

# Research on the Integration Innovation of AI and E-commerce and Its Impact on Future Business Models

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**Abstract:** This paper aims to explore the specific application of Artificial Intelligence (AI) technology in the e-commerce industry and the changes it brings, given the industry's rapid development, intensifying market competition, and evolving user needs. By reviewing the history of e-commerce development, we gain an in-depth understanding of the status of AI application in meeting market demands. The study focuses on the specific application of AI technology in e-commerce operations and its effectiveness, deeply analyzing key areas such as intelligent recommendation systems and data analysis. It reveals how AI can reshape the operational mode and business model of the e-commerce industry by enhancing user experience, optimizing operational efficiency, and deeply exploring data value. Furthermore, the paper explores the potential impact of this integration on the future development of the e-commerce industry and makes predictions on the prospects of AI technology application, providing valuable references for relevant enterprises and researchers. Ultimately, this research concludes that AI technology holds great promise in driving the sustainable and healthy development of the e-commerce industry by enabling more effective market competition response and precise user need satisfaction.

**Keywords:** Artificial Intelligence; E-Commerce; Business Trade; Intelligent Recommendation Systems; Omnichannel Marketing

## 1. Introduction

With the rapid progress of technology, the integration of Artificial Intelligence

technology and e-commerce has become one of the most compelling trends in today's business field. Artificial Intelligence, with its powerful data processing and autonomous learning capabilities, combines with the advantages of a large amount of user consumption data and virtual scene resources available in the field of e-commerce to jointly promote the innovation and development of e-commerce.

E-commerce's evolution reshaped operations, enhancing consumer experience, personalized recommendations. AI technology aids platforms in precisely addressing consumer needs, offering tailored services. AI-powered customer service systems boost quality & efficiency. Globally, e-commerce revolutionized trading, transcending geographical & time constraints. It fosters 24/7 cross-border transactions, propels logistics development, enhances distribution efficiency, and simplifies shopping for consumers.

The integration of Artificial Intelligence technology with the operation mode and business processes of traditional industries has promoted the transformation and upgrading of traditional industries. The application of Artificial Intelligence technology has accelerated retail digitalization innovation, driven the rapid development of e-commerce, become the engine of continuous growth in the scale of e-commerce, also brought endless possibilities for future business models [1].

## 2. Introduction to Artificial Intelligence Technology

### 2.1 Definitions

The concept of Artificial Intelligence (AI) can be defined as a set of intelligent behaviors demonstrated by computer systems or

machines that simulate human intelligence, which defined concerned with intelligent behavior in artifacts, Intelligent behavior, in turn, involves perception, reasoning, learning, communicating, and acting in complex environments. AI has as one of its long-term goals the development of machines that can do these things as well as humans can, or possibly even better [2]. The development and application of AI has had a profound impact on the progress of science and technology and the transformation of daily life.

## **2.2 Development**

The concept of Artificial Intelligence was first introduced at a workshop at Dartmouth College in 1956, marking the birth of the field. The emergence of expert systems allows systems to simulate the behavior of experts. It is an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution [3]. The expert system is composed of a knowledge base, a reasoning machine, and a user interface, and has been applied in the fields of medicine, military, geological exploration, etc., and has achieved significant economic and social benefits, and is a branch of Artificial Intelligence that has attracted much attention and is active in the field.

Technical applications in e-commerce have experienced an evolution from expert systems to machine learning and then to deep learning. At first, expert systems recommended products to users based on rules, but were limited by their static nature. Later, machine learning improved the accuracy of recommendations by analyzing user behavior. In recent years, deep learning of Artificial Intelligence has made a great impact in the field of e-commerce, especially CNN (convolutional neural network) and RNN (recurrent neural network). By parsing the content of the training image, CNN obtains all segmented regions of the image and even the semantic category of each pixel while dividing the image, convolves and pools layer by layer, effectively extracts features of the product image, and provides powerful support for image recognition and recommendation; while RNN is good at processing sequence data and capturing the temporal dependency of user behavior [4], which can optimize the recommendation strategy. By combining the

two, e-commerce platforms can better understand user needs and improve marketing effectiveness.

