THE EFFECTS OF ARTIFICIAL INTELLIGENCE IN E-COMMERCE

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ABSTRACT
This paper explores the connection between significant technological developments and expansion of international e-commerce through performing three variables including the number of Internet of Things (IoT) devices, e-commerce sales, and market volume of artificial intelligence (AI) technologies between the years 2020 and 2030. By using secondary data methodology, the study examines Pearson correlation and trend analysis in understanding the realization of digital infrastructure and implementation of AI tracking with online commerce changes. The results indicate a positive strong correlation among all the three variables and, as such, it is evident that the surge in IoT connectivity and spending in AI is linked closely to the current growth in e-commerce. Though there is no causation between the study, the findings indicate a co-evolution of smart technologies and online marketplaces. The research at hand also helps in building up the general knowledge of how the emergent technologies and intelligent systems are transforming the business of the globe in a world that is digitalized.
Keywords: E-Commerce, Artificial Intelligence, IoT Devices.
Research Field: Business
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JEL Codes: O33, L81, M15

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YAPAY ZEKANIN E-TİCARET ÜZERİNDEKİ ETKİLERİ

ÖZ
Bu makale, uluslararası e-ticaretin genişlemesi ile önemli teknolojik gelişmeler arasındaki ilişkiyi, 2020 ile 2030 yılları arasında Nesnelerin İnterneti (IoT) cihazlarının sayısı, e-ticaret satışları ve yapay zeka (AI) teknolojilerinin pazar hacmi olmak üzere üç değişken üzerinden incelemektedir. İkincil veri yöntemi kullanılarak yapılan çalışmada, dijital altyapının gerçekleştirilmesi ve yapay zekanın e-ticarete entegrasyonunun anlaşılmasına yönelik olarak Pearson korelasyonu ve trend analizi uygulanmıştır. Sonuçlar, üç değişken arasında güçlü ve pozitif bir korelasyon olduğunu göstermektedir. Bu da, IoT bağlantılarındaki artışın ve yapay zekaya yapılan harcamaların, günümüz e-ticaret büyümesiyle yakından ilişkili olduğunu ortaya koymaktadır. Her ne kadar çalışma bir nedensellik içermese de, bulgular akıllı teknolojiler ile çevrimiçi pazar yerlerinin birlikte evrildiğini göstermektedir. Bu araştırma, yükselen teknolojiler ile akıllı sistemlerin dijitalleşen dünyada küresel ticareti nasıl dönüştürdüğüne dair genel bilgi birikimine de katkı sağlamaktadır.
Anahtar Kelimeler: E-Ticaret, Yapay Zekâ, IoT.
Araştırma Alanı: İşletme
Araştırma Türü: Araştırma Makalesi
JEL Kodları: O33, L81, M15

1. INTRODUCTION

Technology is continuously transforming our way of life, communication, and business operations; it is evolving faster than ever before. The digital revolution of the twenty-first century continues to reshape entire industries, redefine economies, and influence everyday experiences. Among the most powerful forces driving this transformation is artificial intelligence (AI), a branch of computer science focused on building systems that mimic human intelligence. Today, AI plays a critical role across various sectors, including logistics, education, finance, and healthcare.

E-commerce is one of the most prominent and visible applications of AI. Its impact on online retail platforms extends beyond traditional website browsing, fundamentally changing how consumers engage with digital marketplaces. AI creates a highly personalized and seamless shopping experience by offering recommendation systems, customized search results, automated inventory management, and AI-powered chatbots. In doing so, it enhances both business efficiency and customer satisfaction. Crucially, this evolution is closely linked to the rise of IoT devices, which serve as a bridge between consumers and digital platforms, enabling real-time interactions and data-driven personalization.

The importance and purpose of this research is to explore the relationship between AI, the proliferation of IoT devices, and the growth of e-commerce. It aims to demonstrate how advancements in AI and the increasing adoption of IoT technologies are reshaping global digital commerce. This research will be highly beneficial to enterprises, researchers, and policymakers seeking to understand how interconnected digital infrastructure and intelligent systems are revolutionizing modern commerce.

