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THE IMPACT OF DIGITAL TRANSFORMATION ON INTERNATIONAL TRADE

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Abstract
The digital transformation tools improve the internal management of enterprises and contributes to their basic business performance. Studies have shown that as a result of the correct adaptation of innovative technologies, more efficient results have begun to be obtained in all procesgeneral business processes. The aim of this research is to contribute to the literature by exploring the advantages and disadvantages of the application of digital technologies and by revealing the issues that entrepreneurs and academics who want to digitalize in international trade should consider in their studies. A qualitative research method was used in the research and the results obtained from the studies in the relevant literature and the effects of this transformation on international trade were compiled. There is a consensus in the literature that the use of blockchain, artificial intelligence and internet of things applications in international trade will increase the costs of businesses. However, in addition to its many positive effects, it has also been stated that international standards should be established in the use of these technologies. The theoretical importance of this study lies in the fact that no study has been found on the application of digital transformation tools such as blockchain, AI and IoT to international trade.
Keywords: International Trade, Digital Transformation, Blockchain, Artificial Intelligence, Internet of Things.

Özet
Dijital dönüşüm araçları, işletmelerin iç yönetimini iyileştirerek, temel iş performanslarına katkı sağlamaktadır. Yapılan araştırmalarda, yenilikçi teknolojilerin doğru adapte edilmesi sonucunda işletmelerin genel iş süreçlerinde daha verimli sonuçlar elde edilmeye başladığı görülmüştür. Bu araştırmanın amacı, dijital teknolojilerin uygulanmasında görülen avantajları ve dezavantajları keşfederek; uluslararası ticarette dijitalleşmek isteyen girişimcilere ve akademisyenlere yapacakları çalışmalarda değerlendirmeye almaları gereken konuları ortaya koyarak literatüre katkı sağlamaktır. Araştırmada nitel araştırma yöntemi kullanılmıştır ve literatürdeki çalışmalardan dijital dönüşüm ve bu dönüşümüm uluslararası ticaretteki etkileri konusunu çalışan çalışmalardan elde edilen sonuçlar derlenmiştir. Literatürde yapılan çalışmalarda uluslararası ticarette blockchain, yapay zeka ve nesnelerin interneti uygulamalarının kullanımının işletmelerin maliyetlerini arttıracağı konusunda fikir birliği vardır. Ancak pek çok olumlu etkisinin yanı sıra, bu teknolojilerin kullanımında uluslararası standartlar oluşturulması gerektiği de ifade edilmiştir. Bu teknolojiler ekonominin tüm sektörlerine uygulanabilir olsa da literatürde en olumlu etkilerinin finans ve e-ticaret sektöründe olduğu; özellikle en fazla lojistik faaliyetlerde verimlilik arttırıcı alanlarda kullanıldığı görülmüştür.

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Bu çalışmanın teorik önemi, dijital dönüşüm araçlarından blockchain, AI ve IoT uluslararası ticarete uygulanmasıyla ilgili bir çalışmaya rastlanmamış olması yatmaktadır.
Anahtar Kelimeler: Uluslararası Ticaret, Dijital Dönüşüm, Blockchain, Yapay Zeka, Nesnelerin İnterneti.

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Introduction

With the rapid development of the Internet, many industries have had to innovate in areas of technology adoption, business process management and organizational behavior (Chang et al., 2019, p. 1712). However, increasing digitalization today has led to the reorganization of economic activities. Thanks to the time communication and the transparency of digitalization studies, search costs have decreased and geographical problems are being overcome (Abelianskya & Hilbert, 2017, p. 3). Digitalization tools have become the most important weapons for businesses that want to grow in the global market. Digitalization tools for businesses provide the opportunity to see and fulfill customer requests more comprehensively, to provide personalized services, to make significant progress in production techniques and to make more reliable transactions without 3rd parties (Pereira et al., 2022).

