

Transformation of International Marketing of Companies in the Context of Sustainable Development and Economic Digitalization

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ABSTRACT

The article examines the processes of transformation of international marketing under the influence of global megatrends – digitalization and sustainable development. The authors substantiate the need to transition from traditional linear marketing models to service-oriented and cyclical approaches. Particular attention is paid to the role of breakthrough technologies (Blockchain, IoT, Big Data and Digital Twins) as tools for overcoming information asymmetry and ensuring radical transparency of supply chains. A conceptual model of the synergy of digital tools and ESG factors is developed, and a mathematical interpretation of the effectiveness of sustainable marketing is proposed through an integral indicator that takes into account digital maturity and investments in sustainable development. Key differences between domestic and international marketing in the context of cross-border regulation and environmental compliance are identified.

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კომპანიების საერთაშორისო მარკეტინგის ტრანსფორმაცია მდგრადი განვითარებისა და ეკონომიკური დიגיტალიზაციის კონტექსტში

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საერთაშორისო მარკეტინგი, მდგრადი განვითარება, დიგიტალიზაცია, ESG ფაქტორები, ციკლური

სტატიაში განხილულია საერთაშორისო მარკეტინგის ტრანსფორმაციის პროცესები გლობალური მეგატრენდების - დიგიტალიზაციისა და მდგრადი განვითარების - გავლენის ქვეშ. ავტორები ასაბუთებენ ტრადიციული წრფივი მარკეტინგის მოდელებიდან სერვისზე ორიენტირებულ და ციკლურ მიდგომებზე გადასვლის აუცილებლობას. განსაკუთრებული ყურადღება ეთმობა რევოლუციური ტექნოლოგიების (ბლოკჩეინი, ნივთების ინტერნეტი, დიდი მონაცემები და ციფრული ტყუპები) როლს, როგორც ინფორმაციული ასიმეტრიის დაძლევისა და მიწოდების ჯაჭვების რადიკალური

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გამჭვირვალობის უზრუნველყოფის ინსტრუმენტებს. შემუშავებულია ციფრული ინსტრუმენტებისა და ESG ფაქტორების სინერგიის კონცეპტუალური მოდელი და შემოთავაზებულია მდგრადი მარკეტინგის ეფექტურობის მათემატიკური ინტერპრეტაცია ინტეგრალური ინდიკატორის მეშვეობით, რომელიც ითვალისწინებს ციფრულ სიმჭიდვრს და მდგრად განვითარებაში ინვესტიციებს. გამოვლენილია ძირითადი განსხვავებები შიდა და საერთაშორისო მარკეტინგს შორის საზღვრისპირა რეგულირებისა და გარემოსდაცვითი შესაბამისობის კონტექსტში.

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Introduction.

The modern world economy is at a bifurcation point, where two fundamental vectors intersect: digital transformation and the imperative of sustainable development. Traditional models of international marketing, focused on aggressive expansion and short-term profit maximization, have exhausted their resources.

Global value chains are becoming the object of meticulous control by stakeholders (investors, governments and the conscious community). Digitalization is not just a set of tools (AI, Big Data, IoT), but as a technological environment that allows implementing ESG (Environmental, Social, Governance) principles in practice. The relevance of the study lies in identifying the mechanisms by which digital assets are converted into sustainable competitive advantages in the international arena. Noting the irreversibility of the above-mentioned megatrends, there is a need to review the fundamental principles of marketing activities. The traditional tools that have served as the basis for market expansion for decades now require reconceptualization. That is why it is advisable to analyze how the classic categories of the marketing mix are transformed under the pressure of environmental imperatives and digital opportunities, turning into a sustainable service-oriented model.

Literature Review.

The problem of transforming marketing strategies in the digital economy and adapting them to the requirements of sustainable development is in the focus of attention of leading domestic and foreign scientists. The fundamental aspects of technological impact on marketing are highlighted in the work of Ph. Kotler at al "Marketing 5.0" [11], which focuses on the application of technology for the well-being of humanity. A significant contribution to understanding the evolution of competition through the introduction of "smart" connected products was made by M. Porter at al [18], which laid the foundation for studying the concept of digital twins, while S. Alkhatib at al [1] conducted a systematic review of the emergence of "green" marketing in the digital age.

The issue of sustainable development, "green" marketing and its modern interpretations is highlighted in the works of S. Babu at al [2], K. Bezdyetko and D. Serogina [5], A. Sharma [16].

