

The Effects of Service Innovation and Service Quality on Customer Satisfaction: A Case of Residential Security Service

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Abstract

Technological innovation services have been imported into the service quality of residential security, showing the improvement of customer satisfaction with the intelligent system. The study hence aims at how service innovation and service quality affect customer satisfaction in residential security services by questionnaire survey. By using random sampling, 316 shares of effective questionnaires were analyzed by SPSS through correlation analysis, regression analysis, and IPA. The results show: 1) Customer satisfaction was significantly positively affected by service quality. 2) Service innovations were significantly positively affected by service quality. 3) Customer satisfaction was significantly positively affected by service innovation. 4) The effect of service quality on customer satisfaction was mediated by service innovation. IPA reveals the minor gaps between expected and actual service satisfaction, and it demonstrates that the service quality of residential security is close to customer satisfaction.

Keywords

Innovation Service, Service Quality, Customer Satisfaction, Residential Security Service

1. Introduction

The development of the security industry in Taiwan has a history of 40 years. In 2010, ECFA was signed. And, in 2011, the early collection list project was implemented to increase financial services for the security industry. According to the Directorate-General of Budget, Accounting and Statistics, in 2010, security has been defined as personnel who monitor and patrol specific sites to prevent damage

to environmental facilities and protect specific financial assets from being stolen by others.

Taiwan Industry Economics Services showed that, in the first half of 2021, the security in traditional business has been developing alongside the smart emerging business (Taiwan Industry Economics Services, 2021). This is due to the accelerated application of technology and the application of cloud technology. For example, biometrics, artificial intelligence, cloud, and big data have made the security industry change with each passing day. The extended integrated services and system security technologies have been greatly improved to better meet the needs of the public and enterprises. As the COVID-19 epidemic has catalyzed the public's demand for "contactless services", the application of security services has become more extensive.

As shown from information provided by Taiwan Industry Economics Services in June of 2021, the number of security companies in Taiwan has increased from 306 in 2000 to 810 in July 2019. It shows that the security industry has grown by more than 1.5 times in the past 20 years. It shows that the total number of security practitioners (including men and women) increased by more than 100,000 in 2020. The turnover of the security industry increased from 26 billion in 2008 to 68.794 billion in 2018, a growth of nearly 1.5 times in ten years. During the outbreak of COVID-19, as of the first quarter of 2021, the economy of the country's security industry increased to 12.13 billion. It shows an annual growth rate of 2.42%. Thus, this shows that the security industry is growing rapidly year by year.

Many scholars believe that service innovation is based on creating value through new or improved service products, service processes, and service business models (Yen et al., 2012). With the development of active services through the Internet of Things (IoT) and artificial intelligence technology, security services will be more diversified, and customer satisfaction and stickiness will be improved. Therefore, the innovation of technology to provide convenient home security services will also become the main direction for the development of the security industry.

Looking back to the past, there are many studies on "service quality" and "customer satisfaction". However, taking the security industry as the subject of discussion, it tends to focus on issues related to competition strategy, technology and technological development, management, legal system, and human resource development. There is little relevant literature on service innovation in the security industry. In response to customer-oriented needs, the service quality of the security industry is bound to be introduced into technologically innovative services. By providing humanized intelligent services, customer stickiness can be enhanced and customer retention can be maintained. The long-term demand of customers is the main development direction of the security industry in the future. Therefore, this study proposes related research on the impact of "service innovation" and "service quality" on "customer satisfaction" by providing intelligent tech-

nology for home security services in the security industry. It is hoped that through this research, home security professionals can understand the real needs of consumers.

2. Review of Related Literature

In order to explore the impact of “service innovation” and “service quality” on “customer satisfaction” in the security industry, a literature review was conducted. Relevant literature was compiled to support this study.

2.1. Literature Review of Service Innovation

2.1.1. Definition of Innovation

Freeman (1982) believed that innovation is the act of commercializing new knowledge by applying it to new products or services. Drucker (1986) believed that innovation can endow existing resources with new capabilities and enable them to create new wealth. Damanpour (1991) stated that innovation can be divided into structural and management innovations, and can also be achieved through improvements in procedures, products, and services. Betz (1993) pointed out that the ultimate goal of innovation is to create revenue in the market. Tidd et al. (2001) believed that innovation is to improve and design the original service or product, and then take it as the core process of enhancing the competitiveness of enterprises. Based on the definition of innovation by the above researchers, this study believes that service innovation is the combination and application of new knowledge, technology, resources and other elements, and the modification and improvement of products or services, so as to successfully develop new products or services and provide consumers experience different from products and services in the past.

