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A Quantitative Study of The Impact of Supply Chain Management on Customer Satisfaction

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Abstract: With the rapid and drastic changes in the business environment, supply chain management has become one of the key factors for the success of enterprises. This study focuses on exploring the impact of supply chain efficiency on customer satisfaction, with special attention to three key factors: service quality, delivery time and price transparency. Through quantitative analysis, it is found that these factors have a significant effect on improving customer satisfaction. The results show that quality service, efficient delivery and clear pricing strategies significantly improve customer satisfaction. In addition, customer trust has been found to mediate between these factors and customer satisfaction. This study provides practical suggestions for enterprises in supply chain management to enhance their competitive advantage.

Keywords: Supply chain management; Customer satisfaction; Service quality; Delivery time; Price transparency.

1. Introduction

In a global and highly competitive business environment, supply chain management has become one of the key factors for enterprise success. An efficient supply chain not only helps to reduce operating costs, but also significantly improves customer service levels, which directly affects customer satisfaction and long-term profitability of enterprises (Power, 2005). Amazon, for example, has achieved significant reductions in order processing times since 2018 thanks to its efficient supply chain management, effectively improving customer satisfaction and strengthening its competitive position in the market.

As companies become increasingly dependent on international markets and suppliers, the complexity of supply chain management continues to increase. The rapid development of technology, especially the application of the Internet, big data and artificial intelligence, has greatly improved the transparency of information, while optimizing inventory management and logistics operations (Chan, & Qi, 2003). These changes have increased customer expectations for service quality, delivery speed and price transparency, which is directly related to their satisfaction and loyalty to the brand.

By gaining a deeper understanding of the impact of supply chain management on customer satisfaction, companies can more effectively adjust their strategies, such as improving service quality, optimizing delivery times and increasing price transparency, thereby enhancing market competitiveness. The study provides practical insights to help businesses understand and manage customer expectations and satisfaction. This is essential to maintain customer loyalty and increase market share. Provides managers with a data and analytics based decision support tool to help them make more informed decisions in supply chain management.

The aim of this study is to deeply analyze and quantify the impact of supply chain management on customer satisfaction, especially focusing on the three key dimensions of service quality, delivery time and price transparency. Specifically, the research objectives include: to develop a comprehensive quantitative model to systematically evaluate the specific impact of service quality, delivery time and price transparency on customer satisfaction. Identify and determine which factors most significantly affect customer satisfaction in supply chain management and how these factors interact.

In order to achieve the above research objectives, this research will focus on the following key issues:

(1) To what extent does supply chain management affect customer satisfaction? Is the effect direct or indirect through other factors?

(2) What intermediary role does service quality play between supply chain management and customer satisfaction? How does its influence compare to other factors?

(3) To what extent does delivery time have a direct impact on customer satisfaction? In improving supply chain management, how can lead times be optimized to maximize customer satisfaction?

(4) What role does price transparency play in customer satisfaction? How should companies manage their pricing strategies to increase transparency and customer satisfaction?

By answering these questions, the study aims to gain insight into how supply chain management, service quality, lead time and price transparency work together to influence customer satisfaction and provide strategies for companies to improve these aspects to enhance customer satisfaction and business outcomes.

2. Literature Review

2.1. Development status of supply chain management

Supply chain refers to the whole process of products from raw material procurement to the final arrival of consumers, including raw material supply, production, transportation, storage, sales and after-sales service (Crandall, Crandall, Chen, Crandall, Crandall, & Chen, 2009). The goal of effective supply chain management is to achieve the lowest cost and shortest time for product circulation while ensuring the highest quality and customer satisfaction. The logistics supply chain plays a crucial role in this process, especially in

the context of globalization and cross-border e-commerce.

With the advent of the digital age, logistics supply chain faces both challenges and opportunities. The global supply chain management market reached a value of $2.72 billion in 2022 and is expected to grow to $7.56 billion by 2032, with a compound annual growth rate (CAGR) of 10.9% between 2023 and 2032. The global supply chain management market size is $21.129 billion in 2022 and is expected to grow at a CAGR of 11.1% from 2023 to 2030. This growth is mainly due to increased demand for this type of software in the retail and consumer goods industries (Jenkins, Studies, & College, 2022). The supply chain management market in China is forecast to grow at a CAGR of 10.41% between 2023 and 2028. The market size is expected to reach $1.69 billion by 2028 (Novitasari, Wijaya, Agustin, Gunardi, & Leo-Paul, 2023). However, despite the rapid development of the logistics market, there are still problems such as inefficiency, high costs and opaque information. These problems not only increase logistics costs, but also affect delivery times and customer satisfaction. Therefore, the promotion of digital logistics model has become the key to improve logistics efficiency and service level.

