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Editors • Winnie Septiani, Wahyukaton Wahyukaton, Rahmi Maulidya and Desinta Rahayu Ningtyas

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Preface: 13th International Seminar on Industrial Engineering and Management

Bismillahirrahmanirrahim,
Assalamu'alaikum Warrahmatullah Wabarrakatuh,

First of all, we apologize for the inconvience in the 13th ISIEM 2021 event, due to the current conditions and situation of COVID 19. The situation made us have to make some critical modifications in the event, including: online presentation of the keynote speaker, online presentation for all candidates that cannot attend the seminar, but we hope we all remain excited to continue to contribute to research publications. Nonetheless, we are trying to prepare this seminar as best we can.

This issue is published in line with the Thirteen International Seminar on Industrial Engineering and Management (13th ISIEM) 2021. The articles cover a broad spectrum of topics in Industrial Engineering and Management, which are Quality Engineering Management, Decision Support System and Artificial Intelligent, Ergonomics, Supply Chain Management, Production System, Operation Research, and Industrial Management. These articles provide an overview of critical research issues reflecting on past achievements and future challenges. Those papers were selected from 137 abstracts, and we send these papers to AIP to be published there as an Open Access Proceeding Scopus. This statistic shows the high competition to get published on this proceeding. This issue and seminar become special as more delegates come and join from various country as well as universities. We host 90 delegates both from abroad and local.

The 13th ISIEM is hosted by eight universities, which are Universitas Pasundan, Universitas Esa Unggul, Universitas Trisakti, Universitas Tarumanagara, Universitas Al-Azhar Indonesia, Atma Jaya Catholic University of Indonesia, Universitas Pancasila and Universitas Mercubuana. This is the thirteenth years of the collaboration of those universities, and the first time we had MOU with AIP in America to publishing the papers that is indexed by Scopus.

In this occasion, let us give special thanks to Prof.Yung-Tsan Jou, PhD (Professor and Chair Department of Industrial and Systems Engineering, Chung Yuan Christian University – Taiwan), Prof. Yun-Chia Liang, PhD (Professor and Chair, Department of Industrial Engineering and Management, Yuan Ze University – Taiwan), Elisa Lumbantoruan (President Director & CEO at ISS Indonesia, Independent Commissioner at PT Indosat Tbk, and Independent Commissioner at Garuda Indonesia) and Naraphorn Paoprasert, Ph.D (Researcher, Department of Industrial Engineering, Faculty of Engineering, Kasetsart University – Thailand), for their contribution as keynote speakers. We are also grateful to all reviewers and editors, for their commitment, effort and dedication in undertaking the task of reviewing all of the abstracts and full papers. Without their help and dedication, it would not be possible to produce this proceeding in such a short time frame. I highly appreciate all members of committees (advisory, steering, and organizing committees) for mutual efforts and invaluable contribution for the success of seminar.

Wassalamu'alaikum Warrahmatullah Wabarrakatuh.

Bandung – West Java Indonesia, July, 28 2021
Dr. Winnie Septiani, ST, MSi, CIQaR
Chairman

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INTERNATIONAL SEMINAR ON INDUSTRIAL ENGINEERING AND MANAGEMENT

[Production and Service System in The New Normal Era]

Bandung, West Java, Indonesia

July 28, 2021

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Proposed development process to improve customer quality of service with fuzzy-servqual and data mining methods in insurance agency FREE

Rina Fitriana ✉; Wawan Kurniawan; Willierod Gerry

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Proposed Development Process to Improve Customer Quality of Service with Fuzzy-Servqual and Data Mining Methods in Insurance Agency

Rina Fitriana[a], Wawan Kurniawan[b], Willierod Gerry[c]

Quality Engineering Laboratory Industrial Engineering Department, Faculty of Industrial Technology, Universitas Trisakti, Jl Kyai Tapa No 1 Grogol Jakarta, Indonesia

[a]Corresponding author: rinaf@trisakti.ac.id
[b]wawan.kurniawan@trisakti.ac.id,
[c]willierodg@gmail.com

Abstract. This study aims to measure and analyze customer satisfaction with the services provided by OV Agency agents. Methos The data used in the study are questionnaires filled by 100 random customers from OV Agency. The study used the Fuzzy-ServQual method and data mining with the Classification-Decision Tree algorithm. Fuzzy-ServQual is used to measure attributes that need to be improved based on the calculation of GAP values with the addition of fuzzy methods to eliminate the obscurity obtained from the results of the questionnaire. The Data Mining Classification Method was used to determine hidden patterns by a decision tree. The results of the calculation of the overall GAP value on the Fuzzy-ServQual method are -0.008 and there are 10 attributes that require improvement. Decision trees are using the Rapid Minner Studio application. Based on the decision tree obtained, if then rule can be obtained as a pattern of satisfaction and dissatisfaction.
Keywords: Service Quality, Fuzzy-ServQual, Data Mining, Classification-Decision Tree

INTRODUCTION

Companies in the service sector are required to improve service quality to increase high global competition. The research is in insurance company. This study aims to analyze agent services to customers using the Fuzzy-ServQual method and Classification-Decision Tree Data Mining.

OV agency gets customer dissatisfaction regarding the services provided by agents. This can be caused by the lack of commitment of the agents in explaining insurance products and reminding clients to pay the premium. In addition, the standard and quality of marketing and service between OV agency agents are not uniform. With the decrease in the level of customer satisfaction with the performance of sales agents, it can reduce the productivity of OV agency.

This study aims to improve the quality of customer service which can be described as follow to know the level of customer satisfaction with the performance of OV agency sales agents, to analyze the calculation of Gap values from the questionnaire and providing suggestions for improving customer service quality using the Fuzzy-ServQual method, to analyze the classification and provide suggestions for improving customer service quality using the Classification-Decision Tree Data Mining method.

