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Deep Integration of Enterprise Marketing and Services Based on Blockchain in the Context of Digital Transformation

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Abstract The deep integration of enterprise marketing and services is an important way to promote digital transformation of enterprises, and it plays an important role in optimizing enterprise services. However, the current integration of enterprise marketing and service still faces problems such as low economic growth, low completion of marketing strategies, and poor service quality. In order to better achieve the deep integration of enterprise marketing and services, this article aims to use blockchain technology to explore the integration of marketing and services in depth, in order to better meet the actual needs of digital transformation and upgrading of enterprises. This article constructs a conceptual model for the integration of enterprise marketing and services, with marketing as the mediating variable, market services as the moderating variable, and fuzzy algorithms in blockchain technology as the core. Empirical tests are conducted through relevant surveys. The research results show that the deep integration of blockchain based enterprise marketing and services can increase the economic benefits of enterprises, resulting in a 3.19% increase in the economic benefits of small and micro enterprises in the first to second quarters of 2021 compared to 2020; The economic benefits in the second to third quarters increased by 13.29% compared to 2020, and the economic benefits in the third to fourth quarters increased by 7.94% compared to 2020. In addition, Cronbach's of the questionnaire scale in this article α The medium coefficients are all above 0.7, with good reliability. The convergence validity SMC values are all greater than 0.4, indicating better effectiveness and reliability. Research has pointed out that the deep integration of blockchain enterprise marketing and services under the background of digital transformation can promote the improvement of market economic benefits, optimize overall marketing strategies, and promote the improvement of enterprise marketing service quality. This study highlights the important impact of blockchain technology on the economic benefits, marketing strategies, and marketing services of enterprises in the integration of marketing and services, providing strong support for enterprises to achieve digital transformation and upgrading. Based on the above research, this article suggests that enterprises should increase their investment in the research and application of blockchain technology, deeply understand the characteristics and advantages of blockchain technology, and apply it to the deep integration of marketing and services. Simultaneously establish a blockchain based marketing and service system to achieve data sharing, process optimization, and collaborative cooperation. In addition, enterprises need to pay attention to customer experience and data security, ensure the security and privacy of customer data through blockchain technology, and optimize customer service processes using blockchain technology to improve customer satisfaction and loyalty.

Index Terms Enterprise Marketing and Service, Fuzzy Algorithm, Digital Transformation, Fuzzy Set Theory

I. Introduction

With the wave of digital transformation sweeping the world, enterprise marketing and service field is facing unprecedented changes and challenges [1]-[3]. Blockchain technology, as a decentralized and highly secure distributed ledger technology, with its unique value transfer and trust establishment mechanism, provides new opportunities for the deep integration of enterprise marketing and service fields. In this context, exploring the deep integration of enterprise marketing and service based on blockchain not only has important theoretical value, but also has far-reaching significance in guiding the practice of enterprises and promoting the innovation of the industry. At present, although digital transformation has become the consensus of enterprise development, but how to effectively integrate marketing and service in practice, to realize the deep integration of the two, is still a major problem faced by many enterprises [4], [5]. The traditional marketing and service model is limited by information asymmetry, cumbersome processes and other issues, it is difficult to meet the increasingly diversified customer needs [6], [7]. The emergence of blockchain technology provides a new possibility to solve these problems. Its decentralization, transparency, non-tampering and other characteristics enable enterprises to establish a more

efficient and secure marketing and service system to maximize customer value. However, although the application of blockchain technology in the field of enterprise marketing and service has a broad prospect, the relevant academic research and practical exploration are still in the initial stage. Most of the existing researches focus on the principles and application scenarios of blockchain technology, and there are relatively few researches on how to integrate blockchain technology with enterprise marketing and service. Therefore, this study aims to fill this research gap and explore the strategies and methods for the deep integration of enterprise marketing and services based on blockchain. This study will comprehensively utilize a variety of methods such as literature research, case analysis, and empirical research, aiming to reveal how blockchain technology promotes the in-depth integration of enterprise marketing and service, and explore its effects in practical applications. At the same time, this study will also focus on the prospects and challenges of the application of blockchain technology in the field of enterprise marketing and service, so as to provide useful references for enterprise practice. Through this study, we expect to provide future scholars with a new research perspective and ideas, and promote the deepening of research in related fields. At the same time, we also expect that this study can provide useful guidance and reference for enterprise practice, and promote enterprises to realize the deep integration and innovative development of marketing and service in the context of digital transformation.

Enterprise marketing is an important means for enterprises to achieve their strategic goals. It is of great significance in promoting the sales of products or services, increasing market share, enhancing brand image and customer satisfaction, meeting customer needs and providing better user experience, helping enterprises establish competitiveness and long-term profitability, achieving strategic goals and sustainable development. In recent years, many scholars have explored enterprise marketing from different perspectives, proposing different marketing methods to enhance enterprise competitiveness. Bandyopadhyay Chinmoy pointed out different issues and challenges of social enterprise marketing by analyzing the existing literature and stated that this study can help social enterprises to understand and plan their marketing activities for better impact and profitability, while future research can draw on the findings of this review [8]. In order to test the role of leader and organizational credibility in business marketing in influencing customers' willingness to support Islamic social enterprises, Hati Sri Rahayu Hijrah, through online and offline surveys, indicated that organizational credibility and organizational branding have a much greater impact on customers' willingness to support Islamic social enterprises than the leader's personal credibility, and this study provides empirical results on the phenomenon of Islamic social entrepreneurship for the the field of marketing and social entrepreneurship [9].Powell Madeline found that social enterprises are adopting a product-oriented marketing approach, which undermines their potential as sustainable public service providers, for this reason, he used service theory to develop an alternative model of marketing and business practices that can make a significant contribution to the delivery of sustainable public services [10].Huang Yan studied the elasticity of enterprise marketing investment based on the equilibrium movement model. He said that enterprise marketing was affected by many factors, which was easy to lead to certain fluctuations in enterprise market influence. It is difficult to effectively control the elasticity of enterprise market influence. The balanced motion model is a simulation of the real situation, which can energize this influence and more intuitively express the marketing influence with figures [11]. The above research provides a comprehensive perspective on marketing issues for social enterprises, revealing the importance of reputation and brand in enterprises, and providing new marketing directions for social enterprises. However, the disadvantage is that the research may lack universality for different cultural backgrounds and evaluation of long-term impacts, and its conclusion page is not applicable to other types or cultural backgrounds of social enterprises. In addition, the study may not have fully considered other factors that may affect customer support. Overall, these studies provide valuable insights and directions for the marketing field and social enterprises.

The significance of blockchain in marketing lies in providing secure, transparent, and tamper proof data records, which helps to establish trust and enhance brand image. At the same time, it also helps to achieve precision marketing and personalized services, improve marketing effectiveness and customer satisfaction. Currently, some scholars have explored the value of blockchain applications in marketing, providing a certain theoretical basis for this study. Due to the traditional centralized data storage mode no longer meeting the security and efficiency requirements of power business data storage, Wang Lingyu proposed a multi-level encrypted power marketing data storage architecture based on blockchain technology. This storage architecture is supported by blockchain technology as the underlying technology, and combined with distributed storage to provide a stable, secure and reliable power data storage solution. He also created distributed storage facilities, A comparative experiment was conducted between the proposed storage mechanism and the centralized storage mechanism, and it was found that the proposed storage mechanism has more advantages in system latency, response time, and throughput compared to traditional storage mechanisms in power data storage. This indicates that the storage mechanism is reasonable and feasible, and has good application prospects [12]. Tan Teck Ming conducted semi-structured

interviews with 18 informants with at least three years of project experience on blockchain exchanges and found that blockchain enables people to trust exchange participants, human guardians in mathematics and cryptography, and exchange assets. He stated that this research is crucial for marketers and practitioners who want to understand online advertising, customer trust The increase in trust threats in privacy and digital rights [13]. Blockchain technology provides higher levels of security and efficiency for the storage of electricity marketing data. Ensure the integrity and credibility of data through distributed storage and encryption mechanisms. Compared to traditional storage mechanisms, this architecture has lower latency, faster response speed, and higher throughput. However, this technology still faces challenges in implementation and popularization, such as technological maturity, cost-effectiveness, regulatory compliance, and user acceptance. Future research should further explore these issues and unleash the greater potential of blockchain in the field of marketing.

