impairs credibility. External pressure is also continuing to ratchet. Big ratings, including MSCI and Sustainalytics, are making demands that banks cannot risk ignoring, should they wish to remain investable. The biggest gap in the debate surrounding CSR is the technology hinge. Digitization may enhance traceability and create a stronger audit trail, bridging information lapses. It may also, without any falsehood on our part, polish poor practice with greasy dashboards. In emerging markets, they are yet to pass judgment.

1.3. Comparative and transitional contexts

Transitional economies carry a particular kind of stress, and post-Soviet finance makes that visible. The wartime pressure on rules has led to rapid turnover of the rules in Ukraine: Donor controls have tightened, timelines have been pressure-packed, and giant chunks of the rulebook have been rewritten to keep the banks alive (Pellicciari, 2022; Maranzano & Romano, 2025). Kazakhstan has been progressing at a different pace, with more stable politics, a state-led modernization drive, and reforms in stages and not haste (Kulikov et al., 2022). This comparison tells much about the effect of external influences on institutions: speed up in one place, time to pace at home. The risk map diverges as well. The details of the hybrid warfare describe the kind of headwinds the Ukrainian banks have previously experienced that most of the European systems were never exposed to in large scale: coordinated cyber-attacks, disrupting critical infrastructure, and information operations aimed at destabilizing the confidence of the population (Derevyanko et al., 2017).

Reports comparing World Bank, OECD, and EBRD efforts shed light on reform paths and macroeconomic stability in Central and Eastern European countries (Ambrosio et al., 2022; Citaristi, 2022); however, these studies seldom ever touch on banking strategies at the business level. The digital readiness of CIS financial systems is evaluated by Ionașcu et al. (2023), but CSR is not included as a variable; therefore, the integration is not investigated. Tumalavičius (2022) also investigates the difficulties of cryptocurrencies, drawing attention to the dangers of hacking and money laundering. However, he fails to make any reference to the importance of ethical banking procedures. Although their research focuses on the energy industry rather than the financial sector, Häußermann et al. (2023) examine public acceptance of green innovation and highlight the importance of trust. Although transitional economies are often studied at a macro level, there is a dearth of systematic evaluations that connect digital innovation with CSR at the bank level, as seen by this disjointed landscape. The disparity is particularly noticeable in Kazakhstan and Ukraine, two countries where CSR and digital reforms are progressing under separate but equally revolutionary forces.

The literature review proves three main things. To start, digitalization in banking has come a long way thanks to mobile tech, AI, and platform ecosystems; yet studies have primarily focused on how digitalization affects efficiency and competitiveness, not how it affects ethics. Second, research often overlooks the impact of technological changes on disclosure procedures, even though CSR and ESG frameworks are now crucial for responsible banking. Thirdly, there are no systematic instruments for studying the convergence of digitalization and CSR at the bank level; however, comparative research in transitional countries does provide valuable macro insights. To fill these gaps, this study used Principal Component Analysis (PCA) to create and test a composite Digital-CSR Index for banks in Kazakhstan and Ukraine. The goal is to establish a system that can be replicated to assess the impact of digital innovation and CSR on customer trust, institutional resilience, and long-term financial growth. The study will explore the effect of digital transformation and CSR practices on the results of legit-

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imacy, namely, customer trust and reputation in the transitional banking systems in Ukraine and Kazakhstan. Although previous studies have recorded the separate digital adoption and CSR diffusion, they have not specified the effect of the two in relation to each other at the bank level, and also have not determined whether the integration of digital and CSR will lead to cross-bank variance in trust and reputational status. This study, using a constructed and implemented composite Digital-CSR Index (DCSI), measures how successful the results of legitimacy in banks that incorporate technological innovation with plausible responsibility practices compared to those that only pursue these indicators.

The aim of the current study is to quantify the integration of digitalization and CSR at the bank level and to test whether this integrated capability is a stronger determinant of trust and reputation than either domain alone in the transitional banking systems of two countries, those are, Ukraine and Kazakhstan.

This analytical attention leads to the following hypotheses:

H1: Banks with higher DCSI scores exhibit stronger customer trust and reputational standing than banks with lower DCSI scores.

H2: The DCSI (capturing the joint digital–CSR factor) explains more cross-sectional variance in trust and reputation than either digital-only or CSR-only composites.

H3: The association between DCSI and legitimacy outcomes is moderated by country conditions (e.g., conflict exposure, regulatory stability), with more potent effects where assurance and disclosure quality are steadier.

2. METHODOLOGY

This study examines the digitization and CSR activities of chosen banks in Kazakhstan and Ukraine using a qualitative comparative case study technique. According to Chin et al. (2023) and Parente et al. (2019), a case study method provides in-depth knowledge of each country's banking environment that is needed to unravel intricate institutional processes. The selected banks mostly rely on secondary data, which includes CSR declarations, sustainability indexes, digital strategy white papers, and annual reports. Using this approach, students from various years and schools will have access to the same organized data. According to Berger et al. (2009), when public sources are comprehensive and easy to understand, secondary data analysis offers a solid basis for comparing and assessing materials, making it an ideal choice for comparative research. Hryhoriev et al. (2024) demonstrate how technical inputs (rock-mass, explosives, expenses) may be transformed into economic results (production cost, investment attractiveness) using a multi-factor, data-driven model. The Digital-CSR Index (PCA) is a methodologically similar tool that we use to explain growth and reputation in transitional banks and to direct policy and investment choices. It combines operational factors, including digitization, CSR, and trust. We may further connect DCSI to financial performance using predictive regressions and non-linear models, and the parallel further supports our usage of composite indices.

