The Impact of the Internet of Things on Business Models and Strategies

Stanislav Petko
Associate Professor,
Department of International Management,
Kyiv National Economic University
named after Vadym Hetman, Ukraine
petkostas1990@gmail.com

Uliana Sytailo
PhD, Assistant Professor,
Department of Business Economics,
Taras Shevchenko National
University of Kyiv, Ukraine
uliana.sytailo@gmail.com

Ihor Nazarkevych
Doctor of Eco Sc.,
Professor, Dept. of Financial Mgmt,
Ivan Franko National University
of Lviv, Ukraine,
Ihor.Nazarkevych@lnu.edu.ua

Daria Popovych
PhD, Associate Professor,
Department of Financial Management,
Faculty of Finance and Business Mgmt.
Ivan Franko National University
of Lviv, Ukraine
dariapopovych@ukr.net

Maksym Naumov
PhD, Associate Professor
Academic and Research Institute of
Economics and Management,
O.M.Beketov National University of
Urban Economy in Kharkiv, Ukraine
maksim.naumov@kname.edu.ua

Abstract

The relevance of our study is due to the rapid development of Internet of Things (IoT) technologies and their significant impact on business models and strategies of enterprises. In the context of the global digital transformation, the introduction of IoT is becoming an important factor that can significantly increase the competitiveness of companies in various fields. The aim of the study is to look at how IoT is affecting the business models and strategies of enterprises in industries such as manufacturing, logistics, healthcare and retail. We also aim to explore how these technological changes are contributing to process optimisation and efficiency gains for companies. In our work, we use a quantitative approach to analyse the adoption of IoT in the above industries. To do this, we analyse statistical data, analysts' reviews and conduct a comparative analysis of business models of companies that have already integrated IoT into their operations. The results showed that the impact of IoT varies by industry. In manufacturing and logistics, IoT is helping to automate processes and increase flexibility, in retail it is helping to customise personalised services, and in healthcare it is helping to improve the quality of patient care. However, challenges remain, including high implementation costs, cybersecurity issues, and infrastructure limitations. The findings of our study confirm that IoT not only improves operational processes but also changes business models, opening up new prospects for development. However, the successful implementation of these technologies requires addressing cybersecurity and infrastructure constraints, which requires additional investment and further research.

Keywords: Intelligent Asset Management, Digital Integration, Supply Chain Optimisation, Implementation of IoT Solutions, Energy Efficiency in Business Global Business Processes

Introduction

The Internet of Things (IoT) is becoming an integral part of modern business, influencing the way we do business and changing business models. Digital technologies are currently rapidly changing the

economy, opening up new opportunities for businesses in various industries. IoT, in particular, is driving this transformation by enabling businesses to automate processes, reduce costs, and increase efficiency (Aljad, 2023; Wnuk &Murari, 2016). The introduction of smart devices allows for real-time data collection and analysis, which helps companies make more informed decisions, respond to market changes, and increase productivity.

The growth in the number of devices connected to the Internet continues to influence global business processes, contributing to the development of such areas as automation, digitalisation and resource optimisation. In this regard, the relevance of the study is to analyse how IoT is transforming business models and strategies of enterprises in various industries (Langleya et al., 2021; Bradul et al., 2021).

Research problem

The article will focus on analysing specific industries where the impact of IoT is particularly noticeable. Each sub-industry is an example of the dramatic changes brought about by the integration of IoT into business processes: a) Manufacturing (Industry 4.0), where IoT is enabling smart manufacturing, increasing the accuracy and efficiency of processes; b) Logistics and transport, where IoT is optimising supply chains and enabling efficient resource management; c) Healthcare, where IoT is facilitating remote patient monitoring and improving the quality of medical care; d) Retail, where IoT is helping to automate inventory and personalise customer service.

Research Focus

The purpose of the study is to determine how the Internet of Things (IoT) is changing business models and strategies of enterprises in various industries.

Objectives of the study:

- analyse how businesses in industries such as manufacturing, logistics, healthcare and retail are implementing IoT;
- to study how IoT affects the transformation of business models in these industries;
- to investigate how the introduction of IoT leads to changes

in the strategies of enterprises, in particular in the context of process optimisation and efficiency.

Literature Review

The development of IoT is fundamentally changing the traditional ways of doing business, offering new opportunities for automation, process optimisation and management efficiency. The issue that this review focuses on is how these technologies are affecting the restructuring of business processes, what are the main implementation challenges, and how businesses are adapting their strategies to the new realities.