With the advancement of the digital era, the storage demand for electric power business data has been growing, and the traditional centralized data storage model has been difficult to meet the increasingly stringent security and efficiency requirements. Although existing research has proposed a power marketing data storage architecture based on blockchain technology, there are still some obvious research gaps in practical applications. First, although blockchain technology provides strong security and trustworthiness for data, its implementation and maintenance costs are relatively high, which largely limits its wide application in small and medium-sized enterprises. How to reduce the implementation cost of blockchain technology while maintaining its security and efficiency is an important direction of current research. Second, although the above studies have experimentally verified the performance advantages of blockchain-based storage mechanisms, they lack studies on long-term stability and scalability. In practical applications, the rapid growth of data volume and the increase in system complexity may have an impact on the performance and stability of the storage mechanism. Finally, for the application of blockchain technology in the field of electricity marketing, we need to study more deeply how to combine it with other marketing tools and technologies to achieve better business results. For example, how to use blockchain technology to improve the transparency of marketing activities and increase customer trust, as well as how to use blockchain data to analyze consumer behavior, are all issues that deserve further exploration. In summary, despite the significant advantages of power marketing data storage architecture based on blockchain technology, there are still many research gaps in practical applications. Future research should be devoted to solving these problems in order to promote the wide application of blockchain technology in the field of power marketing.

In order to better achieve the deep integration of enterprise marketing and services, this article first analyzes the current situation and existing problems of enterprise marketing; Then, the relationship between enterprise marketing and service quality was analyzed; Afterwards, blockchain technology was introduced to explore its application in marketing and service models; Subsequently, an analysis was conducted on blockchain embedding and enterprise business models, and corresponding hypotheses were proposed; Introducing fuzzy algorithms to accurately locate and solve problems in enterprise marketing and services; Finally, empirical research has found that using blockchain technology to promote deep integration of enterprise marketing and services in the context of digital transformation can significantly improve market economic benefits, promote the completion of enterprise marketing strategies, and promote the improvement of service quality. Compared with traditional methods, the advantage of this article's approach lies in its focus on the practical value of applying blockchain technology in the integration of enterprise marketing and services, which helps to promote digital transformation of enterprises and meet their actual needs for digital transformation. This study also found that blockchain technology can improve the transparency and credibility of enterprise marketing and services, reduce trust costs, and improve customer satisfaction and loyalty; At the same time, it can optimize customer service processes, improve customer experience and satisfaction, and enhance brand loyalty. In addition, blockchain technology can promote the process of digital transformation of enterprises, improve their competitiveness and sustainable development capabilities.

II. Theoretical Basis

II. A.Enterprise Marketing and Service

II. A. 1) Overview of Enterprise Marketing

Enterprise marketing refers to the business activities carried out in the market environment to meet the needs of customers, mainly including: market research and selection, product development, pricing and sales [14]. Enterprise marketing environment is an uncontrollable and restricted factor that affects enterprise marketing outside the enterprise marketing system [15].The theoretical system of enterprise marketing is shown in Figure 1.

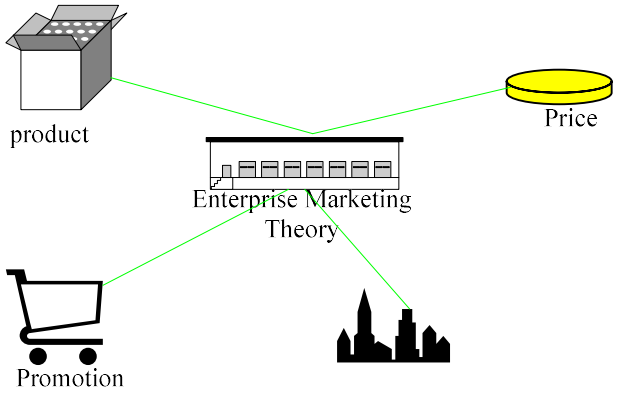


Figure 1: Enterprise marketing theory system

It is an inevitable trend for enterprises to expand the market in the future. However, once enterprises ignore the mutual influence of market supply and demand, many goods are not sold well in the market, and profits are difficult to control [16]. Therefore, enterprises must put marketing positioning in the first place in the marketing process. The relationship between the specific enterprise market and the external market is shown in Figure 2.

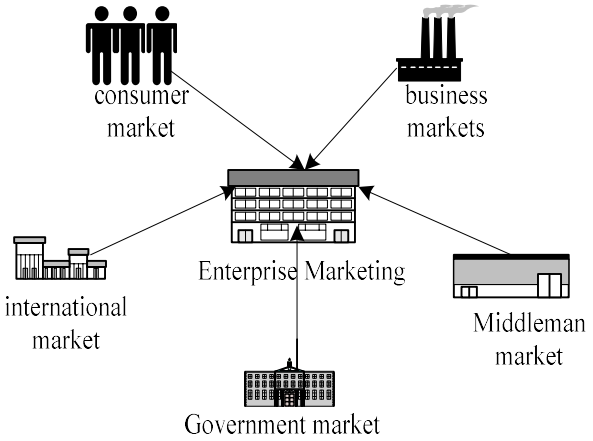


Figure 2: Relationship between enterprise market and external markets

II. A. 2) Problems in Enterprise Marketing

At present, there are five problems in enterprise marketing: limited to traditional marketing concepts, lack of specialized talents, lack of suitable marketing strategies, limited ability to explore new markets, and insufficient emphasis on network technology [17], [18]. Many companies clearly overlook the influence of the marketing department when selling. To develop, enterprises must have the right strategy. Without a clear goal to guide the development direction of the enterprise, it gradually loses its goals in the huge market competition. From the perspective of enterprise development, most decision-makers tend to focus on regions with greater market potential. Therefore, when choosing a market, it is often necessary to comprehensively consider factors such as regional demand, economic development capacity, and consumption potential [19], [20]. At present, in order for a company to develop better, it must integrate its marketing technology and market services to promote its market expansion and maintain its development [21].

II. A. 3) Enterprise Services

Enterprise services refer to services provided by enterprises as the main body and consumers as the service objects, commonly referred to as "customer service" in the business community. The quality of enterprise service is an important standard for measuring the level of enterprise service. The main areas of enterprise services are shown in Figure 3.

