Zozulov Oleksandr
PhD in Economics,
Professor at the Department of Industrial Marketing
(corresponding author)
ORCID ID: 0000-0001-7087-2080

Parfonov Oleksandr
PhD student
ORCID ID: 0009-0007-5692-245X
National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

MACHINE-TO-MACHINE (M2M) MARKET: CURRENT STATE, TRENDS, AND FOUNDATIONS FOR MARKETING AUTOMATION

The study examines the current state and key features of the Machine-to-Machine market, focusing on autonomous systems that function as independent economic agents. The aim is to define the characteristics of marketing interaction in machine-driven environments and outline principles relevant to the development of automated marketing approaches. The methodological basis includes analysis and systematisation of conceptual models describing machine interaction, decision logic and integration mechanisms. The results indicate that competitiveness in M2M environments depends on data quality, system reliability, interoperability and autonomy of operation. The practical significance lies in forming a theoretical foundation for automated marketing strategies that support effective integration, coordination and decision efficiency within autonomous technological ecosystems.

Keywords: *marketing, machine-to-machine, machine customers, marketing automation, communication, ecosystems, IoT, data protocols.*

Зозульов О. В., Парфьонов О. С.
Національний технічний університет України
«Київський політехнічний інститут імені Ігоря Сікорського»

РИНОК МІЖМАШИННОЇ ВЗАЄМОДІЇ: СТАН, ТЕНДЕНЦІЇ ТА ОСНОВИ ДЛЯ АВТОМАТИЗАЦІЇ МАРКЕТИНГУ

У статті досліджуються сучасний стан, ключові тенденції та специфіка функціонування ринку міжмашинної взаємодії, у межах якого автономні технічні системи виступають повноцінними економічними агентами та здійснюють взаємодію на основі формалізованих правил, протоколів і стандартизованих інтерфейсів. Метою дослідження є визначення особливостей маркетингової взаємодії в M2M-екосистемах, характеристик машинної поведінки та обґрунтування концептуальних основ для автоматизації маркетингу на цьому ринку. Предметом дослідження виступають маркетингові стратегії, технічні механізми інтеграції, типи машинних клієнтів, моделі комунікації між пристроями, платформами і хмарними сервісами, а також підходи до забезпечення сумісності в багатокомпонентних цифрових середовищах. Методологічна основа включає систематизацію підходів до аналізу машинної взаємодії, розгляд принципів функціонування автономних пристроїв, вивчення моделей інтеграції, а також оцінювання механізмів алгоритмічного прийняття рішень у цифрових середовищах. Застосовано методи порівняльного аналізу, структурно-функціонального підходу та узагальнення технічних рішень, що забезпечують узгодженість, надійність і автономність роботи M2M-систем. Показано, що M2M-ринок формує нову архітектуру економічних відносин, у межах якої конкурентоспроможність визначають якість і доступність даних, швидкість обміну, надійність інтеграцій, відповідність протоколам та здатність систем працювати автономно. Обґрунтовано необхідність переходу до автоматизованих маркетингових систем, орієнтованих на API-доступність, структурованість даних, машинну індексацію, надійність алгоритмів та метрики продуктивності, придатні для використання у взаємодії з машинними клієнтами. Практичне значення полягає у формуванні концептуальної основи для впровадження автоматизованих маркетингових стратегій на M2M-ринку, що забезпечують підвищення сумісності, прозорості машинної взаємодії та ефективності автономних комерційних процесів.

Ключові слова: *маркетинг, міжмашинна взаємодія, машинні клієнти, автоматизація маркетингу, комунікація, екосистеми, інтернет речей (IoT), протоколи даних.*

Problem statement. The rapid digital transformation of modern economies has led to the emergence of the machine-to-machine (M2M) market. In this market, autonomous technical systems initiate, process, and complete interactions without direct human involvement. This transformation fundamentally changes the structure of economic relations, redefining how market agents interact, create value, and make decisions. M2M interaction constitutes a novel economic phenomenon unparalleled since the formation of traditional trade relations. The global M2M market is experiencing rapid growth driven by the widespread adoption of IoT technologies, the development

of 5G networks, and the growing need for automation in business. According to analysts' estimates, the number of connected IoT devices have reached 16.6 billion in 2023 and 18.6 billion in 2024, with a forecast of about 39 billion by 2030 [1]. The cumulative annual growth rate of the market is about 12–15 per cent, which indicates the dynamic development of the sector. According to estimates by GSMA Intelligence, global revenues from the Internet of Things (IoT) market, including M2M services, may reach $2 trillion by 2030 [2]. According to McKinsey analysts (Fig. 1), the economic potential of this market may reach $5.5–12.6 trillion per year by 2030 (including value for consumers and clients), spanning domains from automated supply chains to algorithmic trading of financial instruments [3].

Machine customers are expected to influence many trillions of US dollars in purchases, and, according to Gartner's forecasts, by 2030 they will account for an average of 15% to 20% of companies' revenues (Fig. 2). Major sectors fuelling this growth currently are smart manufacturing, healthcare, smart grids, logistics, and intelligent transportation systems [4].

The emergence of autonomous systems and networked devices has now led to a new stage of economic relations – machine-to-machine interaction, where machines can independently initiate, negotiate and execute economic actions. These shifts demonstrate that traditional approaches to market interaction are inadequate for explaining how value is created and exchanged in M2M environments. As machine agents take on an increasingly active economic role, it becomes essential to understand the logic of their interactions. The key problem is the lack of a conceptual framework that describes market behaviour in environments dominated by autonomous decision-making. Understanding the logic of machine interactions is therefore essential for determining how marketing should function when the counterpart is a machine rather than a human. This challenge carries both scientific and practical implications, as growing machine participation demands new models that allow firms to remain competitive in automated markets.