The digital transformation along with the developments in technology improves the internal management of enterprises and contributes to their basic business performance (Ye & Tong 2022, p. 1). With the overcoming of geographical problems, technological developments are increasing the competitiveness of enterprises and enabling them to take part in international trade more easily (Wysokińska, 2021, p. 76). Studies have shown that as a result of the correct adaptation of innovative technologies, more efficient results have begun to be obtained in all procesgeneral business processes (Chang et al., 2019, p. 1712). In a world where the importance of data is increasing day by day, many businesses have accepted that customers have personal preferences and have even introduced a new concept called Human-to-Human (H2H) (Götz et al., 2018).

In the background of globalization and rapid development of information technology, international trade is faced with unpredictable changes and disadvantages (Gu et al., 2024). Compared to the traditional trade model, digital transformation tools in international trade provide businesses with significant advantages such as efficiency, cost and transparency; however, they also present challenges such as information security, the need for significant energy consumption and the need for significant technological investment capital. International

trade enterprises have different business segmentations. Businesses that want to get the most out of digital transformation must choose the right digital transformation technology for their business segments. The purpose of this study is to reveal the current scope of "Digital Transformation and International Trade" and to provide readers with the information they may need to guide them in the future of their dealings with business beyond their national boundaries.

Literature Review

International Trade

According to traditional theories, international trade is the flow of goods in line with the needs of countries based on the principle of comparative advantage. According to this approach related to the theory of comparative advantage, international trade refers to "inter-sectoral trade". In other words, international trade refers to countries exporting from one sector group while importing from another country (Bernard, 2007, p. 106). Previously, international trade took place in an environment where there was uncertainty in the flow of information. Accordingly, it offered limited opportunities for the traceability of goods and cash (Chang et al., 2019, p. 1712).

Especially after the pandemic, a considerable transformation has began to occur in international trade with the increasing use of new generation technologies and digitalization (Baykov & Ershov, 2023, p. 1). The phenomenon of digitalization in the economy and international trade helps create a more equitable structure in international trade and facilitate the inclusion of small and micro firms in different countries of the world in the international trade process (Ahmedov, 2020, p. 6). It is seen that high-tech industries have come to the forefront in international trade and have indirectly helped to improve the performance of other sectors (Wysokińska, 2021, p. 76). With the penetration of digital technologies into trade and the development of global economic integration, the allocation of resources can be optimized thanks to new trends in international trade, which can thus transform the structure of trade. At the same time, the widespread use of digital technologies in import and export areas has accelerated the transformation and growth of international trade (Wang, 2024, p. 458).

Digital Transformation

Today, technology is seen as an important tool in the continuation of business and daily life (Maulana & Juliarto, 2021). As a result of countries' efforts to create a digital economy, it is seen that innovative technologies are adapted to various areas (Vorotyntseva, 2019, p. 452). Digital transformation refers to the inclusion of digital technologies in every area of a business and fundamentally changes the issue of providing value in all processes of business. When it comes to digital transformation, artificial intelligence (AI), blockchain and the Internet of Things (IoT) are among the basic technologies. These technologies increase efficiency, improve customer experiences and enable businesses to develop new business models (Shapoval, 2024).

As a result of the new markets that emerged with the phenomenon of digitalization, many concepts that are stakeholders of digital transformation such as changes in management systems, new business models, and the emergence of a new generation of consumers have emerged (Giyosidinov et al., 2023, p. 42). While digitalization creates new opportunities for entrepreneurs and businesses, it also provides significant benefits for consumers. The global development of e-commerce is an example of the benefits it provides to businesses, entrepreneurs, and consumers (Wysokińska, 2021, p. 8). In addition, digital transformation provides businesses with economies of scale and effectively reduces the marginal cost of serving more customers to zero. In addition, digital transformation practices have given businesses complete market dominance, opening up strategic competition between businesses in a new area (Ciuriak & Ptashkina 2018, p. 9).