A significant contribution to the study of digital marketing mechanisms and its innovative component was made by M. Oklander at al [14], who conceptualized digitalization as the dominant marketing model of the 21st century. O. Savytska and V. Salabai [15] explored digital transformations in the conditions of industry 4.0 development. Conceptual aspects of marketing in the digital economy were highlighted by N. Verkhoglyadova at al [19]. I. Arakelova at al [3], U. Balyk at al [4], T. Kniazieva at al [10] investigated the role of digital

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technologies, strategic approaches to digital marketing in the context of digital transformation; M. Dziamulych and I. Reikin [8] devoted a publication to the issue of digitalization of the business environment of cross-border regions. Of particular relevance are studies on investing in innovations, making investment decisions, as well as research on motivations for purchases, brand involvement and the characteristics of e-commerce, which are reflected in the works of the following authors: S. De at al [6], M. Dykha at al [7], R. Pant at [17], T. Wagner [20].

Strategic directions for making management decisions in the context of digital transformation are described in the publication by V. Kutsyk and O. Tymkovych [12], and S. Ilyashenko at al [9] emphasize the need to integrate innovation culture into strategic management.

Despite the availability of solid developments, the mechanisms for direct conversion of digital assets into sustainable competitive advantages in international markets, taking into account regulatory initiatives (which are reflected in the strategies of the Ministry of Digital Transformation of Ukraine [13]), require further formalization. It is the need for scientific substantiation of the synergy of digitalization and environmental responsibility in the international marketing space that determined the choice of the research topic.

The purpose of the article is to theoretically substantiate and develop applied principles for the transformation of international marketing strategies in the context of the synergy of digitalization and sustainable economic development.

To achieve the goal, the following main tasks have been identified: to analyze the reconceptualization of marketing mix elements in the transition to a circular economy model; to determine the role and functions of digital twins, blockchain, and the Internet of Things in overcoming information asymmetry and ensuring ethical consumption; to build a conceptual model of the interaction of digital tools and ESG results in international marketing; to formalize an integrated indicator of sustainable marketing performance to assess the cumulative effect of digital and environmental investments; to identify specific features and barriers of international marketing compared to domestic marketing in the context of global environmental reporting and regulation.

Results.

The transformation of product policy in the international marketing system is a response to the global resource crisis and changing consumer priorities. The traditional linear model of “extraction – production – consumption – waste” is being replaced by the paradigm of the circular economy [1; 5]. Within this paradigm, the product ceases to be the endpoint of marketing efforts and becomes a dynamic carrier of value that persists over many life cycles.

One of the most radical manifestations of transformation is the transition from selling ownership of a physical object to selling a functional result – the Product - as -a- Service (PaaS) model and digital twin [18]. Leading international corporations are radically changing their positioning strategy, for example:

- Philips company in the project “Signify” implements the concept of “light as a service” (Light as a Service), where the client pays not for the lamps, but for uninterrupted lighting;
- Rolls-Royce uses the “Power” model in the aviation industry by the Hour”, where airlines buy flight hours, not the engines themselves.

From a marketing perspective, this means a change in the object of promotion, the focus shifts from technical characteristics and material consumption to operational reliability, energy efficiency and durability [1; 15]. The manufacturing company becomes interested in ensuring that the product works as long as possible without breakdowns, since the costs of repairs now fall on it, and not on the consumer. This creates a natural economic incentive for sustainable development.

Digitalization tools, among which digital twins occupy a key place. These are high-precision virtual models of physical objects that are synchronized with them in real time through a system of IoT sensors [14; 18]. In the context of international marketing, they perform two strategic functions:

1. Preventive maintenance – by analyzing digital twin data, marketers and service engineers can predict critical component wear. This allows them to offer the customer service support before a failure occurs. This

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approach creates an exceptional customer experience (UX) and becomes a key competitive advantage in B2B markets, where equipment downtime costs millions of dollars [3; 10].

2. Formation of a product's "carbon passport" – digital twins allow to calculate the ecological footprint of a product at the design stage. For international marketing, this becomes a tool for substantiating the "green" value of the brand. The company can provide digital evidence that its product meets strict environmental standards, which simplifies entry into highly competitive markets [1].

The transformation of product policy also involves the implementation of the principles of eco-design and modularity. The product is initially designed as a designer that can be easily disassembled, modernized or recycled. Marketing communication in this aspect focuses on maintainability and upgrades. Instead of encouraging the consumer to buy a new model every year, the brand offers "system updates" or replacement of individual modules. This significantly expands the value proposition for eco-conscious consumer segments, for whom the idea of minimizing waste is a priority [5; 12]. Thus, product policy becomes a tool for cultivating a culture of sustainable consumption, where the value of a product is determined not by the moment of purchase, but by the cumulative positive impact on the environment throughout its use.