Sampling technique is a technique in sampling that will be used in research. The sample is part of the number and characteristics possessed by the study population [1]. Determining the number of samples that is most appropriate to use in research depends on the level of accuracy / desired error. The greater the level of error, the smaller the number of samples needed, and conversely the smaller the level of error, the greater the number of samples needed. Determine the number of samples with a 5% error rate based on the Isaac Michael formula as follows:

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$$s = \frac{\lambda^2 . N . P . Q}{d^2 (N - 1) + \lambda^2 . PQ} \quad (1)$$

Information:
s = number of samples
λ = degree of trust
N = population
d = degree of error
P = proportion of target population (50%)
Q = proportion of target population (50%)

There many research about quality service. Customer satisfaction is the key to creating customer loyalty. Many benefits are received by the company by achieving a high level of customer satisfaction, which is in addition to increasing customer loyalty but can also prevent customer turnover, reduce customer sensitivity to prices, reduce marketing failure costs, reduce operating costs caused by increasing numbers of customers, increase advertising effectiveness, and improve business reputation [2].

There are many research about fuzzy servqual. The study of the quality of service by the patient BPJS Health, the highest gap value is the empathy dimension and the lowest gap is the dimension of tangibles (physical proof) thus it can be seen that the dimensions of tangibles (physical evidence) is of concern to improve service quality [3]. The research that measured the service quality by using Fuzzy Servqual by determining the gap between expectations with consumer perception, determining the level of significance between expectations with consumer perceptions, determining the level of service quality and suggesting improvement based on priority by looking at the gap of each quality dimension. Based on the results of data processing, it can be seen that the level of service quality is still low seen from the value of Q t-table[4]. The research evaluated the quality of a large hotel through the fuzzy SERVQUAL and fuzzy AHP. The results showed that the services have many gaps to be improved.[4]

The classification process is a complex technique that connects language, text, information and knowledge theories with computational formalisation, statistical and symbolic approaches, standard and non-standard logics, etc. The propose in this paper a formal model with strong logical foundations based on applicative type systems.[5]

The previous research and the research position can be seen in Table 1.

TABLE 1. Research Position

NO	METHOD	SOURCE
1	Integration of quality service, customer satisfaction, Customer Loyalty, non-probability purposive sampling technique, Structural Equation Modeling	[2]
2	Integration between Fuzzy and Servqual	[3]
3	Integration between the fuzzy SERVQUAL and fuzzy AHP	[4]
4	Integration between classification, applicative systems, collaborative intelligent science	[5]
5	Data Mining classification methods: decision tree (J48), neural Network (MLP) and naive Bayes	[6]
6	Integration between Fuzzy, Quality Function Deployment, and Data Mining	[7]
7	Integration between Six Sigma, FMEA, and Data Mining	[8]
8	Integration between SERVQUAL, Analytical Hierarchy Process (AHP) and Citizen's Score Card	[9]
9	Integration SERVQUAL, service quality, safety concerns and maintenance	[10]
10	Integration between Fuzzy, Servqual, Data Mining	This research position

The position of this research among other studies around the world, can be seen from various aspects above. Can be seen from the aspect of Quality Control research methodology is a combination of fuzzy and method of Servqual, where Servqual is applied simultaneously with fuzzy logic to reduce the subject subjectivity of respondents. Data mining method is also used to know the classification of satisfaction level on OV Agency

RESEARCH METHODOLOGY

The flow of the research methodology can be seen in Figure 1. The results of processing Fuzzy-ServQual methods and Data Mining Classification-Decision Tree. From data processing using the ServQual method, the output value gap is obtained which indicates satisfaction of customers' dissatisfaction with the services of the agents. In the Data Mining method Classification-Decision Tree is expected to output is a decision tree-shaped classification that can be used to make an if then rule. The results of the analysis obtained are used as a reference for making proposals.

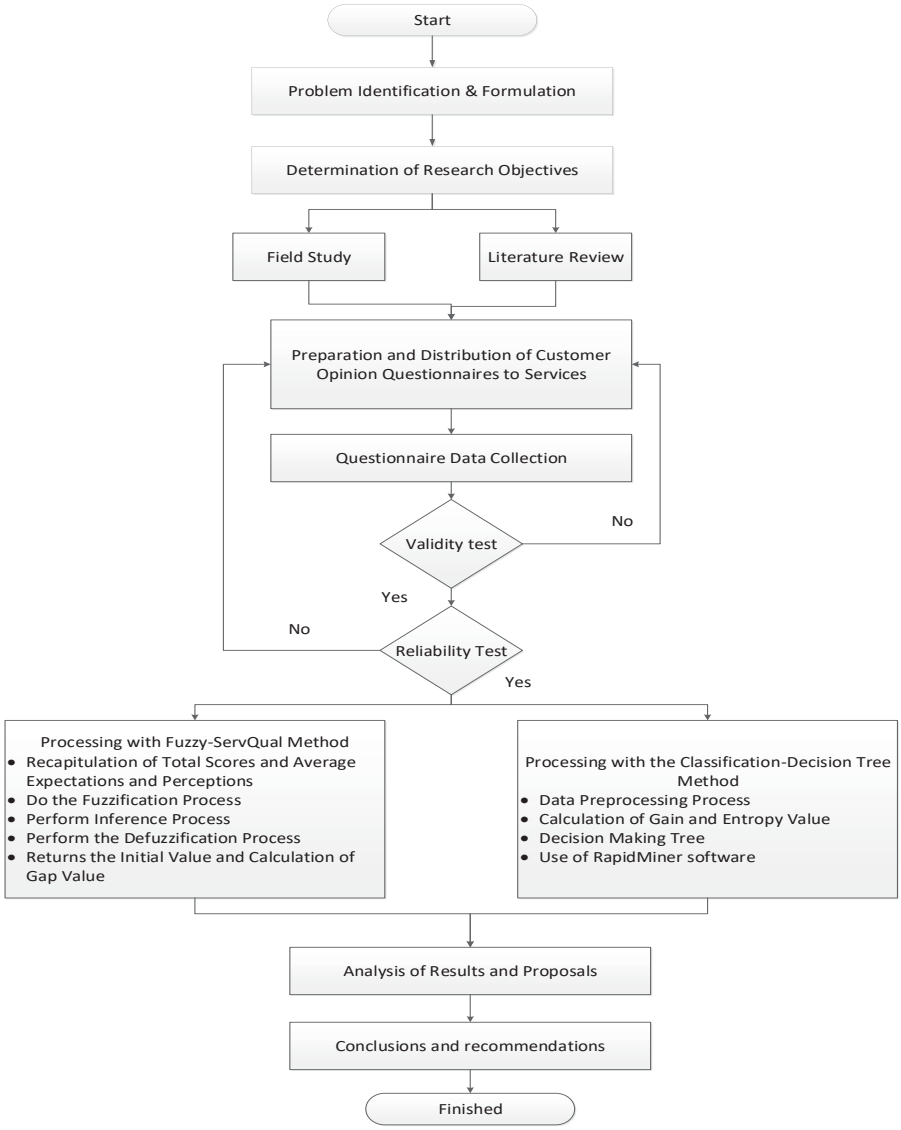

FIGURE 1. Research Methodology Flowchart

RESULTS AND DISCUSSION

Determining the number of samples that is most appropriate to use in research depends on the level of accuracy / desired error. The greater the level of error, the smaller the number of samples needed, and conversely the smaller the level of error, the greater the number of samples needed. Determine the number of samples with a level of error of 5% based on the isaac michael formula as follows:

$$s = \frac{0.95^2 x12000x0.5x0.5}{0.05^2(12000-1)+0.95^2x0.5x0.5} = 89.583 \approx 90$$