2.1.2. Definition of Service Innovation

Hipp et al. (2000) stated that service innovation is to apply new improvement methods to existing services to provide customers with improvements to old solutions or problems that could not be solved in the past, so as to develop new services. Lightfoot and Gebauer (2011) defined service innovation as the combination of products, new technologies and services based on new technologies, and providing customized services to consumers to meet the needs of consumers and satisfy consumers. Yen et al. (2012) proposed that service innovation is a business model based on value creation through new or improved service products, service processes, and servicebusiness models. Liu (2011) believed that service innovation is a new product or service developed by an enterprise alone or in cooperation with other manufacturers by using science and technology to integrate the demand information of various industries, consumers, and markets in the industrial chain.

This study cites the service innovation definition of Lightfoot and Gebauer (2011), combining home security-related products and systems, IoT and AI technology, and home security logistics services, in order to meet the service innova-

tion model of consumers.

2.1.3. Related Literature of Service Innovation

Hertog and Bilderbeek (1999) put forward four dimensions including new service delivery system, new service concept, technical service and new customer interface to explain service innovation. And, it was also believed that service innovation is not mainly to change the nature of the product itself, but to innovate in terms of customer interaction, production and sales model, quality control and assurance, and technical services, so that consumers feel that the new service provided is different from the original service or even better. Avlonitis et al. (2001) divided service innovation into four types: “the novelty of the service to the market”, “the novelty of the delivery process”, “the novelty of the service to the company itself” and “service modification”. Van Ark et al. (2003) divided service innovation into three dimensions: new consumer interface, new business model and new service product to explore the types of service innovation.

This research is based on the innovative service viewpoints of various scholars, whether it is new customer interface, new service delivery system, etc. integrating technologies and resources such as Internet of Things technology, cloud technology, AI artificial intelligence, etc. to develop smart security services.

2.2. Literature Review of Service Quality

Ganesh and Haslinda (2014) pointed out that service is a performance that is not easy to be quantified, but has value and can meet customer needs. Therefore, services are not as intuitive as products (Gorina, 2016), nor can they quantify the quality of services (Yang et al., 2020). With the service concept, it is difficult to achieve good performance without emphasizing quality. Therefore, service quality has always been a “customer-oriented” marketing point of view to enhance the industry’s competitive advantage in the market (Sultan & Wong, 2019). Parasuraman et al. (1985) believed that the result of comparing actual service performance and customer expectations can be called service quality.

The scholars believe that the concept of service quality can effectively explain the difference between consumers’ actual feelings and expected feelings after receiving the service in the process of service quality delivery. This causes a service gap between the industry and consumers, and proposes a theory of service gap model.

Parasuraman et al. (1988) explained that service quality is determined by customers and not defined by managers. A questionnaire with five dimensions and 22 items has been designed. These five dimensions are tangibility, Reliability, Responsiveness, Assurance, and Caring. Through the gap between consumers’ expectations and perceived service to judge the service quality perceived by consumers. Since Parasuraman et al. (1988) proposed that the SERVQUAL scale with five dimensions of service quality has matured and been adopted by many researchers, this study also refers to this basis for related research.

2.3. Literature Review of Customer Satisfaction

Customer satisfaction is usually evaluated by the difference between consumers' security protection services provided by security providers, as well as service attitudes, service technology performance and expected results. When consumers' actual feelings are greater than expected feelings, customer satisfaction will improve, and, vice versa, will feel dissatisfied (Ulaga & Eggert, 2005). When the customer satisfaction is higher, the price of security protection services that consumers are willing to pay will also increase relatively, thereby increasing the willingness of consumers to entrust security providers to implement security protection services again. Therefore, customer satisfaction is often regarded as an important key to an industry's success and long-term competitiveness (Henning & Klee, 1997). Cardozo (1965) was the first researcher to bring the concept of customer satisfaction into the field of marketing. Scholar Xiao et al. (2013) stated that customer satisfaction is the behavior and psychological state shown by consumers when they are looking for, purchasing, using or discriminating products or services. Cai et al. (2015) stated that customer satisfaction is the result of consumers' evaluation between expected usage and actual usage experience.

Based on the above findings, this study will focus on the cognitive differences between consumers' emphasis on services and satisfaction to evaluate the impact of service innovation and service quality.

2.4. Related Research of IPA

IPA analysis represents a two-dimensional resource allocation map constructed by consumers' perception of the "significance" and "satisfaction" of the service quality item (Zhuang and Wei, 2020). The location of each service quality project is divided into four quadrants: "Continued Maintenance Area", "Secondary Improvement Area", "Excessive Supply Area", and "Priority Improvement Area" to provide managers with the priority to strengthen or adjust the attributes of evaluating service quality.