Recognising machines as economic actors creates opportunities for the development of marketing automation strategies aligned with machine decision logic. By
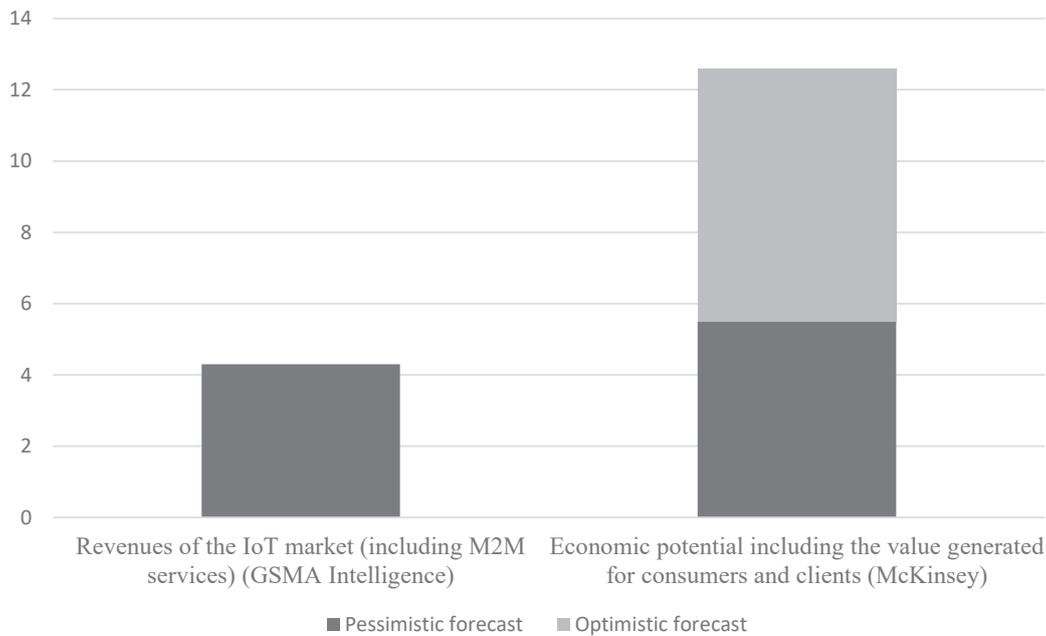

Figure 1. Projected financial indicators of the IoT+M2M market in 2030, trillion USD (McKinsey)
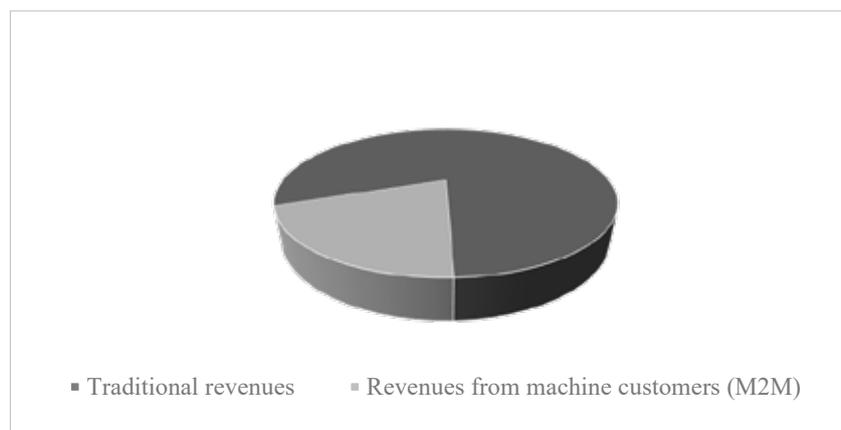

Figure 2. Share of machine customers in company revenues by 2030, % (Gartner)

analysing how devices evaluate options and execute actions, companies can design systems that ensure interoperability, optimise machine-targeted value propositions and coordinate processes in real time. Clarifying the nature of M2M economic relations thus provides the foundation for advancing the next generation of marketing automation technologies.

Analysis of recent research and publications. The contemporary body of research on Machine-to-Machine (M2M) communication demonstrates substantial progress in understanding the technological and market foundations of autonomous machines interaction. The focal point of both early and recent scholarship is technical studies, with a primary focus on communication protocols, system architectures, and interoperability challenges. A systematic examination of these prerequisites is presented in "A Comprehensive Review of M2M Communication Protocols" [5], which characterizes autonomous device-to-device communication as the backbone of the Internet of Things and highlights issues such as scalability, latency, and security that condition the functioning of any M2M ecosystem. A comparable degree of technical depth is evident in the master's thesis of Voloh Maxim [6], which analyses M2M communication layers, data endpoints, automotive telematics, and the structure of embedded networks, demonstrating how continuous data exchange enables autonomous diagnostics, service scheduling, and cross-platform coordination. Collectively, these studies establish the technological environment within which M2M economic interactions unfold. However, these works neglect to consider the economic foundations of M2M market behaviour and fail to analyse how marketing or marketing automation should operate when the primary decision-makers are machines rather than humans. Market-oriented reports extend this technological foundation into broader analyses of adoption, industrial growth, and the commercialisation of M2M connectivity. The long-term scaling of M2M infrastructure is documented in the report "Machine-to-machine (M2M) Connections Market Size, Share, Trends and Growth Drivers" [7] and "Global Managed Machine-to-Machine (M2M) Services Market – Global Market Size, Share, and Trends Analysis" [8], which emphasize the rapid expansion of smart-city deployments, connected vehicles, and healthcare telemetry, along with the growing dominance of Asia-Pacific manufacturers and operators. Historical investment patterns in the conference paper "Who is investing in machine-to-machine communications" [9] show how telecom operators and industrial producers formed the initial backbone of the M2M industry. Sector-specific studies show how M2M technologies materialize in practical economic settings. Reports including "Smart Hospitality Market Report 2025" [10] demonstrate the increasing integration of M2M automation into hospitality environments, industrial asset management, and connected energy systems. The paper "M2M Potentials in logistics and transportation industry" illustrates the operational efficiencies obtained through telematics, automated fleet management, and predictive maintenance [11], while report by DiXi Group demonstrates how smart-meter infrastructures autonomously collect and transmit data, enabling differentiated tariffs and automated consumption decisions [12].

