Proposed improvement of service quality in a university canteen using Servperf, PGCV, and TRIZ methods

Shanti Kirana Anggraeni*, Nuraida Wahyuni, Umi Noer Amanah, Evi Febianti, Ratna Ekawati

Department of Industrial Engineering, Universitas Sultan Ageng Tirtayasa, Banten, Indonesia

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ABSTRACT

Kantin Hijrah at FT Untirta is among the food and beverage businesses located at the Faculty of Engineering, Sultan Ageng Tirtayasa University. Continuous efforts are essential to enhance service quality to achieve satisfied and loyal customers. This study aims to assess the service quality at Kantin Hijrah and suggest improvements by utilizing the SERVPERF, PGCV, and TRIZ methods. Questionnaires were distributed to 97 active FT Untirta students for data collection. According to the SERVPERV method, the service quality yielded a score of 3.64, indicating satisfaction. Additionally, utilizing the PGCV and TRIZ methods identified five attributes for improvement: maintaining cleanliness in the restroom, ensuring a well-kept handwashing area, providing menu books, adequate and well-maintained tables, and chairs, and ensuring the overall comfort of Kantin Hijrah (i.e., maintaining a suitable temperature and reducing noise). Implementing these proposed improvements aims to further enhance the service quality at Kantin Hijrah.

1. Introduction

Service quality stands as a cornerstone for business success across various industries, notably in the food and beverage (F&B) sector, given its pivotal role [1]. The correlation between service quality and customer satisfaction remains profoundly interconnected. Customer satisfaction denotes the emotional response stemming from the comparison between perceived performance and initial expectations. When perceived performance aligns with expectations, consumers experience contentment; however, when there's a disparity, dissatisfaction ensues. Hence, businesses in the food and beverage industry must continually uphold and enhance service quality. A decline in perceived service quality could lead to consumer discontent, potentially steering them toward seeking alternatives [2].

Kantin Hijrah operates as one of the F&B establishments within Sultan Ageng Tirtayasa University, specifically situated in the Faculty of Engineering. On May 28, 2022, bidikutama, an independent media outlet reflecting Untirta student sentiments, published an article titled "Kantin Hijrah, Student: Not Worth It." The article voiced student grievances regarding the canteen's pricing and facilities, citing food and drink prices at the Hijrah Canteen as unreasonably high for students and noted prolonged food serving times [3]. Additionally, student observations revealed discontent with the services, garnering negative public reviews due to extended wait times, unsatisfactory service quality, and food taste not meeting expectations, prompting students to seek alternatives elsewhere.

Resolving complaints originating from these consumers is crucial as they lead to discomfort when purchasing food or drinks at the canteen. Companies that address consumer complaints promptly create an opportunity to regain customer satisfaction and loyalty. Effectively handling complaints can transform dissatisfied customers into satisfied ones, potentially cultivating a base of regular patrons. Moreover, companies heavily rely on customers for revenue and workforce, making their satisfaction indispensable. Hence, prioritizing customer needs and delivering exceptional service is pivotal for a company's survival [4]. Continuous and unresolved complaints can lead to diminished profits and even financial losses for the Hijrah Canteen.

Previously, research was conducted at non-formal education institutions focusing on women's and children's fashion. The aim was to identify technical service priorities required by students, enabling them to acquire competencies aligned with industry standards and meet consumer preferences, employing the Service Performance (SERVPERF) method [5]. Similarly, a study delved into veterinary clinics in Indonesia, offering an overview of service providers within a competitive market. The focus was on devising strategies to retain existing customers and attract new ones, utilizing the SERVPERF method [6]. Furthermore, research in the health sector, specifically at the Pharmaceutical Installation of Sultan Agung Islamic Hospital, utilized the SERVPERF method to gauge customer satisfaction levels [7]. The SERVPERF method serves as a quality measurement based on consumers' actual experiences and assessments of service quality [4].

Research was conducted in the B&F Industry, particularly in cafes, to assess customer satisfaction regarding product quality. The study aimed to identify attributes requiring prioritization for improvement, employing the Potential Gain in Customer Values (PGCV) method [8]. Similarly, within the transportation service industry, particularly trains, the PGCV method was utilized to enhance various attributes [9]. Moreover, another study within the B&F industry, focusing on a coffeeshop, applied the PGCV method to ascertain the order of priority for service improvement [10]. The PGCV method serves as a tool for determining the sequence of improvements necessary for a company's enhancement [8].