Through the above calculations, it was found that the number of sample questionnaires needed was 90 respondents, and rounded up to 100 respondents on the google form.

Respondents' demographics are an important factor in seeing market segmentation, and based on these demographics, it can be seen how the behavior of the consumers studied.

In this study, by the SPSS, 25 program was used in testing validity. Tests were carried out 2 times, namely for the results of the questionnaire questions, the perceptions and questions of respondents' expectations of the performance and service of the OV agency agents.

The validity test calculation uses the value of the table with a 2-way test and a significance level of 5%. The value of freedom degree (dF) is obtained using calculation (dF) = N-2 with N = 100. The results of calculation of degrees of freedom (dF) are 98 with table value = 0.1966. Data is declared valid if the calculated value is greater than the table value. A variable is said to be reliable if it gives an alpha cronbach value> 0.60. After calculating using SPSS 25, the Cronbach alpha value for perception is 0.905 and the Cronbach alpha value for expectation is 0.830. Based on the results of calculations, questionnaire data can be concluded for reliable perceptions and expectations.

Fuzzy-ServQual Method

The first step is to calculate the value of the total score of perception and expectation. The following is a sample calculation of total scores and average scores for questions of perception and expectation.

1. Calculation of question number 3 (Q3) part of perception
Total Score = (0x1) + (7x2) + (32x3) + (46x4) + (15x5) = 369
Average Score = 369/100 = 3.69
2. Calculation of question number 3 (Q3) part of hope
Total Score = (0x1) + (0x0) + (8x3) + (39x4) + (53x5) = 445
Average score = 445/100 = 4.45

The next stage is the fuzzification calculation of the questionnaire questions of perception and expectation [9]. The following are examples of fuzzification calculations from questions of perception and expectation number 3 (Q3).

1. Question number 3 (Q3) Perception
Based on the calculation of the average total score obtained x value of 3.69. Then the fuzzification calculation is as follows:

- Satisfied and Very Satisfied Categories
- Membership function

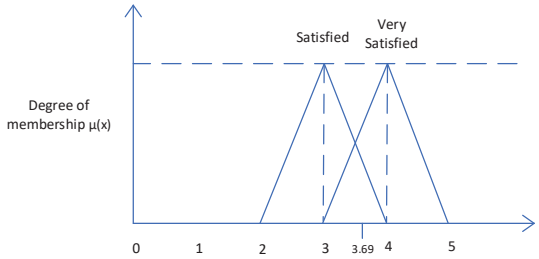

FIGURE 2. Graph of Fuzzy Set Questions Number 3 (Q3) Perception

Fuzzy Set function is in the satisfied and very satisfied category because x = 3.69.

2. Question Number 3 (Q3) Hope

Based on the calculation of the average total score obtained x value of 4.45. Then the fuzzification calculation is as follows:

• Very Satisfied Category
• Membership function
• Fuzzy Set function

Because x = 4.45 and the classification is very satisfied then
μ very satiesfied 4,45, 3, 4, 5= $\frac{5 - 4,45}{5-4}$ = 0,55 for 4<x<5

The inference process is the reasoning used based on the composition of the min. This process consists of determining the rules of the bounding value of each set in each variable and determining the predicate value.

$$Y' = \frac{\Sigma(yi * wi)}{\Sigma wi} \quad (2)$$

After defuzzification results for each question attribute, the next step is to determine the ServQual value by determining the gap value, determining the weight and determining the weighted gap which is the final result of the ServQual score. To determine the gap value the formula is used:

$$\text{Gap} = \text{Performance} - \text{Hope} \quad (3)$$

While the weight value is obtained from the number of attribute questions that exist. Because the questions amount to 15 each questionnaire, the weight values are:

$$\text{Weight} = 1/15 = 0.067$$

Then, the next step is to determine the weighted gap which is the final ServQual score using the approach:

$$\text{ServQual score (weighted gap)} = \text{Gap value} \times \text{Weight} \quad (4)$$

Recapitulation of calculation of ServQual values based on service quality attributes can be seen in Table 2.

TABLE 2. Recapitulation of Defuzzification and Value of GAP

Number	Dimension	Code	Defuzzification		GAP	Weight	GAP	Rank
			Perception	Expectation	(P-E)	(1/15)	Weighted	
1	Reliability	Q3	3.69	4	-0.31	0.067	-0.021	2
		Q4	4	4	0	0.067	0.000	11
		Q10	3.89	4	-0.11	0.067	-0.007	7
		Q11	3.96	4	-0.04	0.067	-0.003	10
2	Assurances	Q9	4	4	0	0.067	0.000	12
		Q15	3.94	4	-0.06	0.067	-0.004	9
3	Tangibles	Q13	3.89	4	-0.11	0.067	-0.007	8
		Q14	4	4	0	0.067	0.000	13
4	Empathy	Q1	4	4	0	0.067	0.000	14
		Q5	4	4	0	0.067	0.000	15
		Q6	3.62	4	-0.38	0.067	-0.025	1
5	Responsiveness	Q2	3.84	4	-0.16	0.067	-0.011	5
		Q7	3.85	4	-0.15	0.067	-0.010	6
		Q8	3.81	4	-0.19	0.067	-0.013	3
		Q12	3.81	4	-0.19	0.067	-0.013	4

$$\text{Overall GAP Score} = \frac{\text{Sum of Total Servqual}}{\text{Sum of Atribute}} = \frac{-0{,}113}{15} = -0{,}008$$

Based on the above calculation, the level of service quality is -0.008, which means that the customer still perceives service quality negatively and has not been in accordance with the expectations of the customer.