With the arrival of the big data era, the application of Artificial Intelligence in e-commerce has become more comprehensive and deeper. The e-commerce platform collects and analyzes massive user data through AI, which can not only optimize product recommendation and advertising, but also gain insights into market trends and user needs, providing powerful support for the company's strategic decision-making.

## **3. The Concept of Electronic Commerce**

### **3.1 Classification and Development History of E-Commerce Platforms**

E-commerce platforms are online platforms that provide e-commerce services, such as online trading, payment and delivery for merchants and consumers [5]. Table 1 shows e-commerce platforms categorized according to function and types of service.

At the beginning of the development of the Internet, many e-commerce platforms have gradually risen. For example, Dangdang, founded in 1999, is one of the earliest e-commerce websites in China and the largest comprehensive online bookstore in China. In the early days of the Internet, Dangdang quickly became a leader in the e-commerce field with its rich book resources and convenient shopping experience.

Taobao, as a model of the first generation of e-commerce, was officially launched in 2003, focusing on C2C e-commerce services. With the further development of the Internet, Taobao gradually expanded its business to B2C, launching Taobao Mall in 2005, creating a platform for brand merchants to sell online, and in 2008, Ali Group acquired Taobao and integrated its Alipay to build a strong e-commerce eco-system. This not only established the model for the modern e-commerce industry, but also enabled the e-commerce model to expand its influence, giving way to more e-commerce platforms.

### **3.2 Current Status of E-Commerce Applications in Areas of Current Market Demand**

In July 2003, China Internet Network Information Center (CNNIC) published the

Twelfth Statistical Report on Internet Development in China. This report showed that the number of Internet users in China was 68 million in 2003, but the number of users who chose online shopping behavior was extremely small, only 0.2% [6]. However, with the passage of time and the continuous development of technology, by 2018, the scale of China's Internet users grew rapidly, and the 43rd Statistical Report on the Development of the Internet in China released by CNNIC showed that as of December 2018, the scale of China's Internet users was 829 million. At the same time, the proportion of people who choose to do online shopping has also jumped dramatically, up to 73.6% [7]. At the same time, the percentage of people who choose to shop online has also increased dramatically, up to 82.0%. What kind of changes are behind such remarkable data changes? If we go back to the psychology of users, it's easy to guess that at that time, Internet users faced with the field of e-commerce were mainly in three states of mind: first, they didn't know the shopping process and how to choose among the many e-commerce platforms; second, they were unwilling to buy products with the risk of return and return goods may cause unnecessary trouble; third, they were afraid of online payment and doubted its security. With the trend of mobility of electronic devices, it has become a new business model.

Mobile e-commerce, using smartphones,

tablets and other devices, enables anytime, anywhere business and commerce activities. This new business model is rooted in technological advances, especially the development of the Internet, smartphones and electronic payment. The fast-paced life makes mobile e-commerce a convenient and fast shopping option to meet people's immediate shopping needs. Social media and online advertisements have become the main ways for consumers to learn about products, allowing them to understand and compare products more quickly and make wise purchasing decisions. Consumers' shopping habits are shifting to mobile e-commerce, promoting the rapid development of this business model, which is based on the use of smartphones, tablets and other devices.

The combination of social media and e-commerce has brought new energy to the e-commerce industry. From 2005 to 2023, China's Internet and e-commerce have experienced profound changes. E-commerce transformed from a doubted concept to a life necessity, reshaping consumption habits. Advancements in science, technology, and market expansion catered to the quest for convenience, efficiency, and personalized shopping, setting the stage for future consumption trends. E-commerce evolved from 'fear of buying' to an ingrained 'online shopping habit.'

**Table 1. User Groups of Different E-Commerce Platforms and Specific Energy Efficiency Case Studies**

type of platforms	information		
	target group	specific function	example
B2B	companies	provide online purchasing, sales, cooperation, trading and other services	1688 Global Source
B2C	consumers	provide consumers with online shopping, payment, after-sales service and so-on	Taobao Tmall
C2C	individuals	provide online trading, sale of second-hand goods, auctions and other services	eBay idle fish
O2O	consumers	provide online booking, offline experience, offline purchase etc.	Meituan Maoyan
S2B2C	Suppliers brands consumers	provide online sales, brand promotion and other services for brands	Yunji NetEase Kaola

#### 4. Specific Examples of the Integration of Artificial Intelligence and E-Commerce

##### 4.1 AI Technology to Support Cross-Border E-Commerce

Data from the National Bureau of Statistics

(NBS) showed that China's cross-border e-commerce import and export reached 23.8 trillion yuan in 2023, up 0.6% from the previous year, and better than major export-oriented economies in a horizontal comparison. Year-on-year growth of 15.6% [8]. This data suggests that cross-border e-commerce

transactions are on the rise, becoming a significant force in the realm of foreign trade. However, the accelerated development of cross-border e-commerce is also confronted with numerous pressing challenges.