A study conducted in the B&F industry, specifically in cafes, aimed to analyze and propose improvements for service quality using the Theory of Inventive Problem Solving (TRIZ) method [11]. Similarly, within the transportation service industry, particularly in ports, the TRIZ method was utilized to identify optimal solutions for improving various service quality attributes [12]. Moreover, in a study focusing on service center services, the TRIZ method was employed to generate suggestions for service improvement [13]. The TRIZ method is a creative problem-solving approach characterized by structured processes integrating a series of problem-solving techniques [11].

A research study was conducted in the B&F industry, specifically in cafes, to assess customer satisfaction regarding service quality, employing the IPA and TRIZ methods [14]. In another study focusing on goods delivery and logistics services, the SERVQUAL and TRIZ methods were employed to analyze and resolve issues related to service quality [15]. Additionally, in research centered on car audio service and sales services, the SERVPERF and IPA methods were used to gauge the importance and performance levels, identifying areas requiring improvement and maintenance [16].

Hence, in the research focused on enhancing the service quality of the Hijrah Canteen, the SERVPERF method is employed to evaluate the service quality.

Subsequently, upon identifying areas for improvement using the PGCV method, proposed enhancements will be suggested to elevate the service quality at the Hijrah Canteen. Consequently, the canteen is anticipated to enhance specific service aspects by implementing relevant improvement strategies.

2. Literature review

2.1. Service quality

Service quality is an endeavor aimed at meeting consumer needs and desires while striking a balance with their expectations [17]. It encompasses five key indicators [18]:

a. Reliability: This involves the capacity to deliver services consistently, accurately, and promptly in a satisfactory manner.
b. Responsiveness: It refers to the willingness of employees to offer services in a prompt, courteous, and friendly manner, while being readily available to swiftly cater to consumer needs.
c. Assurance: This indicator encompasses knowledge, competence, courtesy, and reliability in fulfilling promises, ensuring freedom from risk and uncertainty.
d. Empathy: It denotes the willingness of employees to establish meaningful communication, foster relationships, and demonstrate attentiveness and understanding towards individual consumer needs.
e. Physical evidence (tangible): This aspect highlights a company's ability to manifest its presence to external entities. It includes the appearance and reliability of physical facilities and infrastructure, as well as the overall environmental conditions, serving as tangible evidence of the service quality provided by service providers.

2.2. Customer satisfcation

The origin of the word "satisfaction" comes from Latin, namely "satis" which means good, adequate, and "facio" which means to do simply. Therefore, satisfaction can be interpreted as an effort to fulfill or create something adequate [19]. Customer satisfaction is the attitude or behavior of customers towards a product or service that they have received or consumed. It is also a specific evaluation of the overall service provided by the service provider. Therefore, customer satisfaction can only be assessed based on the experiences they have during the process of purchasing or using services [9].

2.3. Population and sample

Population refers to a general area consisting of objects or subjects with certain qualities and characteristics that are determined by researchers to be studied and then used to make conclusions [20]. A sample, on the other hand, is a portion of the number and characteristics possessed by the population [21].

2.4. Validity test

The validity test is a measurement method that shows the extent to which the instrument can accurately reflect the concept being studied. The higher the validity of the instrument, the more accurate the instrument is in measuring relevant data. Conversely, if the validity is low, it indicates that the instrument is less appropriate to use [9]. If the r count value obtained is greater than the r table value, it can be concluded that the instrument or question item has a significant correlation with the total score and is considered valid. Conversely, if the rcount value is smaller than the rtable value, then the instrument or question item does not have a significant correlation with the total score and is considered invalid [22]. The validity test formula is shown in Eq. (1) [23], where r denotes correlation coefficient, x =denotes item score value, y denotes total score value, and N denotes number of respondents.

$$r_{xy} = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\{N\Sigma X^2 - (\Sigma X)^2\}\{N\Sigma Y^2 - (\Sigma Y)^2\}}} \qquad (1)$$