There are 10 statements that get negative Gap values. The overall improvement proposal can be seen in Table 3.

TABLE 3. Proposed Overall Improvement

Number	Code	The Basis of the Proposal	Proposal	Control
1	Q6	Convenience Agent to contact both face to face and by telephone	Agents want to spend time when customers want to meet or call	Give reward and punishment to those concerned
2	Q3	Clarity of time estimation from Agent to a service process	Agents provide clarity of time estimates responsibly	Give reward and punishment to those concerned
3	Q8	Availability of agent time in serving you	Agents want to spend time when customers ask for help	Give reward and punishment to those concerned
4	Q12	Agent's ability to understand your needs & desires	Increase the experience of being an agent and communicating with customers	Give reward and punishment to those concerned
5	Q2	Speed & alertness of agents in providing responses / responses	Agents are more disciplined in giving responses / responses	Give reward and punishment to those concerned

TABLE 3. Proposed Overall Improvement

Number	Code	The Basis of the Proposal	Proposal	Control
6	Q7	Agent's ability to listen to your needs & desires	Agents want to listen to problems and customer insurance needs	Give reward and punishment to those concerned
7	Q10	Agent's ability to resolve requests & problems	Increase the experience of being an agent and communicating with customers	Give reward and punishment to those concerned
8	Q13	Complete tools, documents or Agent tools when serving you	Always up to date with technology	Provide equipment, documents needed by the agent
9	Q15	Your trust in agents for long-term service	Agents always help and maintain good relationships with customers	Give reward and punishment to those concerned
10	Q11	Knowledge & skills of agents in the field of insurance financial services	Increase experience and diligently attend training from the company	Give reward and punishment to those concerned

Data Mining Classification-Decision Tree

Preprocessing the data used in the form of categorizing the ages from numbers to young, middle and old; old categorization of customers from numbers to new, medium and long; and giving a satisfied statement provided that the value of reality> expectation value.

Gain value is obtained from the value of entropy. After getting the gain value of each attribute for node 1, the largest gain value is chosen where the attribute of the gain value will be the root of the next node. This process is carried out until 1 final attribute is left. The following is an example of calculating the entropy value in total entropy[10]:

$$\text{Total Entropy} = \left(-\frac{90}{100}\, x \log_2 \frac{90}{100}\right) + \left(-\frac{10}{100} x \log_2 \frac{10}{100}\right) = 0.4689955936$$

The following is an example of calculating the gain value at node 1:

$$Gain = 0.4689955936 - \left[\left(\frac{59}{100} x 0.4743454376\right) + \left(\frac{41}{100} x 0.461216041\right)\right] = 0.000033208811$$

An example of the calculation of entropy and gain values can be seen in Table 4.

TABLE 4. Examples of Calculation of Entropy and Gain Values

Node	Attribute	Value	Total of Cases	No	Yes	Entropy	Gain
1	Total		100	90	10	0.468995594	
	Gender						3.32088E-05
		Man	59	53	6	0.474345438	
		Women	41	37	4	0.461216041	
	Age						0.001765135
		Young	13	12	1	0.391243564	
		Middle Age	63	56	7	0.503258335	
		Old	24	22	2	0.41381685	
	Job						0.119220909
		Private and Professional Employees	38	35	3	0.398459274	
		Government Employees	14				
		Insurance Agent	3	13	1	0.371232327	
		College Student	9				
		Businessman	31	0	3	0	
		Housewife	2	9	0	0	
	Long Time Being a Prudential Customer						0.030397505
		New	11	11	0	0	
		Middle	53	49	4	0.386018901	
		Long	36	30	6	0.650022422	

Decision tree results of Rapidminer Studio software are the same as manual calculation decision trees. The results of the decision tree can be seen in Figure 3.

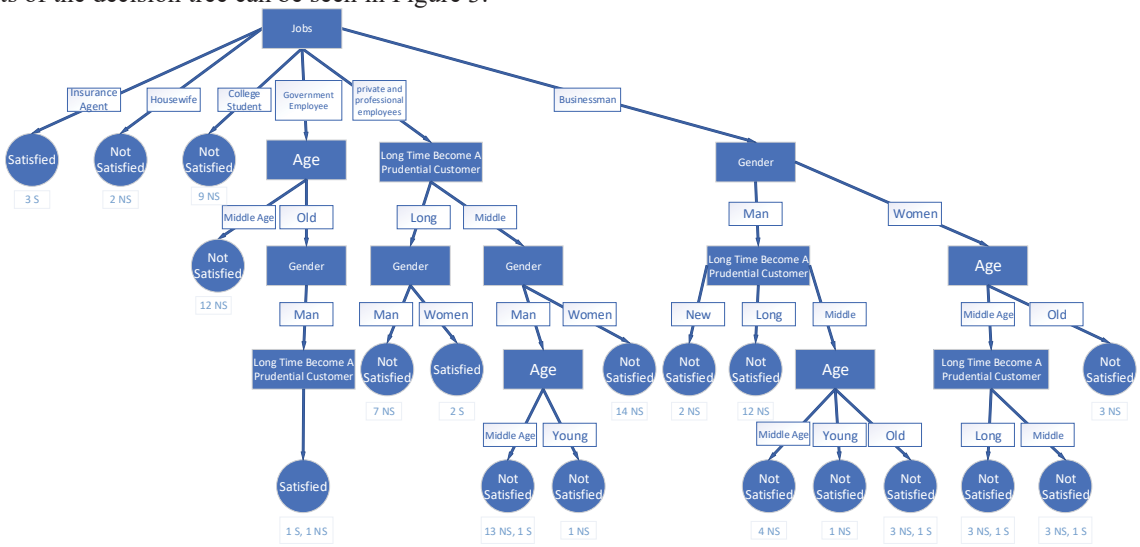

FIGURE 3. Decision Tree

The results of the decision tree can be translated into if then rule. An example of if then rule in the type of work of private employees can be seen in Table 5.

