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Improving International Trade Practices Through Digital Management

Hongfei Liu

Saxo Fintech Business School, University of Sanya, Hainan, 572022, China

Abstract: ***With the rapid development of information technology, digital management has become an important means to improve enterprise operational efficiency and optimize resource allocation. In the field of international trade, traditional practical operating methods have problems such as cumbersome procedures, lagging information, and high costs. Current international trade practices also face information asymmetry, complex processes, and low efficiency, which seriously restrict the international competitiveness of enterprises and urgently need to be innovated through digital management. This paper aims to explore how to improve the level of international trade practices through digital management methods, in order to provide strong support for the internationalization strategy of enterprises. First, this paper analyzes the application background and current status of digital management in international trade, and then summarizes the achievements and shortcomings of existing research. Next, this paper designs an international trade practice model and builds an information platform. Then, through experiments, this paper analyzes the effect of digital management on the improvement of the level of international trade practice. Finally, the results show that after the optimization of digital management, its operational efficiency is improved and the practical level is improved.***

Keywords: Digital management; International trade practice; Information platform; Big data application.

1. INTRODUCTION

In the context of globalized economy, international trade is an important link connecting the economies of various countries, and its development level directly affects the country's economic prosperity and international status. However, traditional international trade practices have many drawbacks, such as poor information transmission, cumbersome procedures, and high costs. These problems have seriously restricted the development of international trade. With the continuous advancement of information technology, digital management has brought innovative opportunities to international trade practices.

This paper aims to study how to improve the level of international trade practices through digital management. First, the purpose and background of the study are clarified, and the importance of digital management in international trade is explained; secondly, the achievements and shortcomings of existing research are analyzed to provide a theoretical basis for this study; then, the specific methods of digital management in international trade practice are studied in detail, and its effects are verified through experiments; finally, the research results are summarized and improvement suggestions are put forward to provide a reference for the digital management of international trade practice and provide strong support for the internationalization strategy of enterprises.

2. RELATED WORK

In the extensive research on digital management and its cross-domain applications, many scholars have conducted in-depth discussions on key issues in digital transformation. Chang et al. focused on blockchain technology, aiming to improve trade transparency and efficiency through its application in global supply chains and cross-border trade, thereby coping with the increasingly complex international trade environment [1]. Wang, from a relational perspective, conducted an in-depth study of the digital marketing capabilities of international companies in order to gain an advantage in the fierce market competition [2]. Katsikeas et al. re-examined the international marketing strategy in the digital age, analyzed the opportunities and challenges it faces, and provided useful ideas for future international marketing [3]. At the same time, Dilyard et al. focused on the role of digital innovation and Industry 4.0 in enhancing the resilience of the global value chain, and proposed corresponding experiences and strategies, providing strong support for building a more stable and efficient global supply chain [4]. Rusch et al. reviewed the application of digital technology in sustainable product management in the circular economy, providing new ideas for promoting green and sustainable product management [5]. In addition, Del Giudice et al. proposed an adaptive model for small and medium-sized intelligent manufacturing enterprises, aiming to promote their digital innovation and enhance their competitiveness [6]. Mohamed et al. discussed the strategic positioning of higher education in digital transformation and provided direction for the future development of higher education [7].

Zhang et al. conducted an in-depth study on the digital transformation of human resource management in the digital age, providing useful reference for the innovation of human resource management [8]. Shen et al. used the case of JD.com to analyze how to strengthen supply chain resilience during the COVID-19 epidemic, providing useful experience for responding to emergencies [9]. Luo et al. explored how digitalization can promote green innovation in China and provide new ideas for achieving sustainable development [10]. However, these studies also pointed out the challenges and problems of current digital management in terms of technology integration, data security, and talent shortage, providing directions for future research.

3. METHOD

3.1 Information Platform Construction

When building a unified international trade information platform, this paper can introduce some models to express its core functions and goals. Its objective function can be expressed as:

$$P = Informationplatform \tag{1}$$

The core value of the platform lies in the rapid transmission and sharing of information, which can be abstracted into information circulation efficiency (Einfo) and information sharing degree (Sinfo):

$$max(E\,inf\,o\,(p)), max(S\,inf(p)) \tag{2}$$

The platform should cover the following key functional modules, each of which has its own specific contribution, and is mainly composed of three modules (Δ is used to represent the increase):

(1) Trade process management (Mtrade)

$$\Delta trade = Mtrade(P) \tag{3}$$

This includes order management, logistics tracking, payment settlement, etc., aiming to improve the efficiency and transparency of trade processes.