However, the transformation of a product into an intellectual service or a cyclical asset inevitably comes into conflict with traditional methods of cost calculation. If the object of sale is not a physical unit, but long-term value and reliability, pricing mechanisms must also evolve. This necessitates a transition from a strategy of maximizing margins to a model of ethical pricing, where price acts not only as an economic indicator, but also as an instrument of social and environmental justice.

Ethical pricing in the digital age goes beyond simple cost calculation. It is based on the Total concept Cost of Ownership and systematic accounting of the social consequences of the company's activities in international markets [15]. Transformation of pricing policy in the context of sustainable development requires abandoning short-term profit maximization in favor of forming a fair value that takes into account the interests of all stakeholders. The practical implementation of this strategy becomes possible due to the convergence of environmental standards and advanced digital solutions, which is manifested in the following key areas:

1. Externalities are taken into account. The price starts to include the costs of future disposal or carbon offsets. Digitalization makes these calculations transparent to the consumer (for example, through QR codes showing the price structure).

2. Dynamic pricing. Thanks to Big algorithms Data companies implement incentive systems [12]:

– Green Discounts – automatic discounts for customers who choose a longer delivery time (with a smaller environmental footprint) or refuse plastic packaging;

– Tokenization – the use of internal digital currencies for the return of used packaging or participation in recycling programs.

3. Transparency through Blockchain. Distributed ledger technology allows justifying a high price for an ethical product by confirming fair wages or the absence of child labor in the supply chain [8; 9].

At the same time, the effectiveness of ethical price signals directly depends on the company's ability to ensure transparent and environmentally optimized delivery of value to the end consumer. The logistics component in international marketing is becoming a critical node where digital route optimization meets the requirements for minimizing the carbon footprint. Thus, "green" distribution becomes a logical continuation of the transformation of product and price into a single omnichannel ecosystem.

The transformation of distribution channels aims to overcome the conflict between delivery speed and environmental friendliness through [8; 12; 13; 15]:

1. AI-optimized logistics flows. Mathematical machine learning models analyze traffic, weather conditions, and vehicle occupancy in real time. This allows you to reduce "empty runs" by 15–20%, which directly affects the brand's environmental image.

2. Omnichannel as a tool for sustainable development: The integration of online and offline channels allows the consumer to pick up the product at a convenient location, minimizing the “last mile” of delivery - the most energy-consuming stage of logistics.

3. Digital localization platforms allow global brands to utilize local warehouses and micro-manufacturing (e.g., 3D printing of parts on site), virtually eliminating the need for cross-border transportation of physical goods.

This transformation of distribution channels, based on the integration of AI and local digital platforms, allows not only to minimize environmental risks, but also to create a foundation for a new economic logic of international marketing. The introduction of Glocal tools and optimization of the “last mile” through omnichannel models is direct confirmation that technological maturity is becoming an integral part of an environmental strategy.

However, for an objective assessment of the success of such transformations in the international arena, a qualitative description of the processes alone is not enough. The task of quantitatively measuring the synergy between the company's digital potential and its investments in sustainable development needs to be solved. In this context, we propose to move from strategic analysis to mathematical modeling, introducing an integral indicator of sustainable marketing performance (E_{sm}). This model allows us to formalize the cumulative effect of transformation using the following components/ingredients (formula 1):

$$E_{sm} = \int_{t_0}^{t_1} (D_{tech} \cdot I_{esg}) + \Delta_{soc} dt \quad (1)$$

where,

E_{sm} – Effect of Sustainable Marketing – is the overall effect of implementing the transformation. This is the increase in brand value that the company receives in the international market.

D_{tech} – Digital Technology Level – a company's digital maturity coefficient (availability of AI, blockchain, IoT). It varies from 0 to 1. If there are no digital tools, then even large investments in ecology work less effectively due to the lack of transparency.

I_{esg} – Investments in ESG – the amount of direct investment in sustainable practices (eco-friendly packaging, ethical sourcing, energy efficiency).

Δ_{soc} – Social Delta – is an additional social effect that is difficult to measure in money (community trust, staff loyalty, lack of scandals).

$\int_{t_0}^{t_1} (D_{tech} \cdot I_{esg}) + \Delta_{soc} dt$ – integral over time. This emphasizes that sustainable development is not a one-time action, but a cumulative effect over a certain period (strategic horizon).