TABLE 5. If Then Rules for Private & Professional Employee Jobs

No	If Then Rule
1	If the type of job is Private & Professional Long Time Become A Prudential Customer is Middle Gender is man, Age is young Then the level of satisfaction is not satisfied
2	If the type of job is Private & Professional Employees Long Time Become A Prudential Customer is Middle Gender is man Age is Middle Then the level of satisfaction is not satisfied
3	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Middle Gender is woman Then the level of satisfaction is not satisfied
4	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Long Gender is male Then the level of satisfaction is not satisfied
5	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Long Gender is female Then the level of satisfaction is satisfied

CONCLUSION

1. The level of customer satisfaction in the fuzzy-servqual and data mining methods has a negative value, which means that the services provided by ov agency are still not in line with customer expectations.
2. From the measurements made using the fuzzy-servqual method, the overall gap value is -0.008. The biggest gap value is in the dimension of empathy with a value of -0.025 followed by a dimension of reliability of -0.021, the dimension of responsiveness with a value of -0.013, a physical dimension with a value of -0.007 and a guarantee of -0.004. Of the 15 questionnaire questions, there were 10 questions that received negative gap values, namely the convenience of agents to contact (q6), clarity of estimated service time (q3), availability of agent time to serve (q8), agent ability to understand customer needs and desires (q12), the speed and alertness of the agent responds (q2), the ability of the agent to listen to customer needs (q7), the ability of the agent to resolve requests and problems (q10), completeness of tools, documents or agent tools (q13), customer trust to the agent for long-term service (q15), knowledge and skills of agents in the field of insurance financial services (q11).
3. From data mining method, it is concluded that there are 2 types of unsatisfied work, namely customers who have jobs as housewives and students. Customers who have jobs as insurance agents are satisfied with the services provided. The other 3 types of work have both perceptions of satisfaction and dissatisfaction, namely customers who have jobs as private and professional employees, civil servants / bumn / bumd, and entrepreneurs.

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Proposed Development Process to Improve Customer Quality of Service with Fuzzy-Servqual and Data Mining Methods in Insurance Agency

Rina Fitriana[a)], Wawan Kurniawan[b)], Willierod Gerry[c)]

Quality Engineering Laboratory Industrial Engineering Department, Faculty of Industrial Technology, Universitas Trisakti, Jl Kyai Tapa No 1 Grogol Jakarta, Indonesia

[a)]Corresponding author: rinaf@trisakti.ac.id
[b)]wawan.kurniawan@trisakti.ac.id,
[c)]willierodg@gmail.com

Abstract. This study aims to measure and analyze customer satisfaction with the services provided by OV Agency agents. Methos The data used in the study are questionnaires filled by 100 random customers from OV Agency. The study used the Fuzzy-ServQual method and data mining with the Classification-Decision Tree algorithm. Fuzzy-ServQual is used to measure attributes that need to be improved based on the calculation of GAP values with the addition of fuzzy methods to eliminate the obscurity obtained from the results of the questionnaire. The Data Mining Classification Method was used to determine hidden patterns by a decision tree. The results of the calculation of the overall GAP value on the Fuzzy-ServQual method are -0.008 and there are 10 attributes that require improvement. Decision trees are using the Rapid Minner Studio application. Based on the decision tree obtained, if then rule can be obtained as a pattern of satisfaction and dissatisfaction.
Keywords: Service Quality, Fuzzy-ServQual, Data Mining, Classification-Decision Tree

INTRODUCTION

Companies in the service sector are required to improve service quality to increase high global competition. The research is in insurance company. This study aims to analyze agent services to customers using the Fuzzy-ServQual method and Classification-Decision Tree Data Mining.

OV agency gets customer dissatisfaction regarding the services provided by agents. This can be caused by the lack of commitment of the agents in explaining insurance products and reminding clients to pay the premium. In addition, the standard and quality of marketing and service between OV agency agents are not uniform. With the decrease in the level of customer satisfaction with the performance of sales agents, it can reduce the productivity of OV agency.

This study aims to improve the quality of customer service which can be described as follow to know the level of customer satisfaction with the performance of OV agency sales agents, to analyze the calculation of Gap values from the questionnaire and providing suggestions for improving customer service quality using the Fuzzy-ServQual method, to analyze the classification and provide suggestions for improving customer service quality using the Classification-Decision Tree Data Mining method.

Sampling technique is a technique in sampling that will be used in research. The sample is part of the number and characteristics possessed by the study population [1]. Determining the number of samples that is most appropriate to use in research depends on the level of accuracy / desired error. The greater the level of error, the smaller the number of samples needed, and conversely the smaller the level of error, the greater the number of samples needed. Determine the number of samples with a 5% error rate based on the Isaac Michael formula as follows:

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$$s = \frac{\lambda^2 . N . P . Q}{d^2 (N - 1) + \lambda^2 . PQ} \quad (1)$$

Information:
s = number of samples
λ = degree of trust
N = population
d = degree of error
P = proportion of target population (50%)
Q = proportion of target population (50%)

There many research about quality service. Customer satisfaction is the key to creating customer loyalty. Many benefits are received by the company by achieving a high level of customer satisfaction, which is in addition to increasing customer loyalty but can also prevent customer turnover, reduce customer sensitivity to prices, reduce marketing failure costs, reduce operating costs caused by increasing numbers of customers, increase advertising effectiveness, and improve business reputation [2].

There are many research about fuzzy servqual. The study of the quality of service by the patient BPJS Health, the highest gap value is the empathy dimension and the lowest gap is the dimension of tangibles (physical proof) thus it can be seen that the dimensions of tangibles (physical evidence) is of concern to improve service quality [3]. The research that measured the service quality by using Fuzzy Servqual by determining the gap between expectations with consumer perception, determining the level of significance between expectations with consumer perceptions, determining the level of service quality and suggesting improvement based on priority by looking at the gap of each quality dimension. Based on the results of data processing, it can be seen that the level of service quality is still low seen from the value of Q t-table[4]. The research evaluated the quality of a large hotel through the fuzzy SERVQUAL and fuzzy AHP. The results showed that the services have many gaps to be improved.[4]

The classification process is a complex technique that connects language, text, information and knowledge theories with computational formalisation, statistical and symbolic approaches, standard and non-standard logics, etc. The propose in this paper a formal model with strong logical foundations based on applicative type systems.[5]

The previous research and the research position can be seen in Table 1.

