IoT Sensors-Powered New Product Development (Deep &Radical Marketing Shifts)

تطوير المنتجات الجديدة المدعمة بمستشعرات إنترنت الأشياء (تحولات تسويقية عميقة وجذرية)

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Abstract:

These research papers discuss a very important topic: the implications of cyber-physical systems on the marketing system in general, and the implications of Internet of Things (IoT) sensors for product and brand management in particular. This is considering the rapid computer developments and digital transformations that are proceeding at an unprecedented pace. The theoretical study concluded that IoT sensors, as a digital innovation, and in light of the tremendous progress of information and telecommunications technologies, satellites, the Internet, and fifth-generation networks, have tangible positive results in improving the outcomes of strategies and policies for goods and services, on the one hand, and in enhancing the outcomes of engineering, design, differentiation, packaging, warranty, positioning, after-sales services, and other decisions, and thus gaining a sustainable competitive advantage based on the needs, desires, and preferences of customers in real time and with unique and differentiated performance.-

Keywords: *New Product Development (NPD);Internet of ThingsSensors (IoT)*
Jel Classification Codes: *L20, M15, M31*

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Introduction:

The Internet of Things is a vast, intelligent network of physical objects that contain embedded communication technology. These objects are equipped with sensors and software that enable them to interact with the internal and external environment by collecting, storing, exchanging, communicating, sending, receiving, and sharing data with each other. The massive investment in the technology and electronics industries, based on creative and talented intellectual capital, over recent decades has led to many amazing discoveries and inventions. As a branch of artificial intelligence, the Internet of Things is one of the most prominent features of the modern computing, digital, and cyber era. It is a prominent feature of the Fourth Industrial Revolution and the current cloud environment. These devices and machines, with their programmed algorithms and connections between physical devices via the internet and remote control, have taken over numerous sectors and impacted a wide range of fields, including business, banking, marketing, trade, manufacturing, services, agriculture, aviation, healthcare, energy, infrastructure, sports, security, society, and philanthropy.

The IoT is about extending the power of the internet beyond computers and smartphones to encompass a whole range of other objects, processes, and environments. The IoT boasts the ability to transmit data across a global network without human-to-human or human-to-computer interaction. Any natural or artificial object can be assigned an Internet Protocol (IP) address and transmitted data across the network. The rapid growth of the IoT is fueled by the production of extremely cheap computer chips and the availability of wireless networks. It's possible to turn any object into part of the Internet of Things. Connecting all these different objects and adding sensors adds a level of digital intelligence to the devices, enabling them to communicate with data in real time without human intervention. IoT makes the world around us more efficient and responsive, merging the digital and physical worlds.

Amid digital transformation and change and modification processes, there are clear, effective, and tangible technological impacts, and numerous and significant repercussions on marketing decisions related to product and brand management. IoT and other technologies are the result and outcome of latent human needs that professional marketers seek to satisfy and fulfill. This is achieved by transferring information to engineers, technicians, designers, physicists, chemists, and others to innovate goods, products, and services that fill this gap and fill this void. Necessity, as they say, spawns' invention.