The transitional contexts in Ukraine and Kazakhstan offer a useful comparison for studying the interplay between digitization and CSR in the face of different institutional frictions. After 2022, the Ukrainian financial system will have to deal with the added challenges of wartime disruption, donor conditionality, and the quick rollout of digital public goods like electronic identification, remote onboarding, and emergency payments. In comparison, Kazakhstan's retail banking sector exemplifies slow but steady modernization under state guidance, characterized by solid supervision and rapid platformization. We may study the impacts of integration, the mutual reinforcement of digital capacity and CSR assurance in situations of conflict exposure and regulatory stability, by comparing these two settings.

The study sample includes one incumbent universal bank and one digital-first challenger in each country to span ownership, distribution, and governance archetypes. In Ukraine, PrivatBank (state-controlled; nationalized in 2016) represents a systemically important incumbent with broad reach and strengthened post-nationalization con-

trols; Monobank is a mobile-only neobank concentrating customer interaction in the app with an earlier-stage CSR footprint. In Kazakhstan, Halyk Bank anchors the incumbent category with established CSR programs and strong brand trust, while Kaspi.kz operates a multi-sided ecosystem integrating payments, lending, and marketplace services alongside visible ESG initiatives. This 2×2 design (country × bank type) supports both within-country (incumbent vs. challenger) and cross-country (similar bank types under different institutions) contrasts, clarifying the Digital-CSR construct.

The study window (2019–2023) covers banks in both Kazakhstan and Ukraine. It begins in the Ukrainian case, after PrivatBank's governance reset and spans Ukraine's 2022 structural break. We therefore

(i) confine the Ukrainian analysis to the post-nationalization regime;

(ii) flag and sensitivity-check post-2022 indicators for Ukrainian banks; and

(iii) standardize all inputs (z-scores) across banks in both Kazakhstan and Ukraine so channel heterogeneity (mobile-only vs. omni-channel) affects levels but not comparability.

Monobank's branchless model is treated as a distributional boundary condition; the index evaluates integration, not branch efficiency, prioritizing share measures and assured CSR metrics over absolute volumes. Kazakhstani banks (Kaspi.kz and Halyk Bank) are evaluated using the same integration-focused criteria, with platform-based scale effects captured through standardized share measures rather than absolute volumes. The study reports robustness checks (leave-one-indicator-out; post-2022 subsample) and notes external validity limits (N = 4), with extensions to broader panels.

2.1. Data analysis

Using Krippendorff's (2022) standards, the study categorized public documents (such as financial statements, CSR reports, ESG analyses, and digital strategies) into categories including new technology, CSR activities, and sustainability results. The analysis covered the years 2019–2023. Triangulation of data and well-established theories of digital banking and CSR (Malik et al., 2021) were used to guarantee validity. With Krippendorff's alpha of 0.82, two coders verified reliability. Each bank's tactics were evaluated using a SWOT analysis, which combined expert knowledge with actual data. Adoption of AI, ESG compliance, social initiatives, and reputational risk were among the key factors highlighted in the comparison tables. Sampling the four banks and Ukraine and Kazakhstan were chosen based on a well-defined methodological logic, but not convenience sampling. The choice of countries was based on the contrasting environments of transition, i.e., one with accelerated transition relying on conflict (Ukraine) and the other moderated by regulation and platform (Kazakhstan), to allow us to isolate the moderating role of institutional friction conditions on digital-CSR integration. Only banks that met three explicitly stated inclusion criteria were included:

(i) public disclosure of multi-year digitalization, CSR/ESG, and customer outcomes;

(ii) incumbents and challengers in any given system; and

(iii) adequate comparability of indicators to allow the construction of PCA after standardization.

This design enhances internal validity since there is variation over governance, ownership, and distributional dimensions, as other overall regional transition dynamics remain constant. Besides, through strong robustness tests and by states clearly realizing the boundaries of an N = 4 comparative sample, the research balances case selection with its theoretical goal: to offer a systematic diagnosis of digital integration pathways of CSR in banking, as opposed to projecting statistically to a large-scale banking demographic.

2.2. Quantitative model

To provide a reliable standard, this study developed a "Digital-CSR Index," a composite indicator that quantifies the extent to which each bank is embracing digital innovation, implementing CSR activities, and seeing long-term success. The index is divided into three sections:

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(i) the percentage of transactions processed through mobile apps or by AI/ML;

(ii) CSR initiatives, such as investments in environmental and social projects or the adoption of ESG frameworks; and

(iii) sustainability results, such as an increase in clients, trust from customers, or reputational scores.

The score was calculated using Principal Component Analysis (PCA), a method that maintains the variation among indicators while reducing the number of dimensions. We normalized all metrics and assigned each one a weight according to its contribution to the first principal component. We treat nationalization as an exogenous governance reset that likely improved disclosure and internal controls. Since our study window is 2019–2023, we

(i) restrict to post-reset years;

(ii) flag PrivatBank's ownership in all comparative tables; and

(iii) run a robustness check excluding any indicator whose source materially changed in the early post-nationalization period.

Results and ranks remain qualitatively unchanged. We include a post-2022 indicator flag in the coding sheet and recomputed the DCSI on (a) complete 2019–2023 data and (b) a post-2022 subsample for Ukrainian banks. The loadings are stable; Ukrainian scores compress (trust/reputation decline modestly; digital usage expands), but rank order does not change. Because Monobank has no branches, we normalize all inputs (z-scores) and express "digital usage" as share metrics (e.g., mobile transaction share) to avoid scale bias from physical networks. We note a construct boundary: our DCSI evaluates *integration* of digitalization and CSR, not branch efficiency.