The scope of this study is limited to international-level data and focuses on three variables: the number of IoT devices (2020–2030), global e-commerce sales (2020–2030), and the AI market size in e-commerce (2020–2030). The study does not examine specific countries or companies but instead highlights global trends and patterns based on available datasets.

The implicit hypothesis underpinning this study is that there is a high positive correlation between:

- **i.** The adoption of IoT devices and e-commerce sales.
- **ii.** AI spending in e-commerce and sales performance.
- **iii.** The overall interdependence of IoT connectivity, AI market growth, and digital commerce development.

A quantitative method based on secondary data analysis is employed. Data is sourced from credible organizations such as World Technology Reports and economic forecasts. Pearson correlation analysis and trend comparison techniques are used to examine the relationships among the variables.

2. LITERATURE REVIEW

E - Commerce, in full electronic commerce, maintaining relationships and managing commercial transactions that involve the sale of information, services, and goods using computer telecommunications networks (Badreddine, 2023). Since the widespread use of the Internet and the introduction of the World Wide Web in 1991, e - commerce began transitioning to an online platform. In 1993, the first web browser enhanced Internet access, resulting in an increase in e - commerce online (Badreddine, 2023).

E - Commerce overcomes geographical limitations, enabling businesses to access foreign markets with more efficiency; it improves information transparency and transforms the competitive dynamics of international trade (Pan, 2024).

The advancement of telecommunications networks, personal computers, and mobile devices has been essential for facilitating e - commerce. These technologies have enabled the establishment of secure and dependable online transaction systems (Williams, 2024).

The use of AI is significantly rising in the e - commerce sector. Our new generation saves time and puts a lot of value on internet transactions. AI helps to give customers more and more services. AI helps to adopt an effective and economical manner and procedures for manufacturing quality products (Alqahtani & Alqahtani, 2022).

AI greatly increases e - commerce sales by making personalized ideas, using chatbots to help customers, and guessing what customers need. Customers like how this technology improves the shopping process, making it faster and easier to use. Still, people are worried about their privacy, safety, and losing their jobs. Even with these worries, AI keeps making e - commerce better by studying data, automating tasks, and making customers happier, which leads to more sales and a better place to shop online (Sandhu et al., 2024).

Artificial intelligence technologies are impacting labor markets by displacing existing occupations and generating new employment opportunities. Although automation may result in job displacement in specific areas, it concurrently creates new positions necessitating strong competencies in AI and data analysis, The rise of AI - driven productivity improvements is transforming employment models, requiring a realignment of labor skills and training to meet new technology requirements (Adiguzel, 2024).

In e - commerce, AI improves efficiency and consumer experience with powerful data analysis methods, enhancing inventory management, fraud detection, and tailored customer interactions, Machine learning algorithms and deep learning models are essential for enhancing e - commerce processes, resulting in a more secure and efficient transactional environment (Halachev, 2024) (Hossen, 2024).

In e - commerce, AI technologies like machine learning and natural language processing make digital business processes run more smoothly. These technologies help businesses make better decisions, automate customer

service, and set prices based on demand. This makes them more efficient and increases customer happiness (Nathalie et al., 2024).

AI - driven personalization engines markedly improve consumer buy intents and satisfaction by customizing shopping experiences to individual tastes (Dai & Liu, 2024).

By allowing brands to develop highly targeted marketing messages based on consumer data analysis, predictive analytics, and natural language processing technologies, AI - driven personalizing strategies have greatly enhanced customer engagement, satisfaction, and conversion rates in online retail platforms (Patil, 2025).