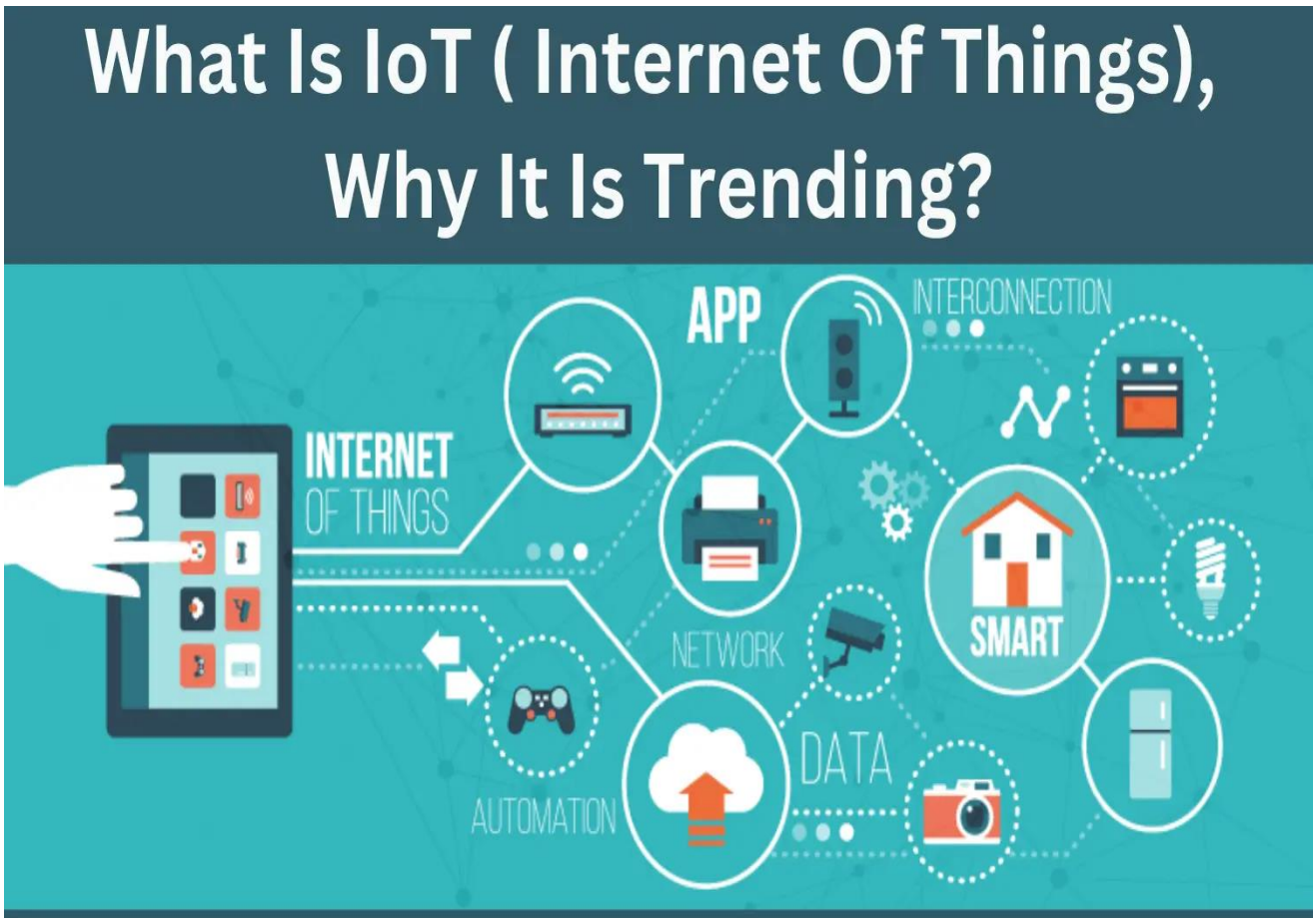
The world of business, marketing, and branding has become more complex and competitive due to the density, abundance, and proliferation of data, and the plethora of alternatives and choices available to consumers and purchasing groups, whether in digital or traditional marketing—more precisely, on the Internet or in the offline physical environment. However, the primary function of marketing, the marketer's assigned role, and the task assigned to him remains the provision of goods and services with superior capacity and exceptional performance in responding to the tastes and aspirations of current and potential consumers, that is, gaining a competitive advantage.

Product and brand management in organizational structures of business organizations ranging from large multinational corporations to small and medium enterprises have greatly benefited from the role of IoT after its use in marketing goods and services. IoT devices are very useful in sending, receiving, collecting, and sharing data from consumers and stakeholders in databases and data warehouses. This massive volume of data is stored and processed in the cloud, without the need for IT specialists. This greatly helps marketers with predictive analysis to understand overall market trends and formulate smart and automated marketing strategies to increase their revenue and boost their sales in the future.

I- Internet of Things Technology... Pros and Cons (Double-Edged Sword)

In 2004, the CEO of NetSilicon predicted that the next era of ICT would be dominated by IoT devices. Networked devices would eventually gain in popularity and importance, far outnumbering traditional computers and networked workstations. Indeed, there is a lot of buzz right now about IoT and its impact on everything from the way we travel and shop to the way manufacturers track their inventories.

Figure n°1:What is IoT (Internet of Things) & Why IoT is Trending?



Source: (Tiwari, M. 2024)