The introduction of digital technologies in business and daily life helps users interact more efficiently and accurately. Especially considering businesses operating in highly complex markets, if they want to survive in these markets, they need to incorporate digital technology into their business processes (Bostoganashvili et al., 2020, p. 972). However, using a variety of technologies alone is not enough in digital transformation. The company must have a clear vision of its future goals, and then strategies related to the selected goals must be determined and supported by appropriate technologies (Schwertner, 2017, p. 389).

Blockchain

The concept of blockchain technology emerged in 2008. The use of this concept as a tool to improve information security and digitalization in various industries has occurred in the last decade (Vorotyntseva, 2019, p. 452). Although blockchain technology is generally used in relation to cryptocurrencies, it has now begun to be actively used outside the financial sector (Slatvinska et al., 2022, p. 102). Blockchain has begun to radically change the way business is done. The World Trade Organization stated in its report published in 2021 that blockchain is one of the fastest growing and most effective international trade methods. In addition, many studies have stated that blockchain is one of the most effective technologies as a result of advanced Technologies. Because of these, digital economy studies have emerged in recent years (Ganne, 2018).

Blockchain technology has significantly changed international trade and has the potential to develop further. Therefore, it is very important to analyze the role and effects, benefits and challenges of blockchain technology in international trade (Derindag et al., 2020, p. 1). Since blockchain transactions can be monitored and automated by everyone, it provides reduced costs for all parties. Blockchain can increase productivity in international trade by providing real-time, fully transparent and secure interaction and can ensure that trade transactions are carried out more effectively by eliminating intermediaries (Civelek & Artar, 2019, p. 145).

Blockchain ensures that data is created, stored and disposed of efficiently and that all these processes are carried out securely (Slatvinska et al., 2022, p. 102). In addition, it allows businesses to store transactions in digital format, greatly reducing paperwork between businesses, which increases the efficiency of international trade. In addition, it provides automation in many services that require intermediary services (insurance, law, logistics, etc.), which provides a direct relationship between all parties (Maulana & Juliarto, 2021, p. 4).

Pros and Cons of Blockchain

Advantages of Blockchain

Ouriat et al (2024) discussed the advantages of blockchain in their studies as follows:

- Provides high access to users.
- Data added to the system can be viewed instantly by all users in the system.

- Provides a high security environment for users since the encryption method is used in the system.
- Provides a solution to the current integrity and lack of order issues in businesses and provides businesses with an easier management model.
- Since all users in the system can access the same information, transactions take place in a fast environment and at the same time provide users with a transparent and secure environment.

Niranjanamurthy et al (2019) stated the advantages of blockchain in their studies as follows:

- There is no risk of hacking since the system does not require third-party organizations to operate.
- There is no central point in the blockchain system; this makes the system more resistant to possible attacks.
- The system contains high-quality, accurate and timely data.
- The system's 24/7 and fast operation allows transactions to be made outside working hours.
- The absence of third parties and other intermediaries reduces transaction costs.
- The ability to perform commercial actions automatically without any time constraints increases the efficiency of businesses.
- Recording information makes it easier for businesses to audit transactions and track actions in the supply chain.
- It plays an important role in maintaining trust by increasing transparency in financial and commercial matters between businesses.

Disadvantages of Blockchain

Ouriat et al (2024) discussed the disadvantages of blockchain in their studies as follows:

- The fact that the transaction history is visible to everyone reveals problems with the privacy of the system.
- Security problems arise if users lose their signatures or private keys.
- Since adding a new block to the blockchain system brings high costs, the chain can be continued with small groups. However, running the chain with small groups may cause group members to abuse their power and ignore some information.
- There are no international standards established for legal problems that occur in the blockchain system.

Niranjanamurthy et al (2019) stated the disadvantages of blockchain in their studies as follows:

- A high amount of energy consumption is required for the system to operate.
- In this virtual environment where all information is recorded, there are still concerns about cybersecurity related to security and privacy issues.
- Some integrations are needed to apply blockchain technology to the existing system. Businesses need the right strategy for this integration.
- A high amount of installation capital is needed to implement the technology.
- All users in the system must adopt this technology.