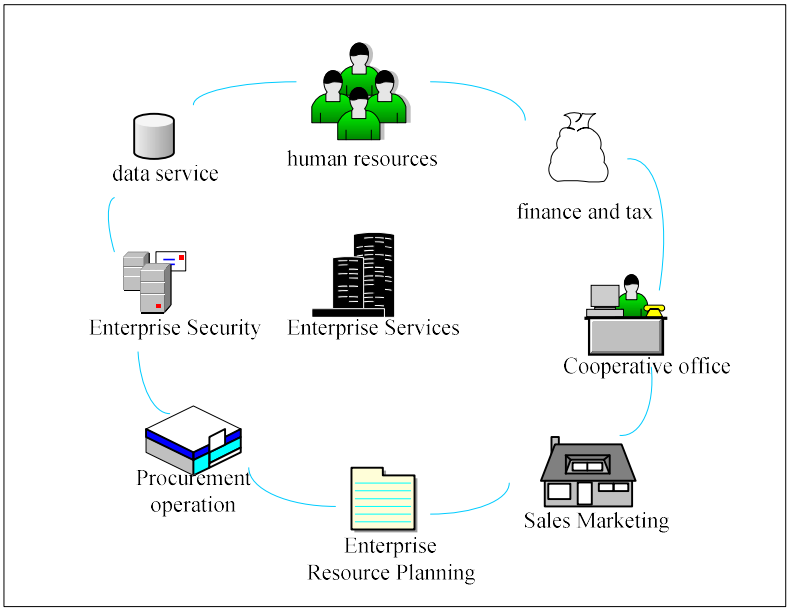


Figure 3: Main areas of enterprise services

II. A. 4) "Deep Integration" of Marketing and Service

The meaning of "deep integration" of marketing and service refers to the close integration of marketing and service to realize the deep interaction and mutual promotion between them. This integration involves a deep understanding of customer needs and market trends, as well as a comprehensive optimization of enterprise marketing and service strategies [22].

Specifically, the deep integration of marketing and service includes customer demand insight, coordination of marketing strategy and service mode, data sharing and integration, integration of intelligent workflow, and cross-departmental cooperation and communication. Through in-depth insight into customer needs and market trends, enterprises can formulate marketing strategies and service models more accurately. This insight includes not only a direct understanding of customer needs, but also an analysis of market trends and competitors. Enterprises need to combine marketing strategy and service mode closely to ensure the coordination and cooperation between them. Through data sharing and integration, enterprises can better understand customer needs and market trends, and provide more accurate data support for the formulation of marketing strategies and service models. At the same time, data sharing also helps enterprises to improve the efficiency and quality of marketing and service. Through the integration of intelligent workflows, enterprises can achieve efficient online and offline collaboration and improve service quality and efficiency. The deep integration of marketing and service requires cooperation and communication between departments. Enterprises need to break down barriers between departments, strengthen cooperation and communication between departments, and ensure the consistency and coordination of marketing and service strategies.

II. B.Blockchain

II. B. 1) Blockchain and marketing and service models

Enterprise marketing, blockchain technology, and service integration are interrelated, and their relationship is mainly reflected in the following aspects: the combination of marketing strategy and blockchain technology: the formulation of enterprise marketing strategy needs to consider multiple factors such as market demand and competitive environment. Blockchain technology can provide more secure and reliable data support for marketing strategies, helping enterprises better understand customer needs and market trends, and thus develop more accurate marketing strategies. The promotion of blockchain technology on service models: Service models are an important link for enterprises to provide comprehensive and efficient services to customers. Blockchain technology can achieve secure storage and sharing of data through decentralization, improve the transparency and credibility of services, and promote further development of service integration. The support of service model for marketing: Service integration provides enterprises with more comprehensive and efficient services, thereby improving customer satisfaction and loyalty. The improvement of customer satisfaction and loyalty can bring more market share and sales revenue to the enterprise, thereby supporting the development of enterprise marketing. In

summary, enterprise marketing, blockchain technology, and service integration are interrelated, and their relationship is mainly reflected in data support, service promotion, and marketing support. In the context of digital transformation, enterprises need to pay more attention to the interrelationships and collaborative development among the three in order to achieve innovation and development.

To integrate marketing and services using blockchain technology, the first step is to establish a trust mechanism: blockchain technology ensures the immutability and transparency of data through decentralization, thereby establishing a trust mechanism. Then achieve data sharing and transparency: Through blockchain technology, enterprises can achieve data sharing and transparency, break information silos, and improve marketing and service efficiency. Meanwhile, this data sharing also helps enterprises better understand customer needs and market trends, providing support for precision marketing. Afterwards, optimize business processes: Blockchain technology can optimize the business processes of enterprises, reduce intermediate links, and lower costs. In the field of marketing and service, this optimization helps to improve service quality and efficiency, enhance customer satisfaction and loyalty. Continuing to strengthen incentive mechanisms: Through blockchain technology, enterprises can create a digital TOKEN incentive system that can enhance project brand loyalty, encourage more people to participate in project and product activities, and better disseminate project and brand information. Establishing a decentralized enterprise system: The decentralized nature of blockchain technology can enable enterprises to establish a system that does not rely on centralized institutions. Enterprises can use blockchain technology to establish a decentralized data management system, where data can be shared by all parties, enhancing information security, reducing enterprise management costs, and improving efficiency.

By using blockchain technology, marketing and services can be integrated to improve enterprise performance. By using blockchain technology to achieve data sharing and transparency, enterprises can better understand customer needs and market trends, develop more accurate marketing strategies, and improve marketing effectiveness. By optimizing business processes and strengthening incentive mechanisms through blockchain technology, enterprises can improve service quality and efficiency, enhance customer satisfaction and loyalty. By using blockchain technology to establish a decentralized enterprise system and optimize business processes, enterprises can reduce management and operational costs. By integrating marketing and services through blockchain technology, enterprises can enhance their brand image and reputation, and enhance their market competitiveness. In summary, integrating marketing and services using blockchain technology can improve enterprise performance, including improving marketing effectiveness, service quality, reducing costs, and enhancing competitiveness.

II. B. 2) Blockchain Embedding and Enterprise Business Model

From the perspective of blockchain, an enterprise business model is an operational system that involves communication and communication between enterprises and external stakeholders, as well as bringing value to communication partners through interaction. According to transaction cost theory, when the degree of information asymmetry increases, the transaction costs caused by people's interactions also increase. Using this business model can effectively reduce transaction risks and improve transaction efficiency. On the one hand, enhanced blockchain relationship embedding capabilities can provide companies with heterogeneous and non redundant information. This inflow of information can enable enterprises to grasp key market and customer information resources earlier than their competitors, which helps enterprises determine their market position, develop new products and design new services to meet customer needs accordingly, while also transmitting their core values, and enabling enterprises to establish a first mover advantage and leading position in the fierce market competition. Blockchain association embedding promotes the dissemination of fine-grained information and tacit knowledge. With the improvement of the quality of external information and the strengthening of knowledge inflow, the ability of enterprise knowledge creation can be further enhanced, which in turn also improves the level of enterprise value creation, and continuously provides customers with diversified and innovative products and services, improving the ability of enterprise value acquisition.In addition, enterprises located in the center of blockchain can also focus their time and energy on serving target customers, reducing enterprise management costs. Continuously creating and providing product value for customers, and transferring value to users to meet their needs, thereby improving customer loyalty.

To sum up, the following assumptions can be proposed:

Hypothesis: Enterprise marketing and service relationship embedding have a significant positive impact on business models.

Hypothesis: Blockchain embedding has a significant positive impact on business models.

To verify the above assumption, this article introduces fuzzy algorithms into the blockchain, optimizes the blockchain through fuzzy algorithms, and validates it through experiments.