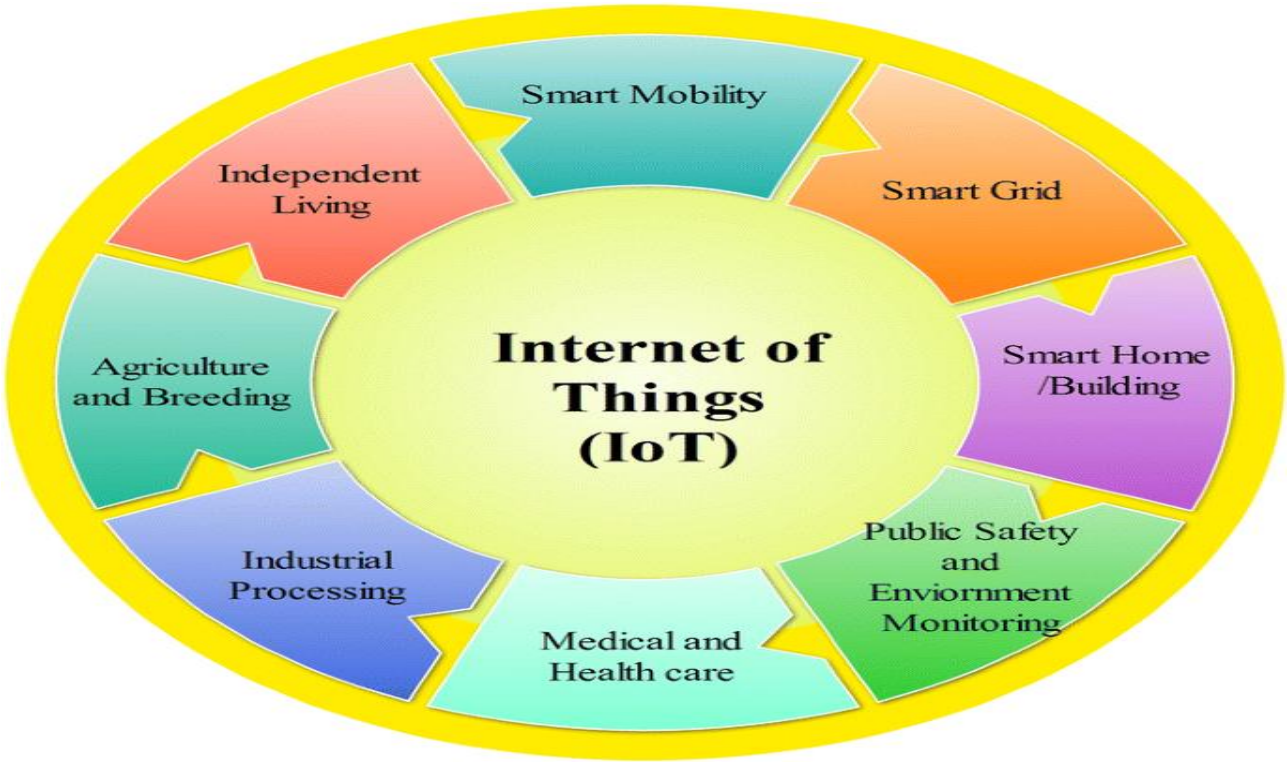
It is extremely difficult to find an accurate definition of the IoT, which is growing at a rapid and record pace in today's world and may reach unprecedented levels in the future. We currently imagine it to be a form of fantasy and illusion. In summary, the IoT system, which is a branch of AI and one of its applications and uses, is a set of digital technologies and systems for a group of interconnected and consistent objects. These objects may be machines, devices, and equipment made of inanimate material, or they may also be living beings such as people, animals, and plants equipped with tiny electronic chips. These objects are linked, connected, and communicate with each other by collecting, sending, receiving, transferring, exchanging, processing, storing, and analyzing data connected online via wired and wireless systems and networks such as Wi-Fi,

Bluetooth, and 5G. The data reaches servers in computer networks, which analyze, study, examine, and understand it, then direct instructions to these objects, which act accordingly. This means interacting with the global information network without the mediation of a keyboard and screen.

With this tremendous and astonishing development, and living in the shadow of this unlimited cyberspace, and living in this interactive environment and virtual environment that includes material and non-material elements, it has become possible for things (natural and physical) to act and decide intelligently and without human intervention or with minimal and limited intervention, although it is common for humans to have detailed programming to communicate with the thing by giving and directing orders, and the thing responds by implementing it. The opposite occurs under the umbrella of the IoT, as things themselves plan, accomplish, and make decisions in a programmed and engineered manner using advanced programming languages and algorithms, and through cloud computing services that connect things to each other. Of course, in this world, everything has a private Internet Protocol (IP) address.

In this context, and to clarify and illustrate the many uses, products, and tools of the IoT that have begun to invade people's daily lives, and their impact on all aspects: thermostats, smartphones, industrial machines, ATMs, insurance premiums, smart cities, gyms, infrastructure, traffic lights, lighting systems, irrigation and watering systems, surgical operations, medical devices, healthcare, logistics, shopping carts, home security, loudspeakers, farms, security surveillance cameras... etc.

Figure n°2:How Internet of Things Change our daily life? IoT applications



Source: (Khanna, A., & Kaur, S. 2020)

Here are more detailed real-world examples and applications:

- Smart digital watches, these monitor and measure vital signs such as blood pressure, heart rate, and temperature. For example, if the watch detects that a person is suffering from

anxiety and psychological stress through measuring the heart rate, as soon as the watch approaches the house, it sends signals to the TV to play the Holy Quran, another to the smart kitchen to prepare natural juice or a hot drink to calm the nerves and improve the mood, another to the bathroom to adjust the water heater temperature, another to the air conditioner in the bedroom, and so on.

- The same applies to smart cars in the IoT environment. If a mechanical or electrical failure occurs in the engine, its accessories, spare parts, sensors, wheels, oils, battery, or any other part of the car, the IoT automatically detects the source of the failure and directly contacts the factory or workshop to identify, inspect, and diagnose the problem. It then works to repair it either at the workshop or at the vehicle's location by contacting the car owner.
- Self-driving cars, their sophisticated sensors detect objects in their path. The self-driving car market will reach $196.97 billion by 2030.
- In the consumer market, IoT technology is synonymous with products related to the concept of smart home or home automation. All electrical appliances and home, office, and kitchen furnishings have been affected by IoT (refrigerators, cameras, screens, air conditioners, vacuum cleaners, washing machines, smart microwave ovens, etc.).
- Fitness devices that measure heart rate and the number of steps taken, then use this information to suggest workout plans tailored to the individual. There are even connected footballs that can track how far and how fast you throw them and record those stats via an app for future training purposes.