3. Research Framework and Hypothesis

Based on literature review, this study established a research framework as shown in Figure 1.

In order to verify whether the service quality and service innovation of the

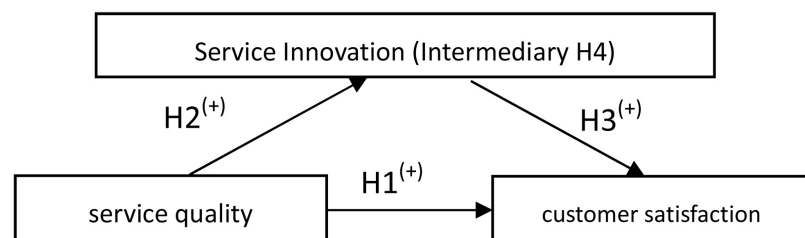


Figure 1. Research framework. Source: Compiled by present study.

security industry have a positive impact on customer satisfaction, and whether service innovation has a mediating effect on service quality and customer satisfaction. The research hypothesis is as follows.

3.1. Literature Review of Service Quality and Customer Satisfaction

Ali et al.'s (2021) research found that when consumers are more satisfied with the service quality provided by the operator, the operator will have higher operating performance. Thus, the impact of service quality on customer satisfaction is very direct. The research of Uzir et al. (2021) indicated that service quality will affect customer satisfaction. Therefore, when the industry provides better services and thereby improves consumers' perceived value, it will be able to effectively improve customer satisfaction.

The above research results show that there is a significant correlation between service quality and customer satisfaction. The results indicate that the more "service quality" meets consumer expectations, the more it will have a positive impact on "customer satisfaction". The better the performance of service quality, the higher the satisfaction of consumers shall be with the security industry. Therefore, this research will put forward the following hypotheses on service quality and customer satisfaction:

H1: "Service quality" has an impact on "customer satisfaction".

3.2. Literature Review of Service Innovation and Service Quality

Danjuma and Rasli's (2012) research pointed out that the improvement of service quality will help strengthen the market advantage, prompt the industry to continue to innovate, and improve the value of services through service innovation, thereby improving customer satisfaction. Lin's (2013) research showed that service innovation has a significant impact on service quality. This means that service innovation has a certain ability to explain service quality. Sok and O'Cass's (2015) research showed that continuous service innovation can effectively improve service quality and outperform competitors in market.

Based on the above research results related to service innovation on service quality, it can be known that there is a significant impact between service innovation and service quality. Therefore, this study will put forward the following hypotheses on service quality and service innovation:

H2: "Service quality" has an impact on "service innovation".

3.3. Literature Review of Service Innovation and Customer Satisfaction

Mahmoud et al. (2018) found that service innovation can provide consumers with innovative solutions and create high value for consumers to meet consumer service needs and improve customer satisfaction. Kong and Masud (2019) found that the purpose of service innovation is to provide customers with high-quality services to satisfy customers and maintain a positive interactive relationship be-

tween operators and customers. Yeh et al.'s (2019) research showed that service innovation has a significant impact on customer satisfaction. The research results of Chen et al. (2021), Li (2020), Lam et al. (2018), and Chai et al. (2018), all pointed out that service innovation has a significant positive relationship with customer satisfaction.

Based on the above research literature, it is shown that there is a significant influence between service innovation and customer satisfaction. This means that there may be a positive relationship between the satisfactions received by the service innovation provided by the security industry. Therefore, this study proposes a research hypothesis that there is a positive relationship between service innovation and customer satisfaction:

H3: Service innovation has an impact on customer satisfaction.

3.4. Literature Review of Service Innovation on Service Quality and Customer Satisfaction

In recent research literature, Smith and Colgate (2007) also found that innovative services can effectively achieve the positive impact of service quality on customer satisfaction. Therefore, service innovation has a partial mediating effect on service quality and customer satisfaction. The research results of Huang (2021), Dong (2018), Chen (2018), Huang (2018), and Yan (2016) all proposed that service quality has a partial mediating effect on service innovation and customer satisfaction.

The above literature shows that service innovation has a mediating effect on service quality and customer satisfaction. Therefore, this study will further verify that service innovation has a mediating effect on service quality and customer satisfaction. That is to say, whether the home security service innovation of security operators meets consumer expectations and meets needs will affect the relationship between security service quality and security operators' satisfaction. Therefore, this study proposes the following hypothesis:

H4: Service innovation has a mediating effect on service quality and customer satisfaction.

