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RELATIONAL MARKETING AND MANAGEMENT MODELS OF LEAN MANUFACTURING CONCEPTS IN THE AGE OF DIGITALIZATION

The article examines the main relational marketing approaches in the context of environmentally-oriented production. This study focuses on the implementation of lean marketing in manufacturing processes using Industry 4.0 technologies. This study analyzes the concepts of lean production, aimed at eliminating waste, optimizing processes, and creating value for the customer with minimal resource consumption. This paper explores the potential of relational marketing as a key approach to building long-term, value-based customer relationships in the context of the Lean Production concept. The possibilities of relational marketing as a tool for strengthening sustainable relationships with customers within the framework of the lean manufacturing philosophy are also considered. Current management models that contribute to the implementation of the principles of loss minimisation, increased operational flexibility and sustainability of business processes are analysed. Particular attention is paid to the influence of digital technologies - CRM systems, automation of client scenarios, data analytics - on the adaptation of relational marketing to the requirements of the Lean approach. The role of digital solutions -

intelligent data processing algorithms - is highlighted. Recommendations are presented on the formation of hybrid marketing and production strategies that help create sustainable value and strengthen the competitive advantage of enterprises in the digital age. The paper examines modern management models that reduce losses, optimize processes, and increase value for the consumer. The paper proposes integration strategies that combine marketing and production processes aimed at achieving sustainable efficiency and competitiveness of enterprises in the digital era.

Keywords: eco-oriented production, lean manufacturing, green marketing, relational marketing, marketing strategies, management, sustainable development, digitalization.

Introduction. Modern economic conditions, characterised by high competition, digital transformation and growing consumer expectations, require enterprises to implement integrated approaches to the management of production and marketing processes. One such approach is the integration of relational marketing and management models with the concept of lean manufacturing. This synergy is particularly important in the era of digitalisation, when the capabilities of intelligent systems, big data analytics and automation provide a qualitatively new level of customer centricity and operational efficiency.

The current stage of digitalisation of business requires a revision of traditional marketing and management practices in favour of more flexible and customer-oriented models. Relational marketing, focused on building long-term mutually beneficial relationships with customers, is becoming an integral element of modern management strategies. It ensures continuous communication, personalisation of offers and growth of customer loyalty, which is especially important for companies implementing the principles of Lean approach. At the same time, Lean production, aimed at eliminating losses and maximising customer value, requires finely tuned systems of interaction both internally and with external stakeholders.

In the age of digitalisation, the relationship between relational marketing and Lean management is being strengthened by the introduction of digital platforms, CRM systems, artificial intelligence technologies and predictive analytics tools. This creates the prerequisites for adaptive, sustainable and customer-centric business models.

Thus, the relevance of the topic is due to the need for scientific understanding and practical application of relational marketing as a basis for effective management of lean production models in the digital economy. The study of this relationship will make it possible to substantiate new approaches to improving the competitiveness of enterprises and the formation of sustainable relationships with consumers on the basis of digital tools.

The prospects of this study are determined by the need to rethink marketing strategies through the prism of lean principles and develop new methodological foundations that ensure synergy between production and marketing efficiency.

However, the issues of their effective application in lean manufacturing conditions remain insufficiently studied. Thus, the analysis and development of approaches to the implementation of relational marketing solutions within the framework of the lean manufacturing concept are urgent tasks of modern marketing science and practice.

Literature review. In the scientific literature and marketing practice the peculiarities of the application of relational marketing in the conditions of lean production, where the priority is given not only to performance, but also to resource efficiency. The purpose of the literature review is to highlight key theoretical and practical aspects of lean production in the context of relational marketing, sustainable development and circular economy.

I would like to acknowledge the work of such scholars: Berezovska L., & Kirichenko A. [1]; Bosovska M., Bovsh L., Okhrimenko A. [2]; Vasyltsiv N. M. [3]; Verkhoglyadova N. I. [4]; Vinogradova O. V., Nedopako N. M. [5]; Kostiuchenko V., Pashchenko I., Sakovets I. [7]; Krymska A.O., Balyk U.O., Klimova I.O. [8]; Livoshko T. [9]; Marchenko O. [10]; Nemish, Y. [11]; Fedorchuk, A. O. [13]; Kharchenko M. O., Panchenko A. O. [14].