The proposed calculation allows us to formalize the process of transformation of international marketing. The mathematical dependence indicates that digital tools (D_{tech}) act as a multiplier for investments in sustainable development (I_{esg}).

Without the right level of digitalization, a company's ESG efforts remain “invisible” or opaque to the global consumer, which negates the marketing effect. Instead, integrating technology allows not only to scale environmental initiatives, but also to ensure a high social delta Δ_{soc} that creates a long-term competitive advantage in the digital economy.

The implementation of the described strategic changes in product, pricing and sales policies would be impossible without an appropriate technological foundation. If sustainable development determines the vector of

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movement, then digitalization provides the necessary tools for its implementation. To understand the mechanics of these processes, it is necessary to consider in detail the role of breakthrough technologies - blockchain, the Internet of Things and big data analytics - as means of overcoming the key barrier to sustainable marketing, which is information asymmetry. To understand the mechanics of these processes, it is necessary to consider the three-level transformation model (Figure 1), which illustrates the transition from digital assets to specific ESG results.

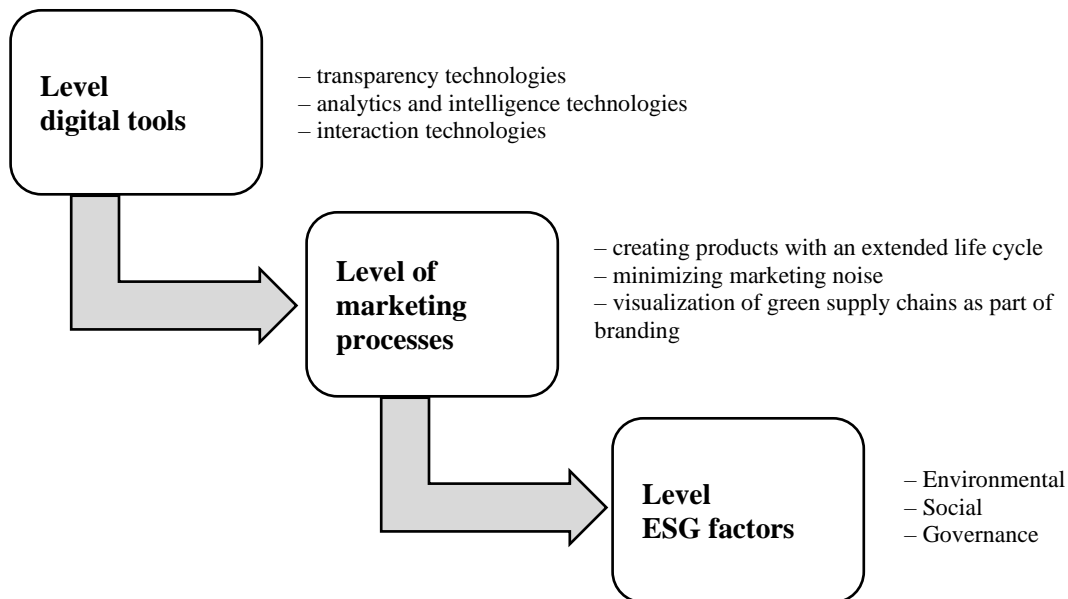


Figure 1. Conceptual three-level model of international marketing transformation in the context of sustainable development

Source: developed by the authors based on [1; 13].

The proposed model (Figure 1) demonstrates that digitalization is not an end in itself, but acts as a critical facilitator of sustainable development. In particular, the interaction in the “AI – Ecology” system allows you to move from reactive to predictive resource management. In international marketing, this is transformed into a greenwashing strategy, where each unit of digital energy spent should generate social or environmental capital [11; 18].

Feedback plays a special role in the model. Thanks to IoT sensors and social media analysis, the company receives instant information about how consumers perceive its ESG initiatives. This avoids the risks of greenwashing, since any brand statement in the digital space can be instantly verified through open data or blockchain registries [8].

In classic international marketing, information asymmetry (when the manufacturer knows more about the product than the consumer) often led to distrust or the phenomenon of greenwashing (declaring environmental friendliness without real grounds). Digitalization creates a “trust environment” where every fact is subject to verification:

1. Blockchain and the concept of “Radical Transparency”. Blockchain is transforming international marketing, turning the supply chain into an open book. The use of immutable records allows a brand to guarantee to the consumer that raw materials were obtained ethically. This is critical for the markets of coffee, diamonds, textiles and rare earth metals. Instead of abstract promises, the company provides the consumer with a QR code

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on the packaging. Scanning allows you to see the “digital journey” of the product. This turns logistics into part of the branding, increasing the customer’s willingness to pay a premium price for proven ethics [8; 14].