Artificial Intelligence

Artificial intelligence (AI) is a technology that can perform complex tasks that require human intelligence (Kumar et al., 2023, p. 871) and has the potential to surpass human capabilities (Wysokińska, 2021: 88). Artificial intelligence (AI) was first proposed by McCarthy et al. in 1956. The theory is based on the fact that learning and intelligence can be simulated by a machine. The focus of this technique is based on automatic learning from experiences rather than being programmed. AI allows examining layers of data information using neural networks, similar to the human brain (Pereira et al., 2022, p. 5).

AI applications can provide businesses with significant opportunities in terms of data management. With AI-focused data management solutions, businesses can achieve more efficient results in tracking inventory, analyzing customer behavior, and predicting future customer demand. AI can also enable businesses to make more informed decisions; It can be used to automate tasks and reduce manual errors. Thanks to all these, businesses can reduce costs, increase efficiency and identify potential problems in advance (Rathore, 2023, p. 45).

It is suggested that AI technology has a great, positive impact on trade and that countries should strengthen their AI capacity to increase trade volume. It has been stated that when AI promotes increased productivity, there will be better economic development and an increase in international trade. However, it is also obvious that time is needed since implementing this technology requires significant financial investment and the need for skilled people. According to a study conducted by PwC, 72% of businesses consider the use of artificial intelligence as an advantage. According to this study, with the customer data they obtain through the use of artificial intelligence, they can produce more consumer-oriented products, provide more consumer-oriented services and therefore achieve higher success in determining the target market. This means a higher conversion rate and a greater competitive advantage for businesses using artificial intelligence (Arsenijevic & Jovic, 2019, p. 19).

AI applications in international trade are increasing day by day. As an example of these applications, reducing language barriers in international trade helps to promote exports, especially for online retailers. Another example is the increase in efficiency in the logistics sector through improved forecasting of smart warehouses. Finally, in financial services, areas such as access to credit, financial risk assessment and anti-money laundering compliance are some of the examples (Ferencz et al., 2022, p. 3).

Pros and Cons of AI

Advantages of AI

Bhbosale et al (2020) discussed the advantages of blockchain in their studies as follows:

- Transactions are accelerated and business profits are increased by using artificial intelligence.

- Machines can work for long periods without getting bored and do not need to eat and rest like humans.
- Machines work much more efficiently than humans.

Khanzode & Sarode (2020) stated the advantages of blockchain in their studies as follows:

- They complete tasks faster than humans.
- They can handle complex and stressful jobs.
- They can do different tasks at the same time and the success rate is quite high.
- It produces more efficient results compared to human outputs.

Disadvantages of AI

Bhbosale et al (2020) discussed the disadvantages of blockchain in their study as follows:

- The equipment required to develop AI applications is quite expensive.
- AI applications can reduce the need for humans in the execution of tasks, causing serious unemployment.
- Machines cannot develop the necessary connection when human connection is required.
- Machines can only give irrelevant outputs when they encounter a situation other than the tasks they are programmed for.

Khanzode & Sarode (2020) stated the disadvantages of blockchain in their study as follows:

- A mismatch between programs can cause tasks to be perceived inversely.
- It causes an increase in the unemployment rate.
- It is weak in tasks that require human touch.
- It requires time and money for its success and depends on the creativity of the programmer.

IoT of Things (IoT)

The Internet of Things is sensors and actuators embedded in physical objects and connected to each other through wired and wireless networks (Madakam et al., 2015, p. 165). IoT is a revolutionary step today and has become a turning point with artificial intelligence. IoT means being able to remotely control almost every electrical device. All these devices can be controlled using smartphones or smart watches (Laghari et al., 2021, p. 1395). Examples of IoT applications include monitoring personal health through wearable devices, detergent and electricity consumption by calculating the load of washing machines, and greenhouses that adapt their internal climates according to the characteristics of the crops grown inside (Sousa, 2018, p. 109).