II. B. 3) Blockchain and Fuzzy Algorithms

The deep integration of marketing and service requires meeting the diversity of customer needs. Fuzzy algorithms can handle uncertainty and fuzziness, better responding to changes in market demand and uncertainty. In marketing and service, a large amount of data needs to be processed, including customer information, market trends, competitor analysis, etc. Fuzzy algorithms can process these complex data, extract useful information, and provide support for the formulation of marketing strategies and service models. The decision-making process of marketing and service often has ambiguity, as many factors are difficult to quantify and determine. Fuzzy algorithms can handle this ambiguity and provide more accurate and reliable support for the decision-making process. Blockchain technology has the characteristics of decentralization, traceability, security and reliability, which can provide more secure and reliable technical support for the deep integration of marketing and services. Meanwhile, blockchain technology can also be combined with fuzzy algorithms to further improve the efficiency and accuracy of data processing and decision-making.

It is supposed that the fuzzy set B of universe A is represented by a membership function $\gamma_B(a)$. This function takes value on the closed interval [0,1] on the real axis. The value of $\gamma_B(a)$ reflects the membership degree of object a on set A. Each $\mathrm{a} \in \mathrm{A}$ has a unique membership function $\gamma_B(a) \in [0,1]$ corresponding to it.

If universe A is discrete and restricted, then fuzzy set B can be expressed as:

$$\mathrm{B} = \left\{\frac{\gamma_\mathrm{B}(\mathrm{a}_1)}{\mathrm{a}_1} + \frac{\gamma_\mathrm{B}(\mathrm{a}_2)}{\mathrm{a}_2} + \cdots\right\} = \left\{\sum_\mathrm{m} \frac{\gamma_\mathrm{B}(\mathrm{a}_\mathrm{m})}{\mathrm{a}_\mathrm{m}}\right\} \tag{1}$$

When universe A is infinite and continuous, the fuzzy set can be marked as:

$$\mathrm{B} = \left\{\int \frac{\gamma_\mathrm{B}(\mathrm{a})}{\mathrm{a}}\right\} \tag{2}$$

When the number of elements in the fuzzy set B is small, the method of ordered pair set can be used. Each element and its corresponding subordinate relationship are combined into a sequence, and the results are as follows:

$$\mathrm{B} = \{(\mathrm{a}, \mathrm{B}(\mathrm{a}) | \mathrm{a} \in \mathrm{A})\} \tag{3}$$

If the order of the elements in the fuzzy set B is determined, the vector can be used to express it as:

$$\mathrm{B} = \left(\mathrm{B}(\mathrm{a}_1), \mathrm{B}(\mathrm{a}_2), \cdots, \mathrm{B}(\mathrm{a}_\mathrm{n})\right) \tag{4}$$

This method arranges the membership relationship of each element into a vector in a certain order, that is, a fuzzy vector.

Although this method can well solve the fuzzy problems in practice, it brings inconvenience to the application of fuzzy mathematics. In order to make up for this defect, the application scope and effect of fuzzy set algorithm are expanded. Therefore, this paper introduces rough set simplification into fuzzy set theory.

$\mathrm{A} = \{\mathrm{a}_1, \mathrm{a}_2, \cdots, \mathrm{a}_\mathrm{t}\} \subset \mathrm{Z}^\mathrm{s}$ is called the finite data set in the feature space. Then the objective function of fuzzy R-means clustering analysis is:

$$\min \mathrm{L_j}(\mathrm{Q}, \mathrm{P}, \mathrm{A}) = \sum_{\mathrm{m}=1}^{\mathrm{d}} \sum_{\mathrm{i}=1}^{\mathrm{t}} \gamma_{\mathrm{mi}}^{\mathrm{j}} \|\mathrm{a_i} - \mathrm{p_m}\|_\mathrm{B}^2 \tag{5}$$

$$\gamma_{mi} \in [0,1], 1 \le m \le d, 1 \le i \le t \tag{6}$$

$$\sum_{m=1}^{d} \gamma_{mi} = 1, 1 \le i \le t \tag{7}$$

Among them: t - Number of elements in the data set, D - Number of sample classifications, $2 \le \mathrm{d} \le \mathrm{t}$, L_j-Objective function, which is the weighted sum of squares of intra class errors, γ_{mi} - The degree of membership of the ith sample to the m-th center.

$$p_m = \frac{\sum_{i=1}^{t} \gamma_{mi}^{j} a_i}{\sum_{i=1}^{t} \gamma_{mi}^{j}}, 1 \le m \le d \tag{8}$$

$$\gamma_{mi} = \frac{1}{\sum_{v=1}^{d} (g_{mi}/g_{vi})^{1/(j-1)}} \tag{9}$$

$$g_{mi} = \|a_i - p_i\|_B^2, 1 \le m \le d, 1 \le i \le t \tag{10}$$

Given the cluster number d and membership matrix Q, the effectiveness measurement function of the cluster is:

$$\mathrm{YH}(Q, d) = \frac{1}{t} \sum_{i=1}^{t} \left(\sum_{m=1}^{d} \gamma_{mi}^2 / \sum_{m=1}^{d} \gamma_{mi}\right) - \frac{1}{d} \sum_{m=1}^{d} \left(\sum_{i=1}^{t} \gamma_{mi}^2 / \sum_{i=1}^{t} \gamma_{mi}\right) \tag{11}$$

After the continuous attributes are fuzzified, the fuzzy rough set needs to deal with a fuzzy equivalent class. Its upper and lower approximations can be defined as:

$$\gamma_{\underline{a}}(Ym) = inf_a\ max\{1 - \gamma_{Ym}(a), \gamma_A(a)\}, \forall m \tag{12}$$

$$\gamma_{\overline{a}}(Ym) = sup_a\ min\{\gamma_{Ym}(a), \gamma_A(a)\}, \forall m \tag{13}$$

Among them: $\gamma_A(a)$-Object a belongs to the membership degree of fuzzy set A on Q;

Ym - The fuzzy equivalence class studied.

After obtaining the corresponding fuzzy set theory, it is determined that the dependence of attribute G on condition attribute D is:

$$\delta_D(G) = \frac{\left|\gamma_{POS_D}(a)\right|}{|Q|} = \frac{\sum_{a \in Q} \gamma_{POS_D}(a)}{|Q|} \tag{14}$$

The above fuzzy set theory is based on the iterative theory to compress the calculation range into the domain that needs to be used for calculation, instead of giving a large amount of calculation to each step as usual, which can greatly improve the calculation speed, but the system can run longer during the calculation. The deepening of theoretical research has led to the birth of the fuzzy rough set reduction algorithm, which is an improvement and optimization based on fuzzy set theory. It not only maintains the ability of the original method to retain target information, but also reduces the computational complexity. It is more suitable for enterprise marketing and services in the blockchain in the context of digital transformation, and can better promote its deep integration.

III. An Empirical Study on the Integration of Enterprise Marketing and Service

Based on theoretical research on enterprise marketing and services, this article proposes a deep integration idea of enterprise marketing and services based on blockchain algorithms in the digital context. Based on the theoretical analysis of blockchain, fuzzy algorithms are introduced to improve and optimize it, making it more suitable for enterprise marketing and services in the digital context, and promoting its in-depth integration towards a better direction. In order to test the feasibility of this view, an empirical analysis is conducted.