First and foremost, the language communication gap represents a significant challenge for cross-border e-commerce. However, the advent of Artificial Intelligence technologies, particularly NLP (natural language processing) and machine translation, is poised to transform this landscape. Intelligent translation systems are capable of translating product information in real time, thereby enhancing communication efficiency and consumer shopping experiences. Moreover, a growing number of platforms have adopted this technology with the aim of bridging linguistic divides and improving transaction success rates.

Secondly, regional cultural differences present a challenge. Artificial Intelligence technology enables merchants to comprehend the requirements and behavioural patterns of consumers in their target markets through the analysis of large data sets and the creation of user profiles. This may, for instance, entail the provision of bespoke style and colour suggestions in the apparel sector, with the objective of enhancing product market acceptance.

Furthermore, consumer experience is a significant consideration. Intelligent logistics systems enhance logistics efficiency and reduce costs by optimizing transportation routes and anticipating consumer demand. Intelligent customer service systems also assist merchants in responding to consumer inquiries in real time, providing personalized after-sales service, and improving consumer satisfaction.

The emergence of cross-border e-commerce has created new avenues for growth, facilitated by the advent of AI technologies. These technologies have addressed the challenges inherent to cross-border e-commerce, including linguistic, cultural, and consumer experience-related issues, while enhancing transactional efficiency and security. As AI technology continues to evolve, cross-border e-commerce is poised to become increasingly integrated, leading to a profound transformation in the conventional approach to foreign trade and offering enhanced support for foreign trade enterprises in terms of order

volume and traffic.

Cross-border e-commerce is experiencing new opportunities for development with the help of Artificial Intelligence technologies. These technologies have solved the problems faced by cross-border e-commerce, such as language, culture and consumer experience, and improved transaction efficiency and security. In the future, with the continuous improvement of AI technology, cross-border e-commerce will further integrate AI in depth, profoundly changing the traditional way of foreign trade and providing more orders and traffic support for foreign trade companies.

In the first quarter of 2024, China's cross-border e-commerce imports and exports grew by 9.6% year-on-year, with exports from overseas warehouses growing by 11.8%. The quality of attracted capital has been steadily improving, with the number of newly established foreign-funded enterprises in China increasing by 20.7% year-on-year, and the proportion of attracted capital in high-tech manufacturing industries increasing by 2.2 percentage points year-on-year [8]. "Li Jun, director of the Institute of International Trade in Services at the Research Institute of the Ministry of Commerce, pointed out that "digital foreign trade is embracing better development opportunities with the support of new technologies such as AI.[9]"

In summary, AI technology and new cross-border e-commerce industry are reshaping the way of foreign trade, providing a broader development space for foreign trade companies. In the future, with the continuous progress of technology and the continuous expansion of application scenes, cross-border e-commerce will play an increasingly important role in global trade.

#### **4.2 Exploration of E-Commerce Platforms in the Field of Artificial Intelligence**

Artificial Intelligence is increasingly being harnessed in e-commerce platforms, demonstrating substantial potential to elevate GMV. This potential primarily resides in two key aspects: product and marketing. By gaining precise insights into user needs and leveraging channel marketing, e-commerce platforms can effectively amplify product buzz, thereby driving GMV growth.

The integration of Generative AI technology and e-commerce marketing presents

unparalleled opportunities. This technology enables e-commerce platforms to conduct diverse creative explorations, enhancing GMV and providing users with a more personalized shopping experience. Additionally, Gen-AI technology automates multi-channel placement and dissemination, significantly boosting marketing efficiency and accuracy.