This research is based on questionnaire sampling based on the customers of the security industry in Taiwan. The questionnaire sampling period is from February 1, 2022 to February 28, 2022. A questionnaire survey was conducted on consumers using security services. A total of 350 questionnaires were distributed and 316 valid questionnaires were collected. The effective questionnaire recovery rate reached 90.29%.

4. Conclusion

4.1. Research Variable Reliability and Validity Analysis

In this study, the KMO value and Bartlett's spherical test were used to test the significance level of variables such as "service innovation", "service quality satisfaction" and "customer satisfaction". And each facet has a high degree of internal

consistency. Therefore, each factor cluster is appropriate and effective, as shown in **Table 1**.

4.2. Descriptive Statistics

4.2.1. Descriptive Statistics on Demographic Variables of the Sample

The distribution of demographic variables of the 316 valid questionnaires collected in this study is shown in **Table 2**.

4.2.2. Descriptive Statistics on Security Industry Service Innovation

The average and standard deviation of AIOT technological innovation services provided by the home security industry is shown in **Table 3**.

4.2.3. Descriptive Statistics on Service Quality Satisfaction

Service quality is based on the research of *Parasuraman et al. (1988)*. Through the gap between consumers' attention and satisfaction, the service quality of consumers' cognition is judged. Therefore, the descriptive statistical analysis in **Table 4** was obtained.

4.2.4. Descriptive Statistics of Customer Satisfaction

Table 5 shows the mean and standard deviation analysis of service satisfaction provided by home security providers.

4.3. Related Analysis

Table 6 illustrates service innovation, service quality, and customer satisfaction have a significant positive correlation.

The correlation analysis results of the five factors of service quality, service innovation and customer satisfaction are shown in **Table 7**. Except for the guarantee of service quality, there is a significant positive correlation among the other factors. There is a significant and highly positive correlation between

Table 1. Validity and reliability analysis table for each variable.

Variable	Factor cluster	KMO	Bartlett's sphericity test <i>p</i> -value	Eigenvalues	Cumulative explained variance %	Number of questions	Facet Cronbach's α	Variable Cronbach's α
Service innovation	Service innovation	0.855	0.000***	3.873	64.549%	6	-	0.890
Service quality satisfaction	Tangible			4.509		5	0.917	
	Reliability			4.236		5	0.949	
	Responsiveness	0.917	0.000***	3.638	73.355%	6	0.925	0.921
	Assurance			2.675		4	0.804	
	Caring			2.547		4	0.814	
Customer satisfaction	Customer satisfaction	0.847	0.000***	3.586	71.721%	5	-	0.901

Note: *** $p < 0.001$. Source: Compiled by present study.

Table 2. Sample distribution of demographic variables.

Background variable	Gender	Number of people	Percentage	Cumulative percentage
Gender	Male	232	73.4	73.4
	Female	84	26.6	100.0
Age	20 - 30 yr. old	12	3.8	3.8
	31 - 40 yr. old	35	11.1	14.9
	41 - 50 yr. old	73	23.1	38.0
	51 - 60 yr. old	114	36.1	73.7
	61 - 70 yr. old	83	26.3	100.0
Marital status	Single	69	21.8	21.8
	Married	247	78.2	100.0
Educational degree	High school and below	61	19.3	19.3
	Vocational School	94	29.7	49.1
	College	110	34.8	83.9
	Graduate Study and above	51	16.1	100.0
Number of children	0	72	22.8	22.8
	1	129	40.8	63.6
	2	98	31.0	94.6
	3 and above	17	5.4	100.0
Number of senior member	0	104	32.9	32.9
	1	124	39.2	72.2
	2	88	27.8	100.0
Income	30,000 NTD and below	27	8.5	8.5
	30,001 - 40,000 NTD	50	15.8	24.4
	40,001 - 50,000 NTD	67	21.2	45.6
	50,001 - 60,000 NTD	91	28.8	74.4
	60,001 - 70,000 NTD	46	14.6	88.9
	70,001 - 80,000 NTD	24	7.6	96.5
	80,001 - 90,000 NTD	11	3.5	100.0
	90,001 NTD and above	0	0	0
Living status	Living Alone	40	12.7	12.7
	live with spouse only	32	10.1	22.8
	live with spouse and children	144	45.6	68.4
	Three generations	28	8.9	77.2
	live with parents	72	22.8	100.0

Source: Compiled by present study.

Table 3. Descriptive statistical analysis of security industry service innovation.