2. The Internet of Things changes the interaction with the product after the point of sale. IoT sensors collect data on load, temperature and intensity of use in real time. This allows for the implementation of a cyclical consumption model, i.e., the system itself signals the need for part replacement or service [15; 18]. This extends the service life of the product and prevents premature disposal of products in landfills. In terms of marketing, this strengthens the “customer-brand” relationship, since the company acts not as a seller, but as a partner in sustainable use. However, the Internet of Things technology generates only a primary array of empirical data. In order for this data to be transformed into strategic marketing decisions, a transition from monitoring individual devices to a systematic analysis of behavioral patterns of entire consumer segments is necessary.

This necessitates the use of big tools Data Analytics, which allows not only to react to the state of the product, but also to predict the ethical expectations of the audience. Thus, technological transformation logically moves into the plane of intellectual segmentation, where the psychographics of environmental responsibility become the object of analysis.

In the context of digital globalization, traditional segmentation by geographic location (Ukraine, Poland, Germany) in international marketing is gradually losing its relevance, giving way to segmentation by value orientations and environmental beliefs. The use of big data analytics allows companies to implement a sustainable development strategy at the level of individual interaction through the following tools [3; 8; 10; 11; 19]:

1. Algorithmic value-based segmentation – using machine learning algorithms to analyze search queries, digital footprints on social media, and retrospective purchase history, it is possible to identify a segment of “conscious consumers” on a global scale. This allows the brand to create homogeneous marketing messages for eco-active groups regardless of their physical location, overcoming national borders through shared ideological attitudes.

2. Hyperpersonalization as a means of minimizing digital noise – big data transforms the concept of mass communications, allowing you to avoid irrelevant mailings, which are de facto a form of “digital garbage”. The company gets the opportunity to offer only those solutions that clearly correspond to the eco-profile of a particular client. This approach not only increases conversion rates, but also demonstrates respect for the consumer’s information space, ensuring high efficiency while significantly reducing the overall advertising pressure on the audience.

However, the functioning of hyper-personalized communications and algorithmic segmentation requires a clear architecture of data flows. In international marketing, sustainable development is based on the company's ability to transform disparate signals from sensors, transactions and logistics nodes into structured marketing assets. This process can be represented as a multi-level mechanism, where digitalization acts as a filter that filters out irrelevant information and leaves only verified value for the consumer. Below is the conceptual structure of this process, which defines the logic of trust formation in the digital environment (Figure 2).

The following diagram (Figure 2) illustrates the mechanism of data transformation into marketing capital. IoT devices and Blockchain nodes generate arrays of primary data about the product. This data passes through the “analytics filter” (Big Data), where they are cleaned of information noise and structured in accordance with the company's strategic goals.

The result of the functioning of this filter is the formation of three marketing assets that determine competitiveness in the international market [8; 11; 12; 14; 18]:

1. Verified eco-claims – creating a foundation of trust through documented confirmation of a product's environmental performance.

2. Consumer engagement – transforming a passive buyer into an active participant in the brand ecosystem through interactive digital services.

3. Resource efficiency – providing the client with quantitative indicators of consumption optimization, which becomes part of the value proposition.