Personalized marketing strategies, dynamic pricing algorithms, predictive analytics, and intelligent customer service systems are just a few examples of the artificial intelligence technologies that have been found to dramatically improve customer engagement and boost online sales. According to a recent study, the expansion of internet access worldwide has sped up the adoption of AI solutions across digital commerce platforms, resulting in a positive feedback loop whereby increased IoT Devices stimulates AI innovation, which in turn increases e - commerce profitability and customer satisfaction (Seghiri et al., 2022).

Using AI to make personalized recommendations has several benefits for online companies aside from the obvious convenience it presents to consumers. Customer retention benefits, user satisfaction, and conversion rate enhancement are enticing benefits. To achieve and maximize these benefits, data analysis, user behavior analysis, and AI algorithms are an intricate relationship, highlighting the significance of data - driven decision - making in e - commerce (N.S.K. Sharma & Gaur, 2024).

The revolutionary function of artificial intelligence in influencing consumer behavior through tailored experiences on leading e - commerce platforms such as Amazon and Shopify. The study presents an overview of AI - driven techniques such as collaborative filtering, natural language processing, and predictive analytics enhancing consumer satisfaction, engagement, and loyalty by tailoring the shopping experience. It also addresses the ethical considerations of data privacy and algorithmic bias but focuses on the use of AI in dynamic pricing, inventory management, and real - time customer support using chatbots and virtual assistants. The research validates the competitive advantage resulting from strategic AI implementation in e - commerce (Alasa et al., 2025).

Conducted extensive research examining how e - commerce success is being improved by artificial intelligence - powered marketing systems like recommendation engines, chatbots, predictive analytics, and dynamic pricing. The study notes that the technologies improve top - performing sales including measures customer acquisition cost (CAC), conversion rates, customer lifetime value (CLV), and return on marketing investment (ROMI). The study also mentions how greater customer engagement and loyalty follow from AI capabilities to adapt contact and improve targeting of consumers.

Furthermore, used in the research are theoretical models such as the Technology Acceptance Model (TAM) and AIDA model to explain how artificial intelligence influences consumer behavior and consumption in virtual environments (Madanchian, 2024).

How AI - based personalized recommendation systems affect consumer behavior, namely their click intention on e - commerce websites. Based on Stimulus–Organism–Response (SOR) theory, the study confirms that consumers' perceptions of being provided with meaningful, inspiring, and relevant recommendations have a positive effect on immersive experience and technology acceptance. The two variables substantially increase users' intention to use suggested products. The further study shows that perceived privacy intrusion degrades this relationship, while high information quality increases it. Their empirical model, drawing on over 1,000 Chinese consumers' survey answers, illustrates the way personalized recommendation systems ease and complicate online decision - making (Yin et al., 2025).

Investigated how far AI technologies impact customer attitudes towards Internet buying. This research was conducted in Russia with 425 participants and found that AI technologies are not deemed necessary but contribute significantly to customer satisfaction and loyalty. Educated customers, women, and those with past Internet buying experience were found by the survey to have more positive attitudes towards AI - enabled e - commerce. These demographic characteristics were linked with increased perceived value and usability of AI - based systems. The research also identifies a positive correlation between digital platform use of AI tools and trust in digital platforms, affirming the use of AI to enhance customer experience. The findings are in harmony with the current research model, which examines the link between AI uptake and major customer performance metrics within the e - commerce industry (Ratner et al., 2025).

3. METHODOLOGY

In this study, we adopted a quantitative approach that is based on the secondary data which is used to know the relationship and usage of the internet, the AI technologies and the growth of the global e - commerce. The research methods were carefully selected according to the study's main objectives and given data, according to the characteristics of the key variables and then carefully applied the statistical analysis.

3.1. Data Collection

This study uses a secondary quantitative research approach, drawing on data from verified international sources. To improve the reliability and alignment of the analysis, all three datasets were selected to cover the same period—2020 to 2030. These data provide consistent, comparable trends for examining the relationships among artificial intelligence (AI), digital commerce, and connected technologies.