(2) Customer Information Management (Mcustomer)

$$\Delta customer = Mcusomer(P) \tag{4}$$

This involves the maintenance of customer information, the recording of transaction history, credit assessment, etc., which helps to enhance the stability and depth of customer relationships.

(3) Supply chain collaboration (Msupply chain)

$$\Delta\,sup\,p\,lychain = M\,sup\,p\,ly\text{chain}(P) \tag{5}$$

This includes supplier management, inventory management, production collaboration, etc., aiming to optimize the efficiency and responsiveness of the supply chain. These functional modules work together to improve the transparency and efficiency of international trade practices (represented by T and E respectively):

$$T(P) = T0 + \Delta trade + \Delta customer + \Delta\,sup\,p\,lychain \tag{6}$$

$$E(P) = E0 + \Delta\text{trade} + \Delta process\_improvement + \ldots \tag{7}$$

Ultimately, the goal of building a unified international trade information platform can be expressed as:

$$T\text{arget} = \max(T(p)), max(E(P)) \tag{8}$$

3.2 Big Data Application and Intelligent Management

In the process of using big data technology and artificial intelligence technology to improve the level of intelligence in international trade practice, this paper uses big data technology to mine valuable information in international trade data, which can be expressed as extracting valuable information or patterns (V) from a large number of international trade data sets (D). This process can be abstracted as:

$$V = Big\ Data\ Mining(D) \tag{9}$$

Among them, Big Data Mining refers to the data mining process in big data technology, D represents the international trade data set, and V represents the extracted valuable information [11-12]. Providing data support for decision-making can be seen as using the extracted valuable information (V) to optimize the decision-making process (Decision Making). This process can be expressed as:

$$OptimalDecision = f(V) \quad (10)$$

Among them, f represents the decision function, which maps valuable information V to the optimal decision. At the same time, artificial intelligence technology is introduced to realize intelligent management functions such as trade forecasting and risk warning, and machine learning models (MLM) and natural language processing models (NLPM) are used to process and analyze international trade data to predict trade trends (T) and identify risks (R). This process can be abstracted as follows:

$$T, R = MLM(D) + NLPM(Dtext) \quad (11)$$

Among them, Dtext represents the international trade dataset containing text information (such as contracts, emails, etc.), MLM and NLPM represent machine learning and natural language processing models respectively, T represents the predicted trade trend, and R represents the identified risk [13-14]. Improving the level of intelligence in international trade practices can be seen as the result of the combined effect of the above processes, that is, using big data technology and artificial intelligence technology to optimize all aspects of international trade practices and improve overall efficiency and accuracy. This process can be expressed as:

$$I = g(V, T, R) \quad (12)$$

Among them, g represents the intelligence level evaluation function, which maps valuable information V, predicted trade trends T and identified risks R to the intelligence level of international trade practices. In summary, the process of using big data technology and artificial intelligence technology to improve the level of intelligence in international trade practices can be expressed as follows:

$$IntelligertLevel = g(f - 1(OptimalDecision), MLM(D) + NLPM(Dtext)) \quad (13)$$

Among them, f−1 represents the inverse process of the decision function, which is used to infer the contribution of valuable information V from the optimal decision. However, it should be noted that the formula here is mainly a simplified model constructed to illustrate the problem. In practical applications, it may need to be adjusted and optimized according to specific circumstances.