These articles propose an approach to the digitalisation of tools used in the implementation of the best available technologies in order to increase resource efficiency and reduce negative environmental impact. The article presents a conceptual approach to digitalisation of industrial systems strategy based on the paradigm of sustainable eco-innovation and circular business models in the context of Industry 5.0.

These sources provide comprehensive analyses and practical recommendations for integrating environmentally oriented strategies and digital technologies into industrial production, contributing to sustainable development and increasing the competitiveness of enterprises.

However, scientific literature and marketing practice insufficiently studied the peculiarities of relational marketing application in the conditions of lean production, where the priority is given not only to efficiency, but also to resource efficiency. Relational marketing in the conditions of sustainable development on the example of entrepreneurship is devoted to very few scientific works, practically there are none. There are separate studies on the principles of lean production, circular economy ta sustainable

development, but there are no works that combine all these concepts: the study of the integration of relational marketing and lean production in the conditions of digitalisation.

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Objectives and tasks. The purpose of this study is to examine the characteristics of relational marketing approaches in the context of environmentally friendly production. To determine the specific features of relational marketing in sustainable development.

And the goal of relational marketing is to build sustainable customer loyalty, which contributes to the growth of repeat purchases and the creation of mutual value for both the company and the consumer. The key pillars of this concept are trust and the provision of added value. This approach is based on shifting the focus from the product to the customer, as a result of which marketing strategies are oriented towards personalised service and satisfaction of individual needs. Relational marketing implies not intrusive sales promotion, but the provision of quality service and support, which guarantees the consumer confidence in the expediency and quality of purchases.

The objectives of the research are: to analyse the synergistic effect of the integration of relational marketing and the concept of lean production (to identify the points of intersection between the Lean philosophy (loss elimination, value maximisation) and the relational marketing model (long-term relationships with customers), to assess the mutual influence of customer focus and production efficiency); to form new management models in the conditions of digital transformation (developing agile, digital-centric management models that address customer needs and optimise processes, integrating CRM systems, IoT, AI and Big Data in support of a relational approach and Lean strategies); developing strategies for personalised customer interaction based on Lean methodology (building

value chains in which the customer is central, adapting production processes to the preferences of target groups); assessing the impact of digitalisation on the effectiveness of relational marketing and Lean management (analysing performance metrics: customer retention rate, return purchase rate, reduction of production losses, etc.); identification of barriers and risks in integrating these concepts in the context of digitalisation (identification of technological, organisational and cultural obstacles in synchronising marketing and Lean approaches, development of mechanisms for personnel adaptation and changes in corporate culture); development of practical recommendations for enterprises to build sustainable and digitally adaptive business models (creation of integrated strategies for managing customer relations and production resources on the basis of digital technologies, application of best practices in the context of digitalisation).

Research methods. To study the topic, a multidisciplinary and multilevel approach can be used, combining both qualitative and quantitative methods. The main research methods are case studies (case analysis), the purpose of which is to study the practical experience of companies integrating relational and Lean strategies with digital technologies, also the expert interview method to obtain qualitative data from specialists in marketing, digital technologies and production management; the system analysis method — establishing relationships between marketing, production, digital technologies and consumer behavior; digital analytics methods and CRM analysis to study customer data, digital footprint, behavior and engagement; Customer Journey Mapping — visualization of the customer's path and identification of points of interaction with Lean and digital processes; BPMN (Business Process Modeling Notation) for modeling management and production processes with a focus on integrating digital and relational approaches; Value Stream Mapping (VSM) — analysis of the value stream at an enterprise to identify losses and opportunities for the implementation of marketing and digital improvements.

Results and discussion. With the rapid digital transformation of business, there are increasing demands for the integration of marketing strategies with managerial models of production efficiency. Modern enterprises are faced with the need to adapt to a dynamically changing market environment due to increasing competitive pressure, digital transformation and growing requirements for sustainable development. In these conditions, the concept of Lean Production becomes not only a tool for

increasing efficiency, but also a strategic direction for business development. However, traditional marketing approaches focused on maximising sales and short-term profits often conflict with Lean principles aimed at eliminating losses, optimising business processes and creating value for the customer. This requires revision of marketing strategies and introduction of new models capable of integrating Lean principles with modern marketing tools. In this context, relational marketing approaches are of particular interest, which combine elements of various marketing concepts (traditional, digital, sustainable marketing, etc.), creating a synergistic effect.