2.5. Reliability test

Reliability refers to the level of trust, consistency, or stability of measurement results. The reliability test is conducted to evaluate whether the scale used in the questionnaire has internal consistency. It shows how consistent the measurement results remain when the same symptoms are measured using the same instrument two or more times. In this study, the instrument used can be a questionnaire. A questionnaire is considered reliable if the answers from the questionnaire remain consistent and stable over time. Therefore, it is important that the questionnaire has a high level of reliability. However, the calculation of reliability can only be done after the validity of the questionnaire is first calculated. The method used to measure questionnaire reliability usually uses the Croncbach's Alpha method. An instrument is declared reliable in preliminary research if the alpha reliability value is 0.7 [24]. The reliability test formula is shown in Eq. (2) [23].

$$r_{xy} = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\{N\Sigma X^2 - (\Sigma X)^2\}\{N\Sigma Y^2 - (\Sigma Y)^2\}}} \qquad (2)$$

Table 1.
Performance satisfaction level assessment [5]

Score	Interval	Service Performance
1	1,00 - < 1,80	Not satisfactory
2	1,80 - < 2,60	Less than satisfactory
3	2,60 - < 3,40	Quite satisfactory
4	3,40 - < 4,20	Satisfactory
5	4,20 - < 5,00	Very satisfactory

where r count is Cronbach's Alpha reliability coefficient, n is the number of question items tested,

$\sum \delta t^2$ dnotes the sum of item score variances, and δt^2 denotes variance of test scores.

2.6. SERVPERF

SERVPERF developed a measurement instrument that focuses on service quality performance. SERVPERF uses a measurement method that only considers the performance perceived by consumers, without paying attention to the difference between consumer performance perceptions and consumer expectations of service quality. This instrument consists of several dimensions, namely responsiveness, empathy, tangible, reliability, assurance [6].

$$\text{Performance} = \frac{\text{total performance score}}{\text{number of respondents}} \qquad (3)$$

2.7. PGCV

The PGCV method is an approach used to determine improvement priorities based on input from users or consumers. By using this method, the order of improvement priorities for each attribute studied can be identified [25]. The PGCV index can be used to analyze the attributes that are the focus of the research. The steps of the PGCV method are as follows [26]:
1. Calculating the Achieved Customer Value (ACV)

$$ACV = I \times P \qquad (4)$$

where ACV is consumer achievement value, I is average value for expectations, P is average value for performance.
2. Calculating Ultimate Desired Customer Value (UDCV)

$$UDCV = I \times P_s \qquad (5)$$

where UDCV is final value of consumer desires, I is average value for expectations, and Ps is maximum performance value in the selected likert scale.
3. Calculating the PGCV index

$$PGCV = UDCV - ACV \qquad (6)$$

If an item obtains the highest PGCV index value, then the item has a top priority in improving its performance. The second item and so on will be followed as the next priority [26].

2.8. TRIZ method

The method comes from the Russian language, Teoriya Resheniya Izobretatel'skikh Zadach (TRIZ) which means Theory Inventive of Problem Solving (TIPS). The TRIZ method is an approach used to solve problems with various creative solutions that involve analyzing contradictions between parameters. The goal is to achieve a profitable solution [12]. In its application, the TRIZ method uses 39 technical parameters as a reference to identify the type of initial solution that can

be used in a problem. These parameters are also used to determine the creative solutions that will be applied in solving the problem. The Contradiction Matrix is a tool used to provide recommendations for solutions that can be used in solving each problem. In this matrix, there are various alternative solutions identified based on the contradiction between the technical parameters of the problem and the initial solution identified earlier. The following are the steps of the TRIZ method [13]:

a. Problem identification in this stage, various problems that exist in a system that needs to be improved are identified. Furthermore, the search for information related to the problem is carried out to gain a deeper understanding and help in determining the right solution.

b. Contradiction analysis Contradiction analysis is conducted after a suitable solution is found based on the information obtained. The solution is then classified in 39 technical parameters in the TRIZ technical parameters table. Two problem-solving tables were created, namely "improving features" which contains the initial solution based on the technical parameters, and "worsening features" which includes the impact that may arise if using the technical parameters as a solution.

c. Elimination of contradictions Once the technical parameters have been identified in the "improving features" and "worsening features" tables, the next step is to find the common ground of solutions using the contradiction matrix table developed by Altshuller. This table contains numbers related to the 40 inventive principles used in problem solving. After collecting all the inventive principle numbers from each problem, the numbers that did not repeat or appeared only once were eliminated.

d. Proposed improvement solutions After elimination, the numbers that appeared more than once were found. These numbers represent solutions to the identified problems. However, since the numbers are still in the form of inventive solution categories in the 40 TRIZ inventive principles, it is necessary to define them more clearly so that the solutions can be understood, accepted, and considered by relevant parties. The goal is to make the solution easy to understand, digest, and become an improvement proposal that can increase or improve the quality related to the existing problems.

