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Digital Marketing Ecosystems and Export Resilience: Evidence from Ukraine and Transition Economies

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ABSTRACT:
The article substantiates an ecosystem-based approach to digital marketing as a resource for strengthening sustainable exports in Ukraine and other post-socialist transition economies. The study develops and applies a cross-country analytical framework for examining the association between national digital marketing ecosystem conditions and export resilience in Ukraine and selected transition economies. Two composite indicators are proposed: the Digital Marketing Ecosystem Index (DMEI), encompassing digital infrastructure, institutional support, and innovation capacity, and the Export Resilience Index (ERI), incorporating export dynamics, partner-country concentration, and competitive position in global trade. The empirical database was constructed using data from The Global Economy and Trade Map for Ukraine and ten comparable countries. Indicators were normalized using the min–max method and aggregated using equal weights. The results reveal Poland's leadership in both DMEI and ERI. Ukraine achieved a DMEI score of 0.273 and an ERI score of 0.527, ranking tenth and eighth, respectively. Its position is characterized by a combination of existing digital infrastructure potential, low institutional performance, and negative export dynamics. Based on the median values of the indices, a sustainable export strategy matrix was developed, distinguishing sustainable digital export leaders, countries with unrealized digital potential, countries characterized by traditional export resilience, and countries with vulnerable export models. The practical value of the findings lies in providing a rationale for an integrated strategy for Ukraine that combines institutional improvement, digitalization of international marketing, innovation support for exporters, and diversification of foreign markets.

Keywords: digital ecosystems; export resilience; sustainable export strategies; digital transformation; quantitative analysis; transition economies; international marketing; market diversification; digital marketing ecosystem; institutional environment; Digital Marketing Ecosystem Index; Export Resilience Index

1. Introduction

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In the contemporary environment of global instability, business digitalization, and increasing geoeconomic risks, export resilience has become one of the key determinants of economic security and long-term development in transition economies. For Ukraine, the issue is especially acute: the full-scale war has damaged production facilities, logistics networks, and energy systems, narrowed access to overseas customers, redirected trade flows, and made export results increasingly dependent on firms' capacity for rapid adjustment.

Under these circumstances, traditional approaches to export development based primarily on production capacity, price advantages, or access to raw materials are no longer sufficient. Modern export competitiveness increasingly depends on enterprises' ability to utilize digital communication channels, international B2B platforms, e-commerce solutions, data analytics, customer relationship management (CRM) systems, digital branding, marketing automation, and artificial intelligence tools. Consequently, digital marketing can no longer be viewed merely as a set of promotional instruments. It is increasingly becoming an ecosystem shaped by digital infrastructure, firms' digital preparedness, institutional conditions, innovation resources, international market intelligence, and the capacity to build durable relationships with customers and partners abroad.

Particular attention should be paid to the mechanisms through which the development of a digital marketing ecosystem may strengthen export resilience. In this study, export resilience refers to the capacity of a country or sector to absorb external shocks, restore export activity, and reallocate sales across foreign markets when demand, logistics, institutional conditions, or competitive pressures change. It is reflected in the continuity or recovery of export flows, broader market coverage, lower dependence on individual trading partners, responsiveness to demand shifts, and the preservation of competitive positions in international markets.

The proposed framework identifies several complementary channels through which the digital marketing ecosystem can contribute to export resilience. First, digital infrastructure reduces information, communication, and market-access barriers by enabling enterprises to use online communication, international B2B platforms, e-commerce, and data-driven marketing tools. Second, digital institutional support reduces transaction uncertainty by strengthening regulatory predictability, trust, transparency, and the security of digital and cross-border interactions. Third, innovation and knowledge capacity enhance firms' ability to use marketing analytics, adapt products and communications to foreign-market requirements, and reconfigure export strategies under changing conditions. Finally, international market connectivity provides a direct transmission mechanism through which digital capabilities can support partner acquisition, geographic diversification, and a more stable presence in international markets.

These channels are expected to operate jointly rather than independently. Digital infrastructure represents a necessary foundation for international digital interaction, but infrastructure alone may generate only limited export-resilience gains when institutional quality is weak or innovation capacity is insufficient. In transition economies, where institutional transformation and uneven digital modernization frequently coexist, institutional quality and innovation capacity are therefore expected to play the strongest enabling role, because they determine whether available digital infrastructure can be

converted into trusted, adaptive, and scalable international marketing activity. At the same time, market connectivity represents the most direct conceptual channel linking ecosystem development with export diversification and reduced dependence on individual foreign markets.

Accordingly, the study advances four theoretical hypotheses. H1: a higher level of digital infrastructure is positively associated with export resilience by reducing barriers to international market access and communication. H2: stronger digital institutional support is positively associated with export resilience by reducing transaction risks and strengthening trust in cross-border market interactions. H3: greater innovation and knowledge capacity is positively associated with export resilience through improved adaptability, competitiveness, and responsiveness to changing foreign-market demand. H4: the combined development of digital infrastructure, institutional support, and innovation capacity is associated with higher export resilience than the development of any single component in isolation, reflecting the complementary nature of the digital marketing ecosystem.

For Ukraine, these mechanisms are especially consequential during the war, as online channels can partly offset logistics interruptions, reduced access to physical trade events, disrupted legacy sales networks, and higher transaction expenses. However, similar relationships are relevant to other transition economies undergoing institutional transformation, digital modernization, and integration into global value chains. The comparative analysis therefore provides an opportunity to examine whether differences in digital marketing ecosystem development are systematically associated with differences in export resilience and to identify sustainable export strategies relevant to Ukraine and other transition economies.

A key methodological contribution of the study lies in its ability to integrate two complementary sources of data. On the one hand, The Global Economy database provides indicators related to digital infrastructure, the institutional environment, innovation capacity, business climate, and the overall level of a country's digital readiness. On the other hand, Trade Map makes it possible to assess export dynamics, a country's share in global exports of specific product groups, import demand dynamics in partner countries, the geographic structure of exports, market concentration, and the potential of external demand. Together, the two databases support the construction of composite measures linking country-level digital and institutional conditions with multidimensional export resilience.

Existing research commonly examines digital marketing transformation, export resilience, and sustainable export development through separate analytical perspectives. Less attention has been devoted to the way country-level digital marketing conditions interact with the capacity of export systems to withstand shocks, diversify markets, and sustain long-term performance. This gap is especially relevant for transition economies and for Ukraine, where wartime disruption and reconstruction needs intensify the interaction between digital, institutional, and export-related factors.

This study aims to construct and apply a comparative country-level framework linking measurable characteristics of digital marketing ecosystems with multidimensional export resilience in Ukraine and selected transition economies.

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The research addresses five interrelated tasks: conceptualizing the digital marketing ecosystem in an export context; constructing the Digital Marketing Ecosystem Index (DMEI); developing the Export Resilience Index (ERI); comparing Ukraine with selected transition economies; and formulating strategic directions for digitally supported sustainable exports.

The object of the study is the processes of digital marketing transformation and the enhancement of export resilience in Ukraine and other transition economies.

The analytical focus covers the theoretical, methodological, and applied relationships linking digital marketing ecosystem conditions, export resilience, and the formation of sustainable export strategies.

The study contributes an integrated country-level analytical architecture that combines digital marketing ecosystem conditions, multidimensional export resilience, and strategy classification within a single comparative framework. Unlike approaches that focus on individual digital tools or general indicators of foreign trade performance, the proposed model enables the evaluation of relationships among digital infrastructure, digital business activity, the institutional environment, innovation capacity, market diversification, and export stability.