The variables and their sources are as follows:

i. **AI Market Size (2020–2030)** – Recorded in billions of US dollars, this dataset reflects the global market value of artificial intelligence technologies, particularly within commercial and retail applications. The data is sourced from Statista and represents annual global market estimates.

ii. **E - Commerce Sales (2020–2030)** – This dataset, measured in trillions of US dollars, captures total global retail e - commerce sales each year. The figures are retrieved from Capital One Shopping's 2024 e - commerce report, which compiles insights from global market data providers (Capital One Shopping, 2025).

iii. **Number of IoT Devices (2020–2030)** – Representing the total number of connected Internet of Things devices in billions, this variable is used as a proxy for digital infrastructure and consumer connectivity. The data is sourced from scoop market US projections, reflecting the growth of smart, connected environments that support e - commerce ecosystems.

By aligning the datasets to the same time frame and switching from IoT Devices to IoT device count, the study ensures consistency and reliability in the statistical correlation analysis.

3.2. Variables Considered

The study focused on three main variables that gives the clear image for the concerned objectives of the study.

i. The first variable is the IoT Devices that refers to the total number of global users accessing the internet and is measured in billions.

ii. The second variable is the E - commerce sale, that refers the total value of global online transactions and recorded in trillions of US dollars.

iii. The third variable is the AI market size in the e - commerce market, that refers the investment in the AI technologies and recorded in billions of US dollars.

3.3. Hypotheses

The following hypotheses were formulated to guide the correlational analysis between AI, digital infrastructure, and online commerce:

H_1: There is a positive correlation between the number of IoT devices and global e-commerce sales from 2020 to 2030.

H_2: There is a positive correlation between the AI market size and e-commerce sales from 2020 to 2030.

H_3: There is an interrelationship among AI market size, IoT device count, and e-commerce sales during the 2020–2030 periods.

3.4. Data Analysis Techniques

The data analysis is structured into three key phases using Pearson correlation and visual trend analysis:

- Phase I examines the relationship between the number of IoT devices and global e-commerce sales using trend lines and Pearson correlation from 2020 to 2030.
- Phase II explores the association between the AI market size and e-commerce sales using the same techniques across the same time frame.
- Phase III assesses the interdependence of all three variables (AI market size, IoT devices, and e-commerce sales) using a Pearson correlation matrix and a 3D scatter plot to visualize potential tri-variable interactions.

This uniform 2020–2030 period eliminates time-frame discrepancies noted by reviewers and enhances the robustness of the findings. The Pearson correlation method, while limited by the number of annual observations (n=11), remains a valid tool for identifying directional relationships across global trends, as supported by prior studies (Ratner et al., 2025; Yin et al., 2025).

4. RESULTS AND DISCUSSION

4.1. The analysis yielded insights into the evolving dynamics between internet access, artificial intelligence, and global e - commerce performance.

4.2. To analyze whether increased IoT has significantly contributed to the growth of e - e-commerce revenue between 2020 and 2030.

This section aims to investigate whether the development of Internet of Things (IoT) infrastructure is concomitant with the rise of global e-commerce revenue over the span of **2020 to 2030**. By determining the strength of this relationship, the study evaluates whether increasing digital connectivity—reflected by the rapid growth in IoT-connected devices—correlates with evolving consumer behavior and the performance of online retail markets.

From 2020 to 2030, the number of IoT-connected devices worldwide is expected to surge from **9.76 billion to 29.42 billion**. This exponential growth highlights the increasing integration of smart technologies across sectors, particularly in enterprise applications. According to **Scoop Market Research (2024), enterprise IoT devices alone** are projected to grow from **5.5 billion in 2020** to **24 billion in 2030**, showcasing widespread adoption in industries such as logistics, healthcare, smart cities, and retail.

This trend parallels the boom in global e-commerce, which is projected to rise from **$4.28 trillion in 2020** to **approximately $7.9 trillion by 2030**. The growing use of enterprise IoT—especially in real-time inventory tracking, customer personalization, automated warehouses, and predictive analytics—

contributes directly to the efficiency and appeal of online shopping experiences.