Among the gains, benefits, and opportunities in the world of IoT technology, which sometimes exceeds the scope of human capabilities, is its ability to make daily routines and complex, repetitive tasks easier in the world of automation, both inside and outside homes, factories, farms, logistics, transportation, government departments, the charitable sector, educational and healthcare services, and more. In other words, the IoT offers a wealth of benefits for applications ranging from everyday household uses to industrial monitoring and manufacturing, and even those specific to entire smart cities. It proactively helps in making better decisions by reducing costs, improving safety, increasing production efficiency and time management, enhancing customer experience, and generating new revenue streams.

As for the concerns, obsessions, and dangers in the world of IoT technology, the urgent question is what if something malfunctions or external interference occurs, such as an internet outage, power outage, or car collision. In addition, there are issues of reliability, credibility, privacy violations, and the disclosure of secrets, and therefore it could also be a security nightmare.

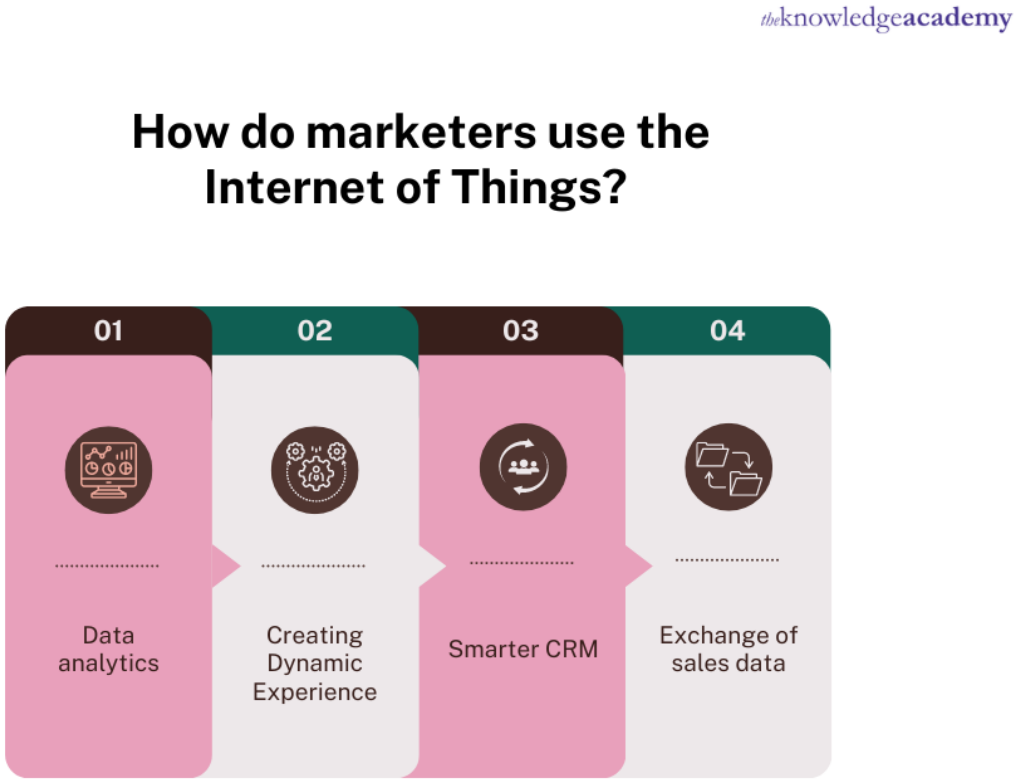
(For more details, see the following scientific article:Hassan, W. H. 2019; Hossein Motlagh, N., et al. 2020; Laghari, A. A., et al. 2021; Khanna, A., & Kaur, S. 2020; Gupta, B. B., &Quamara, M. 2020; Ait Mouha, R. A. R. 2021; Serpanos, D., & Wolf, M. 2018; Koohang, A., et al. 2022; Perwej, Y., et al. 2019; Zikria, Y. B., et al. 2021; Rath, K. C., et al. 2024; Morchid, A., et al. 2024; Singh, B., &Kaunert, C. 2024; Nassereddine, M., & Khang, A. 2024; Neoaz, N. 2025).

II- IoTSolutions-Enabled Marketing Industry (Reengineering & Restructuring)

Modern technology, including the Internet of Things, has invaded all functions within corporate organizational structures, helping them achieve more revenue and sales. Marketing is one of the areas where it has penetrated significantly, remarkably, and on a wide scale. All elements and components of the marketing mix, without exception, have been profoundly and dramatically

affected by the Internet of Things. The latter has become the seed of technological changes in various marketing methods, patterns, and visions. It meets and satisfies the needs of administrative (CMO), tactical (4Ps), strategic (STP), and electronic (E-CRM) marketing tools alike. Given the connection between physical devices to the Internet and sensor networks, the IoT provides the marketing industry with countless advantages and facilitations in performance and achievement, and it is constantly evolving over time.