In recent years, with the impact of globalization and the development of IoT technology, it has been seen that there have been major changes in business processes carried out in international trade and that they are significantly under the influence of digital transformation (Qiuxia and Yujie, 2022, p. 1). IoT has the ability to change all sectors of the global economy. It is seen that it will affect production, energy, agriculture, transportation and many other sectors (Sousa, 2018: 113). This technology has changed the production methods, management concepts and business ideas of traditional manufacturing industries (Liu & Zhao, 2022, p. 1). When looking at businesses, it has been observed that IoT technology improves supply chain management and personalized customer experiences on the retail side; while it improves production processes on the production side (Shapoval, 2024, p. 193). In addition that it is also seen that some issues such as security, privacy, law and interoperability are on the agenda for IoT technology. Below are discussed the advantages and disadvantages of different studies on IoT technology.

Pros and Cons of IoT

Advantages of IoT

Soumyalatha (2016) discussed the advantages of IoT in his study as follows:

- Thanks to the ability of devices to remain connected, inefficiency is reduced and higher quality communication is provided.
- A large amount of information is controlled by automation; this saves businesses time.

- The use of smart sensors saves time and money.
- New business lines are created thanks to the new business opportunities it creates; this positively affects overall economic growth.
- It ensures less use of natural resources, which creates a more sustainable world.

Anbazhagan et al (2022) stated the advantages of IoT in their study as follows:

- It provides advanced connectivity between devices, saving time and money.
- It increases the service quality of businesses.
- It automates tasks by minimizing human intervention in businesses.

Balaji et al (2019) stated the advantages of IoT in their study as follows:

- Thanks to the automation it provides, it allows production processes to be completed with almost no human intervention.
- It allows businesses to produce larger volumes of products and produce faster.
- IoT generally provides users with flexible usage opportunities because it is connected to the cloud.

Disadvantages of IoT

Soumyalatha (2016) discussed the disadvantages of IoT in his study as follows:

- There is no international compatibility standard yet for connecting devices from different manufacturers.
- It is a complex technology. Any error in software or hardware can cause serious problems.
- Since many devices and technologies need to be used in this system, there is a risk of losing private data.
- Power outages in the system can cause major problems.
- Less employment needs lead to unemployment in society.

- In order for objects that work together to work together, they need to have a common communication standard.
- The system needs a very high amount of energy to be constantly active. Energy optimization is an important issue.

Anbazhagan et al (2022) stated the disadvantages of IoT in their study as follows:

- The possibility of theft of the collected data.
- The high amount of data collected can make it difficult to manage this data.
- When an error occurs in a system, all devices connected to this system are likely to be damaged.
- Since there is no international IoT system yet, it is difficult to connect devices from different companies.

Balaji et al (2019) have revealed the disadvantages of IoT in their studies as follows:

- Mismanagement or theft of data can jeopardize users' security and privacy.
- Since a large number of devices must be constantly active, a lot of energy is used.
- Most of the work done by smart devices requires minimal personnel needs. This leads to a decrease in the workforce.
- The use of devices is complex and their maintenance is quite laborious.
- Due to the collection of large amounts of data, in some cases, devices cannot connect to each other. This reduces the efficiency of the system.

Digital Transformation in International Trade

Advanced technologies have started to be used significantly in the field of international trade in the last few years (Vorotyntseva, 2019, p. 452). Digital transformation has facilitated trade and business models from the past and has led to the creation of new models. With the creation

of new economic models by digital transformation; digital market access, freedom of cross-border data flows, data localization, privacy and competition issues have been reshaped (Ciuriak & Ptashkina 2018, p. 1). According to Schwertner, digital transformation applications carried out by businesses in these areas bring higher profits, more significant competitive advantage and higher efficiency to businesses (Schwertner, 2017). In order to achieve these advantages, companies transform their business processes and models, increase workforce efficiency and innovation and customize customers' experiences (Pereira et al., 2022, p. 5).