The Chui, Collins, &Patel (2021) study provides valuable insights into the competitive advantages that IoT provides, including the ability to create new products and optimise processes. This study is notable for its in-depth analysis of examples of successful IoT adaptation in large corporations such as General Electric. However, the study's shortcoming is its lack of attention to small and medium-sized enterprises, which may face financial and technical barriers to IoT adoption. Also, although the authors mention changes in the competitive environment, they do not address cybersecurity, which is a critical aspect of IoT integration.

Udeh, Amajuoyi, Adeusi, &Scott (2024) in their study of the logistics sector, emphasise the key role of IoT in reducing costs and increasing delivery speeds. Their work is good at showing concrete examples, but the emphasis on the challenges of processing large amounts of data and the need for technical infrastructure seems somewhat superficial. The researchers only briefly mention limited technical resources, but do not offer detailed solutions on how small businesses can overcome these challenges. Nevertheless, their work is useful for understanding the impact of IoT on logistics processes, but lacks an analysis of the strategic adaptation of enterprises to new conditions.

Ivanov, &Dolgui (2020), studying the retail industry, clearly demonstrates the benefits of IoT in personalising services and reducing operational costs. However, the drawback of their work is the lack of analysis of the long-term implications of IoT implementation, in particular, how changes in customer experience may affect business

strategy in the future. They also do not address the issue of changing the organisational structure of enterprises in response to new technologies, which is essential for the successful use of IoT.

The paper by Büyüközkan, & Göçer (2018) has the strength that the authors describe in detail the impact of IoT on production processes, in particular the possibilities of automation. They clearly explain how IoT can improve product quality and reduce costs, which is a significant contribution to understanding the economic impact of the technology. However, their study does not sufficiently focus on the challenges for small businesses, for which the cost of IoT adoption can be a limiting factor. It clearly lacks detailed recommendations on how to adapt new technologies for companies with limited resources.

The study by Zhukovska, Goi, Cherednychenko, Zabolotna, & Shyshliuk (2023) demonstrates how IoT affects business intelligence, allowing for faster decision-making. They discuss in detail the advantages in data processing, but the drawback is the lack of attention to the problems with training specialists who could effectively use the data for strategic management. Therefore, the main problem is not only the availability of technology, but also the training of personnel, which was not fully taken into account in their study.

Chikán, & Sprague, (2019), looking at IoT in the energy sector, make a valuable contribution to understanding how these technologies can improve the efficiency of energy management. However, their work does not take into account that the introduction of IoT in this sector is also subject to regulatory constraints and geopolitical factors that can significantly affect the ability to scale the technology in different countries. In addition, insufficient attention has been paid to cybersecurity, which is of utmost importance in this sector.

Ghobakhloo, Iranmanesh, Grybauskas, Vilkas, & Petrait (2021) emphasises the need to change corporate culture for successful IoT implementation, which is an important addition to previous studies. The importance of his work lies in understanding the human factor and adapting management to new conditions. However, as in many other

studies, there is no detailed analysis of the impact of IoT on SMEs, which leaves unresolved the question of how these businesses can adapt to technological change.

Tkach, Kolomiiets, &Radieva (2019) demonstrate in their study of supply chains how smart IoT sensors can improve the efficiency of supplying goods. The advantage of his work is the detailed analysis of the real practical benefits of using IoT. However, Michael also insufficiently explores the problem of standardisation of IoT platforms, which can hinder the effective integration of technologies between different companies.

Thus, analysing the advantages and disadvantages of various studies, it can be concluded that although IoT offers numerous opportunities for automation, process optimisation and management efficiency, significant challenges remain related to security, adaptation to limited resources, and lack of technical expertise. In addition, it is important to continue researching the impact of IoT on SMEs, as most existing work focuses on large corporations that have access to the resources to implement new technologies (Chovhaniuk et al., 2023).

Methods

Sample and Participants

The overall structure of the study is shown in Figure 1. The diagram illustrates the sequence of research stages, from the selection of industries and data collection to analysis, comparison and conclusions, which allows us to clearly understand the logic of the study.

