Research on Intelligent Service Quality Evaluation of Pharmaceutical Companies Based on Hierarchical Analysis

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Abstract. From the perspective of comprehensively improving the quality of intelligent services in the pharmaceutical industry, the service quality evaluation system of pharmaceutical enterprises is constructed in order to improve customer experience. The intelligent service quality evaluation model applicable to pharmaceutical enterprises is established using hierarchical analysis, the weights of each index are calculated, and then customer satisfaction is used to obtain the overall results of intelligent service quality evaluation. According to the evaluation results, the weights of the indexes and the scores of the indexes are the analysis is carried out to determine the weak points of the enterprise's intelligent services, combined with the specific results in a targeted manner, and relevant constructive suggestions are put forward.

Keywords: Hierarchical analysis · Service quality evaluation · Intelligent services

1 Introduction

The advanced all-media manufacturing industry has successively put forward the theme of smart manufacturing, which describes the whole process of smart manufacturing by providing an in-depth and comprehensive analysis of the general development of smart manufacturing in terms of industry chain smart manufacturing, smart factories, smart equipment, smart products, smart services, industrial transformation models and cluster development. The emergence and evolution of the Big Data era has led to a proliferation of research into data networks, cloud computing and other technical aspects. The use of data information to analyse market and potential customer needs in order to add value to services is gradually becoming a focus of attention[1]. Today, intelligent services have become the subject of modern intelligent production. Smart services can save businesses money and increase their efficiency. An outstanding intelligent service system can bring a qualitative leap forward for businesses, making intelligent service an important direction for today's businesses.

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2 Review of the Literature

In 2005, Allmendinger and Lombrelia highlighted that "the cost of smart services exceeds the cost of upgrades and product-related services" and stressed the importance of increasing the value of manufacturing products to customers and companies through smart services. Since then, the term "smart services" has been accepted and rapidly adopted by academics [2]. Patidar, S. Rane, D (2006), who were involved in early research on smart services, argue that smart services can deliver information through intelligent goods. This class of intelligent products can detect changes in the external environment and their own state, and collect, deliver and feedback relevant real-time information in a timely manner [3]. Tang Huamao and Guo Gang (2016) take smart manufacturing as an entry point to analyse the patterns and characteristics of enterprise service activities and innovatively use the integrated smart service model as an efficient, secure and intelligent collaborative enterprise resource to promote enterprise activities in this way [4]. Zhang Hengmei and Wang Manying (2017) proposed using "Internet + manufacturing" to provide intelligent services for customers, focusing on user intuition, and realising the reshaping of the enterprise value chain by integrating various service approaches to complete the transformation from manufacturing to service-oriented manufacturing [5]. Hu Yanjuan and Wu Lizhe (2018) in the evaluation study of cloud manufacturing services by analyzing its influencing factors, using hierarchical analysis and entropy weighting method to determine the index weights [6]. Zhang Wei et al. (2018) proposed a modular intelligent service design method in the context of the manufacturing IoT big data, analyzing the operational environment and service function requirements in the integration of manufacturing and services, using the concept of modularization technology, analyzing the functional relationships between intelligent services using the design structure matrix, and proposing an operational process of initialization, design reconstruction and functional modularization for intelligent service functions with the modular design strategy to determine the functional reconfiguration of intelligent services. The feasibility and superiority of the modular design strategy for intelligent service functions in the manufacturing IoT environment is demonstrated through specific example applications [7]. Jiang Zhibin, Fu Yuehong and Zhou Liping (2021) point out that smart services are the key goal of the service reform of manufacturing [8].

3 Intelligent Service Quality Evaluation Index Construction

3.1 Construction of the Evaluation Index System

By collating the relevant literature and summarising the theories related to intelligent services, and using the SERVOUAL model, this paper changes the original responsiveness to timeliness, assurance to security, and adds the dimension of consistency. As shown in Table 1.

Table 1. Structure of evaluation indicators.