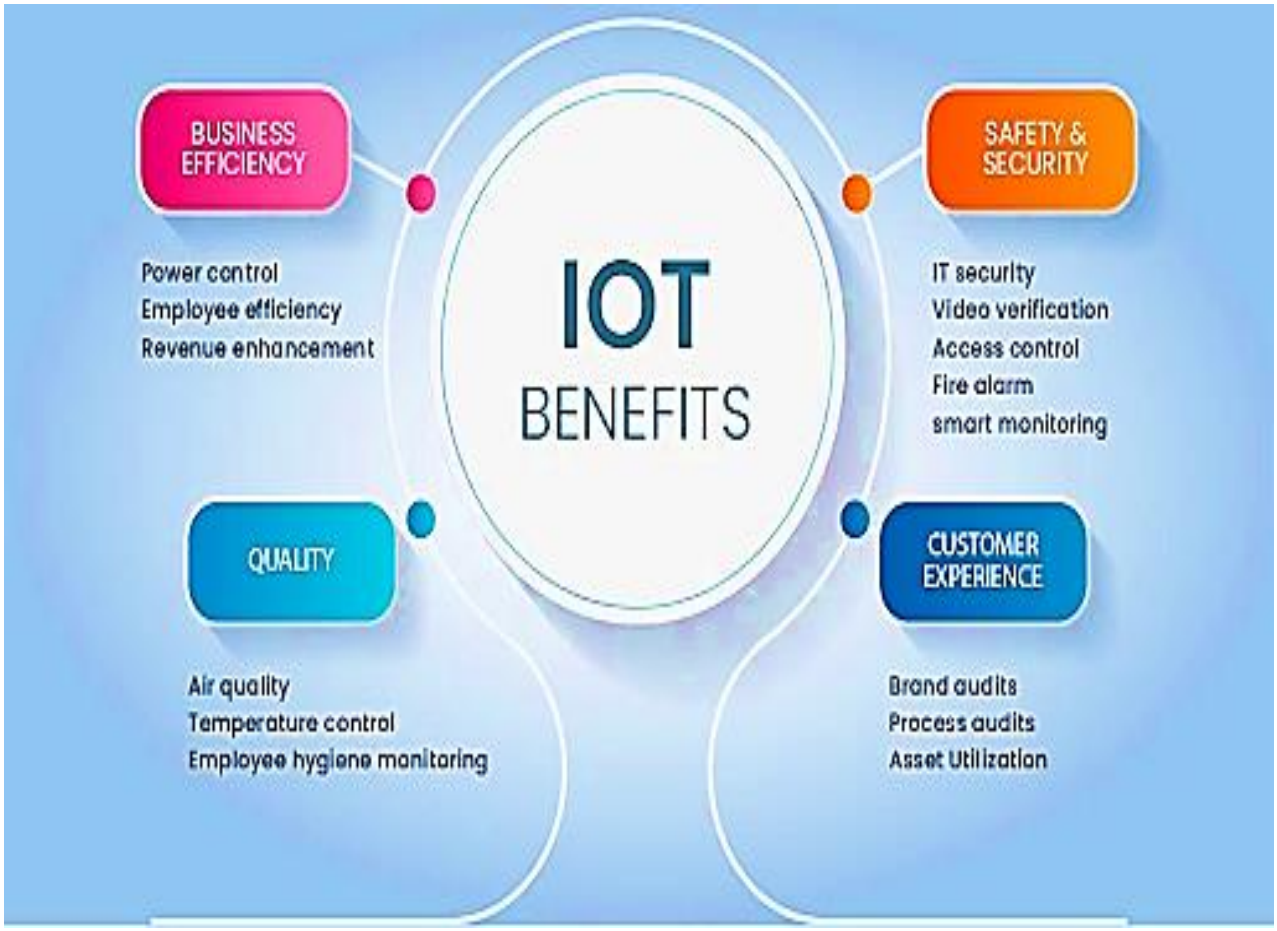
Figure n°3: How do marketers use the Internet of Things?



Source: (Smith, G. 2025)

Some of the most important advantages and gains that a professional marketing specialist benefits from, and which we can highlight, are the following: Marketing flexibility and feedback, given the rapid and effective response to customer problems and inquiries, as devices can instantly transmit data to the web; Positively impacting the customer experience, providing the greatest possible level of satisfaction and happiness, and enhancing brand recognition; Improving communication between marketers and customers through: online advertising, content marketing, product development, social media, and viral marketing.