In the field of supply chain management, technological innovation and digitalization have become the main drivers of industry progress, especially the integration of blockchain technology, artificial intelligence (AI) with machine learning (ML), and the Internet of Things (IoT). Research shows that blockchain technology can significantly improve the transparency of the food supply chain. The use of blockchain in supply chain management can improve supply chain transparency and traceability while reducing administrative costs (Lulu, 2002). Research by Dutta, Choi, Somani, and Butala (2020) shows that blockchain technology has the potential to transform every part of the supply chain, from raw material procurement to distribution to consumers. However, the widespread adoption of blockchain technology in supply chain management still faces challenges, such as technical adaptability and cost-effectiveness issues. The application of artificial intelligence and machine learning in supply chain management has begun to transform the forecasting, planning, and optimization processes of supply chains. While many consumer goods companies have begun to invest in these technologies, most are still limited to solutions that operate independently of each other. To harness the full potential of analytics, integrating the entire end-to-end supply chain and enabling real-time, automated planning is a better approach. Practice has shown that automated supply chain planning can lead to a 4% increase in revenue, a 20% reduction in inventory, and a 10% reduction in supply chain costs (Cooper, & Slagmulder, 1999). With accurate demand forecasting and automated execution, organizations can improve planning efficiency, reduce inventory levels, and reduce supply chain costs. IoT technology is revolutionizing all aspects of the supply chain, from manufacturing, packaging, and transportation to delivery of goods, and on-site product management. IoT devices make it possible to track products and goods and report their status in real time, eliminating guesswork and seamlessly integrating them along the entire chain. The impact of IoT in the supply chain has expanded from simple tracking of goods to every link of the entire chain. For example, at the production end, manufacturers use Internet-connected sensors to detect product defects and improve production quality. IoT devices can also be used to monitor environmental conditions, such as temperature and humidity, from the point of shipment to the point of delivery, ensuring that goods are transported under ideal conditions (Krichen, & Jouida, 2015). In addition, IoT devices also help with inventory management, such as Internet-connected cameras scanning barcodes, or RFID chips placed on inventory, making it easier to keep track of everything in the warehouse. Blockchain technology, AI and ML, as well as the integration of IoT, are driving supply chain management to become more efficient, transparent, and automated. These technological innovations have not only improved the operational efficiency of the supply chain.

2.2. Theoretical Basis

2.2.1. Supply chain management theory

Supply chain management theory emphasizes that supply chain management is a management method that integrates all activities in the supply chain, aiming to optimize the entire supply chain by improving efficiency and reducing costs. Key elements include supplier management, inventory management, order processing, logistics and distribution. Effective supply chain management can help achieve four goals: reduce cash turnaround time; Reduce risk to the business; Achieve profitable growth; Provide predictable income. The seven principles of supply chain management: Divide the customer base according to the service characteristics required by the customer; Design the logistics network of the enterprise according to customer needs and the profitability of the enterprise; Listen to the market demand information, design products closer to customers; Time delay; Strategic sourcing and sourcing to establish win-win cooperation strategies with suppliers; Establishing information systems throughout the supply chain; Establish performance appraisal criteria for the whole supply chain, etc. (Wang Fei, & Yu Yang, 2020).

2.2.2. Service quality theory

Service quality theory, particularly the SERVQUAL model, was proposed by Parasuraman, Zeithaml, and Berry in the late 1980s to evaluate and improve service quality. The SERVQUAL model is based on the customer's perceived difference in service quality, that is, the difference between the expected and actual performance of service quality. Key dimensions include: Reliability (consistency and trustworthiness of service delivery), responsiveness (prompt response and handling of customer needs), assurance (knowledge and courtesy of employees and their ability to provide services), empathy (personalized attention and care for customers), tangibility (physical facilities, equipment, employee appearance and other tangible elements of the service) (Liu Xiangyang, 2003). SERVQUAL is an effective tool for identifying gaps and deficiencies in the service process.

2.2.3. Customer satisfaction theory

Customer satisfaction theory discusses how customers form a sense of satisfaction with products or services. According to this theory, customer satisfaction is the result of comparing customer expectations with actual service or product performance. Key factors include: customer's expected performance level of the service or product, customer's evaluation of the actual service experience, customer's evaluation of the service or product relative to its cost, satisfied customers tend to buy and recommend the product or service repeatedly (Cao Lihe, 2007). The gap between customer expectation and perceived service quality is the key to customer satisfaction.