3. Method

3.1. Research design

Research design is the design or design of the research to be carried out. This research uses quantitative research methods. Quantitative research is a form of research that uses data in the form of numbers as a tool to analyze and gain an understanding of the phenomena or research questions to be known. In this quantitative research using data from respondents of the Hijrah Canteen customer satisfaction survey questionnaire in the form of a Likert scale of each attribute made based on the five service dimensions of the SERVPERF method, namely tangibles, reliability, responsiveness, assurance, and empathy.

The methods used in this research are SERVPERF method, PGCV method and TRIZ method. The SERVPERF method is used to determine service quality by calculating the average performance level of customer satisfaction attributes. The PGCV method is used to determine the priority of improvement based on votes, with this method the order of priority of attribute improvement will be known. After knowing the attributes that get priority improvement, then proceed with the TRIZ method to make improvement proposals to solve problems with various solutions to solve problems that are inventive with the contradiction stage between parameters by considering 39 parameters and 40 principles of the TRIZ method.

3.2. Data collection

The data collection process in this study is obtained from the results of a questionnaire consisting of questions compiled based on the five service dimensions of the SERVPERF method and based on previous research. The population in this study were students of the Faculty of Engineering, Sultan Ageng Tirtayasa University with the status of active students in 2019, 2020, 2021 and 2022. The sampling technique was carried out by nonprobability sampling with purposive sampling. Purposive sampling means a deliberate sampling technique with certain considerations [27].

In this research, the criteria are active students of Faculty of Engineering Untirta Untirta Faculty of Engineering and students who have bought food and drinks at the Hijrah Canteen at least 2 times. The sample size is calculated using Slovin equation.

The population was derived from the count of active students at FT Untirta during the even semester of 2022/2023, totaling 3,110. Consequently, the sample size for this study comprised 97 students. Primary data collection methods involved customer satisfaction surveys and brainstorming sessions with canteen tenants. Additionally, relevant theories were utilized as supportive secondary data for this research.

4. Results and discussions

Table 2 shows 21 question items sourced from the five dimensions of Servqual, namely Reliability, Responsiveness, Assurance, Emphaty, and Tangible.

4.1. Validity test

Based on the validity test calculations, the results showed that all statements that calculated significance were smaller than significance (0.05) or sig. count < sig, so it can be said that all statement items used in the research questionnaire are valid, which means that the instruments (attributes) of this research can be used as measuring tools.

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Table 2.

Question items in the questionnaire

No	Code	Performance/Expectation
1	X1	The food/drinks at the Hijrah Canteen uses good ingredients and good manufacturing methods.
2	X2	The price of food/drinks at the Canteen Hijrah canteen is affordable and in accordance with the taste and quality received.
3	X3	Conformity between the bill amount and price and the amount of food/drink purchased at the Hijrah Canteen.
4	X4	Food/drinks served at Hijrah Canteen is served quickly.
5	X5	Food/drinks served at Hijrah Canteen is served exactly as ordered.
6	X6	The taste of food/drinks at the Hijrah Canteen is consistent or according to expectation
7	X7	Menu variations at Kantin Hijrah are diverse and interesting.
8	X8	Diversity of payment methods at the canteen Hijrah Canteen (cash, Qris and e wallet).
9	X9	The speed of service at the Hijrah Canteen by waiters, especially if there are many customers.
10	X10	Clarity of waiters in conveying the menu available at Hijrah Canteen.
11	X11	Availability of waiters at the Hijrah Canteen in helping consumers.
12	X12	Fast response of waiters at the canteen Hijrah Canteen when consumers need something (tableware, soy sauce, and sauce).
13	X13	Food/drink utensils in the canteen Hijrah Canteen is prepared in a clean.
14	X14	Provision of replacement guarantee food/drinks at Hijrah Canteen if it is not suitable.
15	X15	Understanding of the waiters at the Hijrah Canteen of the available menu
16	X16	Service at Hijrah Canteen process complaints quickly and responsive.
17	X17	The responsiveness of waiters at the Hijrah Canteen in providing solutions if there are consumer complaints.
18	X18	Friendliness of waiters at the Hijrah Canteen in providing services
19	X19	Communication of waiters at the Hijrah Canteen with consumers is done well.
20	X20	Hijrah canteen has enough tables and chairs, clean, and well-maintained.
21	X21	Hijrah canteen has a toilet that is clean and well maintained.
22	X22	Hijrah canteen has hand washing place that is clean and well maintained.
23	X23	Waiters at the Hijrah Canteen dressed neatly and cleanly.
24	X24	Availability of menu books at the Hijrah Canteen.
25	X25	Hijrah Canteen is comfortable (not hot or noisy)

Table 3.