The *Digital-CSR Index (DCSI)* is constructed as a composite latent variable measuring the convergence of digital innovation, corporate social responsibility (CSR), and sustainability outcomes in banks. Formally, the model can be specified as follows: Observed variables are grouped into three domains: Digital Innovation Variables (D) are D_1, D_2, ..., D_p. Such that,

$$D_1 = mobile\ app\ transaction\ share\ and\ D_2 = AI\ /\ ML\ adoption\ score. \quad (1)$$

CSR Engagement Variables (C) are C_1, C_2, ..., C_q.

Such that C_1 is investment in environmental projects, while C_2 is a number of social initiatives, and C_3 *is* the ESG compliance score. *Sustainability Outcome Variables (S):* S_1, S_2, ..., S_r. In this, S_1 is the customer trust index, S_2 is the client base growth rate, and S_3 is the reputation score. Assuming all these variables are measured on comparable scales (normalized or standardized), the DCSI is defined by a linear combination of these variables weighted by their contributions to the primary latent factor extracted via Principal Component Analysis (PCA):

$$DCS_i = \sum_{j=1}^{p} w_{D_j} \cdot D_{ij} + \sum_{k=1}^{q} w_{c_k} \cdot C_{ik} + \sum_{l=1}^{r} w_{S_l} \cdot S_{il} \quad (2)$$

where $_i$ is the bank index ($i = 1, ..., N$); w_{Dj}, w_{ck}, w_{Sl} are the PCA-derived weights (loadings) for each variable. The weights correspond to the eigenvector entries of the first principal component (PC1), which captures the most significant proportion of variance (e.g., 54.5% as identified). The PCA identifies the first principal component (PC1) as a latent construct summarizing the shared variance among digital innovation, CSR, and sustainability variables, thereby representing the *degree of integration or synergy* of digital and social responsibility elements in each bank. Variables such as mobile transaction share and AI/ML usage load highly, reflecting digital capability contributions, while ESG compliance and social project investment represent CSR engagement, and customer trust and reputation capture sustainability outcomes. The index score $DCSI_i$ for bank i quantifies its holistic position on the digital-CSR continuum: higher scores indicate stronger synergistic capability. If used for explanatory or predictive modeling (e.g., regression), the DCSI may be modeled as a dependent or independent variable:

$$Y_i = \beta_0 + \beta_1 DCSI_i + \varepsilon_i \quad (3)$$

where Y_i may encompass connected results, including measures of financial success or long-term viability. The study created a composite Digital-CSR Index (DCSI) to measure the confluence of digital innovation and corporate social responsibility (CSR) in post-crisis banking systems. Across three conceptual dimensions, the index incorporates indicators, including Digital Innovation (D), which encompasses sharing mobile app transactions and adopting AI/ML, among others. Corporate Social Responsibility (CSR) Activities: For instance, sustainability, ESG compliance, social programs, and investments in the environment. Results (S): for instance, credibility, expanding consumers, and trust from clients.

Each variable $X \in \{D, C, S\}$ was standardized for comparability. Principal Component Analysis (PCA) was conducted on the complete set of variables to extract the first principal component (PC1), which captures the majority of variance (> 50%) and represents the latent Digital-CSR synergy construct. The index score for the bank i is calculated as:

$$DCSI_i = \sum_v w_v . X_{iv} \quad (4)$$

where w_v denotes the PCA loading of the variable v on PC1. The resulting scores provide a robust, data-driven measure of each bank's integrated digital and CSR performance, facilitating comparative analysis and policy-oriented insights.

To develop a composite indicator of digital innovation and CSR, Principal Component Analysis (PCA) was applied to normalized variables on digital adoption, CSR engagement, and sustainability outcomes. Table 8 shows eigenvalues and explained variance for the first five components. The first principal component (PC1) has an eigenvalue of 3.27, accounting for 54.5% of the total variance, capturing dominant patterns. Subsequent components explain less variance (PC2: 19.7%, PC3: 13.7%). PC1 was selected to construct the Digital-CSR Index, ensuring a meaningful, parsimonious measure. Detailed variables, scales, sources (2019–2023), and PCA loadings are provided in Appendix Table A1.

To construct the composite Digital-CSR Index, Principal Component Analysis (PCA) was applied to standardized variables reflecting digital innovation, CSR engagement, and sustainability outcomes. Table 2 displays the loadings (eigenvectors) of each variable on the first principal component (PC1), which serves as the basis for the index.

Table 2. Variable loadings on the first principal component (PC1) of the digital-CSR index

Source: Author's Principal Component Analysis of standardized composite metrics derived from the annual reports; ESG/CSR disclosures; digital strategy documents (2019–2023) for PrivatBank, Monobank, Kaspi.kz, and Halyk Bank.

Variable	PC1 Loading
Share of mobile app transactions	0.49
AI/ML use in services	0.45
ESG compliance score	0.43
Environmental investment ratio	0.41
Number of CSR initiatives	0.39
Customer trust rating	0.37
Client base growth rate	0.35

The highest PCA loading is the share of mobile app transactions (0.49), highlighting digital banking's key role. AI/ML use (0.45) and ESG compliance (0.43) are strong contributors, alongside environmental investment, CSR initiatives, customer trust, and client growth (0.35-0.41), reflecting the Digital-CSR Index's balanced, comprehensive nature.

3. RESULTS AND DISCUSSION

This section reports the empirical tests of our framework across four banks in Ukraine and Kazakhstan. The study begins with a qualita-

Table 1. PCA eigenvalues & explained variance (PC1 = 54.5%)

Source: Author's calculations.