Today's market conditions require enterprises not only to increase efficiency, but also to be flexible in their promotional strategies and interaction with customers. In this context, the concept of Lean Production, which aims to minimise waste and create value for the customer, faces the need to adapt marketing approaches to the new requirements of digitalisation, sustainability and personalisation.

Relational marketing is a strategic approach based on the integration of multichannel communications and a variety of marketing tools to form a unified system of interaction focused on establishing and maintaining sustainable relationships with customers. Relational marketing synthesises traditional and digital methods of promotion, which allows both expanding the reach of the target audience and increasing the effectiveness of communication influences. The concept of Lean Production, in turn, focuses on the systematic reduction of all types of costs and unproductive operations, thereby maximising customer value creation.

Traditional marketing strategies focused on sales volumes and attracting new customers are often ineffective in lean approaches, where long-term value and customer loyalty become the key factor. This calls for the development of new marketing systems that can integrate lean principles, minimising redundant costs, increasing the effectiveness of communications and creating personalised value propositions.

In this context, relational marketing approaches that combine elements of traditional, digital, sustainable marketing that uses a relational database (a database based on a relational data model) are promising. The use of relational databases was proposed by Edgar Codd from IBM back in 1970 [19].

Relational marketing as a concept began to emerge in the 1980s in response to growing competition and the realisation that retaining customers could be more profitable than continually attracting new ones. It initially

developed in the B2B (business-to-business) and service industries, where establishing long-term customer relationships was particularly important.

The main stages of relational marketing development may be summarized as loloows.

1960s-1970s: the main approaches of marketing theory. During this period, marketing was mainly oriented towards transactional strategies, focusing on one-off sales and mass advertising. However, the first ideas about the need for customer retention emerged. The theoretical basis of relational marketing was laid in the works of researchers who studied customer satisfaction and repeat purchases [19].

1980s: The term «relationship marketing» is coined. In 1983, Professor Leonard Berry [20] first coined the term relationship marketing in an article published in the Journal of the Academy of Marketing Science. He proposed a concept of marketing that focused not only on attracting customers, but also on building long-term relationships with them.

1990s: Stage of theory development and empirical research.

In 1994, Evert Gummesson [21] expanded the understanding of relational marketing by proposing the concept of '30R' (30 relationships in marketing). He described the importance of interacting not only with customers but also with suppliers, partners and other stakeholders.

In 1995 Christian Grönroos [22] published an important paper emphasising the importance of trust and commitment in the relationship between companies and their customers.

2000s-present phase of digitalisation and CRM development. Important publications from this period include the works of Philip Kotler, Jagdish Sheth [16] and other leading marketers who adapted the concept of relational marketing to the digital environment.

With the development of CRM (Customer Relationship Management) systems, relational marketing gained a technological foundation. Companies started to actively use databases, personalised communications and automated systems to manage customer relationships.

The use of databases plays a key role in relational marketing as it allows you to collect, store, analyse and use customer information to build long-term relationships. The basic principles of databases include:

1. Centralisation and structuring of data. The database should be a single repository of customer, partner and transactional information. Data should be structured by key parameters: personal data, purchase history,

preferences, brand interactions. Relational databases (e.g. MySQL; PostgreSQL) are used. So, MySQL is a database management system based on the relational data model proposed by Edgar Codd [19]. It is used to store, manage and retrieve structured data. It stores data in the form of linked tables. MySQL is characterised by high speed, stability and easy integration with various software systems.

MySQL is used: Web development (basis for storing data on most websites and web applications (e.g. WordPress, Joomla, Drupal), used in conjunction with PHP, Python, JavaScript (LAMP-, or MEAN-stacks); CRM and ERP systems (storing information about customers, orders, transactions (e.g. in Bitrix24, Odoo and other solutions); Online shopping and marketing (user segmentation, purchase history and, behavioural analysis); financial and logistics systems (transaction management, customer database management, reporting); digital marketing and relational marketing (storage and analysis of customer data for personalised communications, interaction with CRM, APIs and BI tools (e.g. for audience segmentation and automated mailings).

Relational marketing is based on building long-term relationships with customers through personalisation and analysis of consumer behaviour. MySQL in this system plays a key role as a means of storing and processing customer data. The main functions of MySQL in relational marketing: storage of customer profiles (name, contacts, purchase history, interactions, responses to promotions); database segmentation — selection of customer groups by interests, behaviour or loyalty; integration with CRM systems (Salesforce, HubSpot, Bitrix24); analysis and personalisation of marketing campaigns — use of SQL queries to generate target audience samples; automation of trigger notifications — generation of mailings and actions based on records in the database.