Target level	Guideline level	Indicator layer
Intelligent Service Quality (A)	Tangible (B1)	With advanced and modern intelligent service system (C1)
		Intelligent service systems are attractive to customers (C2)
		Clean and neat layout of smart service software or website (C3)
		Facilities and equipment to match the services they provide (C4)
	Reliability (B2)	Intelligent service that cares for and quickly resolves customer difficulties (C5)
		Ability to provide a pleasant service experience to customers (C6)
		Ability to deliver the promised services on time (C7)
		The company maintains accurate records (C8)
	Timeliness (B3)	Customers are informed of precise service times in a timely manner (C9)
		Intelligent systems enable timely service delivery (C10)
		Company resolves customer difficulties in a timely manner when smart devices are damaged and unable to provide service (C11)
	Safety (B4)	Intelligent service systems can be trusted (C12)
		The customer feels safe during the transaction (C13)
		Intelligent systems can protect relevant information security and privacy (C14)
	Empathy (B5)	Ability to give customers a personalised service (C15)
		Service hours convenient for all customers (C16)
		Ability to give personal attention to customers (C17)

(*continued*)

Table 1. (*continued*)

Target level	Guideline level	Indicator layer
		Focus on the best interests of the customer (C18)
		Clear understanding of customer needs (C19)
	Consistency (B6)	Timely feedback on product tracking information (C20)
		Accurate product status information provided by the company (C21)

3.2 Analysis of Indicator Dimensions

1. **Tangibility**
   Tangibility refers to the part of the service that is perceived by the customer, such as the various devices used to deliver the service. As the nature of a service is not a physical material form but a process in which an act takes place, it has the property of being imperceptible.
2. **Reliability**
   Reliability refers to a service provider's accurate delivery of promised services. Customer-approved reliability is the most important quality indicator closely related to core services.
3. **Timeliness**
   Timeliness means, first and foremost, responsiveness, i. e. the ability to be ready to provide a quick and effective service to customers. The ability to meet customer needs in a timely manner and to put the customer's interests first refers to the service orientation criteria, which are at the heart of the company.
4. **Safety**
   Security refers to that the intelligent service system and system operation capability can protect customers 'personal privacy security and payment security, make customers feel good, and thus improve customers' confidence in enterprise service quality and security.
5. **Empathy**
   Empathy refers to the ability of companies and their intelligent service systems to position themselves for the benefit of their customers in order to meet their needs, to give appropriate attention and consideration to their customers, to customise their services and to humanise the service process.
6. **Consistency**
   Consistency means that any product developments can be updated in a timely manner, that companies and suppliers, as well as online product presentations and online product developments, can be consistent and that feedback can be accurate and effective.

4 Empirical Analysis

On this basis, an evaluation system for intelligent service quality in company H was established and a questionnaire for intelligent service quality in company H was designed based on the indicators. The questions were determined on a five-point Likert scale: very satisfied, Satisfied, Fair, Dissatisfied and Very Dissatisfied. The higher the ranking, the higher the customer rating of Company H's intelligent service quality, and the weighting of the indicators can be determined at a later stage based on the importance rating survey. By comparing the expected and perceived values of Company H's intelligent service quality, the gaps and shortcomings of Company H's intelligent service were identified. In order to gain a comprehensive understanding of the factors influencing Company H's intelligent service quality and to further study the problems of Company H, we randomly distributed anonymous questionnaires to Company H's customers and returned a total of 323 questionnaires. Among them, 319 cases were valid, accounting for about 98%.

Before determining the indicator weights, it is important to know the importance of each indicator, which is usually determined directly by experts based on their experience. In this paper, users with more than 10 years' experience rated the importance of the six dimensions, and then the importance of each dimension was highlighted based on questionnaire results and experience, resulting in an evaluation matrix and weighting of each indicator.

4.1 Calculation of the Weighting of Primary Indicators

There are six level 1 indicators under the service quality level 1 indicators of the company's intelligent service quality evaluation index system, and the specific judgment matrix and weighting calculation results are shown in Table 2.

$\lambda max = 6.257$, CI $= 0.051$, consistency ratio CR $= 0.041 < 0.10$, passing the consistency test.

Table 2. Tier 1 indicator weights under quality of service.

A	B1	B2	B3	B4	B5	B6
B1	1	1/5	1	1/7	1/3	3
B2	5	1	5	1/3	3	7
B3	1	1/5	1	1/7	1/3	3
B4	7	3	7	1	5	9
B5	3	1/3	3	1/5	1	5
B6	1/3	1/7	1/3	1/9	1/5	1
Weighting	0.06189	0.25146	0.06189	0.46153	0.12201	0.03022

Table 3. Weighting of secondary indicators under tangibility indicators.