Further justification of the proposed model requires an analysis of scholarly approaches to digital marketing ecosystems, export resilience, sustainable exports, and the transformation of international economic activity in transition economies. Such an analysis will make it possible to identify the theoretical foundations underlying the relationship between digital marketing transformation, export performance, market diversification, and long-term export resilience.

2. Literature Review

The issues of digital marketing ecosystems and export resilience emerge at the intersection of several research streams, including digital marketing transformation, the ecosystem approach, international marketing capabilities, export diversification, sustainable export strategies, and the resilience of enterprises and national economies under conditions of crisis-driven transformation. Despite the substantial body of literature within each of these fields, insufficient attention has been devoted to understanding how a country's digital marketing ecosystem influences the ability of its exports to remain stable, diversified, adaptive, and oriented toward sustainable development.

Within the academic literature, digital transformation is increasingly viewed not merely as the adoption of digital technologies but as a broader transformation of business models, organizational processes, market interactions, and value-creation mechanisms. Kannan and Li (2017) proposed one of the foundational frameworks for digital marketing research, demonstrating how digital technologies affect various stages of the marketing process, including market analysis, customer engagement, value proposition development, and communication channel management. Verhoef et al. (2021) portray digital transformation as simultaneous change in operational processes, business-model logic, and customer-facing interactions. These perspectives are particularly relevant to the present study because they allow digital marketing to be understood not simply as a collection of promotional tools but as a component of a broader system of market adaptation.

Nevertheless, a key limitation of this research stream is its predominant focus on the firm level, while the relationship between a country's digital marketing environment and export resilience remains insufficiently operationalized.

Another important body of research examines the impact of artificial intelligence, data analytics, and automation on marketing activities. Davenport et al. (2020) demonstrate that artificial intelligence transforms both marketing strategies and consumer behavior by enhancing demand forecasting, communication personalization, and managerial decision support. De Bruyn et al. (2020) draw attention to the managerial and ethical challenges accompanying AI adoption in marketing, particularly those related to data reliability, transparency, consumer trust, and algorithmic accountability. These findings are directly relevant to export-oriented enterprises, as digital analytics can reduce uncertainty in the selection of foreign markets, the segmentation of international customers, and the identification of potential business partners. However, most studies on artificial intelligence and digital marketing focus primarily on communication effectiveness or sales performance, whereas the contribution of digital tools to export resilience, market diversification, and adaptation to external shocks remains less thoroughly explored.

The ecosystem approach provides an important theoretical foundation for a broader understanding of digital marketing. Adner (2017) defines an ecosystem as a structure of interdependent actors and activities that collectively contribute to value creation. Similarly, Jacobides, Cennamo, and Gawer (2018) conceptualize ecosystems as coordination mechanisms among interdependent organizations that do not necessarily operate within a single hierarchical structure. In the context of this study, this perspective makes it possible to view digital marketing not as an autonomous business function but as an ecosystem that integrates digital infrastructure, platforms, institutions, the business environment, logistics, data analytics, and international market linkages. Nevertheless, the foundational literature on ecosystem theory remains largely conceptual and offers limited quantitative tools for assessing the impact of ecosystems on export resilience.

National digital-readiness frameworks address a related but conceptually broader problem. For example, the Digital Economy and Society Index (DESI) assesses national digital performance across dimensions such as human capital, connectivity, integration of digital technology, and digital public services, whereas the Network Readiness Index (NRI) assesses national digital preparedness through the dimensions of technology, people, governance, and impact (European Commission, 2022; Escalona Reynoso & Lanvin, 2025). These frameworks provide valuable benchmarks of overall digital preparedness, but they are not specifically designed to explain how national digital conditions are converted into international marketing capabilities, foreign-market access, market diversification, and resilience of export flows.

Against this background, the conceptual contribution of the present study lies in linking national ecosystem conditions to a specific international marketing outcome – export resilience. Rather than assessing digitalization as a general characteristic of an economy, the framework focuses on the marketing mechanisms through which national conditions support international market intelligence, partner acquisition, digital communication, trust formation, market adaptation, and diversification. Accordingly, the proposed Digital Marketing Ecosystem Index is not intended to substitute existing digital-readiness indices; rather, it operationalizes the measurable core of a broader marketing-

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oriented ecosystem relevant to sustainable export performance. This distinction is particularly important for transition economies, where technological advancement may coexist with institutional weaknesses, uneven innovation capacity, and exposure to external shocks, thereby limiting the conversion of general digital readiness into resilient export outcomes.

An additional theoretical foundation is provided by the service-dominant logic perspective. Vargo and Lusch (2016) argue that value is created through interactions among multiple actors, institutions, and resources within service ecosystems. In the context of international marketing, this implies that export value is generated not solely by producers but also through interactions with digital platforms, logistics providers, certification bodies, intermediaries, buyers, and national and international institutions. This perspective is particularly relevant for the analysis of sustainable exports because it highlights the role of interconnected market participants in value creation. However, service-dominant logic does not provide sufficiently practical indicators for evaluating digital marketing ecosystems, creating a need for further methodological development through index-based approaches.

A more applied perspective on the issue is provided by studies of enterprise digital internationalization. Jean and Kim (2020) demonstrate that internet capabilities, particularly web capabilities and platform capabilities, positively influence export marketing capabilities and export performance among small and medium-sized enterprises. Vadana et al. (2020) show that the digitalization of value chains facilitates faster, more efficient, and less costly internationalization processes. Dethine, Enjolras, and Monticolo (2020) identify e-commerce, e-marketing, and e-business as key digital drivers of enhanced export management in SMEs. Collectively, these studies confirm that digital technologies reduce barriers to entering foreign markets; however, they provide limited insight into the broader ecosystem conditions that enable such firm-level capabilities to emerge and translate into resilient export performance.

Within the field of international marketing, the concept of dynamic marketing capabilities has gained increasing importance. Pfajfar, Mitręga, and Shoham (2024) review international marketing capabilities through a dynamic-capabilities lens and call for clearer conceptual definitions and more consistent measurement. Zahoor and Lew (2023) demonstrate that strategic flexibility and the adoption of digital technologies strengthen international marketing capabilities and enhance the export performance of small and medium-sized enterprises operating under crisis conditions. Drawing on evidence from Polish exporters, Ciszewska-Mlinarič, Siemieniako, and Wójcik (2024) show that international dynamic marketing capabilities are positively associated with firms' international performance during periods of pandemic-related turbulence. These perspectives are particularly relevant for transition economies, where enterprises frequently operate under conditions of institutional instability, resource constraints, and the need for rapid adaptation to changing external demand. However, this literature provides limited explanation of how institutional, infrastructural, and innovation conditions at the national level shape the development and effectiveness of such marketing capabilities across firms.

The issue of export resilience is closely related to the literature on export diversification. Cadot, Carrère, and Strauss-Kahn (2011) demonstrate that export

diversification is an important driver of economic development and a mechanism for reducing vulnerability to external shocks. This proposition is particularly relevant for transition economies, whose export structures often depend on a limited number of product groups, markets, or logistics routes. Nevertheless, the traditional export diversification literature focuses primarily on the product and geographic composition of exports, while digital marketing factors such as digital platforms, data analytics, online communication channels, CRM systems, and digital branding are rarely considered determinants of diversification.