TABLE 1. Research Position

NO	METHOD	SOURCE
1	Integration of quality service, customer satisfaction, Customer Loyalty, non-probability purposive sampling technique, Structural Equation Modeling	[2]
2	Integration between Fuzzy and Servqual	[3]
3	Integration between the fuzzy SERVQUAL and fuzzy AHP	[4]
4	Integration between classification, applicative systems, collaborative intelligent science	[5]
5	Data Mining classification methods: decision tree (J48), neural Network (MLP) and naive Bayes	[6]
6	Integration between Fuzzy, Quality Function Deployment, and Data Mining	[7]
7	Integration between Six Sigma, FMEA, and Data Mining	[8]
8	Integration between SERVQUAL, Analytical Hierarchy Process (AHP) and Citizen's Score Card	[9]
9	Integration SERVQUAL, service quality, safety concerns and maintenance	[10]
10	Integration between Fuzzy, Servqual, Data Mining	This research position

The position of this research among other studies around the world, can be seen from various aspects above. Can be seen from the aspect of Quality Control research methodology is a combination of fuzzy and method of Servqual, where Servqual is applied simultaneously with fuzzy logic to reduce the subject subjectivity of respondents. Data mining method is also used to know the classification of satisfaction level on OV Agency

RESEARCH METHODOLOGY

The flow of the research methodology can be seen in Figure 1. The results of processing Fuzzy-ServQual methods and Data Mining Classification-Decision Tree. From data processing using the ServQual method, the output value gap is obtained which indicates satisfaction of customers' dissatisfaction with the services of the agents. In the Data Mining method Classification-Decision Tree is expected to output is a decision tree-shaped classification that can be used to make an if then rule. The results of the analysis obtained are used as a reference for making proposals.

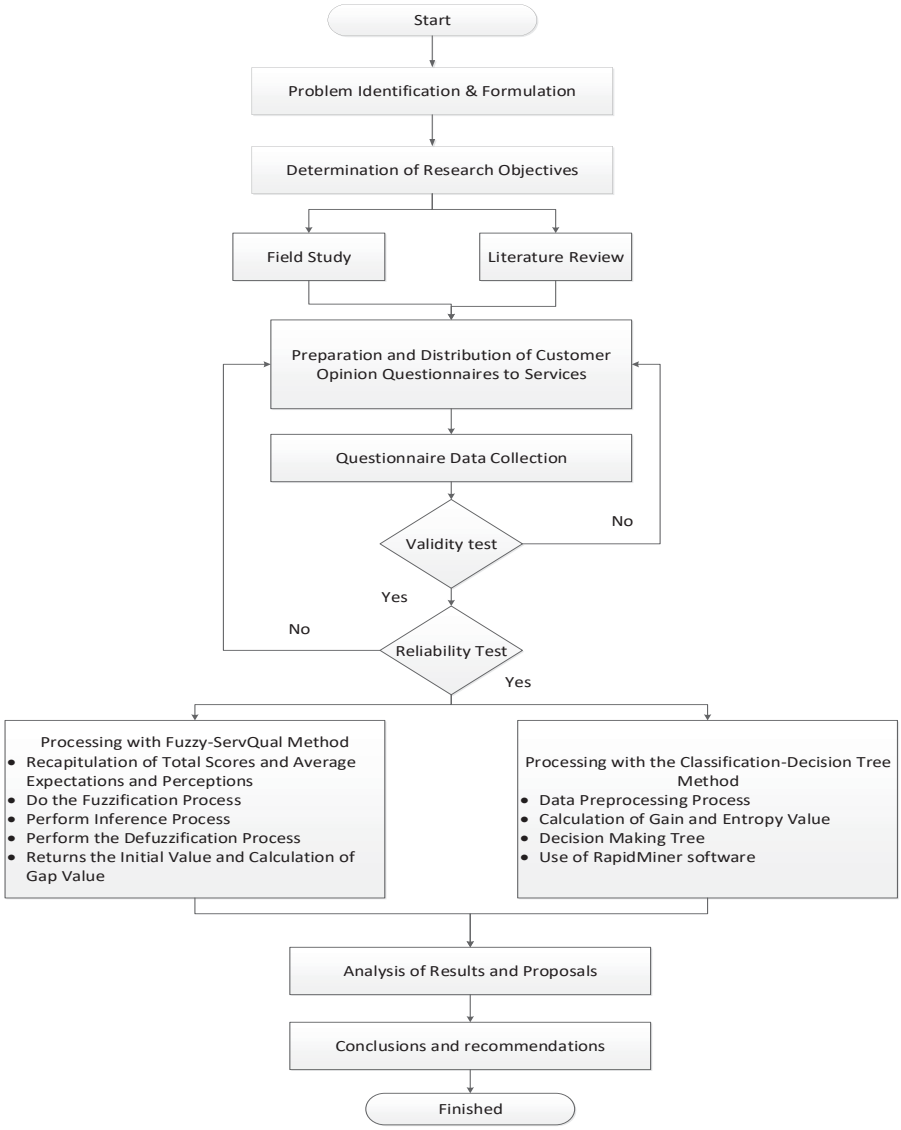

FIGURE 1. Research Methodology Flowchart

RESULTS AND DISCUSSION

Determining the number of samples that is most appropriate to use in research depends on the level of accuracy / desired error. The greater the level of error, the smaller the number of samples needed, and conversely the smaller the level of error, the greater the number of samples needed. Determine the number of samples with a level of error of 5% based on the isaac michael formula as follows:

$$s = \frac{0.95^2 x 12000 x 0.5 x 0.5}{0.05^2 (12000-1) + 0.95^2 x 0.5 x 0.5} = 89.583 \approx 90$$

Through the above calculations, it was found that the number of sample questionnaires needed was 90 respondents, and rounded up to 100 respondents on the google form.

Respondents' demographics are an important factor in seeing market segmentation, and based on these demographics, it can be seen how the behavior of the consumers studied.

In this study, by the SPSS, 25 program was used in testing validity. Tests were carried out 2 times, namely for the results of the questionnaire questions, the perceptions and questions of respondents' expectations of the performance and service of the OV agency agents.

The validity test calculation uses the value of the table with a 2-way test and a significance level of 5%. The value of freedom degree (dF) is obtained using calculation (dF) = N-2 with N = 100. The results of calculation of degrees of freedom (dF) are 98 with table value = 0.1966. Data is declared valid if the calculated value is greater than the table value. A variable is said to be reliable if it gives an alpha cronbach value> 0.60. After calculating using SPSS 25, the Cronbach alpha value for perception is 0.905 and the Cronbach alpha value for expectation is 0.830. Based on the results of calculations, questionnaire data can be concluded for reliable perceptions and expectations.