Figure n°4: Pros and Cons of Implementing Internet of Things (IoT) in Marketing



Source: (Bhagat, V. 2021)

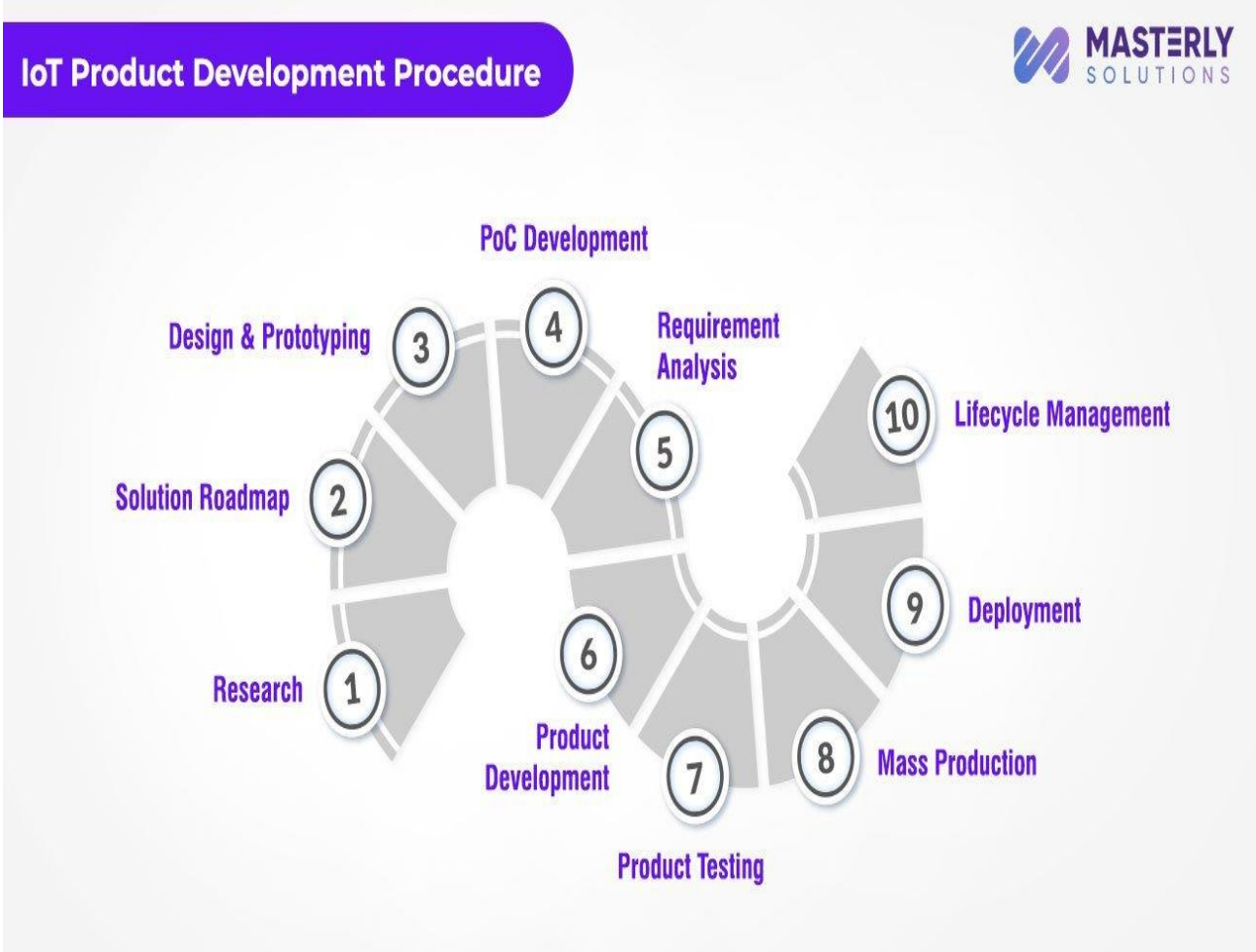
(For more details, see the following scientific article: Liu, Y., et al. 2023; Lo, F. Y., & Campos, N. 2018; Nguyen, B., & Simkin, L. 2017; Miskiewicz, R. 2020; Taylor, M., et al. 2020; Gong, W. 2016; Abashidze, I., & Dąbrowski, M. 2016; Aydınocak, E. U. 2021; Naim, A., et al. 2022)

III- IoT-Based Product & Brand Planning & Development Decisions

Before we delve into the heart of the matter, we must point out that the nature of the product is more than we can count, due to the diversity and abundance of outputs of economic sectors, such as: agriculture and farming (livestock, plant and fish wealth, palm farms and date production...), extractive industries known as traditional energy (oil and gas), mines and minerals, renewable energy (solar energy systems, wind, hydropower and electric batteries...), manufacturing industry (cars, electronics, food and beverages, home and office furniture, textiles, clothing and shoes...), and finally the services sector (hotels, tourism and travel, communications, transportation and

communications, law, real estate, gardens, traffic, restaurants and cafes, retail stores, banks and insurance, health and education...).

Figure n°5: IoT Product Development Procedure



Source: (Masterly Solutions Team. 2023)

The IoT plays a significant role and has had a tremendous impact on improving the quality of products and brands, the latter being an integral part of quality of life. Therefore, the IoT has helped sellers, made life more convenient for buyers, and given them a lot of free time. And who doesn't want some free time? Scientific and technical advances in the use of automation, machine-to-machine (M2M) learning, intelligent robotics, haptic interfaces, virtual reality systems, and other technologies are influencing integration, improving communication, self-monitoring, and analyzing and diagnosing problems without the need for human intervention. The importance of these technologies in quality is increasing, as they are more efficient than humans at performing repetitive functions and executing highly complex tasks. In this context, the marketing approaches most closely linked to product quality under the IoT are consumer behavior (CB), customer experience (CX), and customer relationship management (CRM).