3.3 Composition of International Trade Platform

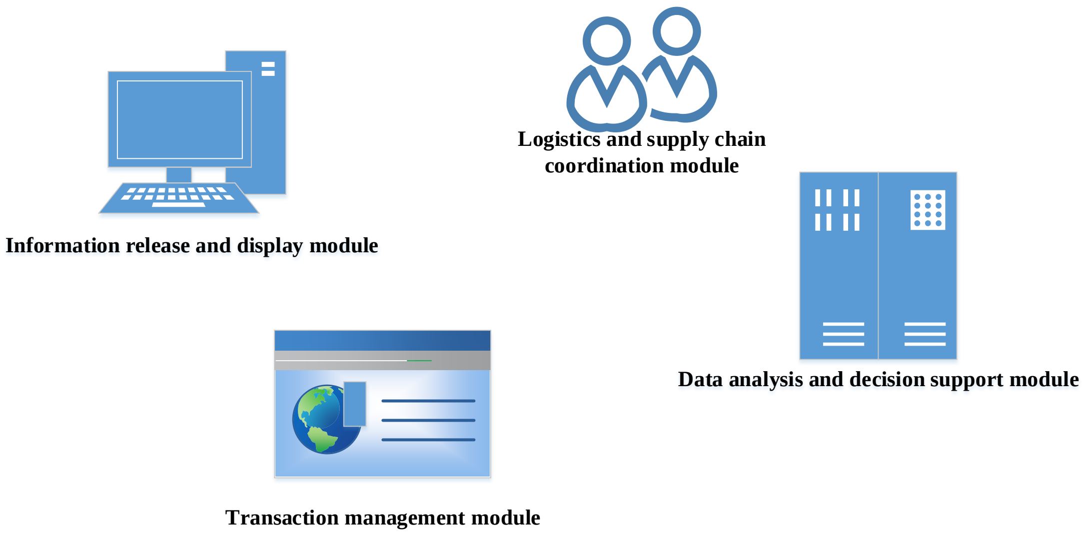

Figure 1: Composition of the international trade platform

The international trade information platform is mainly composed of four key parts, as shown in Figure 1. The details are as follows:

(1) Information release and display module

This module is the information window of the platform, publishing various international trade-related information, including commodity information, enterprise information, trade policy and regulatory information, and real-time updates of various countries' tariff policies, trade barriers, import and export licensing regulations, etc., so that enterprises can keep abreast of policy trends and adjust their trade strategies. Through a variety of display forms, users can quickly and accurately find the information they need, promoting the efficient circulation and connection of trade information [15-16].

(2) Transaction management module

This is one of the core functional areas of the platform. It supports online inquiry and quotation functions. Importers can send inquiries to exporters of interest, and exporters can reply with quotations in a timely manner. Both parties can conduct multiple rounds of communication and negotiation on transaction details such as price, quantity, and delivery date, and the system automatically records the communication history. It has contract signing and management functions and provides standardized electronic contract templates. Enterprises can fill in the contract content and confirm the electronic signature based on the negotiation results. The platform stores and manages the contract to facilitate subsequent inquiries and execution tracking. At the same time, it also integrates payment and settlement functions, cooperates with various international payment channels to ensure the safe flow of transaction funds, supports common letter of credit payment, wire transfer and other methods, and provides payment status query and reconciliation services to ensure clarity and convenience in the financial process for both parties to the transaction.

(3) Logistics and supply chain collaboration module

This module plays an important role in ensuring the smooth transportation and delivery of goods in international trade. It connects numerous logistics companies and freight forwarding companies, provides logistics plan planning and quotation functions, and recommends suitable transportation methods (such as sea, air, land, etc.) and logistics routes for companies based on information such as the weight, volume, and destination of the goods, and provides corresponding cost estimates. At the same time, real-time tracking and sharing of logistics information is realized. Enterprises can view detailed logistics status information such as the departure point, transit stations, and estimated arrival time of the goods on the platform, which is convenient for arranging production and sales plans. In terms of supply chain collaboration, it promotes information exchange between trading companies and suppliers and manufacturers, and improves the operational efficiency and transparency of the entire supply chain.

(4) Data analysis and decision support module

By collecting and analyzing a large amount of trade data on the platform, such as transaction amount, transaction commodity type, transaction region distribution, enterprise transaction frequency, etc., it provides data insights and decision-making basis for enterprises. For example, it can generate market trend analysis reports to help companies understand the changing trends of international market demand for products in different industries so as to adjust product strategies in a timely manner; it can provide competitor analysis so that companies can clearly understand the trade advantages and disadvantages of other companies in the same industry and formulate differentiated competitive strategies; it can also conduct performance evaluation and risk warning based on the company's own transaction data, reminding the company to pay attention to abnormal transaction situations, such as a sudden and sharp drop in order volume, a long payment collection period, etc., and provide corresponding solution suggestions to help companies make more informed decisions in international trade.

4. RESULTS AND DISCUSSION

4.1 Experimental Design

4.1.1 Experimental preparation phase

1) The experimental goal is to comprehensively evaluate the performance of the international trade platform in different scenarios, including functional integrity, load capacity, and data processing efficiency.

2) Preparing experimental equipment, including multiple computers with different performance as simulated clients and a high-performance server to deploy the international trade platform.