Variable	Measured items	Average	Standard deviation	Rank
Service innovation	1) Provide home security monitoring service	3.715	0.790	4
	2) Provide home access control management services	3.680	0.736	6
	3) Provide home care services	3.693	0.771	5
	4) Provide real-time information	4.016	0.724	1
	5) Easy to operate	3.807	0.807	3
	6) Low system failure rate	3.924	0.769	2

Source: Compiled by present study.

Table 4. Descriptive statistical analysis of service quality.

Measurement items	Average value	Rank by significance average	Satisfaction average	Rank by satisfaction average	Mean difference	Rank by mean difference
1) Intelligent security equipment	3.953	17	3.959	14	-0.006	8
2) Easy-to-operate security equipment	4.095	7	3.972	11	0.123	16
3) Security guards are neatly dressed	4.060	10	4.070	3	-0.010	7
4) The system operation manual explains clearly	4.006	13	3.959	15	0.047	12
5) Reasonable service fee	3.962	16	3.902	20	0.060	13
6) Definite fulfillment of the contractual service	4.057	11	3.997	8	0.060	14
7) Trustworthy service attitude	4.247	2	4.025	4	0.222	21
8) Service personnel explain professionally	4.225	4	4.000	7	0.225	23
9) High accuracy of security system information	4.187	5	3.962	13	0.225	22
10) Complete record keeping	4.120	6	3.915	18	0.205	19
11) Can quickly understand customer needs	3.826	21	3.946	16	-0.120	4
12) Actively respond to customer opinions	4.076	9	3.968	12	0.108	15
13) Keep serving passionately	4.079	8	3.937	17	0.142	18
14) Immediate service for emergencies	3.911	19	4.006	6	-0.095	5
15) The system can provide timely feedback information	3.797	22	3.766	24	0.031	11
16) Customers have confidence in service attitude	3.845	20	3.889	22	-0.044	6
17) Customers feel safe	4.016	12	3.994	9	0.022	10
18) Have professional ability	3.680	24	3.899	21	-0.219	2
19) Provide a clear service contract	3.712	23	4.168	1	-0.456	1
20) There is a complaint channel	4.000	14	3.873	23	0.127	17
21) Considerable emphasis on feedback	4.228	3	4.022	5	0.206	20
22) Maintain a good interactive relationship with customers	3.997	15	3.991	10	0.006	9
23) Can take the initiative to care about customers	4.266	1	3.905	19	0.361	24
24) Ability to understand customer needs	3.927	18	4.076	2	-0.149	3

Source: Compiled by present study.

Table 5. A descriptive statistical analysis of customer satisfaction.

Variable	Measured items	Average	Standard deviation	Rank
Customer satisfaction	1) Overall, you feel complete trust in your home security provider	3.693	0.787	5
	2) Overall, the safety protection of home security provider is satisfactory	3.706	0.820	4
	3) Overall, you are satisfied with the care provided by your home security provider	3.994	0.777	1
	4) Overall, you are satisfied with the smart services provided by home security providers	3.807	0.853	3
	5) Overall, the professional service of a home security provider met my expectations	3.924	0.817	2

Source: Compiled by present study.

Table 6. A correlation analysis summary table of each variable.

	Service quality satisfaction	Service innovation	Customer satisfaction
Service quality satisfaction	1		
Service innovation	0.580***	1	
Customer satisfaction	0.547***	0.861***	1

Note: *** $p < 0.001$. Source: Compiled by present study.

Table 7. Correlation analysis summary table of various aspects and variables of service quality satisfaction.

		Service quality satisfaction					Service innovation	Customer satisfaction
		Tangible	Reliability	Responsiveness	Assurance	Caring		
Service quality satisfaction	Tangible	1						
	Reliability	0.694***	1					
	Responsiveness	0.661***	0.661***	1				
	Assurance	0.090	0.015	0.084	1			
	Caring	0.224***	0.230***	0.231***	-0.009	1		
Service innovation		0.475***	0.466***	0.495***	0.140*	0.328***	1	
Customer satisfaction		0.477***	0.459***	0.441***	0.122*	0.290***	0.861***	1

Note: * $p < 0.05$, *** $p < 0.001$. Source: Compiled by present study.

service innovation and customer satisfaction.

4.4. Regression Analysis

4.4.1. Regression Analysis of Service Quality Satisfaction on Customer Satisfaction

As shown in **Table 8**, although the explanatory power of the overall model after revision is 29.7%, service quality satisfaction still has a significant positive impact on customer satisfaction. Thus, Hypothesis 1: "Service quality has an impact on customer satisfaction" receives support through verification.