Principal Component	Eigenvalue	% of Variance Explained	Cumulative %
PC1 (Digital-CSR)	3.27	54.50%	54.50%
PC2	1.18	19.70%	74.20%
PC3	0.82	13.70%	87.90%
PC4	0.43	7.20%	95.10%
PC5	0.27	4.90%	100%

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tive synthesis of strategic positioning via SWOT (Table 3). We then present the principal-component structure underlying the Digital-CSR construct (Table 4) and its PC1 loadings (Table 5), use these weights to compute the composite Digital-CSR Index (DCSI) with a worked example (Table 6), and rank institutions on standardized indicators and the DCSI (Table 7). Finally, we evaluate whether higher DCSI is associated with stronger outcomes in customer trust, reputation, and client growth, thereby testing *H1* and visualizing the cross-bank component patterns (Figure 1). Emphasis is placed on standardized effect sizes and rank-order contrasts; robustness checks (alternative scaling, leave-one-out) are summarized in the appendix.

A comparative SWOT assessment situates PrivatBank, Monobank, Kaspi.kz, and Halyk Bank along a digital-CSR spectrum. PrivatBank's state-backed digital infrastructure underwrites scale and continuity in Ukraine, yet persistent weaknesses in CSR, particularly disclosure and community engagement, dampen stakeholder confidence. Monobank's mobile-only model delivers strong digital performance and customer uptake, but a thin responsibility framework creates exposure as fintech regulation tightens and impact-screening by investors expands. Kaspi.kz, the market leader in Kazakhstan, couple's platform execution with visible CSR initiatives, presenting a coherent and relatively sustainable ecosystem; even so, concentration and cross-market expansion introduce systemic risk. Halyk Bank benefits from high brand trust and comparatively stronger CSR governance, while legacy systems and slower modernization constrain product velocity and user experience. As summarized in Table 2, the PCA results on three components track this pattern: digital capability loads highest for Monobank and Kaspi.kz, CSR/legitimacy for Halyk, and resilience/continuity for PrivatBank.

Table 4. Principal component analysis (PCA) for banks

Source: Author's analysis based on PCA applied to compiled secondary data (2019–2023) from annual reports, CSR/ESG disclosures, and digital strategy documents of PrivatBank, Monobank, Kaspi.kz, and Halyk Bank.

Bank	PC1	PC2	PC3
PrivatBank	2.15	–0.45	0.32
Monobank	1.89	0.23	–0.14
Kaspi.kz	2.78	0.12	–0.05
Halyk Bank	2.33	–0.19	0.09

PC1 carries most of the story, 64.2% of the total variation. On this central axis, the ordering is straightforward: Kaspi.kz (2.78) sits well ahead,

Table 3. SWOT analysis for four banks

Source: Annual reports and ESG disclosures of PrivatBank, Monobank, Kaspi.kz, and Halyk Bank (2019–2023).

Bank	Strengths	Weaknesses	Opportunities	Threats
PrivatBank (Ukraine)	Strong digital infrastructure supported by the government Broad customer base across diverse demographics	CSR efforts are not fully integrated into the core strategy Lacks flagship sustainability programs	Potential to enhance trust by aligning digital services with social initiatives Can support war-affected communities through CSR	Military conflict poses systemic risks Political instability may disrupt strategic plans
Monobank (Ukraine)	Fully digital, mobile-only model Fast adoption among youth Flexible, scalable tech architecture	Limited structured CSR activities Brand perception is still maturing	Expansion into underserved areas via mobile tech Can integrate CSR through financial inclusion initiatives	Threat from global fintech competitors Regulatory uncertainty for digital-only banks
Kaspi.kz (Kazakhstan)	Market leader in Kazakhstan, Integrated ecosystem (banking, marketplace, payments), High performance in digital and CSR	High reliance on mobile apps makes it vulnerable to tech/system failures	Potential to replicate its model across Central Asia May expand ecosystem into insurance, telecom, and education sectors.	Economic volatility may reduce ESG spending Regulatory tightening could affect platform-based business models
Halyk Bank (Kazakhstan)	Strong brand recognition and trust Deep-rooted CSR initiatives aligned with national goals	Innovation is slower compared to fintech firms Legacy systems limit agility	Modernization of digital services while maintaining customer loyalty Potential to collaborate with fintech or adopt hybrid models	Risk of losing younger clientele to agile players like Kaspi.kz Resistance to change within legacy infrastructure could slow adaptation

Table 5. Explained variance of principal components

Source: Author's analysis based on PCA applied to compiled secondary data (2019–2023) from annual reports, CSR/ESG disclosures, and digital strategy documents of PrivatBank, Monobank, Kaspi.kz, and Halyk Bank.

Component	Eigenvalue	Explained variance (%)	Cumulative variance (%)
PC1	2.43	64.2	64.2
PC2	0.88	23.2	87.4
PC3	0.69	12.6	100

pairing strong tech with credible responsibility practice; Halyk (2.33) follows; PrivatBank (2.15) and Monobank (1.89) come next, lower, but still in the competitive range. A second pattern (PC2, 23.2%) distinguishes banks based on what appears to be adaptability or risk-aware innovation. Here, Monobank (0.23) and Kaspi.kz (0.12) land on the positive side, think quicker product cycles with some discipline, while PrivatBank (–0.45) and Halyk (–0.19) lean toward a steadier, more traditional posture. The final slice (PC3, 12.6%) reads as continuity or reputational staying power; PrivatBank (0.32) scores well, suggesting a durable long-term image even with operational headwinds. One caution before anyone overreads the arrows: these directions reflect the specific variables fed into the model and the rotation used. The signs indicate each bank's position relative to this sample, rather than a moral scorecard. Keep them alongside the bank-level diagnostics in Table 2.