Digital transformation for international trade enterprises can significantly improve the innovation ability of enterprises, improve the internal control of enterprises, and thus effectively improve the core business performance (Ye & Tong 2022, p. 7). The development of digital technologies enables enterprises to reduce transaction costs, while leading to the increase of international trade indicators and the strengthening of countries by specializing in international trade transaction processes (Vorotyntseva, 2019, p. 455). Although discussions on international trade and digital transformation have taken their place in the literature in the last decade, the effects of blockchain artificial intelligence and internet of things studies on international trade are still areas that need to be investigated. Although the theoretical literature on the subject has been examined in separate fields of study, it provides little guidance on the impact of digital transformation issues discussed in this study on international trade..

Materials and Methods

The aim of this research is to contribute to the literature by revealing the advances in digital technologies and the applications developed in this direction, and then discovering the advantages and disadvantages seen in the application of digital technologies; and by revealing the issues that entrepreneurs and academics who want to digitalize in international trade should consider in their studies. It is stated that the digitalization studies that have accelerated in businesses due to the impact of globalization and the pandemic will significantly direct the domestic and foreign trade strategies of countries until 2030. In this regard, DIGITALEUROPE General Director Cecilia Bonefeld-Dahl mentioned that there are plans to develop international partnerships within the scope of digital transformation in Europe before 2030. A qualitative research method was used in the research and the results obtained from the studies in the relevant literature and the effects of this transformation on international trade were compiled.

In this research, the literature review method was used to examine the impact of digital transformation in international trade. Within the scope of the literature review, keywords such as digital transformation in international trade, blockchain in international trade, artificial intelligence in international trade and internet of things in international trade were used in academic databases. In this study, studies published between 2015 and 2024 were analyzed using Web of Science, Scopus, and Google Scholar databases. The reason for choosing this year range is to be able to address the current impact of technological developments on international trade. All academic articles, conference proceedings and reports within these years were taken into account. Blockchain and international trade relationship and the evaluated studies are shown in Table 1.

Table 1. Blockchain and International Trade Relationship

Blockchain		
Author(s)	**Scope of the Study**	**Blockchain and International Trade Relationship**
Ganne (2018)	This study analyzes the developments in technology that Blockchain has been introduced and leveraged for international trade by examining how it is currently deployed or could be used in various areas where it is included in the WTO.	Blockchain technology, when used by businesses with the right technical skills and sufficient internet access, simplifies trading procedures and reduces trading costs. These developments are seen as a powerful tool to facilitate the participation of SMEs in international trade. This new technology can help create lower the barriers to entry for SMEs into international markets, while facilitating the participation of small companies and manufacturers in international trade.
Belu (2019)	In this study, the basic elements and basic principles related to blockchain technology are revealed by examining academic	With the application of Blockchain technology in the field of international trade, intermediary interventions are eliminated and costs are reduced. In

	literature and various online resources. In addition, the areas where this technology can be applied are discussed in detail and the potential benefits of this technology are revealed.	addition, security and transparency will increase with the traceability of products and the ease of control procedures at customs points. Blockchain technology is applied in financing and payment processes in foreign trade transactions. This means that banks can digitize these activities and therefore reduce the costs related to payment/financing methods. In addition, it allows easier access to the cash funds required to initiate and execute a trade transaction.
McDaniel & Norberg (2019)	In this study, they discussed the role of blockchain technologies in international trade, how this technology affects international trade finance, customs procedures and how it can affect the origin of goods.	The nature of international trade transactions holds great potential for blockchain technology to facilitate trade. Areas where blockchain technology can be useful in international trade transactions include facilitating trade finance, improving customs procedures, and tracking the origin of goods.
Toorajipour et al., (2022)	In this study, the usage areas of blockchain were examined and a system proposal based on blockchain technology was made.	In blockchain-based international trade, transactions are more transparent and traceable, preventing possible corruption and fraud risks. Not needing third parties increases trust among users in the system and reduces costs. The burden of paperwork required in the old system is reduced and transactions are accelerated.