3. Theoretical Models and Assumptions

During the modeling process, researchers usually need to define variables, set assumptions, select appropriate mathematical or statistical tools, and perform model validation.

(1) Hypothesis:

In this study, the following are the key assumptions:

Hypothesis 1 (H1) : Service quality positively affects customer satisfaction. This means that the improvement of service quality will directly increase customer satisfaction.

Hypothesis 2 (H2) : Optimization of lead time (i.e. faster lead time) positively affects customer satisfaction. This means that shorter lead times increase customer satisfaction with supply chain efficiency.

Hypothesis 3 (H3) : Price transparency positively affects customer satisfaction. This hypothesis suggests that increased price transparency would help increase customer trust and satisfaction.

Hypothesis 4 (H4) : Customer trust plays an intermediary role between service quality, delivery time, price transparency and customer satisfaction. This means that these variables indirectly improve customer satisfaction by enhancing customer trust.

Hypothesis 5 (H5) : There is an interaction between service quality, delivery time, and price transparency that together affect customer satisfaction.

It is assumed that these variables do not act independently, but jointly determine the level of customer satisfaction through mutual influence. These hypotheses are intended to provide a structured framework for research that will enable it to systematically explore and validate how various aspects of supply chain efficiency affect customer satisfaction. By testing these assumptions, the study aims to provide concrete insights on how to effectively manage the supply chain to improve customer satisfaction.

(2) Variables and measurement criteria:

Independent variable:

Service quality: refers to the level of quality demonstrated by the supply chain in the delivery of a product or service. It is measured by relevant questions in the customer satisfaction questionnaire, such as product quality, service response speed, customer service quality, etc.

Lead time: Reflects the total time from the time the order is processed to the time the customer receives the product or service. Measured by statistics and analysis of the average order processing time and delivery time. This information can be obtained through customer order data.

Price transparency: refers to the transparency of the price setting and adjustment process, and the accessibility and understanding of price information to customers. It is measured by the customer's evaluation of the clarity of price strategy and the accessibility of price information in the questionnaire.

Dependent variable:

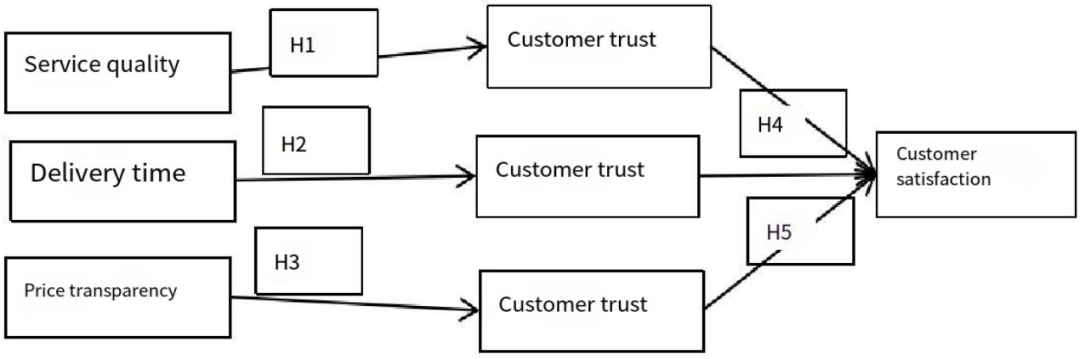
Customer satisfaction: Measures the overall satisfaction of customers with supply chain services. A questionnaire was designed to ask customers about their overall satisfaction with the supply chain service, including the comprehensive score of their satisfaction with the e-commerce platform or a certain purchase experience.

Intermediate variable:

Customer trust: The degree of trust that customers have in the supply chain, especially in terms of service quality, delivery time and price transparency. It is measured by customer's evaluation of supply chain reliability and trustworthiness in questionnaire survey.

These variables and their measurement criteria help to accurately capture the impact of various aspects of supply chain efficiency on customer satisfaction, so as to provide empirical data support for research. Through these measures, the research aims to quantify and analyze the relationship between supply chain efficiency and customer satisfaction, and provide specific guidance for improving the efficiency of supply chain management.

The relationship between the variables in this study and the mind map are as follows.