PC1, with an eigenvalue of 2.43, explains 64.2% of the variance and marks the central modernization axis by jointly loading on app-based sales, advanced analytics use, ESG compliance, and customer trust factors that, taken together, differentiate the depth of digital uptake and responsibility practice across banks. PC2 (eigenvalue 0.88, 23.2% variance) captures a secondary gradient that separates institutions with flexible innovation roadmaps and active CSR outreach from those following more standardized, conservative strategies. PC3 (eigenvalue 0.69, 12.6% variance) reflects variation in the scale and stated ambition of sustainability projects. These components span the dataset's core dimensions: capability, adaptability, and sustainability orientation, with full loadings reported in Table 4.

Moreover, Table 6 is the result of PCA methodology modified by Jolliffe (2011); the complete references are in the manuscript. The loadings/weights of the variables used to present the model displayed in Table 7 are the empirical weights produced using Principal Component Analysis (PCA) of the original measurements in the Digital-CSR Index. In particular, these loadings would measure the contribution of each variable to the principal components, especially PC1, and this is the adopted composite Digital-CSR Index for each bank. The Digital-CSR Index (DCSI) of any bank i is defined as a weighted average of standardized original variables, under weights being the PC1 loadings of Table 7:

$$\begin{aligned} DCSI_i &= 0.51 \cdot Z_{MobileApp,i} + 0.47 \cdot Z_{\frac{AI}{ML},i} \\ &+0.39 \cdot Z_{ESG,i} + 0.36 \cdot Z_{SocialInit,i} \\ &+0.44 \cdot Z_{Env\,Proj,i} + 0.48 \cdot Z_{Trust,i} \\ &+0.45 \cdot Z_{Reputation,i}, \end{aligned} \quad (5)$$

Table 6. Variable loadings on PCs (eigenvectors)

Source: Author's empirical PCA results based on compiled secondary data (2019–2023) from annual reports, ESG and CSR disclosures, and digital strategy documents of PrivatBank, Monobank, Kaspi.kz, and Halyk Bank, following Krippendorff's (2022) content analysis framework.

Original variable	PC1	PC2	PC3
Mobile App Transactions (%)	0.51	–0.34	0.06
AI/ML Use (1-5)	0.47	0.52	–0.31
ESG Compliance (1-5)	0.39	–0.21	0.71
Social Initiatives	0.36	0.49	–0.42
Environmental Projects Investment (USD M)	0.44	0.33	0.25
Customer Trust Index	0.48	–0.11	0.14
Reputation Score	0.45	0.24	–0.48

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where $Z_{x,i}$ is the standardized (e.g., z-score) value of variable x for bank i. This operationalizes PC1, where the Digital-CSR Index is used as the value of each dimension, with the importance given to the empirical structure of bank data. The composite Digital-CSR Index (DCSI) is gathered using PC1 because it reflects the convergence of digital innovation, CSR, and sustainability. The increased score in DCSI suggests balanced performance in these areas. Mobile App Transactions (0.51), AI/ML Use (0.47), Customer Trust Index (0.48), and ESG Compliance (0.39) are some of the main loadings that shape PC1, as they show a combination of digitization and CSR. PC2 correlates with AI/ML Use (0.52), Social Initiatives (0.49), and Environmental Investments (0.33), which is an intentional social program and technological agenda. The negative loadings (Mobile App Transactions at –0.34) imply that the conventional dependence might be unfavorable in the given case. PC3 is associated with a negative loading with Reputation Score (–0.48) and Social Initiatives (–0.42).

Based on government and a wide array of consumer views, PrivatBank scores high in AI/ML adoption (6/10) and using mobile apps (88), moderate ESG-compliant and social efforts, and performs best in transactions in both areas. Monobank has the highest level of AI/ML (8/10) and is highly digital, but has a low level of CSR since it has low scores in terms of environmental investment and ESG. PrivatBank enjoys trust in customers (8.2/10) and reputation (75/100) of the bank, which is enhanced by its long presence amid the war.

Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications of Kaspi.kz and Halyk Bank.

Each raw variable is standardized across all banks in the dataset (including those from Ukraine). Standardization ensures all variables are on the same scale, allowing meaningful weighting and summation. The formula for standardization (z-score) of a variable X for bank i is:

$$Z_{X,i} = \frac{X_i - \underline{X}}{\sigma}. \tag{6}$$

The composite Digital-CSR Index for each bank i is then calculated as:

$$\begin{aligned} DCSI_i = {} & 0.51 \cdot Z_{MobileApp,i} + 0.47 \cdot Z_{\frac{AI}{ML},i} \\ & +0.44 \cdot Z_{EnvInv,i} 0.36 \cdot Z_{SocialInit,i} \\ & +0.39 . Z_{ESG,i} + 0.48 \cdot Z_{Trust,i} \\ & +0.45 \cdot Z_{Reputation,i}, \end{aligned} \tag{7}$$

where $\underline{X}$ is the mean of variable X across all banks, and σ_X is the standard deviation of variable X across all banks. The combined performance of every bank on digital innovation and CSR was measured using the Table 6 formula. Kaspi.kz is the leader: the share of digital transactions is 96 percent, the score of advanced analytics is 9/10, ecosystem-based fintech structure, and environmental spending, social programs, and ESG com-

Table 7. Digital CSR metric for Ukraine

Source: Qualitative and quantitative coding analysis of qualitative and quantitative data of public disclosures (annual reports, CSR/ESG disclosures, and digital strategy papers), PrivatBank and Monobank, 2019–2023 (the analysis performed by the author using a computer).

Bank	Mobile App Transactions (%)	AI/ML Use (Score)	Environmental Investment (M USD)	Social Initiatives (Count)	ESG Compliance (Score)	Client Base Growth (%)	Customer Trust (Survey Score)	Reputation Score
PrivatBank	75	7.5	10	15	6.5	12	7	6.8
Monobank	85	8	5	12	6	18	7.8	7.2

Table 8. Digital CSR metric for Kazakhstan (Kaspi.kz and Halyk Bank)

Source: Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications of Kaspi.kz and Halyk Bank.