Research on global value chains (GVCs) likewise highlights the importance of resilience and international connectivity. In the World Development Report 2020, the World Bank argues that participation in global value chains can contribute to productivity growth, higher incomes, and technological upgrading, while simultaneously exposing countries to technological, trade-related, and geopolitical shocks (World Bank, 2020). The Global Value Chain Development Report 2023 further emphasizes the need to build resilient and sustainable GVCs under conditions of increasing turbulence (WTO et al., 2023). For Ukraine and other transition economies, this implies that export resilience depends not only on production capabilities but also on the ability to maintain international market linkages, adapt logistics networks, communicate effectively with partners, and utilize digital channels for market outreach. Nevertheless, the role of the digital marketing ecosystem in supporting such connections remains insufficiently addressed within the GVC literature.

Another stream of research focuses on sustainable export strategies. Zeriti et al. (2014) introduced the concept of sustainable export marketing strategy fit and demonstrated that the alignment of export marketing strategies with external environmental conditions has a significant impact on export performance. Leonidou et al. (2015) further showed that environmentally oriented export strategies can enhance both competitive advantage and exporter performance. These contributions are important because they broaden the understanding of exports beyond short-term sales growth toward long-term competitiveness and compliance with sustainable development principles. However, these frameworks were developed before the current stage of digital transformation and therefore do not fully incorporate the role of digital platforms, marketing analytics, artificial intelligence, e-commerce, and digital trust in shaping sustainable export strategies.

The measurement of marketing performance represents another important issue relevant to this study. Katsikeas et al. (2016) emphasize that marketing performance is a multidimensional construct and that the diversity of indicators used across studies complicates meaningful comparisons of research findings. This observation is directly applicable to export resilience, which cannot be assessed solely through export growth rates. Instead, it should encompass the stability of export dynamics, market diversification, responsiveness to external demand, a country's competitive position in international markets, and its ability to maintain an international presence during periods of disruption. Accordingly, a composite ERI is introduced to capture export resilience through several complementary dimensions rather than through export growth alone.

The methodological foundation of this study is further strengthened by the availability of international statistical databases. Trade Map provides indicators related to

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export performance, international demand, alternative and competing markets, covering more than 220 countries and territories and over 5,300 products classified under the Harmonized System (International Trade Centre, 2026). The Global Economy database contains indicators for more than 200 countries, including measures of digital infrastructure, institutional quality, innovation capacity, logistics performance, and macroeconomic development (TheGlobalEconomy.com, 2026). The integration of these databases makes it possible to construct a quantitative framework in which the digital marketing ecosystem is assessed through digital, institutional, and innovation-related indicators, while export resilience is evaluated through export dynamics, partner-country concentration, and competitive positions in global trade.

The authors' previous studies provide a progressive foundation for the present research. Earlier work addressed international market diversification and marketing management under internationalization conditions (Tanasiichuk et al., 2020a, 2020b), followed by research on digital communication effectiveness, resilient international market segmentation, and sustainability-oriented digital strategies (Tanasiichuk et al., 2022, 2023, 2024). More recent studies examined enterprise adaptation and resilience under wartime conditions (Kovalchuk et al., 2025; Tanasiichuk et al., 2026). Building on these contributions, the present study shifts the unit of analysis from individual enterprises to national ecosystems and integrates digital, institutional, innovation-related, and export-resilience dimensions within a comparative cross-country framework.

The literature review reveals four interrelated research gaps. First, the country- and cross-country ecosystem dimension of digital marketing remains insufficiently developed. Second, existing national digital-readiness frameworks do not explicitly capture the marketing-specific mechanisms linking digital conditions with foreign-market access, adaptation, diversification, and export resilience. Third, export resilience is rarely examined in conjunction with digital infrastructure, institutional quality, and innovation capacity. Fourth, sustainable export strategies remain insufficiently operationalized through integrated measures of digital marketing ecosystem development, export dynamics, partner concentration, and competitive positioning.

Overall, the existing literature provides a solid theoretical foundation for the study but does not offer a comprehensive marketing-oriented framework that simultaneously integrates national ecosystem conditions, export resilience, and sustainable export strategies. The present research seeks to address this gap through the development of the Digital Marketing Ecosystem Index (DMEI) and the Export Resilience Index (ERI), followed by a comparative analysis of Ukraine and selected transition economies.

3. Research Methodology and Model Development

The results of the theoretical synthesis provide grounds for conceptualizing the digital marketing ecosystem as a multi-level system encompassing interactions among digital infrastructure, the digital business environment, institutional support mechanisms, innovation capacity, digital communication channels, and international market connectivity. Unlike the traditional perspective, which views digital marketing primarily as a collection of promotional tools, the present study considers it an ecosystem-level resource for fostering export resilience.

Within the proposed framework, the digital marketing ecosystem is defined as the set of digital, organizational, institutional, innovation-related, and market conditions that enable enterprises within a country to utilize digital channels for identifying foreign market opportunities, communicating with international partners, adapting marketing strategies, diversifying exports, and maintaining a stable presence in global markets.

Export resilience is conceptualized in this study as the ability of a country to sustain, restore, and diversify export flows under conditions of external shocks, changes in international demand, logistical constraints, institutional instability, and increasing global competition. It is reflected in the capacity to expand or recover exports, reduce dependence on a limited number of foreign markets, and maintain competitive positions in international trade.

Drawing on the reviewed literature, the study is based on the assumption that a higher level of digital marketing ecosystem development is associated with greater export resilience. The expected association operates through digital access, institutional quality, innovation capacity, market diversification, and firms' capacity to recalibrate foreign-market strategies as external conditions evolve.

To empirically test this assumption, two composite indicators are proposed: the Digital Marketing Ecosystem Index (DMEI) and the Export Resilience Index (ERI).

The conceptual logic of the study assumes that the digital marketing ecosystem influences export resilience through several interconnected channels. Digital infrastructure provides the fundamental conditions that enable enterprises to interact with foreign markets through online channels. The digital business environment facilitates the use of e-commerce, international B2B platforms, CRM systems, digital branding, and marketing analytics. The institutional environment determines the level of trust, regulatory predictability, and the security of digital and trade-related transactions. Innovation capacity affects enterprises' ability to develop new market offerings and adapt them to the needs of foreign customers. International connectivity supports the integration of enterprises into global markets, information, and trade networks.

Table 1. Conceptual Channels Linking the Digital Marketing Ecosystem to Export Resilience

Digital Marketing Ecosystem Component	Mechanism of Influence on Exports	Expected Outcome for Export Resilience
Digital infrastructure	Provides access to the internet, digital channels, online communication, and digital services	Reduced barriers to entry into foreign markets
Digital business environment	Supports the use of e-commerce, B2B platforms, CRM systems, digital branding, and digital payments	Faster identification of international partners and diversification of sales channels
Digital institutional support	Ensures regulatory predictability, trust, transparency, and the security of digital interactions	Reduced transaction risks and increased trust in exporters
Innovation and knowledge capacity	Supports innovation, digital adjustment, and responsiveness to shifts in market demand	Improved competitiveness and greater flexibility of export strategies
Digital international connectivity	Facilitates integration into international digital, market, and trade networks	Stronger market diversification and greater stability of international market presence

Source: developed by the authors.