III. A. Research and Design of Enterprise Marketing and Service Integration

III. A. 1) Research Objectives and Issues

The purpose of this study is to deeply understand the application of digital transformation and blockchain technology in enterprise marketing and service. Through research, we can deeply understand how to deeply integrate blockchain technology with enterprise marketing and service under the background of digital transformation, and understand the impact of this integration on enterprise operation, customer experience and brand image. Explore the mechanism and effect of deep integration of enterprise marketing and service based on blockchain. The research will explore the mechanism of deep integration of enterprise marketing and service based on blockchain, including how to use blockchain technology to improve marketing effect, improve service efficiency and enhance customer satisfaction. At the same time, it will also study the effect of this deep integration, including its impact on improving market share and competitiveness of enterprises, and provide strategies and suggestions for enterprises to realize digital transformation. Through research, I hope to provide enterprises with strategies and suggestions on how to better apply blockchain technology to marketing and service, help enterprises realize digital transformation, and improve operational efficiency and customer satisfaction.

This research question includes: What is the mechanism and effect of deep integration of blockchain based enterprise marketing and services? How to evaluate the application of blockchain based deep integration of enterprise marketing and services? How to improve the effectiveness of deep integration of blockchain based enterprise marketing and services?

III. A. 2) Source of experimental data

In order to verify the application effect of blockchain in the deep integration of enterprise marketing and services, this article, with the internal consent of the enterprise, selected a local small and micro enterprise as the research object and obtained relevant information from the enterprise's internal database. And the blockchain method proposed in this article was compared with traditional methods, comparing the market economic benefits, overall marketing strategies, and changes in enterprise marketing service quality before and after applying blockchain optimization for two years (that is, 2020-2021), and corresponding conclusions were drawn.

The economic benefits mainly include profit index, return on investment, sales revenue and cost-benefit ratio. This paper compares the profit levels in different periods to evaluate the economic benefits of enterprises. The completion of enterprise strategic objectives mainly includes key performance indicators and strategic maps. This

paper monitors and evaluates the achievement of key performance indicators, so as to understand the completion of enterprise strategic objectives from 2020 to 2021. The measurement of enterprise service quality mainly covers service satisfaction, problem solving speed and service reliability. This paper evaluates the service satisfaction of enterprises by evaluating tangibility, reliability, responsiveness, authenticity and empathy, so as to understand the level of service quality of enterprises.The profit indicators, return on investment, sales revenue, and cost-effectiveness ratio of the enterprise before the experiment are shown in Table 1:

Table 1: Data status before the experiment

Time	Profit target (ten thousand yuan)	Mercantile rate of return	Sales revenue (ten thousand yuan)	Cost-benefit ratio (ten thousand yuan)
First quarter	3918.2	12.2%	66343.4	59531.1
The second quarter	7827.4	15.9%	34665.3	24756.6
The third quarter	13805	18.8%	14961.5	9866.4
The fourth quarter	9355.7	16.9%	26497.8	22188.6

After collecting these data, the data is then cleaned to remove redundancy and error data, and the data transformation the data conversion for subsequent analysis.

Firstly, obtain marketing and service related data from the internal database of the enterprise. Including customer purchase history, service records, marketing campaign effectiveness, etc. These data can directly reflect the actual effect of blockchain based marketing and service deep integration in the context of digital transformation for enterprises. In order to gain a more comprehensive understanding of industry trends and competition, relevant data is also obtained from third-party sources. Including industry reports, market research data, competitor analysis, etc. In addition, a questionnaire was designed for enterprises and consumers to collect their views, experiences, and satisfaction with the deep integration of blockchain based marketing and services. These data can directly reflect consumers' acceptance and feelings towards this new model.

Before starting to collect data, clarify the research purpose and questions, and determine which types of data need to be collected. According to the research objectives, design survey questionnaires, database query tools, etc. to ensure accurate and efficient collection of required data. Extract marketing and service related data from internal enterprise databases. During this process, it is necessary to ensure the accuracy and completeness of the data. Obtain industry reports, market research data, etc. from third-party data sources through purchase or cooperation. Conduct surveys on consumers and businesses through online or paper questionnaires to collect their views and experiences on the deep integration of blockchain based marketing and services. Clean, organize, and analyze the collected data to extract useful information and provide support for subsequent research. Through the above steps, rich and reliable data sources have been obtained, providing strong support for the research on the deep integration of blockchain based enterprise marketing and services in the context of digital transformation.

III. A. 3) Reliability and validity testing of the questionnaire

The survey targets internal employees, business managers, partners, and consumers. Among them, internal management personnel of the enterprise will focus on investigation. The application of blockchain technology by enterprises in the process of digital transformation; Partners will mainly focus on the cooperation mode with enterprises in digital transformation; Consumers will focus on understanding their acceptance and satisfaction with blockchain based marketing and service models. The survey includes the benefits of integrating enterprise marketing and service models.

This survey was conducted online and in paper format. Online questionnaires are published through internal network platforms or third-party survey platforms of the enterprise, while paper questionnaires are distributed by mail or on-site, mainly targeting senior management personnel of the enterprise. To ensure the accuracy and reliability of the data, cross validation and analysis will be conducted on the questionnaire data from both methods.

According to the different survey subjects, we publish questionnaire links or paper questionnaires through internal network platforms, email group sending, social media, and other means. At the same time, internal publicity and promotion activities are also carried out to increase the attention and participation of employees and partners in the questionnaire survey.

Set the deadline and reminder function for online questionnaires to ensure that all participants can complete the questionnaire within the specified time. Paper questionnaires are collected through mailing or on-site distribution, and a collection deadline is set. During the collection process, the integrity and confidentiality of the questionnaire have been ensured to avoid data leakage.

The collected data will be classified and sorted, and descriptive statistics will be analyzed, so as to have an in-depth understanding of enterprises and consumers' views and experiences on blockchain marketing and service models, so as to provide reference for enterprises to realize digital transformation. At the same time, we will also analyze and interpret the data, and put forward targeted suggestions and improvement measures.

The reasons for using descriptive statistics to analyze the data are: firstly, descriptive statistics can provide an overall overview of the data, such as the mean, which helps to quickly understand the trend of the data center; secondly, understand the dispersion through the standard deviation; and reveal the correlation and outlier between the data, so as to provide a basis for subsequent data analysis and decision.

A total of 154 offline questionnaires were distributed in this paper survey, and 12 invalid questionnaires were collected. Ultimately, 142 valid questionnaires were obtained, with a valid questionnaire response rate of 92.21%.

Table 2: Reliability and validity test results of the questionnaire content

Order number	Variable	Questionnaire content	Reliability analysis	Validity test
			α coefficient	Convergent validity
1	Enterprise marketing and service model	More marketing and service channels for customers	0.875	0.713
2		More flexible channel layout for marketing and service provided to customers	0.842.	0.752
3		More diverse marketing and service channel structures	0.897	0.787
4		Maintain stable business relationships with suppliers and distributors	0.856	0.659
5		Ability to provide value-added services to customers through innovative product combinations	0.812	0.648
6	Benefits of integrating enterprise marketing and service	Significant increase in corporate sales profit margin	0.823	0.638
7		Significant increase in market share of new products	0.751	0.598
8		The number of independent intellectual property rights owned has increased significantly	0.767	0.612
9		Increase in the proportion of high-tech employees	0.785	0.596

Reliability analysis: By calculating Cronbach's α The coefficient indicates that the reliability analysis results of each questionnaire content are above 0.7, indicating a high level of reliability of the questionnaire. Specifically, regarding the content of "enterprise marketing and service models," α The coefficient is 0.875, indicating that the reliability of this part of the content is very high. Validity analysis: For the "enterprise marketing and service model", the convergent validity ranges from 0.713 to 0.787, indicating that this part of the content has good effectiveness. Similarly, for the benefits of integrating enterprise marketing and services, the convergent validity ranges from 0.638 to 0.612, indicating that this part of the content has good effectiveness. Based on the above analysis, the following conclusion can be drawn: the reliability and validity of this questionnaire are both high, which can better reflect the marketing and service models of enterprises, as well as the benefits of integrating enterprise marketing and services. The content design of this questionnaire is reasonable and can effectively measure and evaluate the marketing and service models of enterprises, as well as the benefits of integrating enterprise marketing and services. Based on the above conclusions, the following suggestions can be made: in future research, the questionnaire content can be further optimized to improve the reliability and validity level of the questionnaire. In practical applications, corresponding marketing and service strategies can be developed based on the analysis of the results of the questionnaire to improve the sales profit margin and market share of the enterprise.