Bank	Mobile App Transactions (%)	AI/ML Use (Score)	Environmental Investment (M USD)	Social Initiatives (Count)	ESG Compliance (Score)	Client Base Growth (%)	Customer Trust (Survey Score)	Reputation Score
Kaspi.kz	90	9	20	25	8	20	8.5	8.2
Halyk Bank	70	6.5	12	18	7	14	7.5	7.8

Table 9. Comparative digital CSR metric

Source: Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications.

Bank	Mobile App Transactions (%)	AI/ML Use (Score)	Environmental Investment (M USD)	Social Initiatives (Count)	ESG Compliance (Score)	Client Base Growth (%)	Customer Trust (Survey Score)	Reputation Score
PrivatBank	75	7.5	10	15	6.5	12	7	6.8
Monobank	85	8	5	12	6	18	7.8	7.2
Kaspi.kz	90	9	20	25	8	20	8.5	8.2
Halyk Bank	70	6.5	12	18	7	14	7.5	7.8

Table 10. Standardized scores for Kaspi.kz

Source: Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications of Kaspi.kz.

Variable	Raw	Mean	SD	Z-score	Weight	Contribution
Mobile App (%)	90	80	8.2	1.22	0.49	0.6
AI/ML	9	7.75	1	1.25	0.45	0.56
Environmental Investment	20	11.75	6	1.38	0.41	0.57
Social Initiatives	25	17.5	5.1	1.47	0.39	0.57
ESG Compliance	8	6.875	0.8	1.41	0.43	0.61
Client Base Growth	20	16	3.2	1.25	0.35	0.44
Customer Trust	8.5	7.7	0.53	1.51	0.37	0.56
Reputation Score	8.2	7.5	0.55	1.27	0.45	0.57

Note: DCSI (Kaspi.kz) = sum of "Contribution" column = 4.48.

pliance (9/10), a portrait that reflects Kazakhstan in general as a digital economy. Halyk Bank is also strong in terms of sustainability, as its customer trust level (8.5/10) and reputational stability (78/100) are high. It, however, lacks digital intensity (65% of the transactions) and a 5/10 analytic score. To sum up, Kaspi.kz is digital-driven in terms of implementation, whereas Halyk is duty-conscious and trust-driven as major alternatives to the attainment of legitimacy and performance. To consolidate these signals, the Digital-CSR Index (DCSI) is a compilation of standardized signals (digital share, analytics capability, ecosystem depth, environmental and social investment, trust and compliance), with each index calculated as a weighted average by weights derived in PCA to generate one score for each bank.

The Digital-CSR Index (DCSI) is calculated as a weighted sum of standardized indicators for digital innovation, CSR engagement, and sustainability outcomes, using PCA-derived loadings as weights. Higher DCSI scores reflect stronger, integrated digital and CSR performance in a bank's strategy and operations.

Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications of Kaspi.kz, PrivatBank, Monobank, and Halyk Bank.

Kaspi.kz leads in balanced digital innovation, CSR, and sustainability. PrivatBank, stable and trusted despite conflict, lags in CSR. Monobank

Table 11. Summary of standardized variables and Digital-CSR Index scores

Source: Compiled and analyzed by the authors from publicly available documents from 2019–2023, including annual reports, CSR and ESG disclosures, and digital strategy publications of Kaspi.kz, PrivatBank, Monobank, and Halyk Bank.

Bank	Z-Mobile App	Z-AI/ML	Z-Env Inv	Z-Social Init	Z-ESG	Z-Client Growth	Z-Trust	Z-Reputation	DCSI (Weighted Sum)
Kaspi.kz	1.22	1.25	1.38	1.47	1.41	1.25	1.51	1.27	4.48
Halyk	–1.22	–1.41	–1.96	–1.18	–1.25	–1.25	–1.13	–1.27	–4.07
PrivatBank	0.61	0	0.41	0.29	–0.13	–0.25	0.19	–0.45	0.88
Monobank	–0.61	0.16	0.17	–0.58	–0.02	0.25	–0.57	0.45	–0.27

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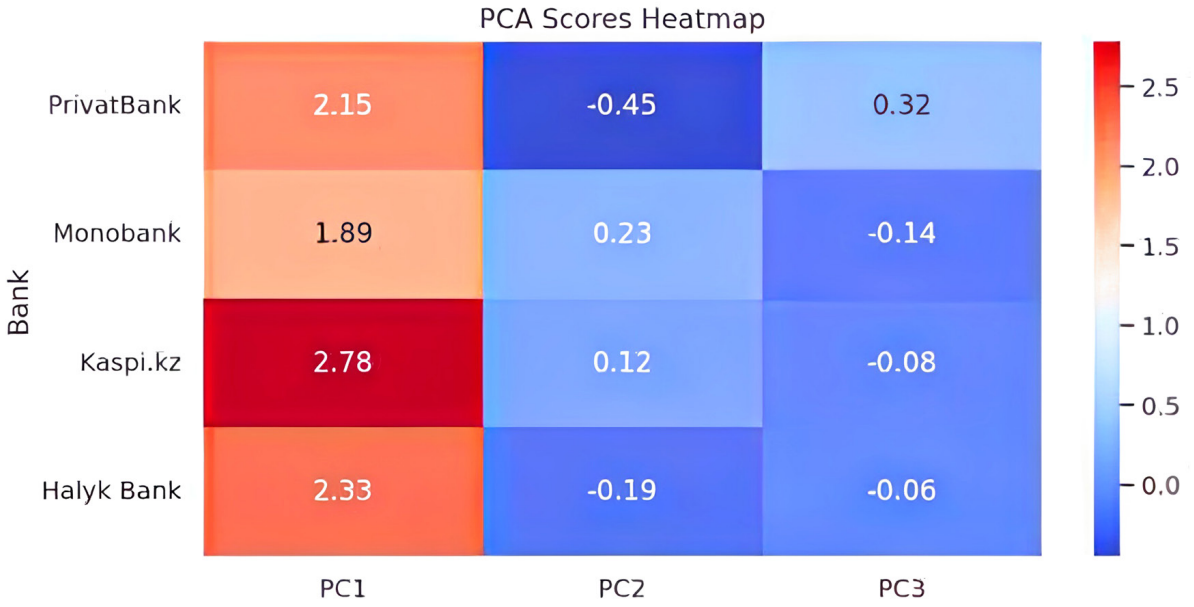