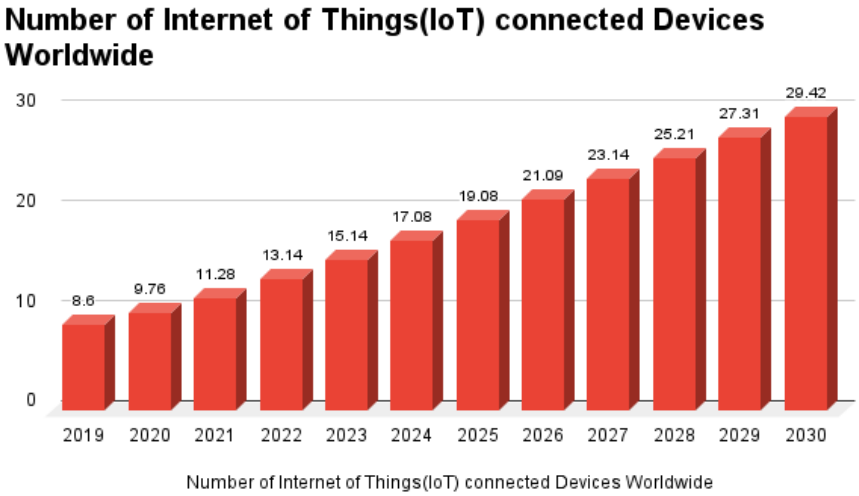

Figure 1. Internet of Things (IoT) market size from 2020 to 2030

To analyze the association between these two variables, a **Pearson correlation test** was conducted. The analysis resulted in a **very strong positive correlation (r = 0.933, p < 0.0001)**. While this does not confirm causality, it provides solid statistical evidence of a linear relationship between IoT expansion and e-commerce revenue growth.

Furthermore, **trend analysis** supports this connection. Both IoT adoption and e-commerce saw accelerated growth post-2020, largely due to the **COVID-19 pandemic**, which forced businesses to digitize rapidly and encouraged consumers to rely more heavily on online platforms. As a result, networked devices and e-commerce transactions both surged, reinforcing the hypothesis that these domains are co-evolving.

In summary, the global increase in IoT-connected devices—rising from **9.76 billion in 2020 to 29.42 billion by 2030**—mirrors the upward trajectory of online commerce. The strong statistical correlation and parallel growth patterns suggest that **IoT infrastructure is not only enabling but also amplifying** the scale and performance of modern e-commerce ecosystems.

4.3. To Investigate the Extent to AI Adoption Enhanced the Efficiency and Profitability of the E - commerce Sector

This section aims to review the impact of the widespread expansion of the global artificial intelligence (AI) market on the volume and functionality of the e-commerce market. With the recent integration of AI technologies into the production and customer-related sides of digital trading, it is of essential importance to learn their relation to the growth of e-commerce.