A smaller but particularly relevant subset of the literature addresses M2M business models, data-exchange dynamics, and the rise of autonomous machine customers. In the publication entitled "On Designing Market Model and Pricing Mechanisms for IoT Data Exchange", the focus is shifted towards the monetisation of machine-generated data and the pricing structures necessary for IoT data marketplaces [13]. A complementary perspective is presented in the article "Machine economies", which shifts from the monetisation of data towards the broader question of how autonomous machine agents can operate within economically efficient systems. Machine economies are examined there through the lens of Pareto efficiency, where efficient outcomes depend on clear property rights, rational agents, perfect information, and low transaction costs. The authors identify four configurations of machine economies – machine-to-human and machine-to-machine interactions under either human or machine governance – showing that real systems rarely achieve Coasean efficiency due to information and coordination limits [14]. The advent of machine customers is discussed in the book "When Machines Become Customers" [15] and is posited as a significant development in the field. The book positions machines as autonomous economic actors and describes the shift as "a business growth megatrend… more significant than the arrival of digital commerce". It is asserted that firms are increasingly creating AI-powered agents that purchase independently. These publications demonstrate the growing academic and industry interest in autonomous purchasing behaviour and algorithmic decision-making.

Although scholars and market analysts describe M2M technologies, map communication architectures, project market growth, explore data-exchange pricing, and increasingly acknowledge machine customers as autonomous economic agents, they do not provide a comprehensive conceptualization of the M2M market as the structure of relations formed between autonomous systems nor do they address how marketing automation should be conceptualised and adapted to M2M environments.

Formulating the purposes of the article. The purpose of this article is to analyse the economic environment formed by machine-to-machine interaction and to determine how marketing should be adapted to markets in which autonomous systems act as primary decision-makers. The study seeks to clarify the behavioural logic of machine agents, the architecture of their interactions, and the parameters that shape decision-making in M2M environments. On this basis, the article aims to establish conceptual foundations for marketing automation and to propose a framework that supports the design of effective automated marketing strategies and ensures interoperability with machine customers in evolving digital ecosystems.

To achieve this purpose, the following research tasks must be completed:

– To analyse the current state of M2M market development and describe the existing forms of autonomous interaction in B2C and B2B segments.

– To identify the fundamental differences between marketing in the M2M market and traditional human-centred marketing approaches.

– To systematise the key parameters of machine decision-making and determine their implications for the design and functioning of marketing automation mechanisms.

– To develop a conceptual model that formalises the logic, structure and operational principles of marketing automation in M2M environments.

– To classify the possible marketing strategies applicable to the M2M market.

Presentation of the main research material. As a rapidly expanding segment of the digital economy, the M2M market is gaining practical significance across telecommunications, logistics, industrial automation and consumer services. The growth of wireless cellular connectivity – particularly LTE, 5G and specialised IoT networks has become a central driver of both current and anticipated expansion in global M2M deployments. Consequently, global cellular IoT/M2M connections surpassed 4 billion in 2024, with China contributing the largest share of this increase and recording a +56% rise in connected devices during the first half of 2024 [16]. In the United States, the number of total wireless connections reached 558 million at the end of 2023. This figure reflects a combined pool of smartphones, wearables and IoT/M2M devices. Separate publicly available statistics for the US M2M segment are not reported, although the upward trajectory of "non-human" connections is evident. According to official regulators, EU markets demonstrate both substantial volumes of M2M-eSIM connectivity and consistently high growth rates in the period of 2023–2025. Germany reported 73.7 million connected M2M devices at the end of 2024 (+17% year-on-year) [17]. In France, the number of M2M SIM cards reached 23.7 million at the end of 2024 [18]. In Spain, the number of M2M connections rose to 13.44 million in December 2024 (+17.7% year-on-year) [19]. The highest global indicator of "M2M SIM cards per 100 inhabitants" in 2023 was observed in Sweden (253), followed by Austria (209) and China (163) [20].

In an M2M ecosystem, the function of procurement managers is increasingly assumed by "smart" devices. These devices are able to identify needs, locate appropriate suppliers, negotiate terms within predefined rules, place orders and monitor their fulfilment. This process unfolds independently, without the need for manual intervention such as phone calls or emails. The present study examines several examples of such interaction already observable today.

Within the B2C sector, M2M interaction pertains to scenarios wherein consumer devices autonomously procure goods and services. This phenomenon is not limited to enhancing user convenience; it also introduces the potential for uninterrupted revenue streams. Smart refrigerators (for example, the Samsung Family Hub / Bespoke AI) are equipped with the capacity to detect missing items, compile a shopping basket and propose an order directly from the device interface or via a smart home system and a user's smartphone. This functionality serves to effectively eliminate the risk of an "empty refrigerator". The status of consumables is monitored by printers, coffee machines and water filtration systems, which initiate the replenishment process automatically through services such as Dash Replenishment. Connected vehicles equipped with telematics systems are capable of autonomously scheduling maintenance appointments, receiving over-the-air updates, and requesting insurance plans that are tailored to driving behaviour. From a marketing perspective, these developments reflect a shift towards greater convenience, continuity and subscription-based business models. They reduce customer churn, support stable monthly recurring revenue and enable transparent usage-based billing, where value can be demonstrated through performance indicators such as uptime, the success rate of automated deliveries and system responsiveness. Figure 3 presents a typology of machine consumers in the B2C market.