MySQL application in Lean management: In the Lean approach, optimising business processes, reducing losses and increasing transparency at all levels are of particular importance. MySQL helps to realise this through structured storage and analysis of production data. The role of MySQL in Lean management models: real-time tracking of production operations — storing data on equipment status, task completion time, inventory levels and defects; integration with visualisation systems and VSM (Value Stream Mapping) — MySQL data is visualised for bottleneck analysis; evaluation of KPIs — SQL queries to calculate OEE, Takt Time, Lead Time and other

metrics; support for Lean digitalisation tools — embedding in IoT and ERP systems where each device or module sends data to the database.

MySQL is a digital tool for information management in strategically important areas: in marketing — for building personalised and effective communications; in Lean management — for increasing transparency of processes and prompt response to deviations.

PostgreSQL is a powerful open source object-relational database management system designed to store, process and analyse large amounts of structured information. It supports advanced data manipulation features, including transactions, nested queries, stored procedures, triggers, indexes, and integration with analytical tools. PostgreSQL is characterised by high reliability, scalability and adaptability for complex digital management tasks.

Implementing Lean principles in a production environment requires transparency of processes, control over resource flows, and timely detection of losses. PostgreSQL provides the foundation for creating flexible information systems that support key elements of the Lean approach.

The main areas of application of PostgreSQL in the Lean environment are: digitalization of production monitoring (collection and storage of data on the equipment status, downtime, line load and product quality; the ability to aggregate information from various sources (sensors, ERP, MES) into a single database); support for analytics and process improvement (use of complex SQL queries to analyze bottlenecks, identify causes of deviations and evaluate performance (e.g. calculating Takt Time, OEE), storing data for building a Value Stream Map (VSM) and subsequent modeling of improvements); integration with digital Lean tools (connection with BPMN and CMMS systems to automate data flows and the ability to develop custom Lean applications using PostgreSQL as a backend database); flexible change management and visualization (working with dynamic data in real time and generating dashboards based on stored data — as a means of supporting decisions to eliminate losses and deviations).

PostgreSQL acts as the intelligent core of Lean enterprises' digital infrastructure, providing reliable management of the data required for continuous process improvement. Thanks to its openness and extensibility, the system effectively adapts to the unique requirements of Lean manufacturing — from operational accounting to strategic analytics.

2. Segmentation and personalisation. Customers are segmented by various characteristics: demographics, behavioural factors, loyalty level. Data

allows you to create personalised offers, increasing customer satisfaction.

3. Dynamic updating and actualisation. Data should be updated regularly to reflect the current state of customer relationships. Automation of update processes is important (through CRM systems, API — an application programming interface, i.e. a set of rules and tools with which one programme can interact with another, integrations and analytics).

4. Analytics and forecasting. Using analytics tools (Big Data, AI (Artificial Intelligence) is a field of computer science that aims to create systems that can mimic human thinking, behaviour and learning. In other words, it is the ability of machines to analyse, make decisions, learn and act according to the situation) to predict customer behaviour. Identifying patterns that help increase customer retention and improve marketing strategies.

5. Data protection and legal compliance. Customer data must be stored in accordance with legal regulations (GDPR is the General Data Protection Regulation (adopted in the EU in 2016, in force since 25 May 2018) [23]. It sets out the rules for processing personal data of EU citizens, and affects all companies that handle this data - regardless of their geographical location, Personal Data Act). Access to information is restricted by security levels and encryption is used.

6. Integration with CRM and omnichannel systems. An important element of the digital infrastructure is the connection of the database to customer relationship management systems and omnichannel communication platforms. This integration enables centralised processing of information about customers, interactions and transactions. One of the leading solutions in this area is Salesforce, a cloud-based ecosystem that integrates sales, marketing, customer service, analytics and business process automation functions into a single platform. By syncing with databases, CRM systems ensure that customer data is complete and up-to-date, support personalised engagement strategies and improve operational efficiency at all levels. It combines sales, marketing, customer service, analytics and process automation into a single ecosystem; HubSpot is an integrated digital platform focused on implementing inbound marketing strategies, driving sales and providing a quality customer experience. Its functionality is aimed at forming and developing long-term relationships with customers through personalised communications, automation of interactions and integrated management within a single environment. Thanks to its user-friendly interface and tight integration of CRM modules with marketing tools, HubSpot is widely used in small and medium-sized businesses as an

effective solution for optimising marketing and operational processes.