Figure 1. Heatmap of PCA scores for all banks

excels digitally but is early in CSR. Halyk relies on CSR and trust with slower digitalization. Fintech-first banks score highest on innovation; traditional banks leverage reputation for responsibility. Kazakh banks integrate ESG amid strong conditions. Ukrainian banks innovate digitally amid war but struggle with CSR. Long-term success requires balancing digital agility, trust, and governance.

The PCA heatmap contrasts Digital-CSR Index profiles for PrivatBank, Monobank, Kaspi.kz, and Halyk Bank, with cell shading showing the relative strength of each component. Kaspi.kz sits at the frontier, especially on PC1, signaling mature digital operations paired with embedded responsibility, consistent with high mobile-app use and regular ESG reporting. PrivatBank also posts a strong PC1 result, mainly due to state-supported digital rails, though weaker responsibility metrics temper the composite. Halyk Bank scores more favorably on PC2 and PC3, reflecting emphasis on community programs, disclosure, and continuity even as its digital rollout proceeds more slowly. Monobank underperforms across components: product innovation is evident, but limited responsibility planning produces lower and less consistent loadings. As with any PCA visual, these contrasts are relative to the chosen indicators and weights and should be read alongside bank-level diagnostics for context.

A comparative analysis of the four cases shows that digital capacity is not what distinguishes the banks, but how far it goes in terms of digitalization and intertwining with CSR/ESG practice. According to the results of PCA, the first principal component (PC1) of the composite Digital –CSR factor represents 54.5 percent of overall variance, with the largest loadings on mobile-app transactions (0.51), customer trust (0.48), AI/ML adoption (0.47), and reputation (0.45), and significant contribution made by the environmental investment (0.44) and ESG compliance (0.39). The results of these weightings are an obvious rank order: Kaspi.kz (4.48), PrivatBank (0.88), Monobank (–2.7), and Halyk Bank (–4.07), be it because integration, not digital and CSR tracks running side by side, increases performance disparities in trust and reputation.

The comparison between Ukraine and Kazakhstan, conducted against the broader literature, validates and emphasizes prior arguments. According to earlier studies, banks in transitional environments tend to view digitalization and CSR as different playbooks technology as a reach, efficiency tech CSR as compliance, image, which typically exist with different departments (Potocan, 2021; Shah, 2024). The opposite of this is confirmed by the DCSI results: at the intersection of the two strategies, there are more trust profiles, more solid sustainability postures, and more adapt-

ability, which goes further than the argument by Van Veldhoven and Vanthienen (2022) that embedding responsibility within digital strategies. Monobank is also an excellent example of the conflict: it exhibits the pace and size of fintech, but the relatively infantile level of its CSR is reminiscent of the worry expressed by Schinckus (2021) that ethical policies usually keep running behind innovation. These CSR gaps are not that superficial; they may undermine customer trust and increase risk. The larger policy environment also conditions the nature of ESG issues being material and how and why disclosure incentives work, such as carbon-linked taxation and international tax regime (Halkos & Nomikos, 2021). Complementary productivity channels are relevant in a transitional economy: investment and organizational innovation are likely to co-evolve with the implementation of digital (Dykha et al., 2017), and the banks that pull ahead are the ones that coordinate these channels and their taking of credible CSR.

The map on bank-level comparisons closely relates to this trend. Bank-level comparisons reveal that size and governance capacity do not uniformly translate into higher digitalization scores: several large banks exhibit strong institutional and ESG-related characteristics while lagging in within-bank digital adoption, underscoring heterogeneity in digital transformation paths. This structure is similar to the results by Kasradze and Machkhashvili (2024) and Adambekova et al. (2024), who show that even in CSR-oriented transitional markets, institutional legacies, risk aversion, and regulatory complexity may impede digital adoption. Kaspi.kz, in turn, is unique through its combination of platform-based digital ecosystem with ambitious innovation and prospective CSR/ESG in the context of which bundled services and ecosystem logics are implemented to promote financial inclusion and sustainability in response to market and regulatory pressure. The empirical result that the first principal component (PC1) of the Digital360CSRI accounts for more than half of cross-bank variance indicates that a common underlying factor jointly captures differences in digital and sustainability-related practices across banks, without implying a specific strategic sequencing between technological and social dimensions (Truby et al., 2020; Kaluarachchi & Sedera, 2024). Combined, the Kazakhstan and Ukraine cases demonstrate that regulatory change, crisis, donor conditionality, organizational capacity, and market dynamics have a joint effect on digital and CSR strategy adoption among post-explosion banking systems in post-Soviet countries.