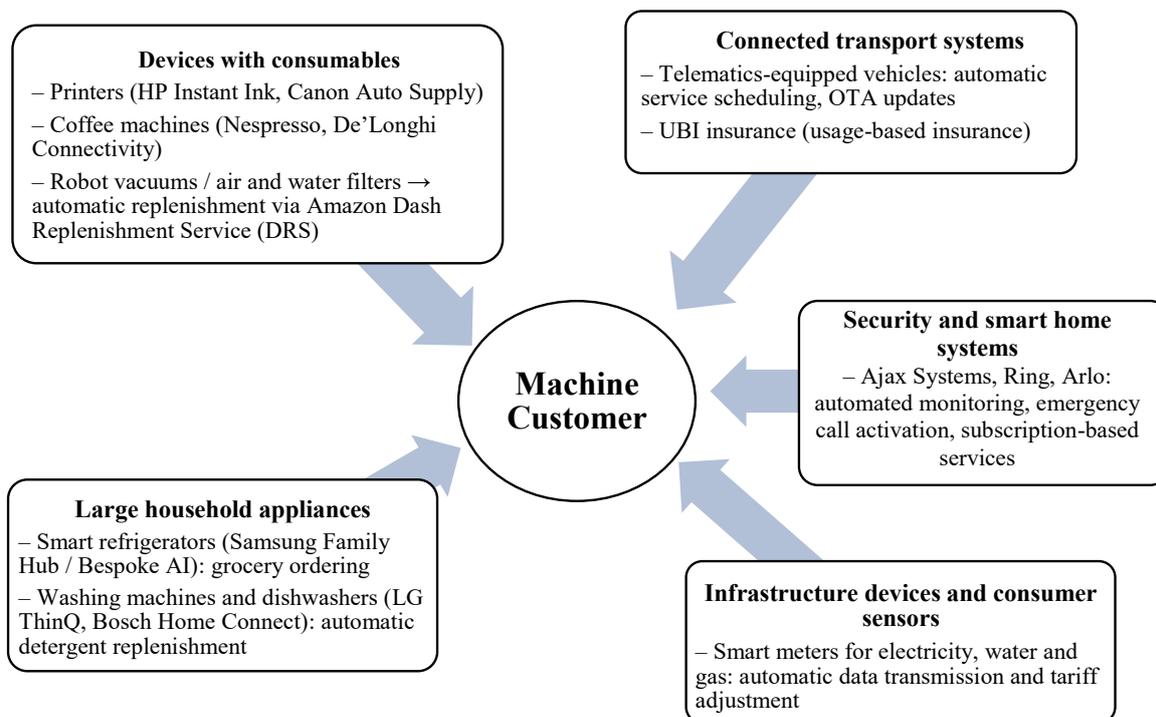**In the industrial B2B market,** M2M interaction is manifested through automated procurement and service

Devices with consumables
– Printers (HP Instant Ink, Canon Auto Supply)
– Coffee machines (Nespresso, De'Longhi Connectivity)
– Robot vacuums / air and water filters → automatic replenishment via Amazon Dash Replenishment Service (DRS)

Connected transport systems
– Telematics-equipped vehicles: automatic service scheduling, OTA updates
– UBI insurance (usage-based insurance)

Machine Customer

Security and smart home systems
– Ajax Systems, Ring, Arlo: automated monitoring, emergency call activation, subscription-based services

Large household appliances
– Smart refrigerators (Samsung Family Hub / Bespoke AI): grocery ordering
– Washing machines and dishwashers (LG ThinQ, Bosch Home Connect): automatic detergent replenishment

Infrastructure devices and consumer sensors
– Smart meters for electricity, water and gas: automatic data transmission and tariff adjustment

Figure 3. Typology of machine consumers in the B2C market

Source: authors' own work

ordering processes that ensure uninterrupted operations. Vending machines are capable of monitoring sales and inventory levels, autonomously generating replenishment orders and optimising restocking routes. Fleet vehicles equipped with telematics systems are programmed to schedule maintenance slots and request spare parts in advance of mechanical failures. POS terminals are programmed to execute software and security key updates on a nightly basis. This procedure is intended to mitigate the risk of payment system outages. Warehouses and production facilities are increasingly adopting vendor-managed inventory (VMI) models, wherein dedicated sensors trigger service and packaging replenishment algorithms. In 1P retail formats, such as Amazon Retail, a centralised system issues automated purchase orders to suppliers based on demand forecasts [21]. Consequently, orders are fulfilled in a timely manner and in full (OTIF), customers receive services that are in accordance with the defined service-level agreements (SLA), and cash flow remains stable and predictable. The implementation of automated procurement processes has been demonstrated to engender a reduction in operational expenditures (OPEX), while preventing occurrences of stockouts and thereby contributing to the augmentation of revenue. The performance of the system can be evaluated using specific indicators, including fill rate (the proportion of orders fulfilled completely), uptime, mean time to repair (MTTR), and the proportion of automated transactions among total operations. Figure 4 presents a typology of machine consumers in the B2B market.

Verified segments of the M2M market are already emerging in Ukraine, the most widespread of which is smart metering (electricity, gas and water), relying on communication solutions provided by mobile operators. According to Dixi Group, referencing the Energy Map of Ukraine [12], 3.29 million smart meters equipped with modems and M2M modules were installed in the country by the end of 2024. All three major Ukrainian mobile operators offer dedicated M2M/IoT solutions and management tools for large SIM-card fleets and process automation.

In the security sector, the Ukrainian manufacturer Ajax Systems extensively employs M2M mechanisms: the Hub and Hub 2 control panels aggregate sensor telemetry, transmit events via GSM/Ethernet and execute automated actions, including the activation of emergency response services, without human intervention. Another domestic producer, AE Charge Point, has deployed a peer-to-peer EV charging network, where each station has its individual owner, while the software platform enables integration into a unified billing environment with cloud-managed charging sessions. Publicly reported indicators include 3 million charging sessions and 30 GWh of transmitted energy as of 2025.