Fuzzy-ServQual Method

The first step is to calculate the value of the total score of perception and expectation. The following is a sample calculation of total scores and average scores for questions of perception and expectation.

1. Calculation of question number 3 (Q3) part of perception

Total Score = (0x1) + (7x2) + (32x3) + (46x4) + (15x5) = 369

Average Score = 369/100 = 3.69

2. Calculation of question number 3 (Q3) part of hope

Total Score = (0x1) + (0x0) + (8x3) + (39x4) + (53x5) = 445

Average score = 445/100 = 4.45

The next stage is the fuzzification calculation of the questionnaire questions of perception and expectation [9]. The following are examples of fuzzification calculations from questions of perception and expectation number 3 (Q3).

1. Question number 3 (Q3) Perception

Based on the calculation of the average total score obtained x value of 3.69. Then the fuzzification calculation is as follows:

- Satisfied and Very Satisfied Categories
- Membership function

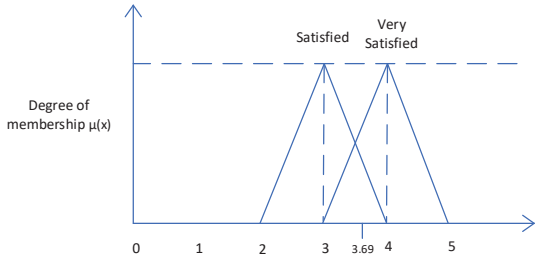

FIGURE 2. Graph of Fuzzy Set Questions Number 3 (Q3) Perception

Fuzzy Set function is in the satisfied and very satisfied category because x = 3.69.

2. Question Number 3 (Q3) Hope

Based on the calculation of the average total score obtained x value of 4.45. Then the fuzzification calculation is as follows:

• Very Satisfied Category
• Membership function
• Fuzzy Set function

Because x = 4.45 and the classification is very satisfied then

μ very satiesfied 4,45, 3, 4, 5= $\frac{5 - 4,45}{5-4}$ = 0,55 for 4<x<5

The inference process is the reasoning used based on the composition of the min. This process consists of determining the rules of the bounding value of each set in each variable and determining the predicate value.

$$Y' = \frac{\Sigma(yi * wi)}{\Sigma wi} \quad (2)$$

After defuzzification results for each question attribute, the next step is to determine the ServQual value by determining the gap value, determining the weight and determining the weighted gap which is the final result of the ServQual score. To determine the gap value the formula is used:

$$\text{Gap} = \text{Performance} - \text{Hope} \quad (3)$$

While the weight value is obtained from the number of attribute questions that exist. Because the questions amount to 15 each questionnaire, the weight values are:

$$\text{Weight} = 1/15 = 0.067$$

Then, the next step is to determine the weighted gap which is the final ServQual score using the approach:

$$\text{ServQual score (weighted gap)} = \text{Gap value} \times \text{Weight} \quad (4)$$

Recapitulation of calculation of ServQual values based on service quality attributes can be seen in Table 2.

TABLE 2. Recapitulation of Defuzzification and Value of GAP

Number	Dimension	Code	Defuzzification		GAP (P-E)	Weight (1/15)	GAP Weighted	Rank
			Perception	Expectation				
1	Reliability	Q3	3.69	4	-0.31	0.067	-0.021	2
		Q4	4	4	0	0.067	0.000	11
		Q10	3.89	4	-0.11	0.067	-0.007	7
		Q11	3.96	4	-0.04	0.067	-0.003	10
2	Assurances	Q9	4	4	0	0.067	0.000	12
		Q15	3.94	4	-0.06	0.067	-0.004	9
3	Tangibles	Q13	3.89	4	-0.11	0.067	-0.007	8
		Q14	4	4	0	0.067	0.000	13
4	Empathy	Q1	4	4	0	0.067	0.000	14
		Q5	4	4	0	0.067	0.000	15
		Q6	3.62	4	-0.38	0.067	-0.025	1
5	Responsiveness	Q2	3.84	4	-0.16	0.067	-0.011	5
		Q7	3.85	4	-0.15	0.067	-0.010	6
		Q8	3.81	4	-0.19	0.067	-0.013	3
		Q12	3.81	4	-0.19	0.067	-0.013	4

$$\text{Overall GAP Score} = \frac{\text{Sum of Total Servqual}}{\text{Sum of Atribute}} = \frac{-0{,}113}{15} = -0{,}008$$

Based on the above calculation, the level of service quality is -0.008, which means that the customer still perceives service quality negatively and has not been in accordance with the expectations of the customer.

There are 10 statements that get negative Gap values. The overall improvement proposal can be seen in Table 3.

TABLE 3. Proposed Overall Improvement

Number	Code	The Basis of the Proposal	Proposal	Control
1	Q6	Convenience Agent to contact both face to face and by telephone	Agents want to spend time when customers want to meet or call	Give reward and punishment to those concerned
2	Q3	Clarity of time estimation from Agent to a service process	Agents provide clarity of time estimates responsibly	Give reward and punishment to those concerned
3	Q8	Availability of agent time in serving you	Agents want to spend time when customers ask for help	Give reward and punishment to those concerned
4	Q12	Agent's ability to understand your needs & desires	Increase the experience of being an agent and communicating with customers	Give reward and punishment to those concerned
5	Q2	Speed & alertness of agents in providing responses / responses	Agents are more disciplined in giving responses / responses	Give reward and punishment to those concerned

TABLE 3. Proposed Overall Improvement

Number	Code	The Basis of the Proposal	Proposal	Control
6	Q7	Agent's ability to listen to your needs & desires	Agents want to listen to problems and customer insurance needs	Give reward and punishment to those concerned
7	Q10	Agent's ability to resolve requests & problems	Increase the experience of being an agent and communicating with customers	Give reward and punishment to those concerned
8	Q13	Complete tools, documents or Agent tools when serving you	Always up to date with technology	Provide equipment, documents needed by the agent
9	Q15	Your trust in agents for long-term service	Agents always help and maintain good relationships with customers	Give reward and punishment to those concerned
10	Q11	Knowledge & skills of agents in the field of insurance financial services	Increase experience and diligently attend training from the company	Give reward and punishment to those concerned

Data Mining Classification-Decision Tree

Preprocessing the data used in the form of categorizing the ages from numbers to young, middle and old; old categorization of customers from numbers to new, medium and long; and giving a satisfied statement provided that the value of reality> expectation value.