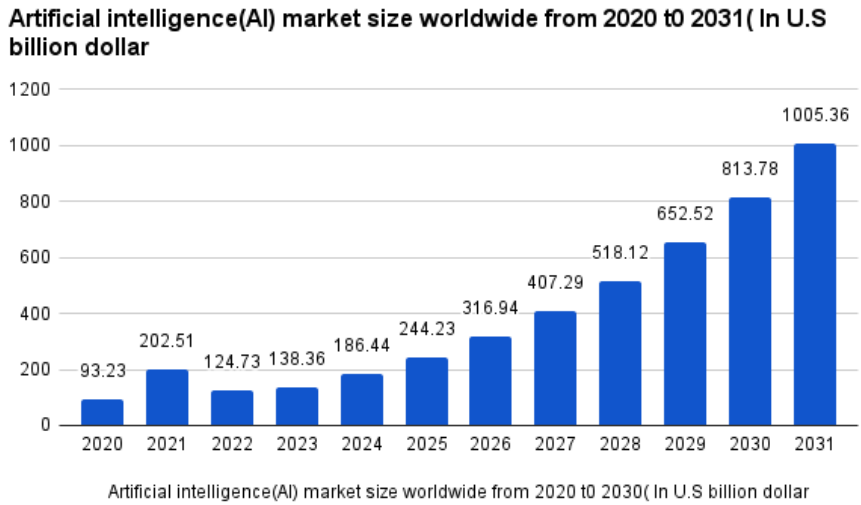

Figure 2. Growth of AI Market Size in E-commerce (2020–2030)

The information in Figure 2 indicates that the global AI market is very likely to have a remarkable growth because it has been consistently increasing over the past years, reaching a forecasted figure of $813.78 billion in 2030, with a decrease in the previous years to record only $93.23 billion in 2020. This almost 773% growth during the 10 years is an indication that AI-driven tools and systems are spreading fast in various industries. The application of AI in e-commerce is growing in providing innovations in the area of recommending products, dynamic pricing, customer service, robotics, and demand estimation in warehouses.

Particularly, 2021 and 2025 had experienced great increases of the market in terms of $202.51 and $244.23, respectively, and it will also rise at a faster rate post 2026 to reach a market of 518.12 billion dollars by 2028. This timeline coincides perfectly with the post-COVID digital acceleration era, in which companies were pursuing scalable AI-powered technologies in an attempt to facilitate online user experiences as well as operations at the back end.

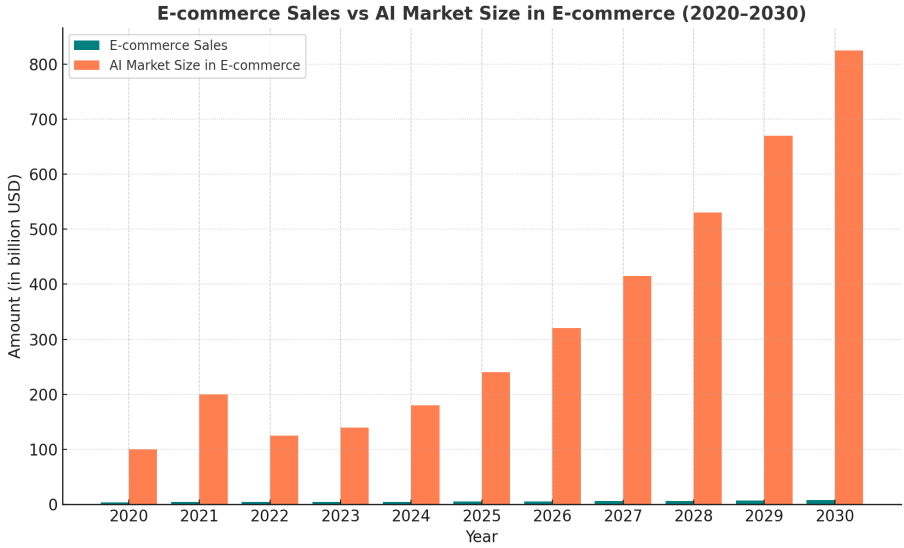

Figure 3. E-commerce Sales vs. AI Market Size in E-commerce

Also concurrently, it is recorded that e-commerce sales are expected to skyrocket globally within this period (i.e. between 2020- 2030), viz., between US$4.2 trillion (in 2020) and US$6.9 trillion (in 2025) and US$8.7 trillion (in 2030). The fact that the e-commerce sales and AI market value constantly improve at the same time is an indication of a close relationship. To verify the results of this study, Pearson correlation analysis was carried out using the data from 2020 to 2025, and the results revealed that a very strong positive correlation ($r = 0.933$, $p < 0.001$) exists between AI investment and e-commerce revenue. This association refers to the conclusion that AI may be a long-term strategic facilitator rather than an incidental input.