Ukrainian agricultural enterprises widely utilise M2M technologies, which underpin precision farming in large agribusiness groups (Kernel, MHP, and others). In the logistics sector, industry practices have shifted from simple vehicle tracking to systemic M2M interaction: Vodafone launched a specialised NB-IoT network and M2M-SIM
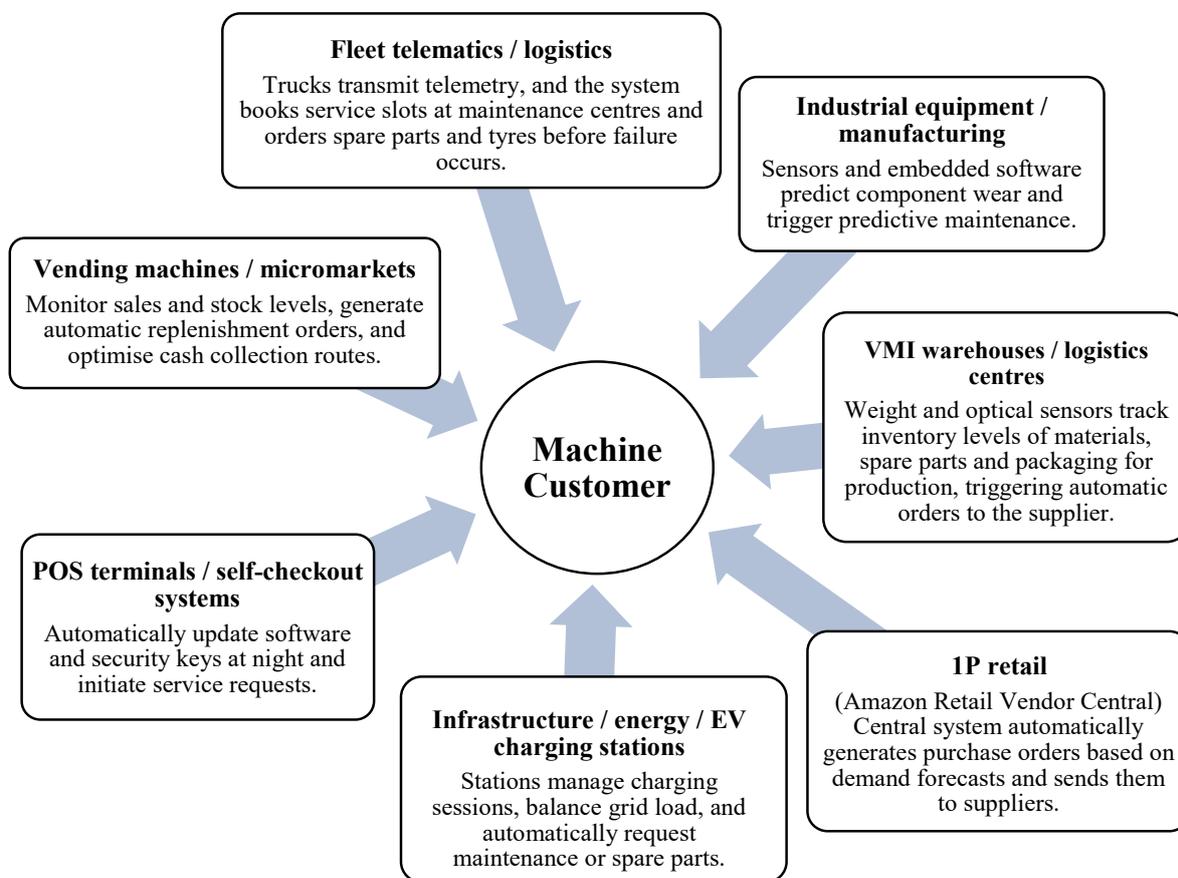

Figure 4. Typology of machine consumers in the B2B market

Source: authors' own work

management platform, enabling fleet telematics, cold-chain monitoring and even municipal transport infrastructure to operate through automated triggers without human involvement. Companies such as M2M.UA have emerged, offering integrated M2M services from SIM connectivity to data analytics and remote device management. The emergence of machine customers and AI-driven agents in Ukraine, as in global markets, should be viewed as a predictable outcome of technological maturation rather than a speculative trend.

These trends indicate the formation of a **new economic phenomenon.** M2M interaction represents not merely an automation or the technical expansion of the Internet of Things, but a distinct type of market organisation in which the speed and precision of decisions exceed human capabilities and machines act as autonomous economic agents. Reliability, interoperability and error-free data exchange become the primary determinants of market performance. Such conditions require a fundamental reconsideration of marketing approaches: traditional tools like emotional appeals, branding and storytelling lose relevance, giving way to technical excellence, data quality and integration simplicity. Marketers must adopt an engineering-oriented perspective, understanding product architecture, system interoperability and security requirements. Data become not only an instrument of marketing but also a core product and unit of exchange, with competitiveness determined by their quality, timeliness and structure.

The M2M market therefore constitutes a novel economic domain whose "consumer" behaviour remains insufficiently understood and requires conceptualisation, including the identification of marketing strategies that will differ significantly from those of classical and even contemporary digital marketing (Figure 5).
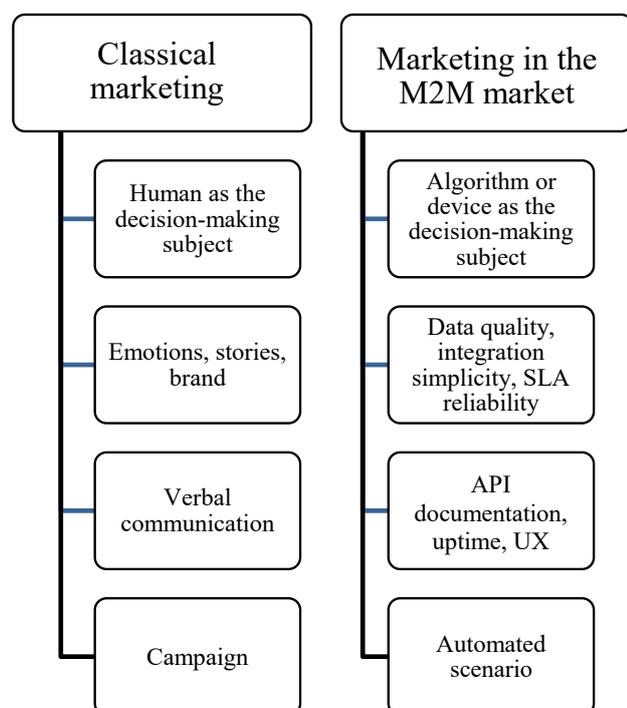