3) Recruiting 50 testers to participate in the experiment, including professionals and ordinary users in the field of

international trade. They will be divided into 5 groups, each with 10 people, to simulate different types of user behaviors, such as buyers who frequently search for products, sellers who upload a large amount of product information, merchants who process orders, analysts who query trade data, and administrators who perform platform management operations.

4.1.2 Experimental implementation phase

1) Functional testing

Each group of testers will be asked to operate on the platform according to their respective roles and tasks, and the data is shown in Table 1. The buyer group performs operations such as product search, screening, detail viewing, adding to shopping cart, and ordering; the seller group performs operations such as product information entry, editing, listing, and delisting; the merchant group processes orders, including confirming orders, shipping, processing refunds, etc.; the analyst group queries various trade data reports and performs data analysis; the administrator group performs user management, permission settings, platform data maintenance and other operations. The functional anomalies encountered by each group of testers during the operation are recorded, such as page display errors, invalid links, unresponsive operations, etc.

Table 1: Experimental basic data

Test personnel grouping	Number of abnormal functions	The page displays the number of errors	Link failure times	No response times
Buyer group	5	2	1	2
Seller group	3	1	1	1
Merchant group	4	1	2	1
Analyst team	2	0	1	1
Administrator group	1	0	0	1

2) Load test

The number of simulated client connections is gradually increased, starting from 100 connections and increasing by 100 each time until it reaches 1000 connections. At each connection level, all testers are asked to operate simultaneously for 10 minutes. The response time, throughput, and resource utilization (such as CPU usage, memory usage, etc.) of the platform under different loads are recorded.

3) Data processing efficiency test

Preparing a large amount of test data, including product data, order data, user data, etc. Let the platform perform operations such as data import, data query, data update and data deletion. Recording the execution time of each operation under different data volumes, starting from 1,000 data items and increasing by 10,000 data items each time until it reaches 100,000 data items.

4.2 Load Capacity

This paper conducts performance testing on the international trade platform with different numbers of simulated client connections. As can be seen from Figure 2, sub-graph 1 is the response time. As the number of connections increases, the response time gradually increases from 100 milliseconds. For example, it reaches 1300 milliseconds when the number of connections reaches 1000, which means that the platform load increases and the processing speed slows down. Because the server resources are tight and the processing capacity reaches a bottleneck under high load, operations such as database queries are delayed due to resource competition. Sub-graph 2 shows the throughput, which starts at 50 requests per second, reaches 100 requests per second when the number of connections reaches 300, and then slows down after exceeding 600. This shows that when the load is light, the platform's processing capacity increases with the load. Because resources are not fully utilized, the processing efficiency decreases after exceeding a certain load because the hardware resources are occupied. Sub-graph 3 reflects the CPU usage in percentage, with the data range being 20-98. It continues to rise from 20% as the number of connections increases, and is close to 95% when the number of connections is 1,000, indicating that the increase in load increases the demand for CPU resources. When the load is low, the CPU is idle. When the load is high, the utilization rate increases due to multiple tasks such as data processing. When it is close to 100%, the platform processing is limited and the hardware needs to be optimized. Sub-graph 4 shows the memory usage, which has been rising steadily from 30% to 92% at 1000. This indicates that the increase in load requires more data to be stored and processed, resulting in more memory usage. Too high a memory usage may cause performance degradation or even crash. It is necessary to plan memory reasonably, optimize structure and storage, and expand capacity in a timely manner.