AIGC(AI-generated content)uses edge data as the basis for further generating promotional materials such as print market posters, booth layout, packaging, etc. by analyzing consumption data and market trends and synchronizing the use of data and text-to-image generation software, which is also playing an increasingly important role in the upgrading of e-commerce business[10]. For cross-border platforms, AIGC tools like ChatGPT, with their language systems and interactive effects, align better with overseas operations, helping to increase GMV, achieve refined operations, and develop intelligent systems.

Amazon, Jingdong, and Pinduoduo have each demonstrated innovative AI applications with varying effectiveness. Amazon excels with its highly personalized recommendation system, which accurately suggests products, significantly boosting conversion rates and user stickiness. However, privacy leakage and filter bubbles are potential risks, as overly precise recommendations may restrict users' information horizons.

Jingdong has achieved remarkable results in intelligent logistics, utilizing path planning and cargo identification to enhance delivery efficiency and accuracy. However, the high investment and maintenance costs of the intelligent logistics system, along with its dependency, pose challenges that could affect the entire logistics network in case of failure.

Pinduoduo leverages AI algorithms for intelligent pricing, enabling dynamic adjustments and enhancing market competitiveness. However, frequent price changes may trigger consumer distrust, and smart pricing accuracy is limited by data quality.

E-commerce platforms use AI algorithms to gain precise consumer demand insights, achieve personalized recommendations, and enhance the shopping experience. AI's application in supply chain and logistics has also optimized e-commerce operations and

service quality. While enjoying increased efficiency, reduced costs, and enhanced user experience, e-commerce platforms face challenges such as data privacy, understanding errors, and technology costs. They must comprehensively consider potential issues and make choices and adjustments according to the actual situation.

### **4.3 Examples of Artificial Intelligence in E-Commerce Marketing Scenarios**

In the context of e-commerce marketing, there are primarily two types of AI solutions. One is to achieve a complete presentation of marketing content and enhance production efficiency. The other is to delve into specific market segments and significantly improve marketing effectiveness through precise channel and content matching. Currently, businesses are more focused on solving the first issue of production efficiency, whereas enhancing marketing effectiveness is the crucial step for businesses to gain more customer favor.

Since 2020, technology companies and enterprises worldwide have actively applied AI technology in the e-commerce sector to enhance user experience, improve operational efficiency, and create greater business value. Recently, Amazon launched seven new generative AI features at the AWS Summit, supporting foundation models from industry-leading providers [11]. Additionally, Google has announced the integration of generative AI technology into its online shopping tools, making search results more precise and meeting users' shopping needs.

AI not only plays a pivotal role in the frontend but also optimizes user experience during transactions. Taking the 618 Shopping Festival in 2023 as an example, e-commerce giants such as Alibaba and JD.com fully leveraged the advantages of AI technology. Alibaba also uses a range of innovative touch tools like Convolutional Neural Networks and Recurrent Neural Networks [12], Firstly, using Multiple Instance Learning method, corresponding nouns, verbs and adjectives are generated based on CNN features extracted from each part of the image; then Maximum Entropy Language Model is used to generate the image captions; and finally, Minimum Error Rate Training used to score and rank the generated sets of sentences with the highest probability

[4]. Minimum Error Rate Training to score and rank the generated sentences with the highest likelihood, significantly improved the quality of content production for merchants. These algorithms can precisely capture key information in images and generate high-quality creative materials accordingly, thereby optimizing merchants' marketing effectiveness. At the same time, Alimama also leveraged advanced serialized intelligent delivery technologies such as MTA+ (Consumption Path Full-Domain and Full-Journey Attribution Technology), ACE+ (Content-Based Intelligent Marketing Express), and SDH (Marketing Privacy Computing Platform) to achieve rapid integration and application of new-generation AI technologies. These technologies not only helped merchants achieve more precise and efficient advertising combinations but also enhanced their omnichannel business capabilities, further strengthening marketing effectiveness.

The researchers of the Jingdong AI digital people have developed a variety of algorithms as well as neural network models that allow them to learn a large number of speech samples, extract the basic features of speech, and learn how to convert text into a coherent speech waveform. In addition to basic speech synthesis techniques, the developers have introduced emotion recognition and voice conversion techniques in order to make the virtual digital person's voice more personalized and emotionally expressive. By analyzing factors such as the speaker's intonation, rhythm and intensity, the emotional state of the speaker can be determined and the synthesized voice can be adjusted to match the corresponding emotion, enhancing the user's sense of immersion [13]. The integrated use of these technologies allows Jingdong AI digital humans to offer users a brand-new shopping experience.