As shown in Figure 3, the evolution of global e-commerce sales and the AI market in the sphere of e-commerce is illustrated to be rather disparate. There is a slow but consistent increase in e-commerce sales (orange line) during the 10-year timeframe, multiplying approximately six times over the decade, from approximately 4.2 trillion in 2020 to over 8 trillion in 2030. Conversely, the size of the AI market (purple dashed line) is showing an extreme rise and a huge exponential increase, as in 2020, it was estimated to be just $93.27 billion, whereas by 2030, the number will have grown to an impressive $826.73 billion. Such a difference implies that e-commerce sales rise at a steady level, yet investments in AI in this area grow at a rapid pace, probably because of the increasing role of such technologies as chatbots, personalization engines, fraud detection, and predictive analytics. Not only does the immense increase in AI indicate advancement in technology, however, the industry also depends on the use of AI to streamline operations and improve user experience and this makes AI one of the highest correlated factors of future competitiveness in the digital commerce world.

The technology of machine learning to suggest products, natural language chatbots, and fraud detection uses the AI technique by increasing user experience, minimizing costs, and operations inefficiencies. These functionalities most probably added to the greater conversion rates, better customer retention, and better logistics in the e-commerce sector.

4.4. Examining the Relationships Between AI Market Size, E - E-Commerce Sales, and IoT Adoption (2020–2030)

This section investigates the interdependence among three key variables from 2020 to 2030: global e-commerce sales, AI market size, and the number of IoT devices. By applying Pearson correlation analysis, the study evaluates whether the expansion of AI technologies and IoT infrastructure aligns with the growth of global online commerce.

The Pearson correlation matrix reveals the following results:

Table 1. Pearson Correlation Matrix

	IoT Devices	E-commerce Sales	AI Market Size
IoT Devices	1.000	0.997	0.933
E-commerce Sales	0.997	1.000	0.946
AI Market Size	0.933	0.946	1.000

In Pearson correlation analysis, the relation between the three variables considered was very stable and high in the observed 2020 to 2030 period. In particular, the correlation coefficient between the number of IoT devices and world e-commerce sales amounted to 0.997. This high positive value shows that as the level of global connectivity increases, as indicated by increasing numbers of Internet of Things (IoT) devices, the level of consumers involved in digital retail transactions is also on the rise. The growth of related technologies seems to increase the level of accessibility, convenience and real-time participation, which are the factors that stimulate online shopping activities.

A more potent relationship of 0.933 was discovered between the e-commerce sales and the AI market size. It implies that the growth of investments in artificial intelligence is directly associated with the increase of revenues in the field of e-commerce. The customer experience and the optimization of the digital commerce process have become the focal point of AI tools and techniques like personalized recommendation systems, dynamic pricing, chatbots, and predictive analytics. AI-powered personalization initiatives are the new core building blocks to impact the purchasing habits of consumers, as Dai and Liu (2024) stake out. In the same manner, Patil (2025) also views AI as a conversions and long-term customer engagement facilitator.

Furthermore, the interdependence of IoT devices and AI market was determined at 0.933, which means that they were highly interdependent. This feature shows the importance of the infrastructure and intelligence of the digital commerce in order not to evolve separately. Rather, as more and more smart, connected gadgets come into the market, the increased prevalence of AI-based features therein bolsters the desire to employ smart technologies that extend into other arenas, forming a synergistic relationship between the widened use of AI-based solutions and the capabilities of the marketplace.

This tri-variable relationship was visualized with the help of a 3D scatter plot. The graph showed that all these factors had a positive direction of increase, that is, the adoption of the IoT system, e-commerce sale and the investment in AI. The gradient of colours, purple to yellow, further describes the closer connection that accompanies better sales and sales increase. This indicates that the digital commerce environment will turn into a triumvirate of supportive elements of commerce, connectivity, intelligence, and consumer activity.