4. Data Source and Sample Analysis

4.1. Data Sources

Academic literature and books

Use the school library or public databases such as CNKI, Web of Science, Google Scholar to search and obtain relevant academic papers and books. Read academic journals and conference papers in related fields to keep abreast of the latest research results and academic perspectives.

Questionnaire survey

Researchers will design a series of questionnaires to investigate the evaluation of customers and other stakeholders on the effectiveness of supply chain management. Data is collected by distributing questionnaires through online survey tools such as Questionstar.

In order to further study the impact of supply chain efficiency on customer satisfaction, this study will use SPSS software for a series of analyses. Reliability analysis: We evaluated the internal consistency of the questionnaire by calculating Cronbach's Alpha coefficient. The results showed that Cronbach's Alpha coefficient was 0.904, well above the commonly accepted standard of 0.7. This shows that our

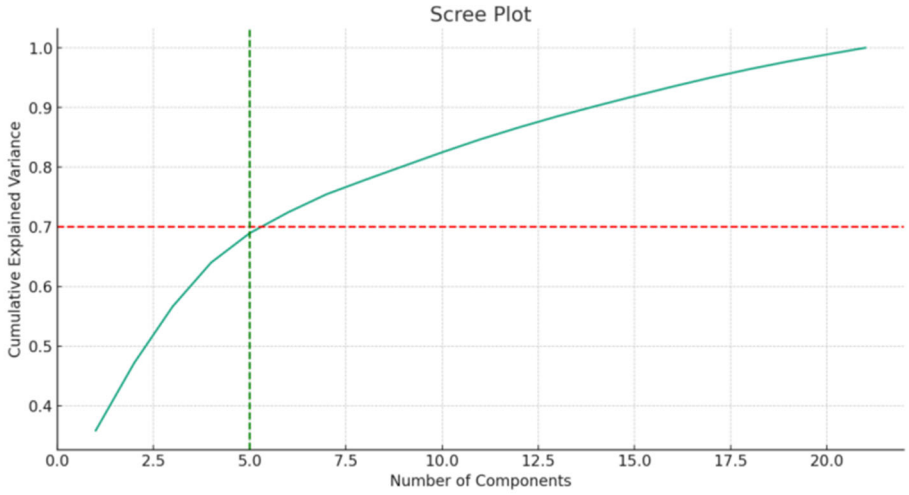
questionnaire has a high internal consistency on various questions, thus ensuring the reliability of the survey.

Validity analysis: exploratory factor analysis

We used principal component analysis (PCA) to conduct exploratory factor analysis (EFA) to test whether the questionnaire items fit the expected factor structure.

Factor extraction: Of the factors extracted by PCA, five have eigenvalues greater than 1 (according to Kaiser criteria). This suggests that most of the variation in the data can be attributed to these five factors.

Cumulative variance interpretation: These five factors have a cumulative variance of more than 70%, meaning that they are fairly representative of the information in the original data set.



The ANOVA (Analysis of Variance) method was used to analyze differences between different age groups on two key indicators: (satisfaction with the quality of products provided by suppliers) and questions (satisfaction with the efficiency of suppliers in processing orders). The analysis results are as follows:

ANOVA

		quadratic sum	degree of freedom	mean square	F	significance
I am satisfied with the quality of the products provided by the supplier.	interblock	24.736	5	4.947	2.968	.012
	intra-class	656.701	394	1.667		
	aggregate	681.438	399			
I am satisfied with the supplier's efficiency in handling orders.	interblock	23.177	5	4.635	3.009	.011
	intra-class	606.920	394	1.540		
	aggregate	630.097	399			

(Product quality satisfaction) :

The F statistic is 2.968 and the p value is 0.012, indicating that there are significant differences in product quality satisfaction among different age groups.

Post-test (Tukey HSD) showed that there was a significant difference between age group 6 (the highest age group) and age group 1 (the lowest age group) in product quality satisfaction (p=0.006), and satisfaction in age group 6 was significantly higher than that in age group 1.

(Order processing efficiency satisfaction) :

The F statistic is 3.009 and the p value is 0.011, which also indicates that there are significant differences in the satisfaction of order processing efficiency among different age groups.

Post-test results did not indicate significant differences between any particular age group, although age group 6 had the highest average score.

5. Correlation Analysis

In this section, the relationship between various aspects of supply chain efficiency and customer satisfaction is deeply discussed through correlation analysis. We applied the Pearson correlation coefficient, a standard method for assessing the strength and direction of a linear relationship between two continuous variables.