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The conceptual model of the digital marketing ecosystem is broader than its empirical operationalization. Due to the limited availability of comparable international indicators across all countries included in the sample, the calculation of the Digital Marketing Ecosystem Index (DMEI) incorporates only three components that can be quantitatively measured using a common data source: digital infrastructure, digital institutional support, and innovation capacity. The digital business environment and international market connectivity remain integral elements of the conceptual framework, but are not included in the current composite index calculation. This narrower operationalization may affect cross-country rankings because countries with relatively advanced e-commerce adoption, digital business practices, B2B platform use, or international digital and market connectivity may receive lower DMEI scores than would be expected under the full conceptual model. Conversely, countries performing relatively strongly on the three measured dimensions may appear more favorable even if their digital business environment or international connectivity is less developed. Therefore, the DMEI should be interpreted as a parsimonious empirical representation of the measurable core of the digital marketing ecosystem rather than as an exhaustive measure of its overall maturity. Country rankings reflect relative performance on the dimensions included in the index and may change if the omitted components are incorporated in future specifications.

To assess the level of digital marketing ecosystem development, the Digital Marketing Ecosystem Index (DMEI) is proposed. The index is designed to compare countries in terms of digital accessibility, the quality of the institutional environment, and innovation capacity.

Assuming equal weights for all components, the index is calculated as follows:

$$DMEI_i = \frac{DI_i + DIS_i + IKC_i}{3} \quad (1)$$

where $DMEI_i$ – Digital Marketing Ecosystem Index of country i;
DI_i – Digital Infrastructure Subindex;
DIS_i – Digital Institutional Support Subindex;
IKC_i – Innovation and Knowledge Capacity Subindex.

Table 2. Structure of the Digital Marketing Ecosystem Index

Subindex	Description	Indicators	Data Source
DI – Digital Infrastructure	Level of digital accessibility and the scale of internet infrastructure	Internet users (% of population); fixed broadband internet subscriptions (thousand subscribers), 2024	The Global Economy
DIS – Digital Institutional Support	Quality of the institutional environment ensuring predictability, trust, and the security of digital and export activities	Government effectiveness; regulatory quality; control of corruption; rule of law	The Global Economy
IKC – Innovation and Knowledge Capacity	National innovation potential supporting firms' digital adjustment and international marketing development	Innovation Index	The Global Economy

Source: developed by the authors.

Following the structure presented in Table 2, normalized values of the primary indicators are aggregated into the corresponding subindices. The Digital Infrastructure Subindex (DI) is calculated as the arithmetic mean of the normalized indicators representing the share of internet users and the number of fixed broadband subscriptions. The Digital Institutional Support Subindex (DIS) is calculated as the average of the normalized indicators of government effectiveness, regulatory quality, control of corruption, and the rule of law. The Innovation and Knowledge Capacity Subindex (IKC) is represented by the normalized value of the Innovation Index.

The indicator of fixed broadband subscriptions is used as a proxy for the scale of digital infrastructure. However, because it is measured in absolute terms, its value is partly determined by country population size rather than exclusively by the intensity or quality of digital infrastructure development**.** Under min–max normalization, larger countries may therefore obtain higher normalized broadband scores simply because they have a greater number of subscribers, whereas smaller countries may be relatively disadvantaged even when broadband penetration is comparable or higher. Since the Digital Infrastructure Subindex combines this indicator with the share of internet users, the population-size effect is partly moderated but not eliminated. Consequently, the absolute broadband measure may introduce an upward bias in the DI and DMEI scores of larger economies and a downward bias in those of smaller economies, thereby reducing the strict comparability of country rankings. The results should therefore be interpreted as comparative patterns rather than precise measures of overall digital marketing ecosystem maturity. Future specifications should replace the absolute broadband indicator with subscriptions per 100 inhabitants or another population-adjusted measure and assess whether the resulting country rankings remain stable.

A distinctive feature of the proposed index is that it does not measure individual digital tools used by enterprises. Instead, it evaluates the overall digital and institutional environment of a country as a prerequisite for international business activity. This approach makes it possible to compare transition economies not only in terms of internet accessibility but also with respect to the quality of the conditions under which enterprises undertake digital transformation and develop international marketing strategies.

To assess the ability of countries to maintain diversified and competitive export flows, the Export Resilience Index (ERI) is proposed. Within the limits of the available empirical database, the index encompasses three dimensions: export dynamics, market diversification, and a country's competitive position in global trade.

Assuming equal weights for all components, the ERI is defined as follows:

$$ERI_i = \frac{EG_i + MD_i + CP_i}{3}, \quad (2)$$

where ERIi – Export Resilience Index of country i;
EGi – Export Growth Subindex;
MDi – Market Diversification Subindex;
CPi – Competitive Position Subindex.

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Table 3. Structure of the Export Resilience Index

Subindex	Description	Indicators	Data Source
EG – Export Growth	Ability of a country to expand or restore export flows	Average annual export growth, 2021–2025; export growth, 2024–2025	Trade Map
MD – Market Diversification	Degree of export dependence on a limited number of partner countries	Concentration of partner countries	Trade Map; authors' calculations
CP – Competitive Position	Country's position in global exports	Country's share in global exports; country's ranking among world exporters	Trade Map

Source: developed by the authors**.**

The Export Growth Subindex (EG) is calculated as the arithmetic mean of the normalized indicators of average annual export growth during 2021–2025 and short-term export growth during 2024–2025. The combination of these two time horizons makes it possible to capture both the overall trajectory of export performance and its most recent dynamics.

The Market Diversification Subindex (MD) is based on the concentration of partner countries. Since a higher level of concentration indicates greater dependence on a limited number of markets, this indicator has a negative orientation and is normalized using a reverse scale. Consequently, lower partner-country concentration results in a higher value of the market diversification subindex.

The Competitive Position Subindex (CP) is calculated using a country's share in global exports and its ranking among world exporters. A country's share in global exports has a positive orientation, whereas the ranking position has a negative orientation because a lower ranking number corresponds to a stronger competitive position.

Indicators such as total exports in 2025, average distance to export markets, and the average annual growth of partner countries' imports are used as supplementary descriptive characteristics but are not directly included in the ERI. Total export value largely overlaps with information captured by a country's share in global exports. The average distance to markets does not have an unambiguous positive or negative interpretation, as greater distance may indicate either higher logistics costs or broader geographic market coverage. Likewise, the growth rate of partner-country imports is excluded from the composite index when it takes the same value for all countries in the sample and therefore does not contribute to their differentiation.

Because the indicators included in the DMEI and ERI are measured in different units, all primary data are normalized to a scale ranging from 0 to 1. For indicators with a positive orientation, min–max normalization is applied:

$$Z_i = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}}, \quad (3)$$

where Zi – normalized value of the indicator;
Xi – actual value of the indicator for country i;
Xmin and Xmax – the minimum and maximum values of the indicator in the sample, respectively.

Indicators with a positive orientation include the share of internet users, the number of fixed broadband subscriptions, government effectiveness, regulatory quality, control of corruption, the rule of law, the Innovation Index, export growth rates, and a country's share in global exports.

For indicators with a negative orientation, reverse min–max normalization is applied:

$$Z_i = \frac{X_{\max} - X_i}{X_{\max} - X_{\min}}, \quad (4)$$

Indicators with a negative orientation include partner-country concentration and a country's ranking among world exporters. In these cases, a lower original value corresponds to a higher normalized score.

Following normalization, the primary indicators are aggregated into the corresponding subindices, and the subindices are subsequently combined into the composite indices DMEI and ERI. Equal weighting is used as the baseline specification because, in the absence of sufficiently established theoretical or empirical evidence assigning consistently greater importance to any individual dimension, it provides a transparent and reproducible benchmark and avoids introducing subjective priorities into the composite indices. Thus, each of the three DMEI subindices – digital infrastructure (DI), digital institutional support (DIS), and innovation and knowledge capacity (IKC) – receives a weight of 1/3. The same approach is applied to the three ERI dimensions – export growth (EG), market diversification (MD), and competitive position (CP).