The IoT will cast its shadow over the world of marketing, specifically scientific research and technical development in the Marketing Creativity and Innovation Department. This begins with the development of innovative and original ideas, then their translation into practical reality for commercial and industrial exploitation. This culminates in the launch of these advanced and innovative products in the targeted consumer markets, according to a carefully considered methodology developed by the Marketing Department. Sellers will be able to access comments, complaints, reports, and notifications, as well as whether buyers like the product or not. This will provide them with access to information related to how, where, and why products are purchased and used, etc. This way, they can make product adjustments or take immediate action when necessary. They can also conduct forecasts to customize products and services to better meet customer needs and expectations, making them more attractive and engaging. This will ensure targeted audiences are targeted accurately and without significant hassle by facilitating customer engagement and responding appropriately.

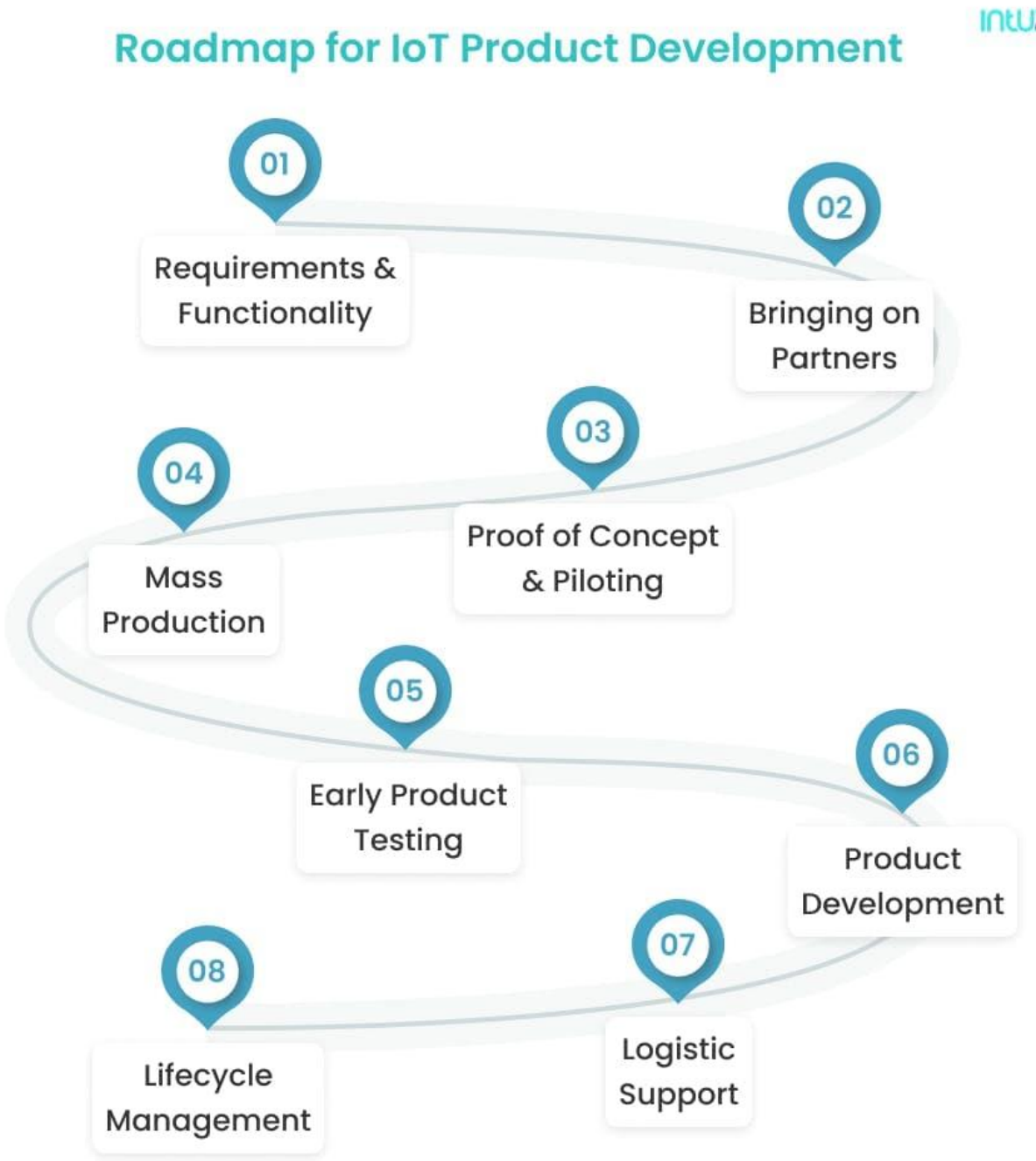
Therefore, the need for more research and studies on the effects of IoT on production plans, operations, and manufacturing for the purposes of marketing products and goods is necessary and inevitable. These studies should be more comprehensive and include several issues and matters related to opportunities, advantages, disadvantages, security, legal, technical, environmental, cultural, and geographical considerations, and identify the most important dilemmas and provide possible solutions.