Service performance level

No.	Code	Performance
1	X1	3,89
2	X2	3,93
3	X3	4,13
4	X4	3,31
5	X5	4,22
6	X6	3,78
7	X7	3,71
8	X8	3,91
9	X9	3,30
10	X10	3,71
11	X11	3,71
12	X12	3,82
13	X13	3,91
14	X14	3,42
15	X15	4,08
16	X16	3,55
17	X17	3,68
18	X18	4,09
19	X19	4,13
20	X20	3,22
21	X21	2,86
22	X22	2,92
23	X23	3,56
24	X24	3,08
25	X25	3,19
	Average	3,64

4.2. Reliability test

Reliability test is conducted to determine whether the scale made on the questionnaire is internally consistent or not. The results present that Cronbach's alpha is much greater than the consensus value (0,7), namely 0,961 for the performance level and 0,976 for the expectation level, so it can be said that the results of the questionnaire are reliable and have a high level of stability as a measuring instrument, which means that the measuring instrument if used repeatedly the results of the test will show permanent results.

4.3. SERVPERF

After testing the results of the questionnaire, data processing of the questionnaire results using the SERVPERF method was carried out to see how customer satisfaction with the quality of service received was carried out. The results of the calculation with the SERVPERF method are shown in Table 3 and 4. From Table 3, the service performance level is 3.64 which means satisfactory. Based on Table 4, the average performance value or performance of each dimension, reability (reliability) 3.86 means satisfactory, responsiveness (responsiveness) 3.64 means satisfactory, assurance (guarantee) 3.80 means satisfactory, empathy (empathy) means satisfactory and tangible (physical evidence) 3.14 means quite satisfactory.

4.4. PGCV

The next step is to determine the priority of improvement in the quality of service of the Hijrah Canteen using the PGCV method. Based on Table 5, the PGCV value of all statements that are prioritized from the highest rank is statement X21 with a value of 9,26, X22 with a value of 8,97, X24 with a value of 8,11, X20 with a value of 8,07 and X25 with a value of 7,71.

Table 4.
Service performance level by dimension

Dimension	Code	Performance
Reliability	X5	4,22
	X3	4,13
	X2	3,93
	X8	3,91
	X1	3,89
	X6	3,78
	X7	3,71
	X4	3,31
Average		3,86
Responsiveness	X12	3,82
	X10	3,71
	X11	3,71
	X9	3,30
Average		3,64
Assurance	X15	4,08
	X13	3,91
	X14	3,42
Average		3,80
Emphaty	X19	4,13
	X18	4,09
	X17	3,68
	X16	3,55
Average		3,86
Tangible	X23	3,56
	X20	3,22
	X25	3,19
	X24	3,08
	X22	2,92
	X21	2,86
Average		3,14

Table 5.
PGCV

No.	Code	ACV	UDCV	PGCV	Priority
1	X21	12,34	21,60	9,26	1
2	X22	12,57	21,55	8,97	2
3	X24	13,03	21,13	8,11	3
4	X20	14,56	22,63	8,07	4
5	X25	13,53	21,24	7,71	5
6	X9	14,66	22,22	7,56	6
7	X4	14,74	22,27	7,53	7
8	X14	14,68	21,44	6,76	8
9	X16	15,43	21,75	6,32	9
10	X23	15,44	21,70	6,26	10
11	X7	16,64	22,42	5,78	11
12	X17	15,90	21,60	5,70	12
13	X11	16,18	21,80	5,62	13
14	X10	16,03	21,60	5,57	14
15	X6	16,97	22,42	5,46	15
16	X12	16,80	21,96	5,16	16
17	X1	17,79	22,89	5,10	17
18	X13	17,68	22,63	4,95	18
19	X8	17,36	22,22	4,86	19
20	X2	17,74	22,58	4,84	20
21	X18	18,78	22,94	4,16	21
22	X15	18,31	22,42	4,11	22
23	X3	18,71	22,63	3,92	23
24	X19	18,54	22,42	3,88	24
25	X5	19,39	22,99	3,60	25