To assess the robustness of the results to the weighting assumption, a sensitivity analysis was conducted using three alternative weighting schemes. In each scenario, one dimension was assigned a moderately higher weight of 0.40, while the remaining two dimensions received weights of 0.30 each. For the DMEI, the alternative specifications sequentially emphasized digital infrastructure, digital institutional support, and innovation capacity; for the ERI, the corresponding scenarios emphasized export growth, market diversification, and competitive position. This approach allows the stability of country rankings to be assessed without imposing extreme weighting differences.

The sensitivity analysis indicates a high degree of ranking stability. Spearman rank correlations between the baseline DMEI ranking and the alternative specifications ranged from 0.991 to 1.000, while the corresponding correlations for the ERI ranged from 0.973 to 0.991. When the median thresholds were recalculated consistently for each alternative specification, all eleven countries retained their original Sustainable Export Strategy Matrix classification. These results suggest that the principal comparative conclusions and strategy classifications are not driven by the equal-weighting assumption, although individual rank positions may vary slightly under alternative specifications. The results of the sensitivity analysis are summarized in Table 4.

Table 4. Sensitivity Analysis of DMEI and ERI Weighting Schemes

Weighting scheme	Component weights	DMEI Spearman ϱ	ERI Spearman ϱ	Strategy classifications retained
Baseline equal weights	0.333 / 0.333 / 0.333	1.000	1.000	11/11

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Weighting scheme	Component weights	DMEI Spearman ϱ	ERI Spearman ϱ	Strategy classifications retained
First dimension emphasized	0.40 / 0.30 / 0.30	0.991	0.991	11/11
Second dimension emphasized	0.30 / 0.40 / 0.30	1.000	0.973	11/11
Third dimension emphasized	0.30 / 0.30 / 0.40	1.000	0.991	11/11

Note: For the DMEI, the first, second, and third dimensions correspond to digital infrastructure (DI), digital institutional support (DIS), and innovation and knowledge capacity (IKC), respectively. For the ERI, they correspond to export growth (EG), market diversification (MD), and competitive position (CP), respectively. Strategy classifications were recalculated using the median DMEI and ERI values under each weighting specification.

Source: authors' calculations.

Future research may further refine the weighting structure through expert elicitation, factor-analytic methods applied to larger country samples, or longitudinal validation of component contributions to export resilience.

For the comparative analysis, a sample of transition economies was constructed, encompassing countries with different levels of digitalization, institutional development, innovation capacity, and integration into international trade.

Table 5. Country Sample for Comparative Analysis

Group	Countries
Primary object of analysis	Ukraine
Central and Eastern European Countries	Poland, Romania, Bulgaria, Hungary, Slovakia
Balkan and Neighboring Transition Economies	Serbia, Moldova
Caucasus	Georgia, Armenia
Central Asia	Kazakhstan

Source: developed by the authors.

The proposed sample makes it possible to assess Ukraine not in isolation but within a comparative framework of countries that share a common experience of post-socialist transformation while differing in their levels of digital modernization, institutional quality, and export performance.

A Sustainable Export Strategy Matrix is used to interpret the combined index results by positioning countries according to their DMEI and ERI outcomes.

Table 6. Sustainable Export Strategy Matrix Based on DMEI and ERI

Country Type	Characteristics	Strategic Interpretation
High DMEI – High ERI	Well-developed digital marketing ecosystem and high export resilience	Leaders of Sustainable Digital Exports
High DMEI – Low ERI	Advanced digital and institutional environment but insufficient export resilience	Underutilized Digital Export Potential
Low DMEI – High ERI	Export resilience is supported primarily by traditional factors	Traditional Export Resilience Requiring Digital Upgrading
Low DMEI – Low ERI	Underdeveloped digital environment and weak export resilience	Vulnerable Export Model

Source: developed by the authors**.**

Median values of the DMEI and ERI are used as thresholds for distinguishing between high and low index values within the sample. Values equal to or above the median are classified as high, whereas values below the median are classified as low. This approach reduces the influence of extreme observations and provides a transparent basis for assigning countries to strategic groups.

Countries exhibiting high values of both DMEI and ERI may be regarded as leaders of sustainable digital exports. For these countries, strategic priorities involve deepening digital integration, expanding exports with greater value creation, and strengthening the use of advanced market analytics. In contrast, countries characterized by a high DMEI but a low ERI face the challenge of converting their digital and institutional potential into tangible export outcomes through the development of international B2B platforms, certification systems, digital branding, and exporter support mechanisms.

For countries with a low DMEI but a high ERI, the primary priority is the digital modernization of traditional export sectors, as their export resilience may depend largely on production capabilities, resource endowments, or geographic advantages. Countries exhibiting low values for both indices require comprehensive digital, institutional, and export transformation.

By combining DMEI and ERI within a common analytical structure, the proposed approach provides a quantitative basis for cross-country comparison of digital marketing conditions and export resilience. Export performance is therefore assessed not through a single trade indicator but through the combined consideration of export dynamics, market diversification, and competitive positioning. Applying this framework to Ukraine and selected transition economies reveals differences in their digital and export-development profiles.

For Ukraine, the proposed approach is particularly relevant because, under conditions of war and post-war reconstruction, export resilience depends not only on the physical recovery of production and transport infrastructure but also on the ability of enterprises to utilize digital channels for partner acquisition, market diversification, international positioning, and strengthening trust in Ukrainian products.

Thus, the outcome of this stage of the research is the development of a conceptual and methodological framework that integrates the Digital Marketing Ecosystem Index (DMEI), the Export Resilience Index (ERI), and the Sustainable Export Strategy Matrix. The empirical application of this framework using data from The Global Economy and Trade Map makes it possible to determine Ukraine's comparative position among transition economies and to formulate practical recommendations for the development of a digitally oriented, sustainable export strategy.

4. Empirical Results and Discussion

The empirical stage compares the selected transition economies using the two composite dimensions developed in this study: DMEI and ERI. Their joint application reveals how countries differ in digital access, institutional and innovation conditions, export dynamics, diversification of trading partners, and competitive positions in international markets.

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The empirical analysis is based on two groups of international statistical sources. Indicators of digital infrastructure, the institutional environment, and innovation capacity were obtained from The Global Economy database. Indicators related to export dynamics, partner-country concentration, a country's share in global exports, and its ranking among world exporters were derived from Trade Map.

The comparative analysis includes Ukraine and ten transition economies: Poland, Romania, Bulgaria, Hungary, Slovakia, Serbia, Moldova, Georgia, Armenia, and Kazakhstan. The sample covers countries from Central and Eastern Europe, the Balkans, the South Caucasus, and Central Asia that share a common experience of market transformation but differ in their levels of digitalization, institutional development, innovation capacity, and integration into global trade. In this study, the term "transition economies" is used in a broad comparative sense to refer to countries with a post-socialist transformation background that currently exhibit different levels of institutional, digital, and economic development.