Looking at each aspect of service quality satisfaction (as shown in **Table 9**), the reactivity (coefficient is 0.119 ($p = 0.058 > 0.05$, $t = |1.902| < 1.96$)) and assurance (coefficient is 0.093 ($p = 0.060 > 0.05$, $t = |1.887| < 1.96$)) are not significant, but tangibility, reliability, and caring have a significant positive impact on customer satisfaction. And, the overall model explanatory power is 30.5%.

4.4.2. Regression Analysis of Service Quality Satisfaction on Service Innovation

Although the overall model has an explanatory power of 33.4% after revision, **Table 10** shows that service quality satisfaction still has a significant positive impact on service innovation. Thus, Hypothesis 2: "Service quality has an effect on service innovation" receives support through verification.

Table 11 shows that service quality satisfaction has a significant positive impact on service innovation. In addition, **Table 11** illustrates tangibles, reliability, responsiveness, assurance, and caring have a significant positive impact on service innovation, and the overall model explanatory power is 34.4%.

Table 8. Service quality satisfaction to customer satisfaction regression coefficient analysis table.

Model	Unstandardized coefficient		R ²	Adj-R ²	T-value	Significance
	Estimated value of B	Standard error				
(Constant)	0.975	0.248			3.927	0.000***
Service quality satisfaction	0.718	0.062	0.299	0.297	11.571	0.000***

Note: *** $p < 0.001$. Source: Compiled by present study.

Table 9. Regression coefficient analysis table for each component of service quality satisfaction on customer satisfaction.

Model	Unstandardized coefficient		R ²	Adj-R ²	T-value	Significance
	Estimated value of B	Standard Error				
(Constant)	0.912	0.309			2.953	0.003**
Tangible	0.197	0.064			3.089	0.002**
Reliability	0.145	0.057	0.305	0.294	2.518	0.012*
Responsiveness	0.119	0.062			1.902	0.058
Assurance	0.093	0.049			1.887	0.060
Caring	0.180	0.052			3.462	0.001***

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Source: Compiled by present study.

Table 10. A regression coefficient analysis table of service quality satisfaction on service innovation.

Model	Unstandardized coefficient		R ²	Adj-R ²	T-value	Significance
	Estimated value of B	Standard error				
(Constant)	1.098	0.217			5.066	0.000***
Service quality satisfaction	0.683	0.054	0.336	0.334	12.609	0.000***

Note: *** $p < 0.001$. Source: Compiled by present study.

Table 11. An analysis table of regression coefficients of each component of service quality satisfaction on service innovation.

Model	Unstandardized coefficient		R ²	Adj-R ²	T-value	Significance
	Estimated value of B	Standard error				
(Constant)	0.945	0.269			3.516	0.001***
Tangible	0.129	0.055			2.333	0.020*
Reliability	0.110	0.050	0.344	0.334	2.204	0.028*
Responsiveness	0.189	0.054			3.474	0.001***
Assurance	0.098	0.043			2.280	0.023*
Caring	0.195	0.045			4.295	0.000***

Note: * $p < 0.05$, *** $p < 0.001$. Source: Compiled by present study.

4.4.3. Regression Analysis of Service Innovation on Customer Satisfaction

Table 12 illustrates that service innovation has a significant positive impact on customer satisfaction, and the explanatory power of the overall model after revision is 74.1%. Thus, Hypothesis 3: “Service innovation has an influence on customer satisfaction” receives support through verification.

Based on the above regression analysis results (as shown in **Table 13**), both service quality satisfaction and service innovation have a significant positive relationship with customer satisfaction. This shows that when consumers are satisfied with the service quality provided by the security industry in line with expectations, they have a positive attitude toward the service innovation provided by the security industry which improves customer satisfaction.

4.5. Mediation Effect Check

The research results are shown in **Table 14**. Condition 1: Service quality satisfaction has a significant impact on customer satisfaction (coefficient $\beta_1 = 0.547$ ($p = 0.000 < 0.05$, $t = |11.571| > 1.96$)), and the overall model explanatory power

Table 12. Regression coefficient analysis table of service innovation on customer satisfaction.

Model	Unstandardized coefficient		R ²	Adj-R ²	T-value	Significance
	Estimated value of B	Standard error				
(Constant)	0.168	0.123			1.365	0.173
Service innovation	0.961	0.032	0.742	0.741	30.017	0.000***

Note: *** $p < 0.001$. Source: Compiled by present study.

Table 13. An overall level regression analysis table of service quality satisfaction and service innovation on customer satisfaction.