**Figure 5. Fundamental differences
in marketing within the M2M market**

Source: authors' own work

Marketing in M2M environments is directly tied to **marketing automation,** because decision-making is performed by machine agents that rely on technical criteria rather than human perception. Devices select suppliers and execute transactions autonomously, which requires marketing systems to communicate value through machine-readable signals rather than narrative or brand messaging. Machine decisions are primarily driven by data. Devices operate only when data are accurate, timely and structured. For marketing automation, this means offerings must be represented as validated data objects with clear metadata and schema definitions. Data quality therefore becomes a core determinant of competitiveness in M2M markets.

Protocol and API compatibility serve as another essential parameter. Machine agents interact only within supported communication frameworks, and incompatibility prevents any form of exchange. As a result, API accessibility, documentation and version stability become central marketing functions. Integration simplicity acts as a practical equivalent of market visibility for machine customers. Operational performance metrics like latency, uptime, error rate, throughput and Mean Time to Repair (MTTR) form objective decision criteria. Marketing automation systems must emphasise performance guarantees and provide real-time reporting, as machines select partners based on quantifiable reliability rather than brand attributes. Security and trust frameworks define whether interactions occur at all. Authentication, certificate validity and encrypted communication determine access. Marketing automation must therefore include automated identity verification and machine-readable compliance signals.

Algorithmic decision logic also shapes behaviour. Rule-based, predictive and adaptive systems require different types of inputs and triggers. Marketing automation must align with the algorithmic model of the machine customer. Finally, decisions depend on ecosystem integration and solutions that do not integrate smoothly are excluded. Marketing automation must minimise integration friction and support standardised schemas. The key parameters of machine decision-making and their corresponding implications for marketing automation are summarised in Table 1.

Effective marketing automation in M2M environments depends on understanding how machine-generated signals are routed, interpreted and translated into economic actions within a layered technical architecture. Figure 6 presents the **conceptual model** that represents this process, linking machine customers with automated marketing mechanisms.

Machine agents including end devices, gateways or edge hubs, and cloud platforms generate telemetry and service requests that enter the system through an **interface layer** defined by APIs, communication protocols and security mechanisms. Within **the core marketing automation layer,** inputs are converted into machine-readable offers and SLA parameters, assessed through algorithmic decision rules and performance thresholds, and used to trigger automated commercial actions such as replenishment orders, service provisioning or pricing adjustments. This layer operationalises the interaction between technical signals and economic behaviour.

An analytics layer monitors uptime, latency, error rates, MTTR, fill rate and the share of automated transactions, feeding this information back into the

Table 1

Key parameters of machine logic and implications for marketing automation

Parameter	Machine Logic	Implications for Marketing Automation
Data quality and structure	Machines require accurate, timely, complete and structured data to evaluate options.	Offerings must be expressed as machine-readable attributes. Strict data validation and metadata standards required.
Protocol and API compatibility	Interaction occurs only through supported protocols and APIs.	API design, documentation and version control become core marketing functions. Integration simplicity differentiates suppliers.
Performance metrics	Decisions are based on latency, uptime, error rate, mean time to repair (MTTR) and throughput.	Marketing value propositions must emphasise performance guarantees and real-time reporting.
Security and trust	Authentication, encryption and certificate validity determine whether interaction occurs.	Automated systems must include identity verification, token management and security compliance indicators.
Ecosystem integration	Machines operate within distributed technical networks.	Marketing automation must support seamless integration across cloud, edge and hybrid infrastructures.
Algorithmic decision model	Decisions follow rule-based, predictive or adaptive AI logic.	Marketing systems must align triggers, data inputs and feedback loops with the customer's algorithmic architecture.

Source: compiled by the authors

decision logic to improve system performance over time. Figure 6 formalises the logic, structure and operational principles of marketing automation in M2M environments, showing how machine decision-making parameters like data quality, interoperability, performance, security and algorithmic behaviour shape the architecture and functioning of automated marketing systems.

These developments reshape market architecture and create a clear need for distinguishing marketing approaches

suited to M2M environments. Systematic classification clarifies how strategies differ in objectives, mechanisms and metrics, and how they support interaction across varying levels of machine autonomy. The principal types of marketing strategies applicable to the M2M market are summarised in Table 2.