Table 7. Information Base for the Empirical Analysis

Assessment Dimension	Indicator	Symbol	Data Source	Use
Digital Infrastructure	Internet users (% of population)	IU	The Global Economy	DMEI
Digital Infrastructure	Fixed Broadband Internet Subscriptions (thousand subscribers), 2024	FBI	The Global Economy	DMEI
Institutional Environment	Government effectiveness	GE	The Global Economy	DMEI
Institutional Environment	Regulatory quality	QL	The Global Economy	DMEI
Institutional Environment	Control of corruption	CC	The Global Economy	DMEI
Institutional Environment	Rule of law	RL	The Global Economy	DMEI
Innovation Capacity	Innovation Index	INN	The Global Economy	DMEI
Export Scale	Total exports, 2025	EX	Trade Map	Descriptive indicator
Export Dynamics	Average annual export growth, 2021–2025	EG_{LT}	Trade Map	ERI
Short-Term Export Dynamics	Export growth, 2024–2025, %	EG_{ST}	Trade Map	ERI
Competitive Position	Country's share in global exports, %	SHARE	Trade Map	ERI
External Demand	Average annual growth of partner-country imports, 2021–2025, %	DA	Trade Map	Descriptive indicator
Market Diversification	Concentration of partner countries	CONC	Trade Map	ERI
Geographic Dimension of Exports	Average distance to partner-country markets	DIST	Trade Map	Descriptive indicator
Competitive Position	Country's ranking among world exporters	RANK	Trade Map	ERI

Source: authors' compilation using The Global Economy and Trade Map data.

Table 7 summarizes the indicators used to construct the two composite indices. The DMEI incorporates seven primary indicators grouped into three subindices: digital infrastructure, digital institutional support, and innovation capacity. The ERI includes five primary indicators combined into three subindices: export growth, market diversification, and competitive position.

For the DMEI, the most recent comparable values available from The Global Economy database were used, while data on fixed broadband internet subscriptions refer to 2024. For export-related indicators, values for 2025 and the dynamic period 2021–2025 were employed.

Table 8. Initial Indicators for Assessing the Digital Marketing Ecosystem

Country	Internet Users (% of Population)	Fixed Broadband Internet Subscriptions (thousand subscribers), 2024	Government Effectiveness	Regulatory Quality	Innovation Index	Control of Corruption	Rule of Law
Ukraine	82,47	8 198	−0,60	−0,30	29,7	−0,67	−0,72
Poland	88,58	9 774	0,67	0,69	37,7	0,79	0,58
Romania	91,29	6 807	0,42	0,38	34,3	0,03	0,37
Bulgaria	82,44	610	0,04	0,29	39,1	−0,24	−0,03
Hungary	93,78	3 633	0,50	0,34	40,0	0,04	0,19
Slovakia	89,83	1 862	0,66	0,40	35,5	0,11	0,56
Serbia	87,69	2 204	0,10	0,08	31,7	−0,56	−0,20
Moldova	77,37	899	0,26	−0,05	27,4	−0,29	−0,16
Georgia	83,80	1 158	0,46	0,65	31,2	0,38	0,15
Armenia	81,34	604	−0,36	0,14	30,4	0,14	−0,14
Kazakhstan	93,39	3 154	0,15	0,05	26,3	−0,07	−0,38

Source: authors' compilation using The Global Economy data.

The indicator of fixed broadband internet subscriptions is presented in absolute terms and is therefore partially influenced by a country's population size. In this study, it is used as a proxy for the scale of digital infrastructure, whereas the share of internet users reflects the level of digital inclusion within the population. This characteristic should be taken into account when interpreting the DMEI.

The initial values reveal substantial heterogeneity among the countries included in the sample. The highest levels of internet usage are observed in Hungary and Kazakhstan, while Moldova records the lowest value. Poland has the largest number of fixed broadband internet subscriptions and simultaneously demonstrates the strongest institutional indicators. The highest Innovation Index is recorded in Hungary, with Bulgaria exhibiting a similarly high value.

Ukraine demonstrates a relatively high level of digital inclusion and a substantial number of broadband internet subscriptions. However, its position is weakened by negative values for government effectiveness, regulatory quality, control of corruption, and the rule of law. This indicates a gap between the existing digital infrastructure and the

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quality of the institutional environment required for the full utilization of digital potential in international marketing and export activities.

Table 9. Initial Indicators for Assessing Export Resilience in Transition Economies

Country	Exports in 2025 (thousand USD)	Average Annual Export Growth, 2021–2025 (%)	Export Growth, 2024–2025 (%)	Share in World Exports (%)	Import Growth of Partner Countries (%)	Partner Concentration	Average Distance to Markets (km)	Rank in World Exports
Ukraine	42 323 659	−8	−9	0,20	3	0,06	2 643	62
Poland	413 853 357	5	8	1,60	3	0,10	1 560	20
Romania	109 066 366	5	9	0,40	3	0,07	1 681	40
Bulgaria	47 062 980	2	−2	0,20	3	0,05	1 809	59
Hungary	163 704 116	3	6	0,60	3	0,09	1 684	35
Slovakia	125 621 943	5	9	0,50	3	0,09	1 386	37
Serbia	36 123 189	9	9	0,10	3	0,05	1 618	66
Moldova	3 782 695	2	6	0,01	3	0,12	1 077	126
Georgia	3 603 713	0	13	0,02	3	0,07	2 539	128
Armenia	2 708 878	14	−37	0,02	3	0,18	5 672	136
Kazakhstan	79 041 226	6	−3	0,30	3	0,10	3 823	49

Source: authors' compilation using Trade Map data**.**

The indicators of total export value, average annual growth of partner-country imports, and average distance to markets are used for contextual interpretation but are not directly included in the ERI. Total export value partially overlaps with the indicator of a country's share in global exports. The indicator of partner-country import growth has the same value for all countries in the sample and therefore does not provide cross-country differentiation. The average distance to markets does not have a clear directional interpretation, as a greater distance may simultaneously indicate broader geographic export coverage and higher logistics costs.

The ERI incorporates the average annual export growth rate for 2021–2025, export growth in 2024–2025, partner-country concentration, a country's share in global exports, and its ranking among world exporters. Export growth indicators and the share in global exports are positively oriented variables. Partner concentration and ranking position are negatively oriented variables; therefore, inverse min–max normalization was applied to these indicators.

Prior to aggregation, all indicators were normalized to a scale ranging from 0 to 1. The Digital Infrastructure Subindex was calculated as the average of the normalized values of internet user penetration and fixed broadband internet subscriptions. The Digital Institutional Support Subindex was computed as the average of government effectiveness, regulatory quality, control of corruption, and rule of law indicators. The Innovation Capacity Subindex was represented by the normalized value of the Innovation Index.

The DMEI was calculated as the arithmetic mean of the three subindices with equal weights. Within the ERI, the Export Growth Subindex was calculated as the average of the long-term and short-term export growth indicators. The Market Diversification Subindex was represented by the inversely normalized partner concentration indicator. The Competitive Position Subindex was calculated as the average of the normalized share in global exports and the inversely normalized ranking position among world exporters.

The results of the composite assessment are presented in Table 10.

Table 10. Results of the DMEI and ERI Calculation for Transition Economies

Country	DMEI	DMEI Rank	ERI	ERI Rank	Strategy Type According to the Matrix
Ukraine	0,273	10	0,527	8	Vulnerable Export Model
Poland	0,891	1	0,787	1	Leader of Sustainable Digital Exports
Romania	0,683	3	0,713	3	Leader of Sustainable Digital Exports
Bulgaria	0,523	5	0,656	6	Leader of Sustainable Digital Exports
Hungary	0,780	2	0,664	5	Leader of Sustainable Digital Exports
Slovakia	0,641	4	0,676	4	Leader of Sustainable Digital Exports
Serbia	0,383	7	0,725	2	Traditional Export Resilience Requiring Digital Upgrading
Moldova	0,167	11	0,387	10	Vulnerable Export Model
Georgia	0,460	6	0,522	9	Underutilized Digital Export Potential
Armenia	0,276	9	0,168	11	Vulnerable Export Model
Kazakhstan	0,344	8	0,580	7	Vulnerable Export Model

Source: authors' compilation using The Global Economy and Trade Map data.