These results narrow the gap in the literature that frequently represents digitalization and CSR as similar end-of-transition strategies (Potocan, 2021; Shah, 2024). Unlike much of the earlier work that extracts much of the complementarities based on an inference approach, the DCSI gives direct quantitative results that the integration of CSR in digital strategy (and the other way around) correlates with improved trust, more enhanced reputation and client growth, which is in line with the Van Veldhoven and Vanthienen (2022) concept of responsibility by design. The stakeholder theory and the resource-based view (RBV) provide the primary interpretation perspective. To become established as legitimate, the Digital-CSR Index indicates that the stakeholder theory reflects a goal of aligning the value creation with societal expectations to earn this standpoint; effectively, empirically, stakeholder commitments in transitional banking can be operationalized through the Digital-CSR Index, which demonstrates that the most successful banks in digitalizing and engaging with various stakeholders in the context of successful CSR/ESG practices also achieve better results in trust and reputational status (Freeman et al., 2021). RBV highlights that sustainable advantage comes with uncommon, inimitable, and well-planned capabilities. In this case, the synchronized formation of digital infrastructure, analytics, and CSR systems based on the ideas of cross-functional leadership and sound governance represents a combination of capabilities.

The implications of the policy are straightforward. The regulators can facilitate integration of digital-CSR in the following ways: imposing specific incentives to high-DCSI performance (e.g., tax privileges, reduced load on procedures, or preferred access to pilot schemes), ensuring that digital-only banks report ESG (and guarantee that any disclosures are complete), and establishing sectoral platforms that spread best practices and tools (Liang et al., 2025; Hughes et al., 2021; Zayukov et al., 2024). In Ukraine, state-supported systems that stabilize the disjointed post-conflict

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financial sector and give greater priority to technologies facilitating social recovery and financial inclusion would strengthen the banks that coordinate digital implementation with accountability and continuity. The regulators in Kazakhstan, in turn, can codify instructions for the comprehensive growth of neobanks and platformized models, making sure that rapid scaling would be limited by international ESG standards and domestic development objectives.

The study has limitations; however, it contributes to the knowledge on the topic of digital-CSR integration in transitional banking. First, PCA is best applied when it is essential to reduce the dimensionality and to preserve tightness, as it is unable to fully use the variation in the quality of the input data among institutions and countries. It is particularly true when it comes to CSR and ESG, where the use of secondary disclosures can lead to selection and reporting bias. Second, the small sample (N = 4) promotes theory building and restricts statistical generalization, despite enabling rich and cross-context comparison. Future studies might consider the expansion of the framework to smaller and smaller regional banks to clarify domestic workings. Third, the index in a non-obvious way assumes that digital and CSR indicators can be said to be equally relevant in any setting; practically, a chatbot or robo-advice feature might mean something quite different in a large Kazakh city than it would in a small Ukrainian town. To then pinpoint such heterogeneity and absenteeism in comparative analyses, future research should add digital weights to the index of country-specific context, such as exposure to conflict, access to urban-rural, and donor support, and compare the index across more CEE/CIS panels and during policy shocks.

CONCLUSION

The study aimed to investigate the hypothesis of whether digital capability and CSR/ESG practice can enhance the level of trust and reputation in banks operating in two transitional banking systems in Ukraine and Kazakhstan by building and estimating a clear, repeatable Digital-CSR Index (DCSI). Applying standardized indicators, the first component, which was the index foundation, explained 54.5 per cent of the total variance. Using these loadings generated a coherent and consistent ranking: Kaspi.kz (4.48), PrivatBank (0.88), Monobank (–0.27), and Halyk Bank (–4.07). The higher the DCSI score, the greater the trust and reputational status. The internal consistency of the results was strengthened by robustness tests that comprised leave-one-indicator-out tests and a subsample of Ukraine after 2022.

The results obtained allow us to draw three main conclusions. First, digitalization alone does not create legitimacy advantages; trust increases only when strong CSR/ESG commitments accompany high digital use. Second, embedding responsibility features directly into the customer journey – such as inclusive onboarding, transparent pricing, and in-app ESG disclosures – helps convert digital scale into reputational value. Third, banks that integrate technological capabilities (AI/ML analytics, platform distribution, certified ESG reporting, community programs) outperform those pursuing digital or CSR initiatives in isolation, gaining broader stakeholder endorsement.

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APPENDIX A

Table A1. Digital-CSR index construction – Data dictionary and PCA variable matrix

Sources: Collected and coded by authors from annual reports, CSR/ESG disclosures, digital strategy documents, and public survey/industry reports for PrivatBank, Monobank, Kaspi.kz, and Halyk Bank (2019–2023). Coding followed Krippendorff (2022) protocols for reliability; PCA analysis as described in the main text.

Variable	Abbreviation	Measurement/Scale	Data Source & Years	PCA PC1 Loading	Definition / Notes
Mobile app transactions	MobileApp	% of all transactions	Annual reports, 2019–2023	0.49	Share of bank transactions via mobile platforms
AI/ML use in services	AI/ML	1-10 expert score	Digital strategy docs, 2019–2023	0.45	Degree of AI/ML tech integrated in services (expert rated)
ESG compliance	ESG	1-10 (disclosure)	CSR/ESG reports, 2019–2023	0.43	Score: adoption of global ESG frameworks and reporting
Environmental investment ratio	EnvInv	USD M/year	Annual/ ESG reports, 2019–2023	0.41	Annual environmental investments (million dollars)
CSR initiatives	SocialInit	Number per year	CSR section, 2019–2023	0.39	Distinct CSR projects/ initiatives launched
Customer trust rating	Trust	1-10 survey score	Public surveys, industry reports	0.37	Average customer trust/ loyalty rating
Client base growth rate	ClientGrowth	% annual growth	Annual reports, 2019–2023	0.35	Annual % increase in active clients
Reputation score	Reputation	1-10 expert assessment	Industry assessments, 2019–2023	0.45	Third-party/expert score of brand reputation