From Table 2, it can be seen that the scale Cronbach's α The medium coefficients are all above 0.7, which means that the internal consistency of the scale is high and the reliability is good. Convergence validity SMC values are all greater than 0.4, with good validity. Overall, the reliability and validity of the scale are good.

III. B. Comparison of Results under Two Methods

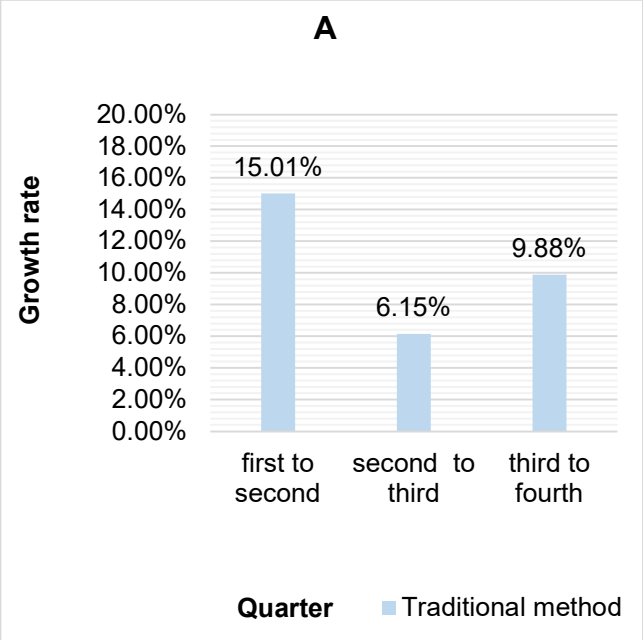
III. B. 1) Comparison of Changes in Enterprise Marketing Economic Benefits

As the purpose of serving the enterprise directly, the economic benefit of the enterprise is also the basis for the development of the enterprise and the guarantee for the survival of the enterprise. At the same time, economic efficiency is also an important indicator to measure the marketing efficiency of an enterprise. Table 3shows the economic benefits of the enterprise in each quarter from 2020 to 2021 before and after using fuzzy algorithm to optimize its marketing and services.

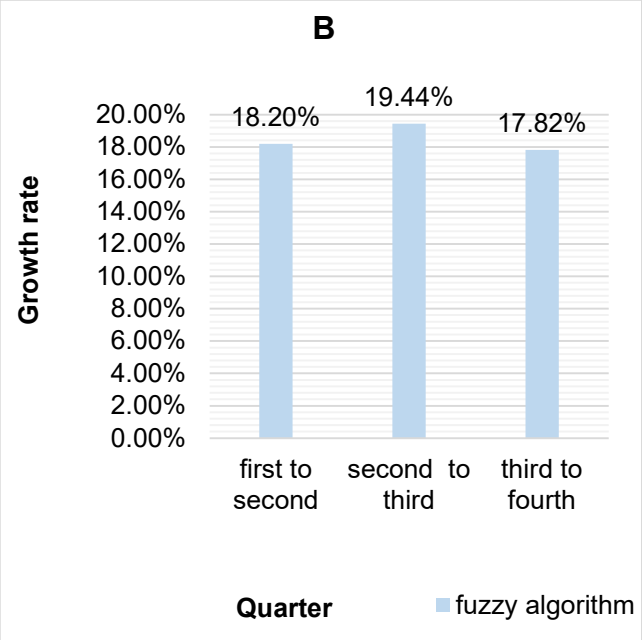
Table 3: Economic benefits of each quarter in the past two years

quarter	2020	2021
first	125 thousand and 900	179 thousand and 700
second	144 thousand and 800	212 thousand and 400
third	153 thousand and 700	253 thousand and 700
fourth	168 thousand and 900	298thousand and 900

It can be seen from Table 3 that the overall economic benefits of the enterprise in each quarter of 2020-2021 increases, but there is also declines. This shows that there are many factors affecting the economic benefits of enterprises. The specific trend of economic benefits of the enterprise is shown in Figure 4.



(A): Changes in quarterly economic benefit growth based on traditional methods in 2020



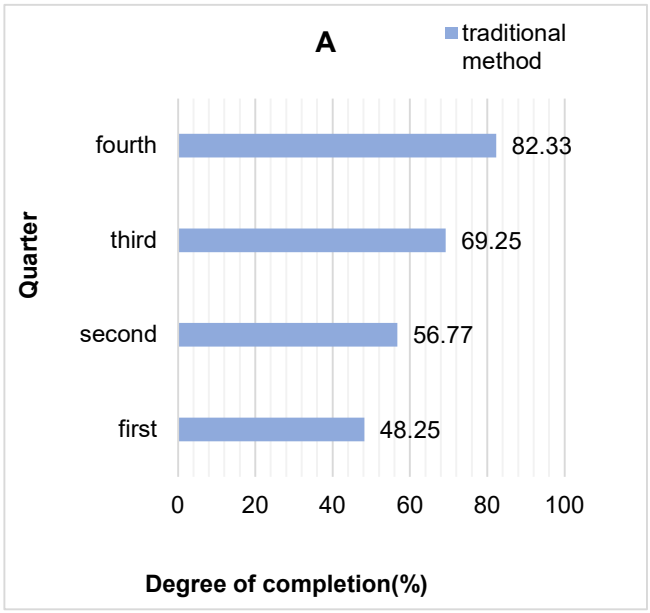
(B): Changes in quarterly economic benefit growth based on this method in 2021

Figure 4: Changes in economic benefit growth of the enterprise in recent two years

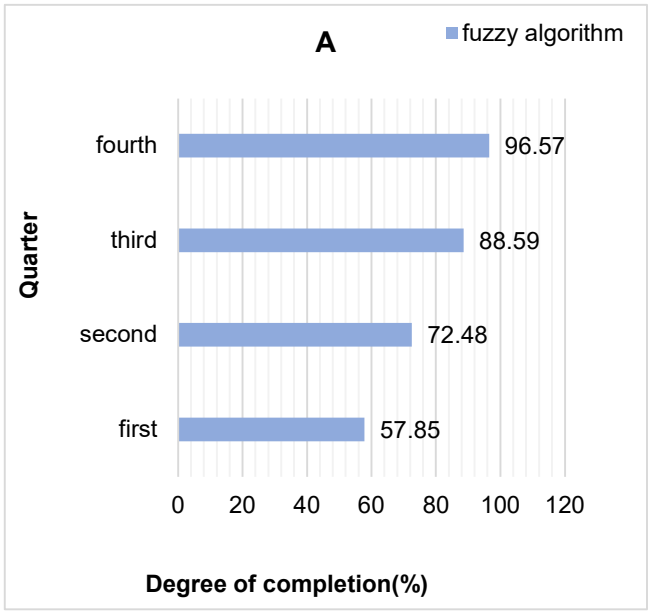
It can be seen from Figure 4 (A) and Figure 4 (B) that the economic benefit of the enterprise increases by 15.01% from the first quarter to the second quarter of 2020. In the first to second quarters of 2021, the growth benefit is 18.20%, and the economic benefit is 3.19% higher than the previous year. Similarly, from the second quarter to the third quarter, the economic efficiency is 13.29% higher than that of the previous year. From the third quarter to the fourth quarter, the economic efficiency is 7.94% higher than that of the previous year. It can be seen that integrating the marketing and service of the enterprise through the method in this article can help improve the economic benefits of the enterprise in each quarter, ensure good corporate profits and promote the development of the enterprise during the reform and transformation.