To assign countries to the strategy matrix, the median values of the indices within the sample were used as threshold values. The median DMEI equals 0.460, while the median ERI equals 0.656. Values equal to or above the respective median were classified as high, whereas values below the median were classified as low.

The results reveal substantial differences among the analyzed countries in terms of digital marketing ecosystem development. Poland ranked first with a DMEI value of 0.891. High scores were also recorded for Hungary, Romania, Slovakia, and Bulgaria. Their positions are supported by a combination of high internet penetration, well-developed internet infrastructure, relatively favorable institutional conditions, and strong innovation capacity.

Hungary ranked second in terms of DMEI, driven by the highest level of internet usage and the highest Innovation Index value in the sample. Romania and Slovakia demonstrate a balanced combination of digital accessibility and institutional quality. Bulgaria has a smaller scale of fixed broadband internet connectivity; however, its position is substantially strengthened by a high level of innovation capacity.

Georgia achieved a DMEI value of 0.460, ranking sixth in the sample. Its strengths include relatively high scores for regulatory quality, government effectiveness, and control of corruption, whereas the scale of its digital infrastructure remains a weaker aspect. Serbia, Kazakhstan, Ukraine, Armenia, and Moldova recorded DMEI values below the sample median.

Ukraine achieved a DMEI score of 0.273, ranking tenth among the eleven countries included in the sample. Although the country demonstrates relatively high

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absolute numbers of fixed broadband internet subscriptions, these strengths are insufficient to offset its low scores for government effectiveness, regulatory quality, control of corruption, and the rule of law. Therefore, the principal constraint on the development of Ukraine's digital marketing ecosystem is not limited to the state of digital infrastructure but is primarily associated with the insufficient quality of the institutional environment.

In terms of export resilience, Poland ranked first with an ERI value of 0.787. This result is driven by positive export dynamics, the largest share in global exports, and the strongest ranking position among the countries under analysis.

Serbia ranked second in terms of ERI, achieving a score of 0.725. Its performance is explained by high export growth rates and the lowest level of partner-country concentration in the sample. At the same time, Serbia's DMEI remains below the median level, indicating that its export resilience is supported more by traditional export factors than by the advantages of a highly developed digital marketing ecosystem.

Romania, Slovakia, Hungary, and Bulgaria also recorded ERI values equal to or above the median threshold. Romania and Slovakia demonstrate positive long-term and short-term export dynamics, relatively low partner concentration, and favorable competitive positions. Hungary benefits from a high share in global exports and a strong ranking among world exporters. Bulgaria achieved a high diversification subindex due to the lowest concentration of partner countries, although its short-term export performance was negative.

Ukraine recorded an ERI value of 0.527, placing eighth among the eleven countries. A positive contribution to the index is provided by the relatively low concentration of partner countries, indicating a certain degree of geographic export diversification. However, the average annual decline in exports during 2021–2025 and the decrease in exports during 2024–2025 substantially reduce the overall index value.

These country-level results can be interpreted in the context of the literature on digital internationalization, dynamic marketing capabilities, export diversification, and crisis resilience. Poland provides the clearest case in which relatively strong ecosystem conditions coincide with high export resilience. This pattern is consistent with firm-level research showing that digital capabilities facilitate internationalization by improving access to foreign markets, platform use, and export management (Jean & Kim, 2020; Vadana et al., 2020; Dethine et al., 2020). It is also consistent with evidence from Polish exporters demonstrating that international dynamic marketing capabilities contribute positively to international performance under turbulent conditions (Ciszewska-Mlinarič et al., 2024). The present findings extend this evidence by showing that the favorable firm-level outcomes identified in previous studies coexist with a broader national environment characterized by relatively strong digital infrastructure, institutional quality, and innovation capacity. Poland therefore provides country-level evidence consistent with the proposition that enterprise-level digital and marketing capabilities are more likely to be associated with resilient export outcomes when they are embedded in supportive ecosystem conditions.

Serbia provides a contrasting case and therefore qualifies the assumption that higher digital marketing ecosystem development is necessarily associated with greater export resilience. Despite a DMEI below the sample median, Serbia ranks second in ERI because of strong export dynamics and low partner-country concentration. This finding is

consistent with the export-diversification literature, which identifies diversification as an important mechanism for reducing exposure to external shocks (Cadot et al., 2011). At the same time, Serbia demonstrates that export resilience may be sustained by favorable trade dynamics and diversified market structures even when the digital marketing ecosystem remains comparatively less developed. Thus, digital marketing ecosystem development should be regarded as an enabling factor rather than a sufficient condition for export resilience.

Ukraine illustrates a different configuration. Its below-median DMEI and ERI are consistent with crisis-oriented research emphasizing that digital technologies and strategic flexibility can support international marketing performance under adverse conditions, but that their effects depend on firms' ability to mobilize and reconfigure complementary capabilities (Zahoor & Lew, 2023). Previous studies of Ukrainian enterprises similarly show that wartime adaptation relies on marketing flexibility, digital communication, and international market reorientation (Kovalchuk et al., 2025; Tanasiichuk et al., 2026). The country-level evidence obtained in this study complements these firm-level findings by demonstrating that relatively developed elements of digital infrastructure do not automatically translate into resilient export outcomes when institutional weaknesses and severe negative export shocks constrain firms' ability to exploit digital opportunities. Ukraine therefore confirms the importance of digital and marketing adaptation identified in the crisis-resilience literature, while also revealing the national ecosystem constraints within which enterprise-level capabilities operate.

Taken together, the comparison of Poland, Serbia, and Ukraine advances the predominantly firm-level literature in two respects. First, it shows that digital internationalization and dynamic marketing capabilities are embedded in national ecosystem conditions and that their potential contribution to export performance may differ depending on institutional quality, innovation capacity, and market structure. Second, the results demonstrate that the relationship between digital marketing ecosystem development and export resilience is not deterministic: Poland represents a configuration in which high digital marketing ecosystem development coincides with high export resilience, Serbia demonstrates resilience supported primarily by diversification and export dynamics despite weaker digital marketing ecosystem development, while Ukraine illustrates how institutional and crisis-related constraints may prevent existing digital potential from being converted into resilient export performance. The country-level perspective therefore complements enterprise-based research by identifying the broader conditions under which digital marketing capabilities can contribute to sustainable export resilience across transition economies.

The comparative results suggest that Ukraine's primary challenge is not merely the structure of its export markets but, above all, its ability to stabilize and restore export flows under conditions of war, destruction of production and energy infrastructure, disruption of logistics routes, and rising transaction costs.

According to the matrix-based classification, Poland, Romania, Bulgaria, Hungary, and Slovakia belong to the group of leaders of sustainable digital exports. These countries combine relatively advanced digital and institutional environments with high levels of export resilience. Their experience may serve as a useful benchmark for the development of a digitally oriented export policy in Ukraine.

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Georgia falls into the category of countries with underutilized digital export potential. Its DMEI value corresponds to the median threshold, whereas its ERI remains below the median. This indicates that existing digital and institutional capabilities have not yet been fully transformed into resilient export outcomes.