Figure 1. Visualised research design
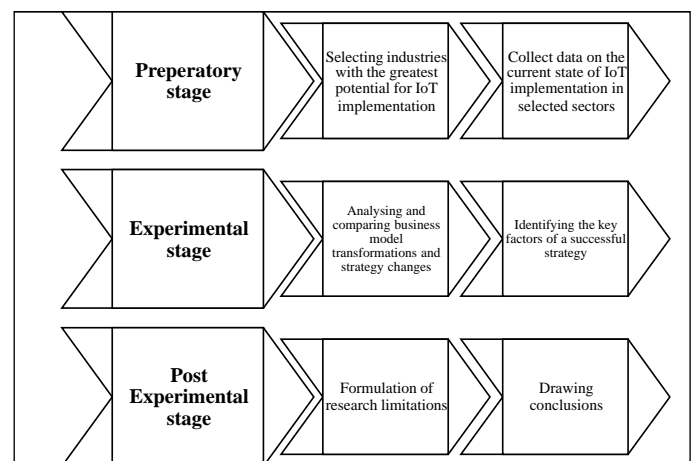
Four sectors were selected for the study: manufacturing, logistics, healthcare and retail. These sectors formed the basis for the comparative analysis, as their selection was based on several important criteria (Dobrovolska, 2023; Dobrovolska et al., 2023).

Firstly, these industries are actively implementing the Internet of Things (IoT), which allows us to clearly see the impact of new technologies on business processes. They are examples of how innovations are already changing the way business is done, and therefore are important for detailed analysis.

Second, they play a key role in the global economy. Manufacturing, for example, is the backbone of many other sectors, and it is here that IoT has shown its potential to increase productivity and efficiency through automation and smart systems. Logistics is another strategic sector where IoT is helping to optimise transport, reduce costs and improve real-time tracking of goods (Evans et al., 2017).

In healthcare, IoT is changing the approach to medical services, making them more accessible and of higher quality through the ability to remotely monitor patients' conditions.

Retailers, in turn, are using IoT to personalise purchases and manage inventory, which significantly improves customer service and operational efficiency.

Instruments and Procedures

Several sources were used to collect data for this study, including McKinsey reports "IoT value set to accelerate through 2030: Where and how to capture it" (2021) and PwC's "Digital Trends in Operations Survey"(2024), as well as analytical studies from IDC and Statista databases focusing on IoT adoption trends in various industries. The main focus was on the sections related to the impact of IoT on business models, performance indicators of technology implementation, and key challenges for enterprises.

Data was collected based on the analysis of quantitative and qualitative indicators from these documents. For example, the McKinsey report analysed in detail the Economic Impact by Sector section, which provides specific estimates of the impact of IoT on production processes and logistics (Grynko et al., 2021; Dykha et al., 2021). It analysed productivity growth, automation and resource savings. The PwC report focused on the sections on the introduction of digital technologies in the healthcare and retail sectors, where successful examples of IoT implementation were analysed.

Data Analysis

- content analysis of reports - a selective analysis of such sections as "Innovation and Digital Transformation", "Efficiency of IoT Investments" and "Risks of New Technology Implementation" from McKinsey and PwC studies allowed us to assess in detail the impact of IoT on business models;

- quantitative analysis of statistical data - the collected statistical data was analysed using Microsoft Excel and SPSS. This allowed us to conduct a correlation analysis between the level of IoT adoption and changes in the business strategies of enterprises.

Results

The Internet of Things has become one of the key drivers of the fourth industrial revolution, or Industry 4.0. Businesses are using IoT to automate production processes, integrate cyber-physical systems, and collect big data to make real-time decisions (Kuczabski et al., 2023; Redko et al., 2024). Every year, more and more manufacturing companies are turning to IoT technologies to increase their competitiveness and improve their business models (Table 1).

Table 1.IoT adoption in various industries

Industry	Examples of IoT implementation	IoT technologies	Effect of implementation
Production	Sensors on equipment for condition monitoring, optimisation of production processes	Sensors, monitoring systems, AI	Reduce downtime, improve product quality, optimise equipment maintenance costs
Logistics and transport	Real-time cargo tracking, warehouse inventory management	GPS trackers, RFID, intelligent systems	Improving delivery accuracy, optimising routes, reducing logistics costs

Industry	Examples of IoT implementation	IoT technologies	Effect of implementation
Healthcare	Remote patient monitoring, automated control of medical equipment	Biosensors, medical devices with IoT connectivity	Improving the quality of patient care, reducing the burden on medical staff, and identifying problems quickly
Retail	Smart shelves, automated inventory control, personalised shopping	RFID, sensors, analytics platforms	Reduce losses due to shortages or overstocks, improve customer experience, increase sales