Gain value is obtained from the value of entropy. After getting the gain value of each attribute for node 1, the largest gain value is chosen where the attribute of the gain value will be the root of the next node. This process is carried out until 1 final attribute is left. The following is an example of calculating the entropy value in total entropy[10]:

$$\text{Total Entropy} = \left(-\frac{90}{100}\, x \log_2 \frac{90}{100}\right) + \left(-\frac{10}{100} x \log_2 \frac{10}{100}\right) = 0.4689955936$$

The following is an example of calculating the gain value at node 1:

$$Gain = 0.4689955936 - \left[\left(\frac{59}{100} x 0.4743454376\right) + \left(\frac{41}{100} x 0.461216041\right)\right] = 0.000033208811$$

An example of the calculation of entropy and gain values can be seen in Table 4.

TABLE 4. Examples of Calculation of Entropy and Gain Values

Node	Attribute	Value	Total of Cases	No	Yes	Entropy	Gain
1	Total		100	90	10	0.468995594	
	Gender						3.32088E-05
		Man	59	53	6	0.474345438	
		Women	41	37	4	0.461216041	
	Age						0.001765135
		Young	13	12	1	0.391243564	
		Middle Age	63	56	7	0.503258335	
		Old	24	22	2	0.41381685	
	Job						0.119220909
		Private and Professional Employees	38	35	3	0.398459274	
		Government Employees	14				
		Insurance Agent	3	13	1	0.371232327	
		College Student	9				
		Businessman	31	0	3	0	
		Housewife	2	9	0	0	
	Long Time Being a Prudential Customer						0.030397505
		New	11	11	0	0	
		Middle	53	49	4	0.386018901	
		Long	36	30	6	0.650022422	

Decision tree results of Rapidminer Studio software are the same as manual calculation decision trees. The results of the decision tree can be seen in Figure 3.

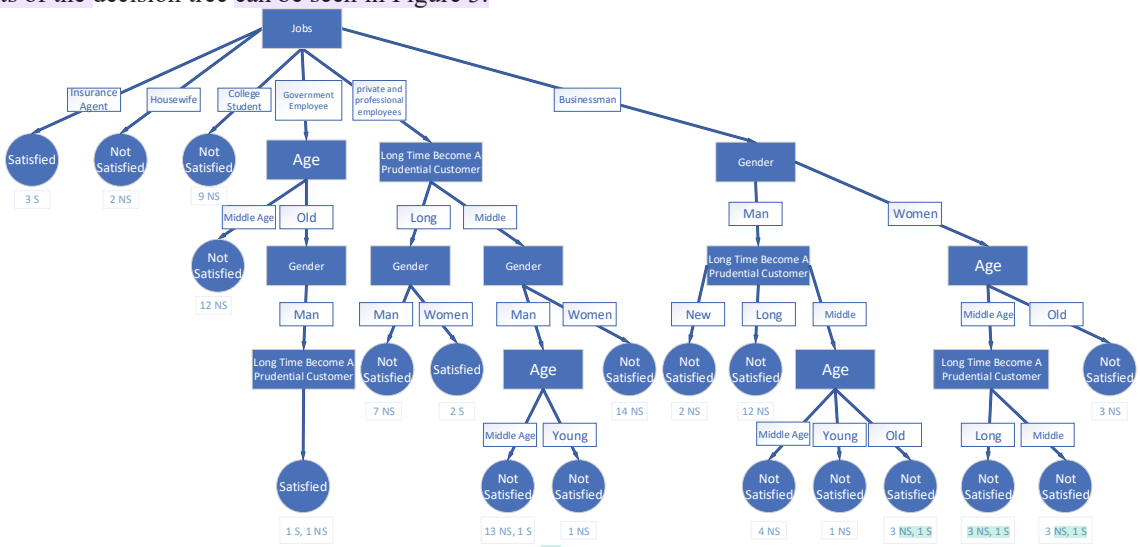

FIGURE 3. Decision Tree

The results of the decision tree can be translated into if then rule. An example of if then rule in the type of work of private employees can be seen in Table 5.

TABLE 5. If Then Rules for Private & Professional Employee Jobs

No	If Then Rule
1	If the type of job is Private & Professional Long Time Become A Prudential Customer is Middle Gender is man, Age is young Then the level of satisfaction is not satisfied
2	If the type of job is Private & Professional Employees Long Time Become A Prudential Customer is Middle Gender is man Age is Middle Then the level of satisfaction is not satisfied
3	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Middle Gender is woman Then the level of satisfaction is not satisfied
4	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Long Gender is male Then the level of satisfaction is not satisfied
5	If the type of work is Private & Professional Employees Long Time Become A Prudential Customer is Long Gender is female Then the level of satisfaction is satisfied

CONCLUSION

1. The level of customer satisfaction in the fuzzy-servqual and data mining methods has a negative value, which means that the services provided by ov agency are still not in line with customer expectations.
2. From the measurements made using the fuzzy-servqual method, the overall gap value is -0.008. The biggest gap value is in the dimension of empathy with a value of -0.025 followed by a dimension of reliability of -0.021, the dimension of responsiveness with a value of -0.013, a physical dimension with a value of -0.007 and a guarantee of -0.004. Of the 15 questionnaire questions, there were 10 questions that received negative gap values, namely the convenience of agents to contact (q6), clarity of estimated service time (q3), availability of agent time to serve (q8), agent ability to understand customer needs and desires (q12), the speed and alertness of the agent responds (q2), the ability of the agent to listen to customer needs (q7), the ability of the agent to resolve requests and problems (q10), completeness of tools, documents or agent tools (q13), customer trust to the agent for long-term service (q15), knowledge and skills of agents in the field of insurance financial services (q11).
3. From data mining method, it is concluded that there are 2 types of unsatisfied work, namely customers who have jobs as housewives and students. Customers who have jobs as insurance agents are satisfied with the services provided. The other 3 types of work have both perceptions of satisfaction and dissatisfaction, namely customers who have jobs as private and professional employees, civil servants / bumn / bumd, and entrepreneurs.

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