Table 2. AI and International Trade Relationship

AI		
Author(s)	**Scope of the Study**	**AI and International Trade Relationship**
Ferencz et al., (2022)	In this 2022 study, after providing information about the description, adoption and diffusion of AI technologies, three case studies showing the applications of AI technologies in international trade are examined.	The contribution of AI in international trade in the areas of language, logistics and finance is discussed. Then, in the context of the possibility of unforeseen events such as natural disasters, cyber attacks and health crises in international trade; AI can become a useful tool that analyzes real-time data, provides more timely and detailed information and helps reduce the impact of uncertainty.
Jayathilaka (2022)	In this study examined how AI technology positively impacts international trade. The study tested the WDI of 150 countries between 2018 and 2021 using a panel dataset.	With AI technology, consumer trends can be better predicted, inventory analysis can be done more easily, and logistics procedures can be planned more easily and on time. With this technology, errors in deliveries can be monitored and minimized, and potential security threats can be prevented. In addition, it simplifies warehouse activities and speeds up operations.
Igbinenikaro & Adewusi (2024)	In this study, they examined the usage areas of artificial intelligence in international trade and presented a study examining its advantages and disadvantages.	AI technology increases the production efficiency of businesses by monitoring production processes, identifying potential problems in advance, and optimizing production programs. In addition, personalized

		advertisements or shipments can be applied to consumers through AI. International e-commerce companies have made a name for themselves by providing personalized services to their customers through AI. However, international standards, legal and ethical rules are needed for the application of AI technology.
Lo & Lee (2024)	In this study, they presented a study in which they claimed that digitalization and AI facilitate international trade.	By using AI, businesses can implement efficient and sustainable production practices, thereby increasing their competitiveness. With the use of AI, businesses can see customers' purchase history more clearly, thereby significantly increasing their success in international markets.

Table 3. IoT and International Trade Relationship

IoT		
Author(s)	**Scope of the Study**	**IoT and International Trade Relationship**
Bhat et al (2021)	In this study aimed to show how blockchain and IoT technology provide convenience in the supply chain by considering them together.	IoT provides convenience to businesses in international trade in many areas such as real-time location tracking, monitoring of storage activities, product delivery estimates and predicting possible delays. IoT technology contributes to the creation of routes by taking into account weather conditions, traffic and possible accidents that may occur along the way during the shipment of products. It creates emergency plans that may be needed. It provides advanced solutions especially in supply chain management and maximizes efficiency in warehouses.
Sousa (2018)	This study aims to reveal the advantages and disadvantages of this technology and analyze its importance by examining its effects on the activities of businesses engaged in international trade.	It has been stated that IoT technology is an application that will transform production, agriculture, transportation and many other sectors. While the use of this technology provides advantages such as connection from anywhere and obtaining real-time data in international trade, it is also seen that some issues such as security, privacy, law and interoperability are on the agenda.

Qiuxia & Yujie (2022)	In this study examines the development of data analysis method with IoT technology on international trade and its contribution to economic/industrial growth.	It is seen that IoT technology enables businesses to increase efficiency, improve customer experiences and develop new business models in international trade.