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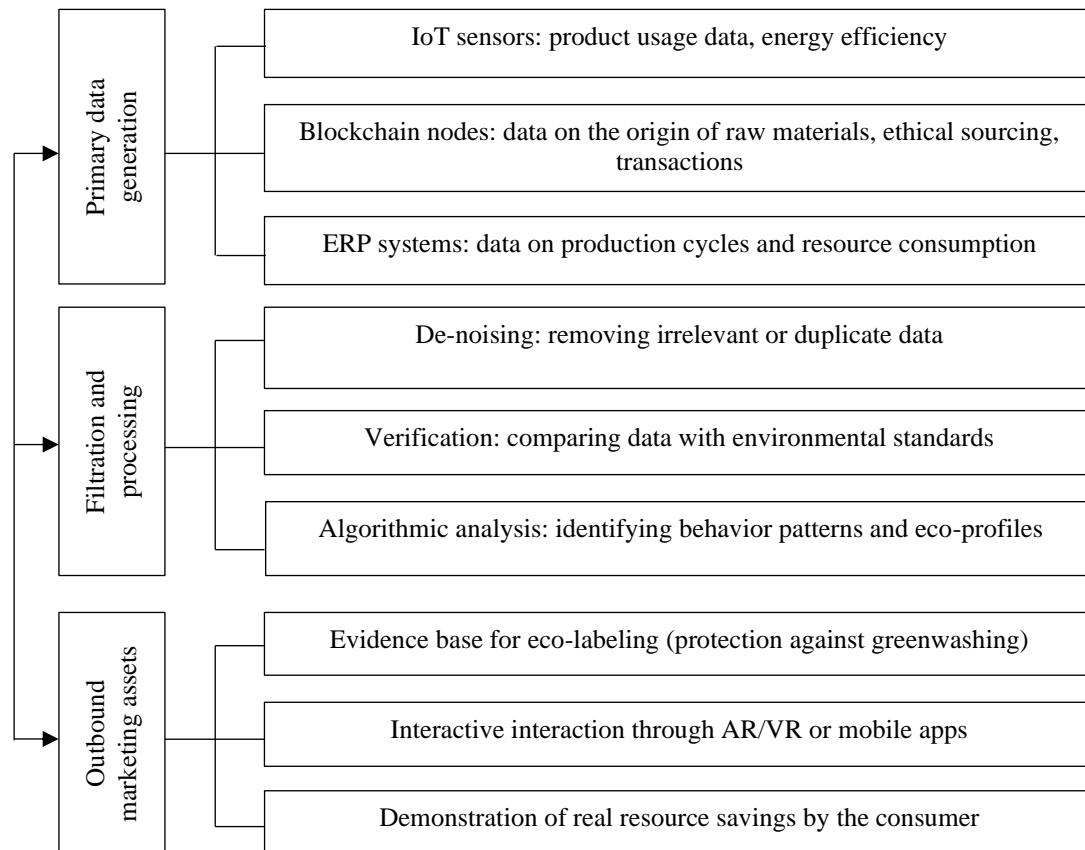


Figure 2. Digital marketing transparency filter

Source: developed by the authors based on [8; 14].

Thus, technology becomes a bridge connecting ethical production with the demanding global consumer, eliminating any information asymmetry and creating a transparent environment for sustainable development.

However, the effectiveness of this “digital bridge” directly depends on taking into account the specifics of the target audiences. Although technological tools (IoT, Blockchain, Big Data) remains universal, the strategic emphases of marketing transformation are significantly determined by the type of market segment [10; 15]. In international practice, the results of digital transparency and resource efficiency are transmitted through various mechanisms of influence, which necessitates a differentiated approach to the B2C and B2B sectors [3; 4].

The transformation of marketing in the context of sustainable development has specific manifestations that are determined by the nature of decision-making and the level of responsibility of market participants:

1. Personalization and social impact in the B2C segment. In the era of total digitalization, the consumer is transformed into a “prosumer” – an active subject who simultaneously consumes and participates in creating value [11; 14]. International brands use deep learning algorithms to analyze individual eco-preferences, forming personalized eco-proposals based on the customer’s lifestyle. The main vector of transformation here is co-creation. Through specialized digital platforms and mobile applications, customers are involved in the development of environmentally friendly packaging, the selection of product ingredients or the design of local

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recycling programs. This allows companies not only to sell goods, but also to create a joint social impact with the customer, where digital data is evidence of each person's real contribution to environmental protection.

2. System integration and compliance in industrial marketing (B2B). Unlike the emotionally charged B2C segment, in international B2B marketing the emphasis shifts to the plane of technological integration, energy efficiency and strict compliance [15; 18]. Digitalization here acts not as a means of personalization, but as a tool for systemic risk control.

Modern digital ecosystems allow for the generation of integrated sustainability reports in real time, which is becoming a critical factor in the selection of a contractor. In global tenders, the presence of digital evidence of a low carbon footprint and supply chain transparency is a prerequisite for admission. Thus, the transformation in the industrial sector is aimed at creating seamless information flows between the supplier and the customer, where environmental responsibility is confirmed by automated monitoring systems.

In order to summarize the analysis of differences in approaches and visualize the evolution of marketing tools, it is advisable to provide a comparative characteristic. This will allow us to clearly distinguish between outdated expansion methods and new strategies based on the synergy of digitalization and environmental responsibility. Table 1 shows the main vectors of change in the structure of international marketing.