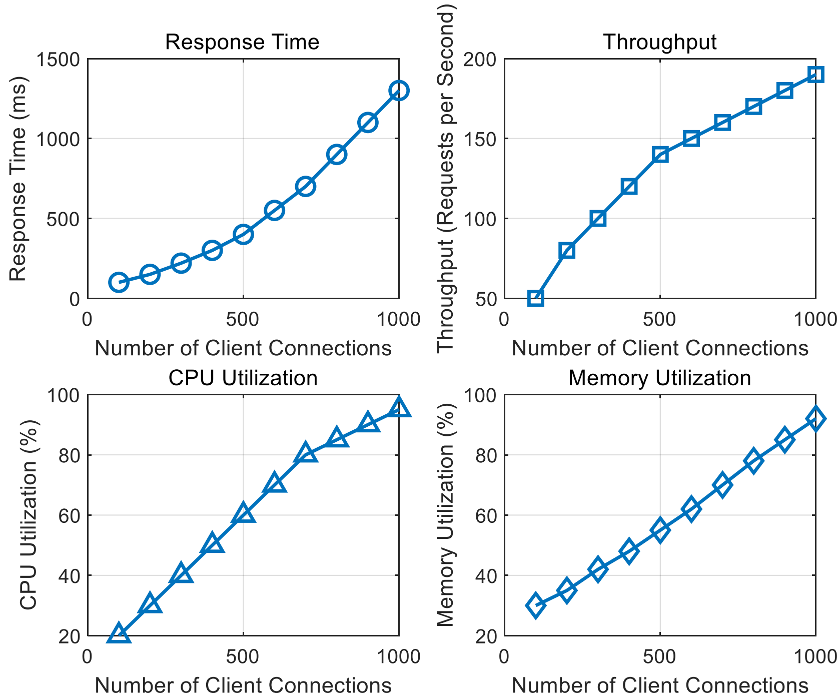

Figure 2: Load capacity

4.3 Data Processing Efficiency

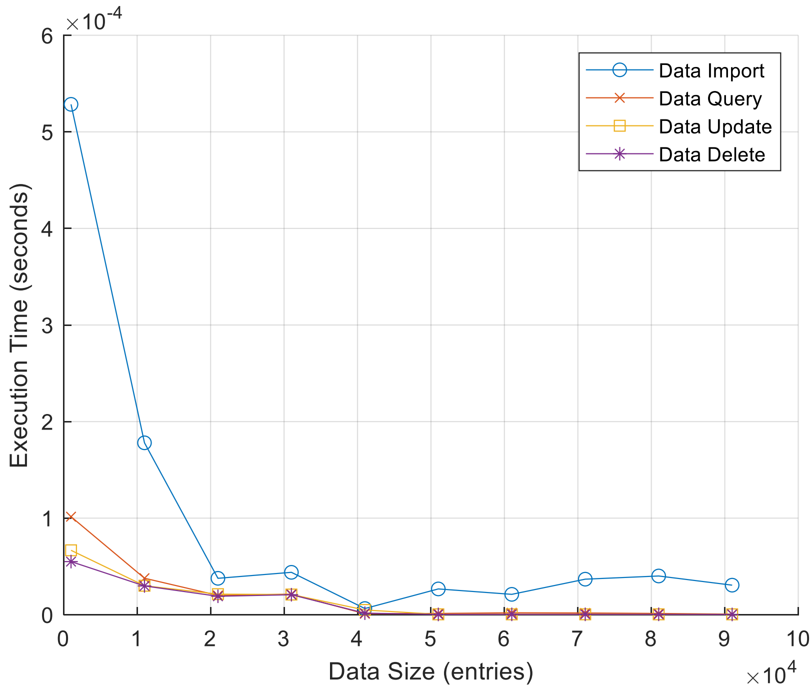

Figure 3: Data processing efficiency

Figure 3 shows the changes in execution time of the four data processing operations of data import, data query, data update and data deletion under different data volumes. In this figure, the amount of data processed by the platform ranges from 1,000 to 100,000. The shorter the execution time, the higher the data processing efficiency. The data import time increases sharply to about 5 seconds when the data volume is less than 10 items, and the execution time is less than 1 second when the data volume exceeds 102 items; the data query execution time increases to 1-2 seconds after the data volume is less than 10 items, and the execution time is less than 1 second when the data volume exceeds 10^4 items; the execution time of data update is almost always less than 1 second in the entire data volume range, and the increase in data volume is very small; the execution time of data deletion is less than 0.1 second when the data volume is less than 10^4 entries, and it always remains less than 1 second as the data volume increases. In general, the execution time of data import increases the fastest, data deletion increases the slowest, and data query and update increase relatively slowly. This information is of great significance for optimizing data processing procedures and evaluating system performance.

5. CONCLUSION

This paper focuses on the application of digital management in international trade practice and verifies its remarkable effectiveness through experimental testing. Experimental data shows that digital management can significantly improve the data processing efficiency and load capacity of international trade practices and enhance the international competitiveness of enterprises. Looking ahead, research can further focus on personalized solutions and in-depth case analysis of digital management in international trade practices, and provide more precise digital management guidance for different industries and enterprises. At the same time, this paper should also actively explore the application potential of emerging technologies such as blockchain technology and Internet of Things technology in international trade, so as to further enhance the security and reliability of international trade practices while improving the efficiency of international trade practices.

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