Bitrix24 is a comprehensive digital platform for automating management, communication and marketing processes, focused on increasing the efficiency of internal and external business interactions. By integrating CRM, project management, collaboration and analytics modules, the system helps minimise the loss of time, resources and information, which is in line with the key principles of lean manufacturing.

With the ability to adapt business processes, track tasks in real time, and provide analytical support for management decisions, this platform is widely used by organisations seeking operational flexibility, cost reduction, and a value-based customer relationship model. This platform is an all-in-one platform for business management, sales and communications, combining CRM, tasks, chat, telephony, websites and automation in a single interface. It is especially popular among small and medium-sized businesses). It is important to synchronise data with various interaction channels (email, messengers, social networks, mobile applications).

7. Automation of marketing processes. Using databases allows you to automate marketing campaigns (email newsletters, trigger notifications - these are automatic messages that are sent to the user in response to a certain action, event or condition. They are launched by a trigger - that is, a signal that the system recognizes and reacts to it in a predetermined way). Scenarios for interaction with clients are configured based on their behavior and preferences.

The use of databases in relational marketing helps companies build personalized and long-term relationships with customers, increasing their loyalty and value for the business. Integration with CRM, analytics and data protection are key aspects of the effective use of these databases.

Relational marketing developed as an alternative to traditional marketing approaches focused on one-time sales. It has evolved from theoretical concepts to practical tools, including CRM and digital strategies, making it an important direction in modern marketing.

Relational marketing is a strategy focused on building and maintaining long-term relationships with customers, partners, and other stakeholders. Unlike traditional transactional marketing, which focuses on one-time sales, relational marketing is aimed at creating strong connections, increasing customer loyalty, and increasing their lifetime value. Relational marketing was formed as a conceptual opposite to transactional models that emphasize one-time purchases and sales. And today, relational marketing forms

positions that enhance and improve the quality of a product. Its development reflects the transition from theoretical foundations to applied solutions, including customer relationship management (CRM) systems and digital communication technologies. In modern conditions, relational marketing is a strategic direction aimed at forming sustainable, long-term relationships with consumers based on a personalized approach and value interaction.

The main principles of relational marketing are:

- long-term relationships — priority is given not to a one-time transaction, but to sustainable interaction;
- customer focus — satisfying customer needs becomes a key task on an ongoing basis;
- personalization — an individual approach to each client, taking into account their preferences for the long term;
- two-way communication — active interaction with clients through various channels without intermediaries;
- loyalty and trust — loyalty programs, bonuses and privileges for regular customers.

Relational marketing tools can be: CRM systems for managing customer data, loyalty programs and bonus systems, personalized offers and mailings, content marketing and social networks, after-sales service and support. These tools are similar to the usual mechanisms used in marketing, but with the only difference that the entire marketing policy is aimed at long-term cooperation. Relational marketing is especially relevant in conditions of high competition, when customer retention becomes more important than attracting new ones.

The technological basis of Customer Relationship Management (CRM) for relational marketing is innovative approaches to digitalization in the context of Industry 4.0. CRM systems are the foundation of relational marketing, providing automated management of customer relationships. They allow companies to collect, analyze and use data to create a personalized experience and increase customer loyalty.

The architecture of a CRM system, which is built on the basis of several key components:

- customer database: a centralized storage of information about customers, including contact information, purchase history, preferences and interactions,
- analytical module: tools for data analysis, forecasting customer behavior and evaluating the effectiveness of marketing strategies,

– process automation: mechanisms for managing communications (email marketing, chat bots, reminders), optimizing sales and customer service,
– integration with external platforms: connecting CRM with social networks, e-commerce platforms, ERP systems and other business applications.