III. B. 2) Corporate Overall Marketing Strategy Comparison

If an enterprise wants to better promote the integration of marketing and service, it cannot do without its market strategy, which is closely related to the ultimate success of the enterprise and is an important goal to achieve the success of the enterprise. The enterprise strategy is mainly reflected in the market planning, price strategy, quality assurance and service strategy. After comparing the economic benefits of each quarter of the company in the past two years, the next step is to compare the completion of the overall marketing strategic objectives of the company in each quarter. The completion degree of the enterprise's strategic objectives in 2020 and 2021 is shown in Figure 5.



(A): Changes in the quarterly completion of strategic objectives based on traditional methods in 2020



(B): Changes in the completion degree of quarterly strategic objectives based on the method in this article in 2021

Figure 5: The completion of the enterprise's strategic objectives in recent two years

It can be seen from Figure 5 (A) and Figure 5 (B) that the completion rate of the enterprise's strategic objectives in the first quarter of 2020 is 48.25%, while in 2021 it is 57.85%. Compared with the first quarter of the previous year, the completion of the enterprise's strategic objectives increases by 9.6%. In the fourth quarter, the final completion degree of the enterprise's strategic objectives in 2020 is 82.33%, and in 2021 is 96.57%, an increase of 14.24% over the previous year. This shows that integrating enterprise marketing and service through the method in this article can help improve the ability of enterprises to plan the market, better implement price strategies, service strategies, and ensure quality, ultimately promoting the completion of enterprise strategic objectives, and promoting enterprise growth.

In addition to the investigation on the completion of the business strategy of the enterprise, it also investigates whether the implementation and completion of the enterprise's strategic objectives are important for the management and decision-making levels of the enterprise. The specific investigation results are shown in Representation 23.

Table 4: Changes in the company's understanding of the facts and importance of completing the strategic objectives in the past two years

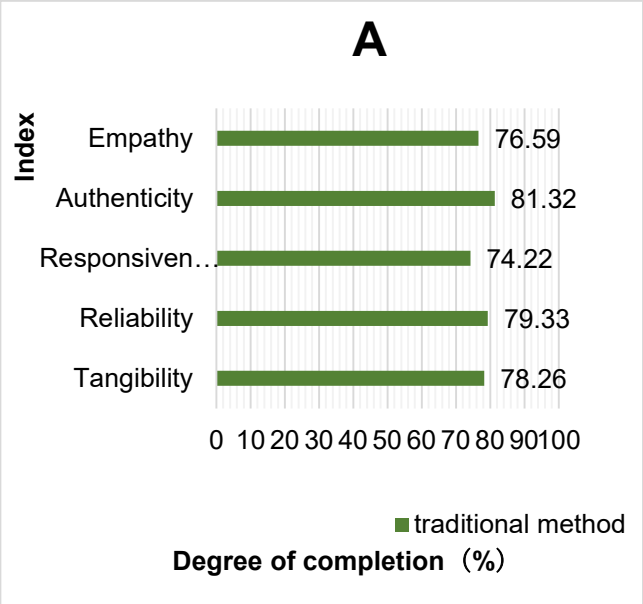
Importance	2020	2021
very important	45.78%	75.99%
Commonly	38.54%	21.33%
Unimportant	15.68%	2.68%

It can be seen from Table 4 that the management and decision-making levels of the enterprise generally believe that the implementation and completion of the enterprise's strategic objectives are not particularly important in 2020. However, in 2021, the concept of most management and decision-making levels has changed, and 75.99% of managers think it is important. This may be because after the integration of marketing and service of the enterprise through this method and the expected results. The concept of the management and decision-making begins to change.

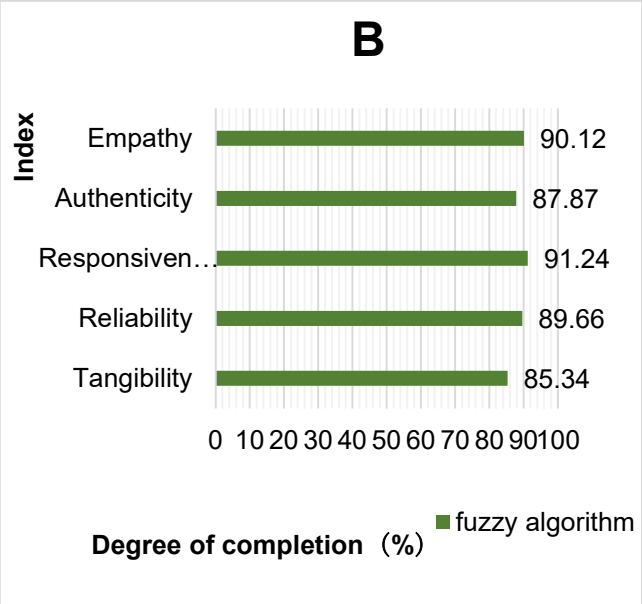
III. B. 3) Comparison of Marketing Service Quality

This paper studies the integration of enterprise marketing and service, so the change of service quality is also an important indicator to measure the integration effect of marketing and service. Service quality mainly includes five

aspects: tangibility, reliability, responsiveness, authenticity and empathy. The changes of service quality of the enterprise in recent two years are shown in Figure 6.



(A): Enterprise service quality based on traditional methods in 2020



(B): Enterprise service quality based on this method in 2021

Figure 6: Comparison of changes in service quality of the enterprise in recent two years

It can be seen from Figure 6 (A) and Figure 6 (B) that, compared with the service quality standard, the service quality of the enterprise is about 70% to 80% in 2020, and only the authenticity exceeds 80%. In 2021, the service quality of the enterprise exceeds 85%. It can be seen that it is effective to conduct deep integration of enterprise marketing and service through this algorithm. It can improve enterprise service quality, customer satisfaction and ultimately customer loyalty.

Finally, this article also statistically analyzed the economic benefits, completion of marketing strategies, and changes in service quality over time between traditional and proposed methods, with a confidence interval of 95%. The results are shown in Table 5:

Table 5: Changes in economic benefits, completion of marketing strategies, and service quality over time

Test indicators	Traditional method	This paper method	t-values	p-value
Economic benefits	$10.35\% \pm 2.46\%$	$18.49\% \pm 4.54\%$	6.45	0.024
Completion of marketing strategy	$64.15\% \pm 1.96\%$	$78.87\% \pm 4.33\%$	10.32	0.015
Service quality	$77.94\% \pm 3.02\%$	$88.85\% \pm 5.12\%$	12.28	0.008

According to Table 5, within a 95% confidence interval, the average economic benefits, marketing strategy completion, and service quality for the entire year of 2020 under the traditional method were significantly lower than those in 2021 using the method proposed in this paper, with statistical significance ($p<0.05$). This indicates that with the passage of time, the use of the method in this article has a significant effect on improving the economic benefits of enterprises, promoting the completion of marketing strategies, and improving the quality of enterprise services.In terms of economic benefits, the use of the method proposed in this paper shows a significant improvement in 2021 compared to the traditional method in 2020. This means that the new method is more economically advantageous and can bring greater profits or cost savings to the organization. The new method also shows a significant advantage in terms of marketing strategy completion. This means that the new method is more able to accurately execute the marketing plan and increase the effectiveness of the marketing strategy, thus better achieving the firm's marketing objectives. The improvement in service quality is also significant. In modern organizations, service quality is often a key factor in customer satisfaction and loyalty. Using the method proposed in this paper can significantly improve service quality, thus enhancing customer satisfaction and loyalty and further promoting the development of enterprises. In summary, the method proposed in this paper significantly improves

economic efficiency, marketing strategy completion and service quality compared to traditional methods. This result has important practical significance and provides better management and decision-making support for enterprises.