Source: compiled by authorsbased on (Chui et al., 2021; Pavlenchyk et al., 2021)

Prior to the introduction of IoT, businesses relied heavily on linear and centralised production processes. For many companies, the main goal was to mass-produce at minimum cost, without much flexibility. There was limited real-time tracking of production processes, which created difficulties with supply chain management and caused delays due to equipment breakdowns. A study conducted by PwC in 2024 found that only 15% of manufacturing companies used automated systems to monitor processes in real time (Digital Trends in Operations Survey, 2024; Telnova et al., 2023).

With the introduction of IoT, manufacturing companies have begun to shift to new business models that provide for greater flexibility and product personalisation. Sensors installed on production equipment allow businesses to monitor its condition and performance in real time. This helps reduce downtime and prevent accidents. According to a McKinsey report (2021), companies that have implemented IoT have been able to reduce downtime by 30% and energy costs by 20% (Chui et al., 2021; Zayed et al., 2022a).

A significant example of such changes is the experience of Siemens, which uses IoT to optimise its production under the concept of "digital twins". This allows them to simulate production processes and identify potential problems before they actually occur. Another large company, General Electric, uses predictive maintenance technologies to reduce the risk of equipment breakdowns, which has helped reduce maintenance costs by 25% (Udeh et al., 2024; Yuzevych et al., 2019; Kashchena et al., 2023).

A PwC report (2024) shows that in 2022, more than 40% of manufacturing companies worldwide have already integrated IoT solutions into their processes. This figure is expected to exceed 70% by 2025. Innovative approaches allow companies not only to cut costs but also to adapt their business models to the new requirements of a market that is increasingly focused on personalised and smart products (Ivankov et al., 2023).

Thus, the introduction of IoT contributes to the transformation of business models from static and centralised systems to flexible, data-driven and process-automated ones. This increases productivity, reduces costs, and ensures long-term market competitiveness.

In the logistics sector, the IoT has also brought about significant changes, increasing efficiency and transparency. Companies that have incorporated IoT into their operations have been able to achieve a higher level of real-time control over vehicles, goods and routes, which has a positive impact on productivity, reduces costs and improves service quality (Fankhauser et al., 2020; Zapata-Cantu& González, 2021; Vasylieva& James, 2021).

Before the advent of IoT, most logistics companies operated on static delivery plans, relying heavily on human control. Delays often occurred due to bad weather, technical problems with transport or other unforeseen events. This resulted in additional costs due to inefficient route planning and extended delivery times.

The situation has improved significantly since the integration of IoT. Automated tracking systems provide real-time information about the location of vehicles, the condition of goods and road conditions. For example, the use of GPS technology in combination with IoT sensors allows you to determine the best routes, avoiding traffic jams and impassable areas. According to a report by Statista

(2024), the introduction of IoT has increased delivery efficiency by 25% while reducing transport costs by 15% (Industrial IoT - Worldwide, 2024; Sopronenkov et al., 2023).

One of the most striking examples of successful use of IoT is UPS. It has implemented a truck monitoring system that analyses routes, vehicle condition, and driver behaviour. This made it possible to optimise delivery and avoid downtime due to technical breakdowns or incorrect routes. As a result of using this system, UPS has reduced its mileage by 10 million miles per year, resulting in significant fuel savings and reduced CO2 emissions (Zhukovska et al., 2023; Klosok-Bazan& Machnik-Słomka, 2017).

Another example is Amazon, which uses IoT in its warehouses and logistics centres. Thanks to smart sensors and automated inventory management systems, the company has managed to reduce order processing time and increase delivery accuracy to 99%, which has significantly improved the quality of customer service and reduced the number of errors in order fulfilment (Harsanto et al., 2022; Verbivska et al., 2022; Yuldashev et al., 2022).

IoT technologies have also significantly changed modern medicine, making it more accessible and efficient. They have a significant impact on people's quality of life, allowing patients to receive timely and more accurate medical care.

Just a few years ago, patients had to visit a doctor regularly to monitor their health. It was inconvenient, time-consuming, and could delay the detection of health problems. But now, thanks to the IoT, the situation has changed dramatically. For example, modern fitness trackers and medical sensors collect real-time data on patients' health status. Doctors can respond to changes more quickly, which reduces health risks and improves treatment outcomes (Zeynalli& Rahimli, 2022; Guseva et al., 2022; Namestiuk, 2023).