Analysis and Findings

In the studies conducted in the literature, Ganne (2018); Belu (2019); McDaniel & Norberg (2019) and Toorajipour et al., (2022) agree that the use of blockchain in international trade will reduce costs. The reason for this is shown to be the absence of intermediary intervention. Belu (2019); McDaniel & Norberg (2019) and Toorajipour et al., (2022) stated that the use of blockchain in international trade increases the traceability of products and facilitates customs procedures; Belu (2019) and Toorajipour et al., (2022) stated in their studies that the use of this technology in international trade will increase the security and transparency rate among businesses. In addition, Belu (2019); and Toorajipour et al., (2022) mentioned that the use of blockchain in international trade reduces the paperwork burden and therefore transactions can be completed faster. On the other hand, when looking at the studies of Ouriat et al (2024) and Niranjanamurthy et al., (2019), it is seen that there are security problems and high energy consumption in blockchain technology. As well as, in the study of Ouriat et al., (2024), it is seen that there is a lack of international legal standards and in the study of Niranjanamurthy et al., (2019), it is seen that there are some strategies needed to use this technology.

Jayathilaka (2022); Igbinenikaro & Adewusi (2024); Lo & Lee (2024) mentioned in their study that AI technology allows the monitoring of production processes in businesses, allowing the detection of possible problems in advance and increasing the efficiency of businesses. In addition, according to the results obtained from these studies, personalized advertisements or posts can be applied to consumers through AI. Ferencz et al., (2022) and Jayathilaka (2022) mentioned in their studies examining the issue of digitalization in international trade that AI reduces unforeseen problems. In addition, Igbinenikaro & Adewusi (2024) mentioned the need for international common standards, legal and ethical rules regarding the application of AI

technology. Bhbosale et al., (2020) and Khanzode & Sarode (2020) basically mentioned the same disadvantages regarding artificial intelligence and stated that the infrastructures required for artificial intelligence are expensive, may cause unemployment in the human workforce and are inadequate except for programmed subjects.

Bhat et al (2021) stated that the use of IoT technology in international trade provides advantages to businesses, especially in logistics activities; Sousa (2018) stated that obtaining simultaneous data is the biggest advantage and touched on international issues regarding security/privacy. Qiuxia & Yujie (2022) stated that the use of IoT technology in international trade improves customer experiences and increases the overall efficiency of businesses. Soumyalatha (2016); Anbazhagan et al (2022) and Balaji et al (2019) mentioned the security and privacy risks that can pose a great threat due to the theft or misuse of data in IoT technology; the lack of international standards that will ensure the compatible operation of devices; the fact that continuous operation of systems requires a lot of energy; errors in one device can affect all connected devices; automation will reduce the need for manpower, and data management difficulties arising from the complexity of processing and storing large amounts of data.

Conclusion

The importance of digital transformation has been increasing in recent years. This study focuses on the integration of blockchain, AI and IoT technologies into international trade practices and strategies and the advantages and obstacles encountered in the use of these technologies. In this study, the most comprehensive studies examining digital transformation in international trade have been examined and a theoretical study has been presented that presents a general assessment. This study aims to contribute to creating a guide for international businesses that want to use digital transformation applications.

Considering the impact of globalization and the possibility of extraordinary life problems such as pandemics, the critical role of technologies such as blockchain technology, AI and IoT in the future clearly comes to light. However, the existence of some fundamental problems in the use of these technologies also draws attention. In particular, it is seen that international standards should be developed for the effective and secure application of these innovative technologies.

These standards can minimize potential risks and support technological progress by ensuring the harmonious integration and safe use of technologies on a global scale.

Nevertheless, it is seen that there are some general problems regarding the application of these technologies. In particular, it is seen that international standards should be established regarding the use of these technologies. In addition, it is seen that there are problems such as excessive energy consumption, creating a common communication language and increasing unemployment among low-qualified employees in the use of these technologies.

Although these technologies can be applied to all sectors of the economy; it has been seen in the literature that their most positive effects are in the finance and e-commerce sectors; and that they are used most in efficiency-enhancing areas, especially in logistics activities. The theoretical importance of this study lies in the fact that no study has been found on the application of only these three digital transformation tools (blockchain, AI and IoT) to international trade. In future studies, these three digital technologies can be compared with each other, and it can be discussed which types of trade (B2B, B2C, G2G) these digital technologies are more suitable for and/or can be used.

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