III. C. Discussion

In the global trend of digital transformation, enterprises are actively seeking to integrate new technologies to enhance competitiveness. Blockchain technology, due to its characteristics of decentralization, transparency, and immutability, has become one of the popular choices for digital transformation, especially showing potential important roles in enterprise marketing and services. Through empirical research on small and micro enterprises, it has been found that blockchain can deeply integrate enterprise marketing and services, and promote certain growth in enterprise economic benefits. The economic benefits of this small and micro enterprise increased by 3.19% in the first to second quarters of 2021 compared to 2020, and by 7.94% in the third to fourth quarters compared to 2020. In addition, the completion rate of the company's strategic goals in the first quarter of 2021 increased by 9.6% compared to the same period in 2020, and the overall completion rate in the fourth quarter was 14.24% higher than in 2020. The results of the study show that blockchain technology has a significant positive impact on the marketing and services of micro and small enterprises, contributing to the growth of their economic efficiency and the fulfillment of their strategic goals. This validates the potential and value of blockchain technology in enterprise operations and provides new development opportunities for MSMEs. These findings are important for promoting the widespread use of blockchain technology in enterprises. Compared to using previous traditional methods, the empirical study shows that the application of blockchain technology in the marketing and services of micro and small enterprises brings about more significant growth in economic benefits and an increase in the fulfillment rate of strategic goals. The deep integration capability of blockchain promotes the efficiency and effectiveness of enterprise operations, showing its obvious advantages over traditional methods and bringing new development opportunities and growth momentum to MSMEs.

The research contribution of this article is to promote the digital transformation of enterprises: With the deepening of digital transformation, enterprises need to continuously innovate marketing and service models to adapt to changes in market demand. The research on the deep integration of blockchain based enterprise marketing and services provides new solutions for enterprises, which helps to promote their digital transformation. Improving marketing and service efficiency: Through blockchain technology, enterprises can establish trust mechanisms, achieve data sharing and transparency, and thus improve the efficiency of marketing and services. This deep integration helps enterprises better understand customer needs and market trends, develop more precise marketing strategies, and improve customer satisfaction and loyalty. Enhancing data security and privacy protection: In the process of digital transformation, data security and privacy protection are important challenges faced by enterprises. The research on deep integration of enterprise marketing and services based on blockchain technology ensures data security and privacy protection, providing more reliable technical support for enterprises. Promoting enterprise innovation and development: Research on the deep integration of blockchain based enterprise marketing and services provides new ideas and methods for enterprises, which helps to promote innovation and development. This deep integration helps enterprises better adapt to market changes and meet customer needs, improving their competitiveness and market share. In summary, the research on the deep integration of blockchain based enterprise marketing and services under the background of digital transformation provides new solutions and development directions for enterprises, which helps to promote their digital transformation and innovative development.

In the process of deep integration of blockchain based enterprise marketing and services in the context of digital transformation, it is necessary to pay attention to the following lessons: first, pay attention to data security and privacy protection: In the process of digital transformation, enterprises need to pay attention to data security and privacy protection to ensure that customer information is not leaked. Secondly, constantly innovating marketing and service models: In the context of digital transformation, enterprises need to constantly innovate marketing and service models to adapt to changes in market demand. In addition, establishing trust mechanisms: By using blockchain technology to establish trust mechanisms, data sharing and transparency can be achieved, improving marketing and service efficiency. Finally, fully utilize the advantages of blockchain technology: In the process of digital transformation, enterprises need to fully utilize the advantages of blockchain technology to improve the security and efficiency of marketing and services. Therefore, enterprises need to establish sound data security and privacy protection mechanisms to ensure that customer information is not leaked. Enterprises also need to continuously innovate their marketing and service models to adapt to changes in market demand. We can understand market demand and trends by conducting market research, analyzing competitors, and other means. In addition, enterprises can establish trust mechanisms through blockchain technology to achieve data sharing and transparency. By establishing distributed ledgers, smart contracts, and other technological means, this goal can be achieved. At the same time, enterprises should fully utilize the advantages of blockchain technology to improve the

security and efficiency of marketing and services. This goal can be achieved through optimizing business processes, reducing costs, and other means.

IV. Conclusion

In the wave of digital transformation, the deep integration of blockchain based enterprise marketing and services has shown enormous potential and value. Through the introduction of blockchain technology, enterprises can establish a more transparent and trustworthy marketing and service system, thereby improving customer satisfaction, enhancing brand image, and improving operational efficiency. This integration not only helps enterprises stand out in fierce market competition, but also helps promote sustainable development, achieve long-term profitability and strategic goals. This article uses a questionnaire survey to explore the interrelationship between enterprise marketing and services, business models, and blockchain embedding, and conducts relevant validation through empirical research. The main research conclusions are as follows: Firstly, blockchain embedding has a significant promoting effect on the economic benefits of enterprise innovation. This means that enterprises should pay attention to both marketing and innovation, and the positive promotion of blockchain technology for enterprise innovation can better promote the digital transformation of enterprises. In addition, blockchain embedding plays a positive role in both enterprise marketing and business model transformation of services. This means that enterprises need to clarify the development direction of their marketing and service, determine their value propositions, optimize product design based on customer satisfaction, and continuously create value for customers. This greatly improves the flexibility of enterprise marketing, thereby enhancing the level of enterprise market service and value acquisition capabilities, and ultimately promoting the improvement of enterprise innovation capabilities and the integration of enterprise marketing and service.The research on the deep integration of enterprise marketing and services based on blockchain is an innovation of enterprise marketing and service models in the context of digital transformation. It utilizes the decentralized, secure, transparent, and immutable characteristics of blockchain technology to change the information asymmetry problem of traditional marketing and service models, and improve the trust between enterprises and customers. For enterprise managers, the deep integration of blockchain based enterprise marketing and services provides a new management concept and tool. It can help enterprises better understand customer needs, optimize marketing strategies, and improve service efficiency and quality. At the same time, it can also help enterprises establish more transparent and fair internal management mechanisms, improve operational efficiency and competitiveness. For policymakers, the research results on the deep integration of blockchain based enterprise marketing and services can provide reference for policy-making. With the continuous development and application of blockchain technology, there will be more possibilities for research on the deep integration of blockchain based enterprise marketing and services. Future research can further explore how to use blockchain technology to achieve more precise marketing strategies, how to protect consumer privacy, and how to address legal and ethical issues related to blockchain technology in enterprise marketing and services. At the same time, research can also be conducted on how to combine blockchain technology with other emerging technologies (such as artificial intelligence, big data, etc.) to promote further innovation in enterprise marketing and service models.

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