A striking example is smart insulin pumps for people with diabetes. These devices automatically monitor glucose levels and inject insulin, making life much easier for patients. For example, Medtronic's pumps help to avoid errors in insulin dosing and increase user comfort. Studies show that the use of such devices reduces the risk of diabetes complications by 30% (Schaltegger et al., 2016; Varela et al., 2023; Zayed et al., 2022b).

Another example is telemedicine, which actively uses IoT technologies. In the UK, according to the NHS, the number of hospitalisations has decreased by 20% due to remote monitoring of patients' condition. Doctors are able to monitor patients' health in time, even at a great distance, which significantly improves the quality of care. Accenture's research confirms that telemedicine technologies are making medical care more accurate and faster (Investments in digital core technology pave the way for businesses to thrive amid change and capture the value of generative AI, 2024; Hirna et al., 2022; Raki et al., 2021).

Thus, the introduction of IoT in healthcare has made services more accessible, personalised and efficient, which has a positive impact on the overall level of healthcare.

The Internet of Things has also significantly changed retail, affecting all major aspects of the business - from inventory management to customer interaction and security. Modern stores are increasingly using smart technologies to not only improve service but also optimise resource management.

For example, IoT inventory control has become a real breakthrough in retail. According to a McKinsey study (2024), stores that use IoT to monitor inventory in real time have been able to reduce the cost of overstocking by 20%. Real-time sensors and tracking systems allow businesses to easily monitor the number of goods on the shelves and automatically replenish stocks. This helps to avoid situations where goods run out when customers need them most

Customer interaction has also changed thanks to the IoT. Technology allows stores to better understand customer behaviour by analysing their preferences and habits. Accenture's research shows that stores that have implemented personalised offers have been able to increase customer satisfaction by 15%. For example, smart shelves or mobile apps that use IoT can send special offers or discounts in real time based on previous purchases. This not

only increases sales, but also improves the overall customer experience (Investing in digital core technology paves the way for businesses to thrive amid change and capture the value of generative AI, 2024; Zaitsev, 2023).

Equally important is the issue of security, which has also been addressed by IoT. Video surveillance and security systems with smart sensors are able to respond quickly to suspicious activity or theft. According to Retail Systems Research, stores that have implemented such technologies have been able to reduce theft losses by 18%. This not only protects the business from financial losses, but also ensures the safety of customers and staff (The Candid Voice in Retail Technology: Objective Insights, Pragmatic Advice, 2024; Worldwide Industrial Internet of Things and Intelligence Strategies…, n.d.).Table 2 summarises information on the transformation of business models under the influence of IoT.

Table 2. Business model transformation under the influence of IoT

Industry	Type of business model before IoT implementation	Type of business model after IoT implementation
Production	Traditional model with a focus on linear production and cost minimisation	Flexible data -driven model, fault prediction and automated maintenance
Logistics and transport	Simple model with fixed routes and manual process control	Dynamic model with real -time route optimisation and inventory management via IoT
Healthcare	A linear model with a focus on personal patient visits	Remote monitoring of patients' health, proactive care through IoT and telemedicine
Retail	Sales model through physical stores and standard distribution channels	Omnichannel model with online sales, personalisation and inventory management via IoT

Source: compiled by authorson the basis of (Chui et al., 2021; Industrial IoT - Worldwide, 2024).

The dynamics of IoT technology adoption in the industries under study shows steady growth in 2018-2022. Let's take a closer look at each of the industries (Table 3).

Table 3. Dynamics of IoT adoption in various industries

Industry	Percentage of businesses that have implemented IoT				
	2018	2019	2020	2021	2022
Production	28.4%	35.1%	43%	52.3%	60.1%
Logistics	18.2%	25.7%	32.3%	41.6%	50.9%
Healthcare	12.3%	18.1%	26.9%	33.4%	42.6%
Retail	16.5%	22.7%	30.4%	38.5%	46.7%

Source: compiled byauthors based on (Chui et al., 2021; Udeh et al., 2024; Industrial IoT - Worldwide, 2024; Mokiy et al., 2020)

Manufacturing shows the highest rate of IoT adoption among other sectors. While in 2018 only 28.4% of companies used these technologies, in 2022 this figure rose to 60.1%. This indicates that manufacturing companies have quickly realised the benefits of automation and efficiency gains offered by IoT. The annual growth here has been fairly stable, indicating a steady adoption of technology.