		Customer satisfaction					
		Normalized β (p -value)	T-value	F-value	p -value	R ²	ΔR^2
Model 1	Service quality satisfaction	0.547 (0.000***)	11.571	133.891	0.000***	0.299	0.299
Model 2	Service quality satisfaction	0.072 (0.042*)	2.042	457.133	0.000***	0.745	0.446
	Service innovation	0.820 (0.000***)	23.396				

Note: * $p < 0.05$, *** $p < 0.001$. Source: Compiled by present study.

is 29.9%; Condition 2: Service quality satisfaction has a significant impact on service innovation (coefficient $\beta_2 = 0.580$ ($p = 0.000 < 0.05$, $t = |12.609| > 1.96$)), and the overall model explanatory power is 33.6%; Condition 3: The satisfaction coefficient of service quality is 0.072 ($p = 0.042 < 0.05$, $t = |2.042| > 1.96$), and the coefficient of service innovation is 0.820 ($p = 0.000 < 0.05$, $t = |23.396| > 1.96$). Under the condition that the effect of service innovation still exists, the effect of service quality satisfaction on customer satisfaction in the third condition is significant, and the overall model explanatory power is 74.5%. Therefore, service innovation is a partial intermediary. The reason is that, under Condition 3, while the influence of service innovation still exists, it is found that the influence of service quality satisfaction on customer satisfaction has decreased and reached a significant level. Thus, service innovation has a partial mediating effect on service quality satisfaction and customer satisfaction. Thus, Hypothesis Four: "Service innovation has a mediating effect on service quality and customer satisfaction" receives support through verification.

4.6. IPA Analysis

After the regression test that service quality has a significant impact on customer

Table 14. Shows verifying evidence of the effect of service innovation on service quality satisfaction and customer satisfaction.

Variable name	Dependent variables					
	Customer satisfaction (Model 1)		Service innovation (Model 2)		Customer satisfaction (Model 3)	
	Normalized β Value (<i>p</i> -value)	T-value	Normalized β Value (<i>p</i> -value)	T-value	Normalized β Value (<i>p</i> -value)	T-value
Independent variables						
Service quality satisfaction	0.547 (0.000***)	11.571	0.580 (0.000***)	12.609	0.072 (0.042*)	2.042
Mediation variable						
Service innovation					0.820 (0.000***)	23.396
F	133.891		158.979		457.133	
<i>p</i> -value	0.000***		0.000***		0.000***	
R ²	0.299		0.336		0.745	
Adj-R ²	0.297		0.334		0.743	
Hypothesis testing	verified		verified		verified	

Note: * $p < 0.05$, *** $p < 0.001$. Source: Compiled by present study.

satisfaction verification, this study further uses IPA to explore the strong and weak relationship between consumers' service quality and satisfaction, so as to implement customer-oriented services. This study takes the average value of service quality (4.011) and the average value of satisfaction (3.967) as the central coordinates. The service quality (24 questions) provided by the subjects in the current home security industry is used as drop points in the four quadrants. **Figure 2** is the IPA analysis of the significance and satisfaction of service quality, marking the placement points of 24 security industry service quality measurement items in the four quadrants, so as to serve as a reference for establishing a perfect home security service.

The IPA analysis chart in **Figure 2** shows that although consumers pay less attention to service quality items such as (14) "prompt service for emergencies", (19) "providing a clear service contract", and (24) "understanding customer needs". However, satisfaction is higher than expected. This means that the industry should avoid wasting resources and oversupplying.

In the third quadrant are: (5) "the service fee is reasonable", (15) "the system can provide timely feedback information", (16) "customers have confidence in the service attitude", (18) "professional ability", and (20) "there is a channel for complaints". Although the degree of attention is low, the satisfaction of service quality tends to be more average. The fourth quadrant is for consumers with higher attention. However, in terms of (10) "preserving complete record data",