Serbia belongs to the group characterized by traditional export resilience requiring digital upgrading. The country exhibits a high ERI but a DMEI below the median level. Its export performance is supported by favorable export dynamics and diversified trade partnerships, whereas further progress in digital and institutional development remains necessary.

Ukraine, Moldova, Armenia, and Kazakhstan are classified as countries with a vulnerable export model, as both of their index values fall below the sample medians. Nevertheless, the underlying causes differ across these countries. In Ukraine's case, the key constraints are negative export dynamics and weaknesses in the institutional environment. Moldova is characterized by a relatively small export base, a high concentration of trading partners, and a weak competitive position. Armenia's performance is adversely affected by a sharp short-term decline in exports, the highest level of partner concentration, and the lowest ranking position among the countries analyzed. Kazakhstan demonstrates a comparatively higher ERI, but its DMEI is constrained by a low Innovation Index and less favorable institutional conditions.

The findings indicate that a developed digital infrastructure alone does not automatically translate into export resilience. Sustainable export performance requires the combination of digital capabilities with a supportive institutional environment, strong innovation capacity, stable export dynamics, diversified export markets, and a stronger competitive position in global trade.

For Ukraine, a sustainable export strategy should simultaneously focus on restoring export flows, improving the quality of the institutional environment, supporting innovation activities, and promoting the development of international B2B platforms, digital branding, marketing analytics, and programs facilitating firms' entry into new foreign markets. Policy support should prioritize small and medium-sized exporters, which frequently face resource constraints in finding foreign partners, obtaining product certification, and building communications for international markets.

The interpretation of the results should take into account several limitations of the study. First, the indicator of fixed broadband internet subscriptions is measured in absolute terms, which may create an advantage for countries with larger populations. Second, the international indicators included in the DMEI are represented by the most recent available observations, which may correspond to different reporting years. Third, the ERI captures available dimensions of export dynamics, market diversification, and competitive position, but does not include a direct measure of export volatility due to the absence of a complete annual time series in the compiled dataset. Fourth, the index framework identifies cross-country associations but cannot determine whether changes in digital marketing ecosystem conditions cause changes in export resilience.

Thus, the empirical application of the proposed framework revealed substantial differences among transition economies in terms of both DMEI and ERI. Ukraine possesses several relatively developed elements of digital infrastructure; however, its transformation into resilient export outcomes is constrained by unfavorable export

dynamics, institutional weaknesses, and insufficient innovation capacity. These findings justify the need for an integrated strategy that combines digital marketing transformation, institutional improvement, external market diversification, and the restoration of Ukraine's competitive position in global trade.

5. Conclusions

Overall, the research establishes a country-level analytical framework that connects measurable characteristics of digital marketing ecosystems with multidimensional patterns of export resilience. Unlike approaches that treat digital marketing primarily as a set of promotional tools, the proposed framework conceptualizes it as an ecosystem in which digital infrastructure, institutional quality, innovation capacity, international marketing channels, and market linkages jointly create the conditions necessary for sustainable export activity.

To operationalize the framework quantitatively, two composite indices were developed: the Digital Marketing Ecosystem Index (DMEI) and the Export Resilience Index (ERI). The DMEI combines the subindices of digital infrastructure, digital institutional support, and innovation capacity. The ERI incorporates export dynamics, market diversification, and a country's competitive position in global trade. The application of min–max normalization and equal weighting provided a transparent and reproducible basis for cross-country comparison, while the sensitivity analysis confirmed a high degree of ranking stability under alternative weighting specifications.

The empirical application of the framework revealed substantial differences among the countries included in the analysis. Poland ranked first according to both indices, achieving a DMEI of 0.891 and an ERI of 0.787. Strong performances were also recorded for Romania, Hungary, Slovakia, and Bulgaria, which combine relatively advanced digital and institutional environments with resilient export positions.

Serbia ranked second in terms of ERI while recording a DMEI value below the sample median. This finding suggests that its export resilience is supported primarily by favorable export dynamics and a diversified structure of trading partners, whereas its digital marketing ecosystem requires further development. Georgia, by contrast, exhibits a relatively favorable digital and institutional environment but a lower level of export resilience, indicating that its digital export potential has not yet been fully realized.

Ukraine achieved a DMEI score of 0.273 and an ERI score of 0.527, ranking tenth and eighth, respectively, among the eleven countries included in the sample. Its strengths include a relatively high level of internet usage, a substantial scale of broadband internet infrastructure, and a comparatively low concentration of export partners. At the same time, low scores for government effectiveness, regulatory quality, control of corruption, and the rule of law limit the transformation of digital potential into sustainable international marketing and export outcomes. Negative export dynamics during 2021–2025 further weaken Ukraine's position in terms of export resilience.

The matrix-based analysis enabled the classification of countries into four strategic groups. Poland, Romania, Bulgaria, Hungary, and Slovakia were identified as leaders of sustainable digital exports; Georgia was classified as a country with underutilized digital export potential; Serbia was categorized as a country characterized by traditional

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export resilience requiring digital upgrading; and Ukraine, Moldova, Armenia, and Kazakhstan were assigned to the group of countries with a vulnerable export model. This classification indicates that the existence of digital infrastructure alone does not guarantee export resilience without adequate institutional quality, innovation capacity, and favorable export dynamics.

For Ukraine, priority areas should include improving the institutional environment, digitalizing export support mechanisms, developing international B2B platforms, marketing analytics, and digital branding, supporting product certification, strengthening enterprise innovation capacity, and diversifying foreign markets. Particular attention should be given to small and medium-sized exporters, for whom digital channels can reduce partner-search costs and partially compensate for the physical and logistical constraints associated with wartime conditions.

The study has several limitations that should be considered when interpreting the results. First, the use of the absolute number of fixed broadband internet subscriptions may introduce a population-size effect into cross-country comparisons. Second, the international indicators included in the DMEI are based on the most recent available observations and therefore may refer to different reporting years. Third, the ERI does not include a direct measure of export volatility because a sufficiently complete annual time series was not available for all countries in the sample. Fourth, the relatively limited sample of eleven transition economies constrains the generalizability of the findings beyond the analyzed institutional and regional context. Finally, the current comparative index-based design identifies associations between digital marketing ecosystem development and export resilience but does not establish causal effects.

Future research should develop the proposed framework in several directions. First, annual DMEI and ERI values should be calculated over a longer time horizon to examine whether improvements in digital marketing ecosystem conditions precede changes in export resilience and whether these relationships remain stable across different stages of economic and geopolitical turbulence. Second, the country sample should be expanded beyond transition economies to include advanced, emerging, conflict-affected, and post-conflict economies, which would allow the external validity and broader applicability of the framework to be assessed. Third, digital infrastructure indicators should be recalculated using population-adjusted measures, such as fixed broadband subscriptions per 100 inhabitants, to reduce the influence of country size on comparative rankings. Fourth, future studies should apply longitudinal econometric approaches, including panel-data models with country and time effects, lagged specifications, and, where data permit, dynamic panel or other causal-inference techniques, to assess whether changes in DMEI and its individual components are associated with subsequent improvements in ERI. Fifth, the ERI should be extended by incorporating direct measures of export volatility, speed of export recovery after shocks, and the stability of market diversification over time. These extensions would make it possible to test whether improvements in digital marketing ecosystem development are associated with greater export resilience over time and to determine whether the proposed framework remains applicable beyond the specific context of transition economies and wartime Ukraine.

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