Logistics is also showing significant growth in the use of IoT. In 2018, only 18.2% of companies had implemented IoT solutions, but by 2022, this figure had increased to 50.9%. This indicates the growing role of optimising transport and warehouse operations through IoT.

Healthcare, although it started with a rather low rate in 2018 (12.3%), is showing steady growth. By 2022, 42.6% of healthcare facilities will have already implemented IoT technologies. This can be explained by the increased need for remote patient monitoring and automation of care processes, especially amid the COVID-19 pandemic.

Retail also shows significant progress in IoT adoption. In 2018, only 16.5% of stores used smart technologies, and in 2022, this figure rose to 46.7%. Stores are implementing IoT to improve customer experience and automate inventory management processes (Hrosul et al., 2021).

In general, all the industries under consideration show a trend towards active implementation of IoT, which indicates the importance of these technologies in increasing the productivity and competitiveness of enterprises (Fig. 2).
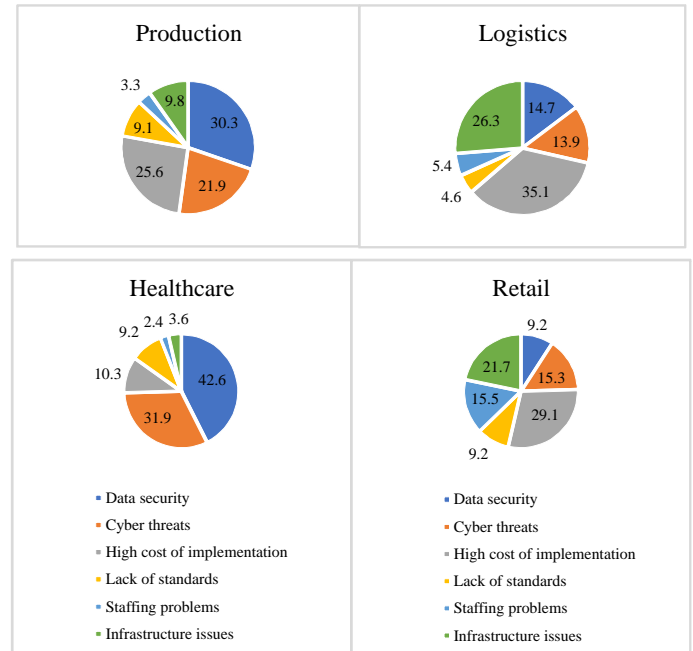
Figure 2. The impact of IoT on enterprise productivity
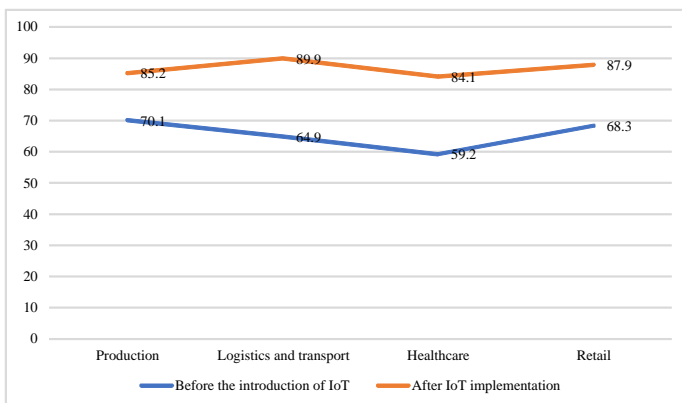
Source: compiled by authors based on (Chui et al., 2021; Udeh et al., 2024; Industrial IoT - Worldwide, 2024)

An analysis of the data in Fig. 3 on the challenges and risks of IoT integration in various industries provides a deeper understanding of the main barriers faced by enterprises when implementing the Internet of Things

Figure 3. Challenges and risks of IoT integration in various industries

Source: compiled by authors based on (Chui et al., 2021; Udeh et al., 2024; Industrial IoT - Worldwide, 2024)

In the manufacturing sector, the biggest challenges are data security (30.3%) and high implementation costs (25.6%). Companies are concerned about protecting confidential information and the risk of data leakage due to cyber threats. At the same time, significant investments in infrastructure and equipment for IoT implementation remain one of the most difficult barriers for many businesses.