Key CRM technologies used in relational marketing:

– Big Data and artificial intelligence (AI). Analysis of large data sets helps segment customers and predict their behavior. AI algorithms recommend personalized offers based on customer preferences.
– Cloud technologies (Cloud CRM). Cloud CRM (Salesforce, HubSpot, Zoho) provide access to data from anywhere in the world and reduce infrastructure costs. Provide data security and convenient scalability.
– Marketing automation. Automated email newsletters, push notifications, chatbots help maintain communication with customers. Triggered interaction scenarios increase customer engagement.
– Omnichannel and integration. CRM combines data from online and offline channels (website, social networks, messengers, phone calls, offline stores). Customers get a single experience of interaction with the brand.
– Blockchain and data security. Protecting customers' personal data, preventing fraud. Increased transparency and trust in customer relationships.

CRM functions for relational marketing:

– Personalization of interactions: CRM analyzes data and offers personalized offers.
– Automation of communication: CRM sets up email campaigns, reminders, push notifications and chatbots.
– Prediction of customer behavior: AI algorithms predict which customers are prone to repeat purchases or may leave.
– Monitoring customer satisfaction: CRM collects feedback and analyzes the level of customer satisfaction.
– Loyalty programs: manage bonus systems and discounts for regular customers.

Popular CRM systems for relational marketing.

– Salesforce — one of the leading cloud CRMs, uses AI (Einstein) for data analysis.
– HubSpot CRM — a free option with powerful marketing tools.
– Microsoft Dynamics 365 — integration with the Microsoft ecosystem.
– Zoho CRM — convenient for small and medium businesses.

CRM systems are the technological basis of relational marketing, providing data collection and analysis, automation of interactions and a personalized approach to clients. The development of artificial intelligence, Big Data and cloud technologies makes CRM tools increasingly powerful and effective.

When considering relational marketing, greenwashing and business models can either complement or contradict each other, depending on the company's strategic approach to sustainability. Some companies use greenwashing elements as part of their business strategy, creating the illusion of environmental friendliness to increase consumer loyalty and attract investors. In this case, greenwashing becomes a marketing tool that fits into traditional business models aimed at increasing sales and the company's market value. For example, brands that claim to use "green" materials, but do not disclose the actual amount of recycled materials. Companies that advertise carbon neutrality, but do not take significant steps to reduce emissions.

Contradictions between Greenwashing and business models within relational marketing. On the other hand, greenwashing contradicts sustainable and ethical business models focused on long-term development. Companies that truly integrate ESG principles (environmental, social and governance factors) strive to actually reduce their negative impact on the environment.

Examples of conflicts include cases where, in circular economy-based business models, greenwashing undermines consumer trust by devaluing genuine efforts, and in strictly regulated industries such as electricity generation, it can result in legal and reputational risks.

Thus, the choice between real sustainability and greenwashing determines the long-term competitiveness of a company. Organizations that rely on «greenwashing» may win in the short term, but risk losing the trust of the audience and facing sanctions. In systems that include people (for example, production systems, social systems, the national economy), functioning depends on the management carried out by people. All these branches have in common a systems approach, a systems principle of research — consideration of the studied set not as a simple sum of components (linearly interacting objects), but as a set of nonlinear and multi-level interacting objects. There is a need to develop scientifically based approaches to the formation of marketing systems that can combine the principles of lean manufacturing with the capabilities of relational marketing to create sustainable competitiveness of enterprises. Modern businesses face challenges related to the depletion of natural resources,

climate change and increasing consumer demands for environmental responsibility of brands. In this context, the concepts of sustainable development, circular economy and relational marketing are acquiring strategic importance for companies striving for long-term success.

The concept of lean production, focused on the systematic identification and elimination of losses, assumes the creation of maximum value for the end consumer with minimal resource expenditure. The introduction of Lean philosophy into management and production practices requires corresponding changes in the field of marketing, since efficiency and rationality are becoming key determinants of all business processes.

Traditional marketing models, which focus primarily on increasing sales volumes and aggressively acquiring new customers, in some cases conflict with the principles of Lean, which prioritizes sustainable development, customer retention, and long-term value. Mass communications, excessive advertising budgets, and unproductive distribution channels can be seen as forms of marketing waste that require optimization.

Sustainable development is a concept aimed at the harmonious development of the economy, society and ecology without harming future generations. Companies following the principles of sustainable development receive a number of advantages: economic benefit — cost optimization through resource conservation, increased production efficiency, innovation and competitiveness — the introduction of environmentally friendly technologies and new business models, access to financing — sustainable companies attract ESG investors and receive preferential lending terms, social loyalty — consumers increasingly choose brands focused on the principles of sustainable development. The circular economy is a model based on a closed production cycle, in which waste is transformed into a resource. It helps to minimize the ecological footprint and maximize the value of products. The advantages of the circular economy: reduced raw material costs — reuse of materials, reduced waste — recycling, secondary production, supply stability — dependence on new natural resources is reduced, regulatory compliance — companies avoid fines for environmental pollution.