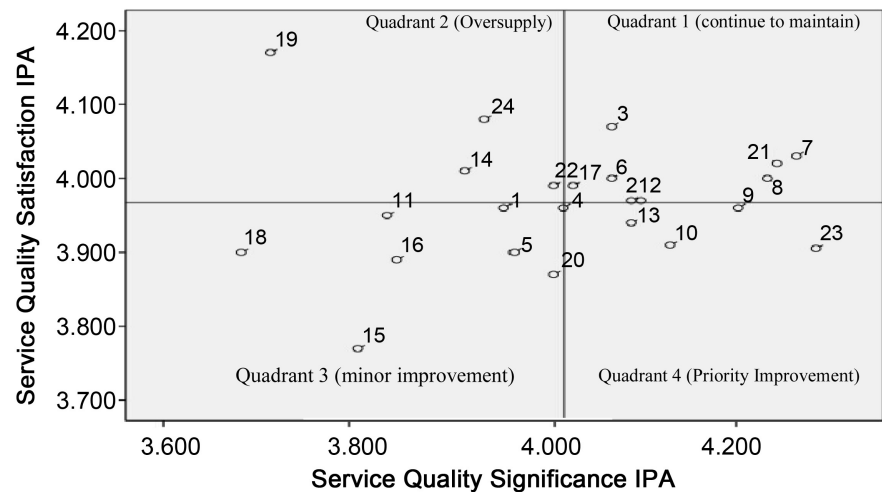


Figure 2. Illustrates IPA analysis chart of significance and satisfaction of service quality of security industry.

(13) “maintaining enthusiasm for service”, and (23) “being able to take the initiative to care for customers”, the satisfaction of consumers is lower than that of consumers, but their satisfaction is close to the average. From the point of view of the meaning of the items, the service attitude of security service personnel must be strengthened and trained to improve consumers’ recognition and satisfaction with home security service quality items.

5. Management Practice Implications

The security industry responds to changes in environmental needs, such as: information technology continuing to innovate, sudden epidemics forcing consumers to change consumption behaviors, etc. in response to the Internet of Things and AI technology to provide service innovation technology, due to trends. It can be concluded from the study: from the perspective of overall service quality satisfaction, home security service quality satisfaction has a significant positive impact on customer satisfaction; and, from the perspective of service quality satisfaction, tangibility, and reliability, caring has a significant positive impact on customer satisfaction. This is consistent with the findings of [Zeng and Hong \(2019\)](#), [Ali et al. \(2021\)](#), [Uzir et al. \(2021\)](#), and other researchers who found that service quality has a positive impact on customer satisfaction. The IPA analysis illustrates home security services in terms of tangibility (e.g.: 3. The security guards are neatly dressed), reliability (e.g.: 7. The service attitude is trustworthy), caring (e.g.: 21. Considerable attention to feedback) and other aspects of service quality can meet expectations and exceed expectations. It further helps to improve the overall satisfaction of consumers with security providers. However, the guarantee and responsiveness of service quality have no significant impact. This may be taken as a reference for home security professionals to consider for changes for improving overall customer satisfaction.

From the research results, it can be concluded that home security service quality

satisfaction has a significant positive impact on service innovation, and it also has a significant positive impact on the aspects of service quality satisfaction. This is consistent with the research results of [Chen et al. \(2021\)](#), [Ren \(2018\)](#), and [Lam et al. \(2018\)](#). Further analysis with IPA illustrates when home security is tangible (such as: 2. With intelligent security equipment), reliability (such as: 8. The service personnel explain professionalism), responsiveness (such as: 14. Immediate service for emergencies), guarantee (such as: 6. Can be surely fulfilling the service contract), caring (such as: 21. Paying great attention to customer opinions and needs) and other aspects of service quality can make consumers feel very satisfied. Therefore, it is suggested that home security operators can combine AIOT technological innovation services to highlight the high-quality service quality of customer value. The results of service innovation on customer satisfaction are consistent with [Yeh et al. \(2019\)](#), [Chen et al. \(2021\)](#), [Li \(2020\)](#), and other researchers who proposed that service innovation has a significant positive impact on customer satisfaction. If home security operators use AIOT technological innovation services to meet consumers' diverse service needs and bring consumers high-value service experiences, it will help improve consumers' overall satisfaction with home security operators. Finally, this study verifies that service innovation has a partial mediating effect on service quality satisfaction and customer satisfaction, indicating that service quality satisfaction will not only directly affect customer satisfaction, but also indirectly affect customer satisfaction through service innovation. This is consistent with [Huang \(2021\)](#), [Dong \(2018\)](#), [Chen \(2018\)](#), and other studies having a partial mediation effect.

This study conducts empirical research on service innovation, service quality, and customer satisfaction based on the responses of consumers who have used security services. The results verify that service innovation and service quality have a significant positive impact on customer satisfaction. And IPA analysis can more clearly point out whether there is room for improvement between consumer expectations and actual satisfaction. Although studies have confirmed that there is a significant positive relationship between variables, technology is changing with each passing day. If the security industry wants to follow technological innovation and update services, the investment cost is something that operators need to consider. As far as consumers are concerned, will product updates affect operating techniques and require more security costs, making them discouraged? These are not considered in this study. In addition, from the perspective of social marketing thinking, how to use social media to manage customer groups from click-through rate to stickiness and then to conversion rate is also another thinking track for interested researchers.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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