B1	C1	C2	C3	C4
C1	1	1/5	1/3	1
C2	5	1	3	5
C3	3	1/3	1	3
C4	1	1/5	1/3	1
Weighting	0.10072	0.56611	0.20120	0.13197

4.2 Calculation of Secondary Indicator Weights

Similarly, the above steps were repeated for each secondary indicator to derive the weights for each secondary indicator. The specific judgement matrix and weight calculation results are shown in Table 3.

$\lambda max = 4.116$, CI = 0.039, consistency ratio CR = 0.043 < 0.10, passed the consistency test.

Similarly, under Reliability, $\lambda max = 4.015$, CI = 0.005, consistency ratio CR = 0.005 < 0.10, passing the consistency test.

Under Timeliness, $\lambda max = 3.039$, CI = 0.019, consistency ratio CR = 0.037 < 0.10, passing the consistency test.

Under Safety, $\lambda max = 3.000$, CI = 0.000, consistency ratio CR = 0.000 < 0.10, passed the consistency test.

Under Empathy, $\lambda max = 5.289$, CI = 0.072, consistency ratio CR = 0.065 < 0.10, passing the consistency test.

Under Consistency, $\lambda max = 2.000$, CI = 0.000, consistency ratio CR = 0 < 0.10, passed the consistency test.

After constructing a comparison matrix for all the secondary indicators, we can calculate the weights of all the tertiary indicators and, after passing the consistency test, check the individual weights and the total weights of each indicator,as shown in Table 4.

Of the six level 1 indicators under the service quality dimension, B4 > B2 > B5 > B1 = B3 > B6, which could indicate that the security of the company's intelligent service quality is one of the aspects that customers are most concerned about and is the one factor that has the greatest impact on the evaluation of the customer's perceived service quality, and therefore the company should pay particular attention to the impact that security has on its customers.

Of the indicators in the secondary indicators, C12 and C13 are the most heavily weighted, indicating that the company is most concerned with transaction security and system security.

Table 4. Summary of indicator weights.

Tier 1 indicators	Weighting	Secondary indicators	Single weighting	Total weighting
B1	0.06189	C1	0.10072	0.00623
		C2	0.56611	0.03504
		C3	0.20120	0.01245
		C4	0.13197	0.00817
B2	0.25146	C5	0.48241	0.12131
		C6	0.27180	0.06835
		C7	0.15751	0.03961
		C8	0.08829	0.02220
B3	0.06189	C9	0.10616	0.00657
		C10	0.63335	0.03920
		C11	0.26050	0.01612
B4	0.46153	C12	0.42857	0.19780
		C13	0.42857	0.19780
		C14	0.14286	0.06593
B5	0.12201	C15	0.12102	0.01477
		C16	0.04560	0.00556
		C17	0.04560	0.00556
		C18	0.35425	0.04322
		C19	0.43352	0.05289
B6	0.03022	C20	0.25000	0.00756
		C21	0.75000	0.02267

5 Conclusion and Outlook

Digitalisation and intelligence have become a core strength and key factor for companies to improve their competitiveness. How to make intelligent systems truly serve both the company and the customer will be a severe test for both management and service-oriented manufacturing companies. Intelligent services are receiving attention from all sectors of society. To grasp the market for intelligent services, it is important to understand the concerns of customers and the factors that affect customer satisfaction. From this research, it is clear that security is a major breakthrough in how to enable customers to have a good service experience. In this dimension of security, companies should improve all the indicators involved in conjunction with specific results. For example, for the three indicators of smart service systems being trusted; customers feeling safe during transactions; and smart systems being able to protect the security and privacy of relevant information, companies should strengthen their technical and human defences.

The trend towards intelligent development will inevitably change existing management systems and traditional service theories for service companies. In addition to expanding the impact of smart services per se, we must also focus on the entire service process before, during and after service, and further analyse changes in smart services and customer behaviour. In the future, academics need to continue their research and study to make more contributions to improving the interaction mechanism of smart services, enhancing customer satisfaction in smart environments and accelerating the process of intelligence.

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