Table 1. Comparative characteristics of traditional and transformed approaches to international marketing in the context of sustainable development

Direction of transformation	Traditional approach	Transformed approach (digitalization of ESG strategies)
Segmentation	By demographics and geography	By eco-consciousness and digital behavior (psychographics)
Communications	One-way broadcasting (ATL/BTL)	Interactive ecosystems, social media, omnichannel
Distribution	Physical channels, maximizing reach	D2C (Direct-to-Consumer), logistics optimization through AI
Branding	Orientation towards status and quality	Values-based, transparency and impact marketing

Source: developed by the authors based on [11; 14; 15; 18].

The transformation of international marketing is not a cosmetic update of individual tools, but a full-scale transition to a new business philosophy. In this model, digitalization acts not only as a communication channel, but also becomes a guarantor of transparency and a real contribution of the company to sustainable development, which is critically important for maintaining competitiveness in global markets. However, any change in strategic paradigms will remain only a theoretical construct without taking into account the anthropocentric factor - the transformation of the consciousness of the consumer himself.

The digital environment does not simply provide new channels of communication, it fundamentally changes the architecture of human perception, forming specific psych technological responses. In the context of sustainable development, this means that marketing influence must adapt to new cognitive patterns, where the speed of information processing is combined with a high demand for ethical brand authenticity [11; 14]. This leads to the isolation of the psych technological aspect as a critical factor in the success of digital transformation.

The digital environment shapes specific psych technological patterns that determine the effectiveness of international brands [8; 10; 11; 15; 19]:

1. Attention economy and time compression. In the digital space, time is becoming the most scarce resource. International marketing must comply with the principles of instant relevance: the message about the brand's environmental responsibility should be concise, visually structured and unobtrusive. The concept of

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“instant marketing” combined with sustainable values allows you to capture the consumer's attention without creating “digital noise”.

2. Digital capital as a foundation of trust. Since direct personal contact between the manufacturer and the consumer is often absent in international marketing, the role of the brand's “digital capital” becomes dominant. Social proof (Social Proof) – reviews, ratings on global platforms, transparency of responses on social networks – are transformed into digital markers of sustainable development. For the consumer, a high rating in the digital environment is the equivalent of an ethical certificate of quality.

3. Gamification of eco-behavior. Transforming consumer habits is most effectively achieved through game mechanics. Using mobile applications to incentivize socially responsible actions (e.g., earning bonus tokens for saving electricity, sorting garbage, or choosing “green” routes) turns the complex process of ethical choice into an engaging interactive experience. This allows brands to build lasting loyalty based on shared achievements in the field of sustainable development.

Thus, the psych technological component acts as a connecting link between digital tools and ethical goals, transforming technologies into means of humanizing marketing communications.

Despite the versatility of digital tools, their implementation varies significantly across geographical and legal boundaries. Successful work in the domestic market does not automatically guarantee effectiveness on a global scale, where factors such as cross-border regulation, the “digital divide” and cross-cultural differences in the perception of environmental values come into play. This requires a separate comparative analysis of transformation processes in the domestic and international dimensions.

The processes of digitalization and greening of marketing have fundamentally different architectures depending on the geographical scope of the company's activities. If in the domestic market transformation is a tool for optimizing costs and increasing loyalty, then on an international scale it turns into a strategic asset that ensures the legitimacy of the brand's presence in markets with high regulatory requirements.

The foundation of the transformation of international marketing is the need to comply with strict regulatory frameworks. Carbon is becoming a key challenge for export-oriented companies Border Adjustment Mechanism (CBAM) – a mechanism for carbon adjustment of imports into the EU. This forces international marketers to include carbon footprint data in the digital product description. In parallel, the digitalization of marketing communications must strictly comply with GDPR (General Data Protection Regulation) standards. Data Protection Regulation), which creates a double burden: the company must be as transparent as possible in environmental data and as protected as possible in personal data [1; 13].

The transformation of international marketing faces the phenomenon of the “double divide,” where uneven digital development across countries overlaps with varying degrees of societal readiness for sustainable consumption.

Unlike a domestic market, where reporting and data collection standards are homogeneous, international marketing requires the creation of interoperable digital ecosystems. Data collected using IoT sensors at production sites in one country must be automatically verified and recognized by auditors in another. This requires the implementation of common data transfer protocols and cloud solutions that allow for the harmonization of environmental reporting (e.g., according to GRI or SASB standards) for global investors and consumers.

In an international environment, marketing takes on the characteristics of “digital diplomacy”. The use of a digital product passport, containing the full history of its life cycle in a blockchain registry, is the most convincing evidence of a brand's ethics. This allows companies to avoid discrimination in foreign markets where local regulators require confirmation of the absence of deforestation or compliance with human rights in supply chains [8; 14].