Conclusions. The current state and observed trends of the Machine-to-Machine market like rapid growth in connected devices, increasing autonomy of machine
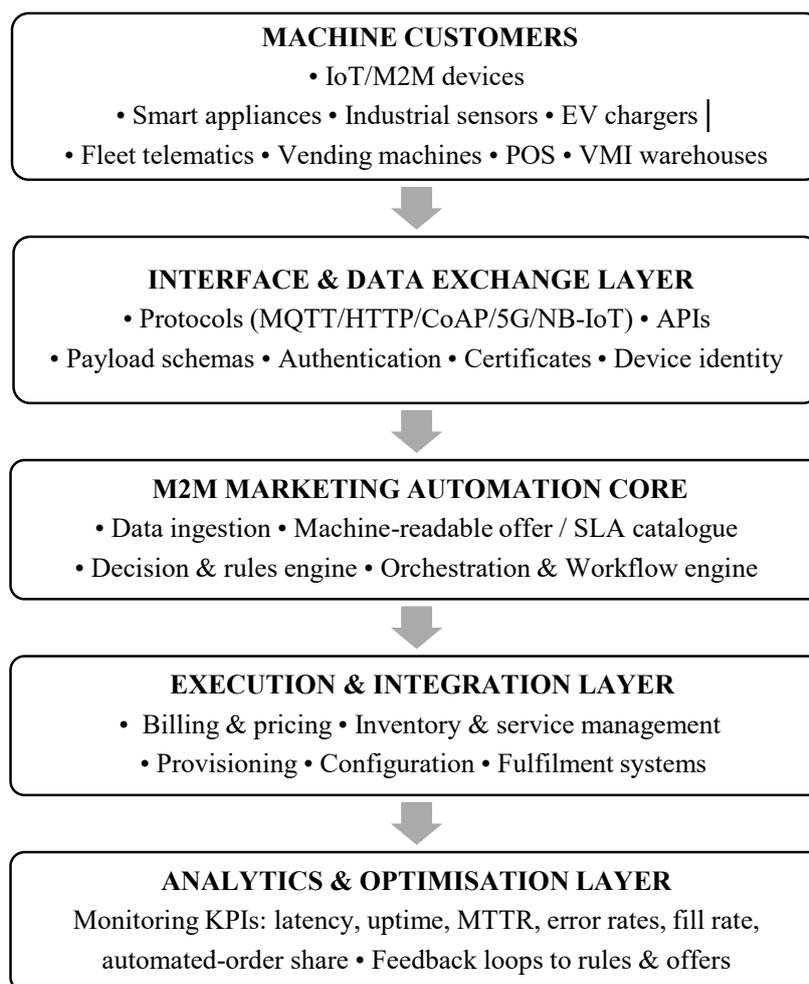
MACHINE CUSTOMERS
• IoT/M2M devices
• Smart appliances • Industrial sensors • EV chargers |
• Fleet telematics • Vending machines • POS • VMI warehouses

INTERFACE & DATA EXCHANGE LAYER
• Protocols (MQTT/HTTP/CoAP/5G/NB-IoT) • APIs
• Payload schemas • Authentication • Certificates • Device identity

M2M MARKETING AUTOMATION CORE
• Data ingestion • Machine-readable offer / SLA catalogue
• Decision & rules engine • Orchestration & Workflow engine

EXECUTION & INTEGRATION LAYER
• Billing & pricing • Inventory & service management
• Provisioning • Configuration • Fulfilment systems

ANALYTICS & OPTIMISATION LAYER
Monitoring KPIs: latency, uptime, MTTR, error rates, fill rate, automated-order share • Feedback loops to rules & offers

Figure 6. Conceptual Model of Marketing Automation in M2M Environments

Source: authors' own work

Table 2

Classification of marketing strategies in the M2M market

Strategy Type	Description	Tools	Key Metrics	Examples
API Marketing	Promotion through technical documentation quality, integration simplicity, and developer experience.	– Interactive documentation – SDKs and libraries – Sandbox environments – Developer portals	– Number of API calls – Time to first call – Adoption rate – API uptime	Telnyx, Soracom – promoted through integration convenience
Data Marketing	Competition based on data quality, freshness, and completeness for algorithmic consumption.	– Metadata optimisation – Standardised data schemas – Real–time data streams – Data quality toolkit	– Data freshness – Completeness index – Accuracy index – Response time	Bloomberg Terminal, IoT meteorological data services
Protocol Marketing	Promotion through standardisation, compatibility, and broad protocol support.	– Participation in standardisation bodies – Certification programs – Compatibility testing	– Protocol adoption – Ecosystem partners – Device compatibility – Standard compliance	MQTT, Zigbee, Thread
Algorithmic SEO	Optimisation for machine search via structured data and schema markup.	– Schema.org markup – JSON–LD structuring – API discoverability tools – Machine–readable specs	– Crawlability score – Structured data coverage – API rating – Discovery rate	Google Shopping Feed, Product APIs
Predictive Marketing	Forecasting needs based on behavioural patterns and proactive service proposals.	– Machine learning models – Predictive analytics – Behavioural triggers – Automated outreach	– Forecast accuracy – Proactive conversion rate – Lead time reduction – Churn prediction	AWS Predictive Maintenance, SAP Predictive Analytics
Integration Marketing	Building ecosystems and partnerships enabling seamless integration.	– Partner programs – Integration marketplaces – Pre–built connectors	– Ecosystem growth – Integration time – Cross-sell rate – Ecosystem value	Salesforce AppExchange, Zapier
Performance-based Marketing	Outcome-based pricing and SLA-driven commercial relationships.	– SLA guarantees – Performance dashboards – Automated compensation models	– SLA compliance – Uptime % – Performance score – Cost per outcome	AWS SLA, Cloudflare performance guarantees
Blockchain Marketing	Transparency, immutability and automated execution via smart contracts.	– Smart contracts – Tokenisation – Decentralised reputation – Transparent audits	– Transaction volume – Smart contract execution – Token velocity – Network effects	IOTA for M2M payments, supply-chain tracking
Edge Marketing	Promotion through local processing, low latency, and autonomous operation.	– Edge computing capabilities – Offline functionality – Local decision logic – Bandwidth optimisation	– Latency reduction – Offline operation capability – Edge adoption rate – Data locality	AWS Greengrass, Azure IoT Edge
Security-driven Marketing	Competition based on security, trust and compliance guarantees.	– Security certificates – Penetration testing – Compliance documentation – Zero-trust architecture	– Security incidents – Certification coverage – Compliance score – Trust index	Cisco IoT Security, Palo Alto Networks

Source: compiled by the authors

agents and the expansion of protocol-based ecosystems show that effective interaction now depends on technically coordinated strategies rather than traditional marketing tools. The study demonstrates that API-, protocol- and integration-focused approaches work best when applied together, with security serving as an essential foundation. Developer experience: easy onboarding, clear examples and predictable updates strongly affects how quickly machine customers integrate and begin operating within M2M systems. These findings confirm that marketing in the M2M market is becoming inseparable from technical design and automated decision processes. Future research should analyse how rising machine autonomy will reshape B2B procurement, how AI-driven marketing agents may interact with algorithmic buyers and how decentralised M2M marketplaces may emerge. Such work will help build marketing automation systems that better correspond to the logic, performance needs and interoperability requirements of autonomous machine agents.