According to DataProt, by 2030 there will be over 25.4 billion active IoT devices, so product managers need to understand the importance of IoT technology and become fully aware of it, as it is present everywhere today, from the grocery store to the airport and even the gym, and thus get the maximum value from data and other customer-related information from the many web-connected devices.

According to Mordor Intelligence, the connected medical device market size was valued at $57.48 billion in 2023 and is expected to reach $115.51 billion by 2028. Medical facilities and the medical research sector are leveraging IoT, advances in computing power, wireless technology, and big data analytics techniques to analyze large amounts of complex, heterogeneous medical data, which has significantly transformed the healthcare industry over the past few years.

According to Statista, the global smart agriculture market is expected to grow to $34.1 billion by 2026. IoT is contributing to the digital transformation of the food, agricultural, livestock, and crop sectors, using technology connected to computing tools, electronic equipment, sensors, and monitoring devices to collect environmental data and climate conditions related to weather, humidity, temperature, and irrigation. This results in effective sustainable solutions, providing more environmentally friendly production methods, higher efficiency and productivity, and superior food quality.

Figure n°6: Roadmap for IoT Product Development



Source: (Intuz.com Team. 2025)

Examples that can also be cited of product strategies leveraging IoT include:

- Smart TVs and other devices that can update their firmware and send usage information to the manufacturer.
- Mothers can monitor their child's physical condition via smartphone, such as breathing, skin temperature, and other information.

- Blood banks can send text messages to people with the same blood type in urgent and close-by cases.
- Clinic reminders for doctor appointments.
- Smart speakers that play audio.
- Network-connected printers that can initiate service requests.
- Smart traffic lights at intersections, which can alleviate traffic congestion and reduce waiting times.
- Public lighting is required on smart city streets according to weather conditions.
- Smart scales, smart robotic vacuum cleaners, smart light switches, doorbells, security systems, refrigerators, sensors, tracking devices, etc.

(For more details, see the following scientific article:Wang, Y., et al. 2019; Moradi, M. 2021; Tariq, B., et al. 2020; Häusler, E., et al. 2023; Bastos dos Reis, F., et al. 2022; Yerpude, S., & Singhal, T. K. 2018; Gogineni, S. K., et al. 2019; Prasad, B. 2020; Thongprasert, A., &Jiamsanguanwong, A. 2021; Golovatchev, J., et al. 2016; Lee, B. 2021; Fagroud, F. Z., et al. 2019).

Conclusion:

Recently, the Internet of Things has emerged as a large network of smart devices connected to the Internet, linking the physical world with the digital world. It feeds data to and from cloud computing environments, providing rich, collaborative data that contributes to achieving quality of life goals, sustainability aspirations, and improving work practices. This technology, which is an integral part of artificial intelligence and machine learning, along with its automated solutions and software, has changed the lives of everyone, whether individuals, companies, or governments. It helps everyone be more connected to the world around them and perform more important work at a higher level. It is constantly evolving and improving over time. Among the practical applications of the Internet of Things that have sparked a digital revolution in developed countries, and global companies have begun to realize their added value as they quickly embrace it to operate more efficiently, better understand customers, provide enhanced customer service, improve decision-making, and increase business value without human intervention, are the smart home that automatically adjusts heating and lighting, and the smart factory that monitors industrial machinery for problems and then automatically adjusts to avoid breakdowns. There are countless other examples.

In a related context, managing and developing products and brands, from planning to monitoring, under IoT data contributes to informed marketing and production decisions based on modern technology. Target audiences can provide immediate and real-time feedback about their experience. Therefore, if a product fails to meet customer expectations, the company won't have to wait long for feedback to flow in. This will significantly reduce costs sooner rather than later, and marketers will now be able to make data-driven strategic decisions to improve their products. In conclusion, it can be said that the need to embrace modern digital and electronic technologies, represented by the Internet of Things (IoT), as a branch of artificial intelligence, is intensifying and growing in marketing management in general, and in product planning and development in particular. This is particularly true given the urgent impetus to revisit the philosophy of production, operations, and manufacturing, as well as product engineering and design decisions, due to the violence of computer and cyber competition, technical wars, and information battles in a virtual environment. In this environment, survival is for the strongest, and victory is for the smartest in harnessing marketing technology by increasing the amount of data acquired through connected devices and expanding the scope of analytics. This leads to the introduction of customized products that inevitably improve and enhance the customer experience, a phenomenon known as hyper-personalization.

Ultimately, the recommendations inspired by this research emphasize the need to harness disruptive technologies and digital innovations in general, and the use of IoT sensors in particular, in new product development, given the tremendous benefits that professional marketers can gain from hyper-personalization of customer experiences.

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