AI also plays a significant role in enhancing users' experience. Digital human technology, through highly simulated virtual images combined with intelligent interaction, provides users with a new shopping experience. Compared to traditional marketing, digital human technology is not restricted by time or location, can continuously attract user attention, and enhances brand exposure and sales conversion rates.

Backed by its strong AI capabilities, Baidu has

successfully transformed from an internet company primarily focused on search services to an AI-driven company. From a profitability perspective, Baidu's performance in the first quarter was impressive, achieving revenue of 31.144 billion yuan, a year-on-year increase of 10%. Under non-GAAP, Baidu's net profit reached 5.727 billion yuan, a year-on-year increase of 48%.

In terms of core revenue, Baidu's core revenue in the first quarter was 23 billion yuan, with online marketing revenue of 16.6 billion yuan, a year-on-year increase of 6%. Non-advertising revenue reached 6.4 billion yuan, a year-on-year increase of 11%, accounting for nearly one-third of core revenue. This transformation indicates that Baidu is gradually reducing its reliance on a single advertising business and achieving diversified development.

Overall, both foreign and domestic enterprises consider introducing AI into e-commerce marketing scenarios as a crucial strategy. This not only reflects the significant role of AI technology in modern business but also indicates the future development trend of the e-commerce industry. With the continuous advancement and maturity of AI technology, we can anticipate that the e-commerce industry will achieve more efficient and intelligent services, providing consumers with better shopping experiences. At the same time, businesses will also tap into more business value through AI technology to achieve sustained growth.

## **5. Conclusions and Outlook**

This paper discusses the integration between artificial intelligence and e-commerce innovation and its impact on future business models. On the basis of reviewing the development history of e-commerce, analyzes the specific applications of AI in e-commerce, such as intelligent recommendation, automated customer service and data analysis, revealing its wide application and potential in e-commerce. The article predicts the impact of this integration and innovation on the future development of the e-commerce industry, also points out that mobile e-commerce has become a new growth point, the close integration of social media and e-commerce has brought unprecedented development opportunities for the e-commerce industry, which has promoted

the continuous innovation and upgrading of the industry.

Commerce platforms have been able to gain precise insight into consumer demand through the in-depth use of Artificial Intelligence technology. With the help of intelligent algorithms, the platform analyzes users' shopping history, browsing records and preference information, and provides users with personalized product recommendations, thus significantly optimizing their shopping experience. Artificial Intelligence has also demonstrated strong potential and advantages in the areas of supply chain management and logistics and distribution. E-commerce platforms use intelligent forecasting and scheduling functions to optimize inventory management and logistics and distribution paths, effectively reducing operating costs and improving operational efficiency.

Artificial Intelligence technology has become an integral component of e-commerce, offering more efficient and intelligent solutions to enterprises and fostering its development. The future trends and research directions for the application of Artificial Intelligence technology in e-commerce primarily encompass the following aspects. First of all, the field of intelligent recommendation will continue to play an important role, using Artificial Intelligence technology to provide personalized recommendation services to improve user satisfaction and purchase intention. Artificial Intelligence technology can also analyze blockchain data, help enterprises make decisions to optimize logistics efficiency and inventory management, and improve operational efficiency. In terms of intelligent customer service, AI technology realizes automatic responses and problem solving through upgraded natural language processing and machine learning, improving customer satisfaction and service efficiency. Artificial Intelligence technology also plays an important role in the field of security prevention, safeguarding the security and stability of websites and trading platforms, and reducing fraud and risk.

Artificial Intelligence technology brings convenience to the e-commerce supply chain, but there are also potential risks. E-commerce involves a large amount of user data and sensitive information, which may lead to data leakage and privacy abuse if security measures

are insufficient. In addition, automated decision-making for e-commerce operations, such as intelligent recommendation and pricing strategies, may be affected by data quality and algorithmic limitations, leading to decision-making errors and negatively affecting the operational efficiency of e-commerce platforms and consumer experience.

With the progress and development of the times, Artificial Intelligence technology has entered the fast lane. We have reason to believe that in the future field of e-commerce, AI technology will continue to play an important role and become an important driving force for e-commerce to continue to innovate and change.

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