To successfully transition to digital sustainable marketing, companies go through the following stages [3; 11; 15]:

1. Digital maturity and environmental footprint audit.

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2. Integrating ESG goals into marketing strategy.
3. Development of a digital platform for interaction with stakeholders.
4. Monitoring and adjusting the strategy based on real data.

Summarizing the comprehensive analysis of structural changes in international marketing, we can say that we are witnessing the birth of a new management paradigm. The synergy of digitalization and sustainable development is shaping an environment where ethics becomes measurable and technology becomes humanistic.

The final stage of the analysis of the transformation of international marketing is the definition of specific metrics that allow assessing the success of the transition to a digital and sustainable development model. In global practice, the most relevant coordinate system for such an assessment is ESG criteria. Digital tools in this context act not only as means of increasing efficiency, but also as the main drivers of the formation of new types of marketing assets. Table 2 systematizes the relationship between the implementation of digital solutions and the resulting marketing effect in terms of key ESG components.

Table 2. The impact of digital tools on the formation of marketing effect in the ESG system

ESG component	The impact of digital tools	Marketing effect
Environmental (E)	Optimization of logistics flows through AI and machine learning significantly reduces carbon emissions	Formation and consolidation of the image of an “Eco-Leader” on the international arena
Social (S)	Monitoring labor conditions and supplier ethics through Blockchain; ensuring digital inclusion	Growing emotional brand attachment and fundamental trust
Governance (G)	Automation of non-financial reporting; high level of cybersecurity of consumer data	Minimizing reputational risks and increasing investment attractiveness in global markets

Source: developed by the authors based on [1; 15; 19].

The transformation of international marketing in modern conditions is not just an adaptation to new technologies, but a process of converting digital capabilities into sustainable reputational capital. Each element of the ESG component finds its digital reflection, which allows the company to reach a level of radical transparency, where business ethics are confirmed not by declarative statements, but by verified data in real time.

It is important to emphasize that the synergy effect is achieved precisely when ESG investments are superimposed on a high level of digital maturity. Without the right technological foundation, a company’s sustainability efforts will remain fragmented and vulnerable to criticism of greenwashing. In contrast, the integration of blockchain for social standards control and AI for environmental optimization creates a sustainable competitive advantage that cannot be easily copied.

Thus, the transformation of international marketing in the context of digitalization becomes the foundation for the formation of a new model of global leadership. It is based on the ability of the brand to be simultaneously technological, ethical and adaptive to cross-cultural consumption. The results obtained allow us to formulate a number of general conclusions regarding the future development trajectories of global companies.

Conclusions.

The conducted research allows us to state that the modern transformation of international marketing in the context of sustainable development and digitalization of the economy is not an adaptive process, but represents a fundamental change in the business paradigm. Based on the results obtained, the following key conclusions were formulated:

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1. Conceptual transition to ecosystems of trust. Traditional manipulative methods of marketing influence are losing their effectiveness under the pressure of the global consumer's demand for ethics. The transformation of international marketing is a strategic path from stimulating uncontrolled consumption to building transparent ecosystems, where digital technologies act as a guarantor of the authenticity of environmental claims. This allows us to level out information asymmetry and transform declarative "green" marketing into a verified tool for creating value.

2. Technological determination of sustainable development. It has been proven that digitalization is a key facilitator of sustainable development. The implementation of the concepts of digital twins and Product - as -a-Service allows us to implement the circular economy model in practice, extending the life cycle of goods and optimizing logistics flows. The proposed integrated indicator of sustainable marketing performance demonstrates that the level of digital maturity of a company is a critical multiplier, without which investments in ESG factors do not bring the expected reputational and economic effect in the international market.

3. Value segmentation and psych technological adaptation. In the digital age, classic geographic segmentation is giving way to psychographic analysis of eco-consciousness. Using AI for hyper personalization allows you to minimize "digital noise", ensuring respect for the consumer's information space. At the same time, the success of the transformation depends on the ability of brands to adapt to the "attention economy" and introduce elements of gamification to stimulate socially responsible customer behavior.

4. Ethical imperative. The final vector of transformation is the ethical use of data. In conditions of total transparency, a brand's "digital capital" becomes its most valuable asset. Companies that are able to combine technological excellence with humanistic values will gain long-term competitive advantage, transforming sustainable development from a forced constraint into a source of innovative growth.

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