References:

1. Satyajit Sinha Number of connected IoT devices growing 14% to 21.1 billion globally in 2025. 28.10.2025. Available at: https://iot-analytics.com/number-connected-iot-devices/

2. Rohit Gurung, Matthew Iji. IoT revenue forecast to 2030: charting growth by region, vertical and product. (2025). GSMA Intelligence, 2025. Available at: https://www.gsmaintelligence.com/research/iot-revenue-forecast-to-2030-charting-growth-by-region-vertical-and-product

3. Chui M., Collins M., Patel M. The Internet of Things: Catching up to an accelerating opportunity. Mckinsey. 2021. Available at: https://www.mckinsey.com/capabilities/tech-and-ai/our-insights/iot-value-set-to-accelerate-through-2030-where-and-how-to-capture-it#/

4. Don Scheibenreif, Mark Raskino. Machine Customers Will Decide Who Gets Their Trillion-Dollar Business. Is It You? Gartner Inc. 06.01.2022. Available at: https://www.gartner.com/en/articles/machine-customers-will-decide-who-gets-their-trillion-dollar-business-is-it-you

5. Hafizur Rahman, M. Naderuzzaman. A Comprehensive Review of M2M Communication Protocols. *Open Access Journal on Engineering Applications*. 30.07.2025. Available at: https://journals.indexcopernicus.com/api/file/viewByFileId/2451943

6. Volokh Maksym. Use of Machine-to-Machine Communication Technology to Extend the Service Life of Smart Vehicles: Master's Thesis. National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", 2024. 118 p. Available at: https://ela.kpi.ua/server/api/core/bitstreams/537c859f-b1de-40bb-9ad1-94850aa1adf6/content

7. Machine-to-machine (M2M) Connections Market Size, Share, Trends and Growth Drivers 2033. MarketsandMarkets, 2024. Available at: https://www.marketsandmarkets.com/Market-Reports/machine-to-machine-market-732.html (accessed 20.11.2025)

8. Global Managed Machine-to-Machine (M2M) Services Market Size, Share, and Trends Analysis. Data Bridge Market Research, 2024. Available at: https://www.databridgemarketresearch.com/reports/global-managed-machine-to-machine-m2m-services-market (accessed 20.11.2025)

9. Laya A., Bratu V., Markendahl J. Who is investing in machine-to-machine communications. Available at: https://www.econstor.eu/bitstream/10419/88475/1/774034017.pdf

10. Raksha Sharma. Smart Hospitality Market Report 2025 – Analysis, Share 2034. 2025. Available at: https://www.thebusinessresearchcompany.com/report/smart-hospitality-global-market-report (accessed 09.11.2025).

11. Mehmood Y., Marwat S. N. K., Kuladinithi K. et al., M2M Potentials in logistics and transportation industry. *Logistics Research*. Issue 9, no 1, p. 15. DOI: https://doi.org/10.1007/s12159-016-0142-y

12. One in five Ukrainians saved on night electricity tariffs in 2024. Dixigroup. Available at: https://dixigroup.org/en/one-in-five-ukrainians-saved-on-night-electricity-tariffs-in-2024

13. Zheng Z., Mao W., Xing Y. et al. On Designing Market Model and Pricing Mechanisms for IoT Data Exchange. *IEEE Transactions on Mobile Computing*. Vol. 23, Issue 11. P. 10202–10218. DOI: https://doi.org/10.1109/TMC.2024.3373811

14. Hartwich E., Rieger A., Sedlmeir J. et al. Machine economies. *Electronic Markets*. Issue 33, no 1, p. 36. DOI: https://doi.org/10.1007/s12525-023-00649-0

15. Mark Raskino, Don Scheibenreif. When Machines Become Customers: Ready or not, AI enabled non-human customers are coming to your business. How you adapt will make or break your future. Gartner Inc., 2025. 268 p. Also available online. Available at: https://www.amazon.com/dp/B0FND72TMB#

16. Satyajit Sinha. Global cellular IoT connections surpassed 4 billion in 2024, driven by 5G and LTE Cat 1 bis. (26.11.2024). IoT Analytics, 2024. Available at: https://iot-analytics.com/global-cellular-iot-connections

17. Jahresbericht Telekommunikation 2024. (2024). Bundesnetzagentur, 2024. Available at: https://data.bundesnetzagentur.de/Bundesnetzagentur/SharedDocs/Mediathek/Jahresberichte/JB2024TK.pdf

18. Services mobiles – 4e trimestre 2024: Observatoire des marchés des communications électroniques. (23.05.2025). ARCEP, 2025. Available at: https://www.arcep.fr/fileadmin/reprise/observatoire/obs-mobile/2024/t4-2024/obs-mobile-T4-2024_060225.pdf

19. Mobile telephony closed 2024 with 61.25 million lines. CNMC National Commission of Markets and Competition. 2024. Available at: https://www.cnmc.es/prensa/datos-diciembre-telecos-20250306 (accessed 01.12.2025).

20. Organisation for Economic Co-operation and Development (OECD). M2M (machine-to-machine) SIM cards per 100 inhabitants. (2023). Available at: https://goingdigital.oecd.org/en/indicator/12

21. Vendor Retail Procurement Orders API. (10.2025). Amazon, 2025. Available at: https://developer-docs.amazon.com/sp-api/docs/vendor-retail-procurement-orders-api