The analysis found that there was a significant moderate positive correlation between product quality satisfaction and customer service response speed (r was about 0.61). This means that high customer satisfaction with product quality is usually accompanied by high customer service response speed. This finding suggests that high product quality and

high customer service go hand in hand in increasing customer satisfaction.

There was also a moderate positive correlation between service reliability and employee professionalism and politeness (r was about 0.57). This shows that service reliability is closely related to the professional performance and polite attitude of employees, and further emphasizes the importance of human resource management in improving the efficiency of the supply chain.

There is a strong correlation between user experience and product quality satisfaction (r is about 0.64). This suggests that the user experience, specifically the interface and functionality of a website or app, plays an important role in the overall perception of product quality.

These findings highlight the importance of several key factors in supply chain management: product quality, customer service efficiency, service reliability, and optimizing the user experience. Enterprises should focus on improving these areas to enhance customer satisfaction. For example, investing in customer service training to improve the speed and quality of service; Strengthen product quality control; And optimizing the user experience of your website or app.

These measures can not only improve customer satisfaction, but also help to build brand reputation, promote customer loyalty, and ultimately enhance the market competitiveness of enterprises. By considering and improving these key areas together, companies can effectively increase supply chain efficiency while achieving higher levels of customer satisfaction. This strategy is key to achieving sustainable business growth and customer loyalty.

Considering the results of the model, the following conclusions can be drawn: user experience, recommendation intention, industry status and trust are crucial to the influence of customers on the overall service satisfaction of suppliers. Optimizing the user experience, improving the willingness of customers to recommend, strengthening the industry position and building trust are the key areas to improve the overall customer satisfaction. The positive influence of these factors indicates that enterprises should invest resources and efforts in these aspects to improve customer satisfaction and loyalty.

Based on the above conclusions, the following recommendations can be made: In terms of user experience, the functionality and aesthetics of the website or application should be enhanced to provide a smoother user experience. In terms of recommendation intention, customers can be encouraged to recommend others by providing high-quality products and services and optimizing customer experience. In terms of industry status, enterprises can enhance their status in the industry through innovation, improving service quality and brand image construction. Finally, in terms of trust, it is suggested to establish a transparent communication mechanism and high standard of service quality to enhance customers' trust. These recommendations help companies improve supply chain management, increase customer satisfaction, and enhance competitiveness.

6. Conclusion

Through quantitative analysis, this study reveals how service quality, delivery time and price transparency affect customer satisfaction, which provides a new perspective for the theory of supply chain management. In particular, when it comes to service quality, our findings highlight the importance of consistency and speed of response, providing new insights into how improving service standards can improve customer satisfaction. In addition, our research highlights the importance of delivery time management, revealing the direct impact of fast and on-time delivery on customer satisfaction. The price transparency results highlight the importance of fair and clear pricing strategies to build customer trust.

From a practical point of view, this study provides specific recommendations for enterprises on how to enhance customer satisfaction by improving supply chain efficiency. For example, enterprises can improve service quality by improving customer service processes and improving response speed; Reduce delivery times by optimizing logistics and delivery processes; And increase customer trust by making pricing strategies more transparent. These strategies not only help to improve customer satisfaction, but also enhance the market competitiveness of enterprises.

Finally, the findings of this study have important guiding value for supply chain managers and decision makers. With a deep understanding of the drivers of customer satisfaction, managers can more effectively develop strategies to optimize supply chain operations and stay ahead of fierce market competition. At the same time, these findings also provide a new direction for future research in the field of supply chain management, especially to explore the dynamic changes in the relationship between supply chain efficiency and customer satisfaction in different industries and market environments.

This study also found that customer trust plays an intermediary role between service quality, delivery time, price transparency and customer satisfaction. This finding highlights the importance of enhancing customer trust in the process of improving customer satisfaction. Enterprises not only need to pay attention to the direct quality of products and services, but also need to work hard to enhance the trust relationship between customers and customers, so as to strengthen customer satisfaction with products and services.

In summary, the results of this study provide important strategic directions for the practice of supply chain management, especially in terms of improving service quality, optimizing delivery time and improving price transparency. By implementing these strategies, enterprises can effectively improve customer satisfaction and gain an advantage in the competition. This study also provides a new perspective for future academic research and practical exploration, especially in further exploring the long-term impact of different supply chain management practices on customer satisfaction. Going forward, the study of supply chain management should continue to deepen to more fully understand its role and impact in the changing market environment.

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