In the context of digitalization and the growing need for customer focus, the need to transform marketing strategies focused on integrating a lean approach is increasing. This determines the transition from transactional to relational marketing, within which the emphasis is increased on building trusting relationships, personalized service and optimizing communication

costs. Thus, a new paradigm of marketing activities is being formed that corresponds to the goals and objectives of Lean management.

Conclusions. Marketing process automation technologies (marketing automation), new generation CRM system tools, and the use of integrated KPIs that allow linking marketing indicators with operational metrics of lean manufacturing are acquiring particular importance. Digitalization of approaches ensures synergy between various interaction channels and forms the basis for sustainable, customer-oriented and cost-effective marketing activities that comply with Lean management principles.

Thus, the set of identified tools and methods can be considered as a basis for the formation of an adaptive marketing model that contributes to the achievement of the strategic goals of the enterprise in the context of resource constraints and increased requirements for sustainable development.

The concept of lean production, aimed at eliminating excess costs and ensuring maximum consumer value, necessitates a rethinking of traditional marketing approaches. Classical marketing models, focused primarily on increasing sales volumes and actively attracting new customers, often do not correlate with the principles of Lean, which emphasize efficiency, sustainability and long-term relationships. This creates an objective need to develop adaptive marketing strategies that harmoniously integrate into the paradigm of Lean management.

Thus, the effective implementation of lean manufacturing principles in the marketing sphere requires a strategic transformation of existing approaches to promotion. In the context of the digital economy and increased requirements for resource efficiency, the integration of relational marketing strategies that ensure the integrity of the communication space and the adaptability of channels of interaction with the target audience is of particular importance. This combination contributes not only to the optimization of operational processes and the reduction of transaction costs, but also to the formation of sustainable consumer value, while simultaneously strengthening the company's competitive position in the market.

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РЕЛЯЦІЙНИЙ МАРКЕТИНГ І МОДЕЛІ УПРАВЛІННЯ КОНЦЕПЦІЙ «БЕРЕЖЛИВОГО ВИРОБНИЦТВА» В ЕПОХУ ЦИФРОВІЗАЦІЇ

У статті розглядаються основні підходи реляційного маркетингу в контексті екологічно орієнтованого виробництва. Це дослідження зосереджено на впровадженні бережливого маркетингу у виробничих процесах з використанням технологій Індустрії 4.0. У цьому дослідженні аналізуються концепції бережливого виробництва, спрямовані на усунення відходів, оптимізацію процесів і створення цінності для клієнта з мінімальним споживанням ресурсів. У цьому документі досліджується потенціал реляційного маркетингу як ключового підходу до побудови довгострокових стосунків із клієнтами на основі цінностей у контексті концепції бережливого виробництва. Також розглядаються можливості реляційного маркетингу як інструменту зміцнення стійких відносин із клієнтами в рамках філософії бережливого виробництва. Проаналізовано існуючі моделі управління, які сприяють реалізації принципів мінімізації збитків, підвищення операційної гнучкості та сталості бізнес-процесів. Особливу увагу приділено впливу цифрових технологій: CRM-систем, автоматизації клієнтських сценаріїв, аналізу даних на адаптацію реляційного маркетингу до вимог Lean-підходу. Висвітлюється роль цифрових рішень — інтелектуальних алгоритмів обробки даних. Представлено рекомендації щодо формування гібридних маркетингових і виробничих стратегій, які сприяють створенню стійкої вартості та зміцненню конкурентних переваг підприємств у цифрову епоху. У статті розглядаються сучасні моделі управління, які зменшують втрати, оптимізують процеси та збільшують цінність для споживача. У статті запропоновано стратегії інтеграції, які поєднують маркетингові та виробничі процеси, спрямовані на досягнення сталої ефективності та конкурентоспроможності підприємств у цифрову еру.

Ключові слова: екоорієнтоване виробництво, бережливе виробництво, зелений маркетинг, реляційний маркетинг, маркетингові стратегії, менеджмент, сталий розвиток, цифровізація.

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