In the logistics sector, the biggest challenges are the high cost of implementation (35.1%) and infrastructure issues (26.3%). As IoT requires sophisticated technical solutions to ensure smooth operation, businesses often face the need to upgrade their infrastructure, which is a costly process. Geographical features of the regions may also require additional financial investments.

In healthcare, the main challenges are data security (42.6%) and cyber threats (31.9%). Healthcare information is extremely sensitive, so healthcare organisations must

ensure a high level of data protection. Even minor security breaches can lead to serious consequences for both patients and the reputation of institutions.

In the retail sector, the main challenges remain the high cost of implementation (29.1%) and infrastructure issues (21.7%). Despite the potential benefits of IoT, such as increased efficiency and personalised service, not all companies have sufficient resources to implement these technologies on a large scale. Infrastructure issues also pose obstacles to the full implementation of IoT.

In general, the main challenges of IoT adoption, such as data security, high cost and infrastructure issues, are common to all industries. This points to the need to find affordable solutions and improve security to facilitate the integration of IoT into business models across industries.

Discussion

The Internet of Things is playing a crucial role in changing the business models and strategies of modern enterprises. The purpose of this paper is to explore how the introduction of IoT is transforming business models and what opportunities and risks accompany this process.

Our research has shown that IoT adoption is having a significant impact on various industries, including manufacturing, logistics, healthcare and retail. In the manufacturing sector, IoT is enabling the automation of most operational processes, increasing production efficiency and reducing the time it takes to complete tasks. Businesses are using connected sensors and analytics to predict equipment maintenance and reduce production line downtime.

In logistics, the introduction of IoT has helped to improve real-time tracking of goods, allowing companies to optimise supply chains and reduce costs. Thanks to these technologies, businesses can better plan routes and control storage conditions for goods, especially those with special transport requirements.

In the healthcare industry, IoT plays a crucial role in improving the accuracy of patient diagnosis and monitoring. Healthcare facilities have begun to actively implement connected medical devices that provide continuous monitoring of patients' conditions. This allows doctors to respond more quickly to changes in health status, which improves the quality of healthcare services.

For retailers, IoT enables the collection and analysis of real-time data on consumer behaviour, which helps to improve service customisation and predict customer needs. As a result, companies can respond more quickly to changes in demand and improve their sales strategies.

Comparing our own results with those of other researchers, we can note a significant degree of overlap in the identified trends. For example, the conclusions about the impact of IoT on the transformation of business models in manufacturing are confirmed by similar research results of many authors. According to Wnuk, &Murari, (2016), IoT in the manufacturing industry can significantly improve productivity and process automation, which is in line with our findings on the introduction of connected sensors and analytical systems. Also, Udeh, Amajuoyi, Adeusi, &Scott (2024) confirms our findings that IoT contributes to supply chain optimisation in logistics by enabling efficient inventory and transport route management.

However, not all aspects of our research coincide with the results of other authors. For example, in the healthcare sector, our results highlight data security challenges at 42.6%, while Chui, Collins, Patel (2021) focuses on the primary role of healthcare efficiency and reduced response times due to IoT, leaving security issues in the background. This difference may be due to different emphases in the studies and variations in the objects of analysis.

In the retail sector, our findings on the impact of IoT on personalising customer experience are in line with Langleya, Doornb, Irene, Stieglitzd, Lazovikb, Boonstra (2021), who also highlight the importance of IoT for better understanding consumer needs and quickly adapting offers.

The findings allow us to draw several important conclusions. Firstly, in most industries, IoT does indeed play a key role in transforming business models, optimising processes and improving customer experience. For example, in manufacturing and logistics, the results show that IoT can significantly reduce costs, increase productivity and provide predictability of risks.

An unexpected finding was the high level of challenges related to data security, especially in healthcare, which we noted in our results. Although we anticipated that security would be one of the most important challenges, 42.6% of enterprises identify this issue as a major one, which was much higher than expected. This can be explained by the ever-increasing dependence of healthcare facilities on digital technologies and the specifics of processing confidential medical data, which increases the requirements for information protection.

Another unexpected aspect was that the high cost of IoT adoption remains one of the main barriers in industries such as logistics and retail, despite expectations that the cost of technology will decrease over time. This indicates that while the infrastructure for IoT is becoming more affordable, significant investment is still required to integrate it on a large scale.