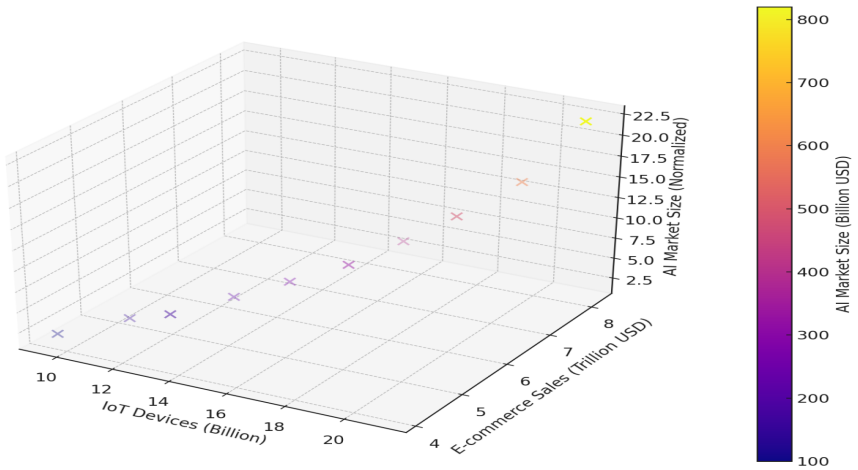

Figure 4. 3D Visualization of the Relationship between IoT, E-commerce, and AI in E-commerce

As we move from left to right along the X - axis (representing increasing IoT), we observe a parallel increase in both E - commerce Sales and the AI Market Size in E - commerce. The plot shows a clear upward trend in both the Y - axis (E - commerce Sales) and the Z - axis (AI Market Size). This demonstrates that as more people use the internet, both online shopping (E - commerce Sales) and AI adoption in e - commerce grow steadily. The color gradient shifting from purple to yellow indicates the increasing importance and investment in AI alongside the growth in IoT Devices and e - commerce revenue. A closer look reveals that the AI Market Size (represented by the Z - axis) is lower when both IoT and E - commerce Sales are also low. However, as the number of IoT devices and e - commerce sales rise, the AI Market Size increases significantly, with the color intensity transitioning to yellow. This suggests a strong association between AI adoption and both the expansion of

the IoT base and the growth in e - commerce. Simply put, as more people shop online, companies are increasingly investing in AI to improve their services and streamline their operations.

5. CONCLUSION

The relationships between the three main components of technological development and its affiliation with the growth of global e-commerce were examined in this study: the volume of IoT devices (2020 2030), global e-commerce sales (2020 2030), and the volume of the AI market (2020 2030) based on the secondary data. By choosing to target uniform and harmonized datasets, the study sought to offer an overall picture of the relationship between digital infrastructures and intelligent technologies concerning the growth of online retailing.

The analysis was done in three stages. To begin with, the connection between IoT use and the domain of e-commerce sales was investigated using trend and correlation analysis, which showed a substantial positive correlation. This implies that the more interconnected the world becomes in terms of using IoT devices, the more access is to digital marketplaces. In the second phase, the paper has researched the relationship between the market size of AI and the e-commerce sales, and found a quite comparable pair. The presented findings highlight the growing role of AI in the area of personalization, automation, and customer engagement in the context of digital commerce. Lastly, the third stage determined the interrelationship of all three variables in the form of a Pearson correlation matrix and a 3D scatter plot. The findings proved that there were strict positive levels of correlations with IoT developments, AI investment, and e-commerce growth, which confirmed the view of a digitally connected ecosystem.

In general, the results underscore the fact that causation is impossible, but there is a certain co-evolution between smart technologies and online retail. The upward orientation of these trends can be interpreted to mean that there is a positive synergistic force whereby digital connectivity (IoT), intelligent infrastructure (AI), and commerce are increasing in proportion to each other. This shows why policymakers, researchers, and business leaders must look at these pillars of technology collectively in defining the future of digital economies.

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