The high level of challenges related to data security can be explained by the rapid evolution of cyber threats and the need to adapt defence mechanisms to new challenges. Given the sensitive nature of medical data, even small vulnerabilities can lead to serious consequences. This makes data security the number one priority for healthcare organisations, even though efficiency and improved healthcare also remain important objectives.

Regarding the high cost of IoT adoption, it is possible that not all companies are sufficiently aware of the long-term benefits that IoT can provide, so such costs may seem too high in the initial stages. In addition, infrastructure constraints, especially in geographically dispersed regions, can have a significant impact on the overall cost of projects.

Overall, the results of our research show that the main objectives have been successfully met. We have identified key challenges and opportunities for IoT integration in various sectors, such as manufacturing, logistics, healthcare, and retail. Our findings significantly complement existing research in this area, in particular on data security and the high costs of technology implementation, and provide new perspectives for future research.

On the other hand, they can be used to develop recommendations aimed at strengthening the innovation component of Ukraine's economy, increasing its international competitiveness and ensuring national security. In the author's opinion, the following steps in this direction are advisable:

1. Develop a regulatory framework to support the implementation of IoT in business, especially in the context of data protection and cybersecurity.

2. Supporting small and medium-sized enterprises through grant programmes or concessional lending to implement IoT, which will reduce the cost of entering the market for new technologies.

3. Investing in infrastructure to expand IoT capabilities, including the development of 5G networks and improving the reliability of Internet connections in remote regions.

4. Educational initiatives to train professionals who will work with IoT technologies, as well as to raise awareness of the long-term benefits of their implementation.

Limitations of the study and scientific novelty

One of the key limitations of this study is its focus on four specific industries: manufacturing, logistics, healthcare, and retail. This narrow specialisation may limit the applicability of the findings to other sectors of the economy, particularly those with different levels of digitalisation or different regulatory requirements. For example, industries with lower levels of digitalisation or specific regulatory conditions may face different challenges or benefits when integrating IoT. This should be taken into account when interpreting our findings and applying them to different markets.

In addition, it is worth noting that the study was predominantly quantitative and relied on available statistical data. While this provides a general picture of IoT adoption in these industries, it may not take into account all the nuances or contextual factors that influence this process. Future research could turn to more in-depth qualitative analysis or compare industries from different countries for a more comprehensive understanding of the impact of IoT on business models and strategies.

In terms of contribution to the scientific field, the study significantly expands the existing knowledge on the digital transformation of enterprises, demonstrating how the Internet of Things is not only affecting the optimisation of operations, but also significant changes in business models in various industries. We have identified both new opportunities for companies to develop and specific challenges they face. At the same time, we highlighted the need for further investment in infrastructure and cybersecurity to unlock the full potential of IoT in these sectors.

Conclusion

The study fulfilled all its objectives, which allows us to draw several key conclusions.

The article reveals that the use of the Internet of Things (IoT) in areas such as manufacturing, logistics, healthcare and retail has different levels of maturity and is accompanied by certain challenges. In the manufacturing sector, IoT is helping to automate processes and increase productivity, but high implementation costs and cybersecurity issues remain major barriers. In logistics, the main effect is to optimise supply chain management, although limited infrastructure slows down the scaling process. Healthcare is facing challenges related to patient data security, and retail is opening up new avenues for personalisation, but requires significant financial investment.

The study showed that the introduction of IoT not only improves individual operational processes, but also contributes to a radical transformation of business models in these sectors. For manufacturing and logistics, the key aspects are increasing flexibility and adaptability, which allows companies to respond quickly to changing market conditions and increase competitiveness.

The article examines the impact of IoT on changes in the strategies of enterprises, in particular, in the area of process optimisation and efficiency. The introduction of IoT allows companies to use new tools for monitoring, analysing and managing data, which helps to make more informed management decisions.

Future Studies

Future research should delve deeper into understanding how different industries can overcome existing barriers to IoT adoption. In particular, effective strategies to address high costs, cybersecurity, and infrastructure constraints should be explored. In addition, it is important to study in detail the impact of IoT on small and medium-sized businesses, as large companies usually have more resources to integrate new technologies. Further research should also focus on cross-industry comparisons and analysis of how different regulatory environments can facilitate or hinder the introduction of IoT into business processes.

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