Table 6.
PGCV by dimension

No	Dimension	Code	ACV	UDCV	PGCV	Priority
1		X4	14,74	22,27	7,53	1
2		X7	16,64	22,42	5,78	2
3		X6	16,97	22,42	5,46	3
4	Reliability	X1	17,79	22,89	5,10	4
5		X8	17,36	22,22	4,86	5
6		X2	17,74	22,58	4,84	6
7		X3	18,71	22,63	3,92	7
8		X5	19,39	22,99	3,60	8
9		X9	14,66	22,22	7,56	1
10	Responsiveness	X11	16,18	21,80	5,62	2
11		X10	16,03	21,60	5,57	3
12		X12	16,80	21,96	5,16	4
13		X14	14,68	21,44	6,76	1
14	Assurance	X13	17,68	22,63	4,95	2
15		X15	18,31	22,42	4,11	3
16		X16	15,43	21,75	6,32	1
17	Emphaty	X17	15,90	21,60	5,70	2
18		X18	18,78	22,94	4,16	3
19		X19	18,54	22,42	3,88	4
20		X21	12,34	21,60	9,26	1
21		X22	12,57	21,55	8,97	2
22	Tangible	X24	13,03	21,13	8,11	3
23		X20	14,56	22,63	8,07	4
24		X25	13,53	21,24	7,71	5
25		X23	15,44	21,70	6,26	6

Table 7.
Problem identification

Code	Statement or Problem
X21	Hijrah FT Untirta canteen has clean and well-maintained toilets.
X22	Hijrah FT Untirta Canteen has a clean and well-maintained hand washing area.
X24	Availability of menu book in the canteen.
X20	Hijrah FT Untirta Canteen has enough tables and chairs that are clean and well-maintained.
X25	Hijrah FT Untirta canteen is comfortable (not hot and not noisy).

Table 8.
Contradiction analysis

Code	Problems	Improving Feature	Technical Parameter	Worsening Feature	Technical Parameters
X21	Having clean and well-maintained toilets	Conduct regular maintenance on the cleanliness of the toilet	Duration of action by a stationary object (16)	Increased working time or longer working time	Loss of time (25)
X22	Having clean and well-maintained handwashing station	Conduct regular maintenance on the cleanliness of the handwashing station	Duration of action by a stationary object (16)	Increased working time or longer working time	Loss of time (25)
X24	Menu book availability	Provision of menu book for customers	Quantity of substance (26)	Additional costs to create a menu book	Difficulty of detecting and measuring (37)
X25	Have enough tables and chairs, clean and well-maintained.	Waiters should be more responsive to the cleanliness of tables and chairs.	Speed (9)	The adjustment of each waiter in preparing orders and maintaining cleanliness	Adaptability (35)
X20	Comfortable cafeteria (not hot and not noisy)	Provide air conditioning facilities	Quantity of substance (26)	Additional cost to purchase air conditioner	Difficulty of detecting and measuring (37)

4.5. TRIZ

After obtaining the statement that prioritizes improvement from the highest rank, it is continued by using the TRIZ method which aims to solve problems by determining the improvement solution.

1. Problem Identification

The first step is to identify the problems that occur, where the problem is the statement that gets the 5 highest ranks in the calculation of the PGCV method. Based on Table 7, it can be seen that the statements or attributes that are prioritized for improvement are statement 21, namely having a clean toilet that is also maintained, statement 22, namely having a clean hand washing place that is also maintained, statement 24,

namely the availability of menu books, statement 20, namely having tables and chairs that are sufficient in number, clean, and maintained and statement 25, namely a comfortable canteen (not hot and not noisy).

2. Contradiction Analysis

After the problem identification stage, the contradiction analysis stage is carried out. At this stage, the initial solution of the problem is determined in terms of technical parameters (improving feature) and the determination of the impact or consequences of the selection of technical parameters if used as a solution (worsening feature) and translated into the form of categories in 39 TRIZ parameters. Based on Table 8, the improving features and worsening features with their technical parameters can be identified from the existing problems.

3. Elimination of Contradictions

The next stage after contradiction analysis is the contradiction elimination stage, at this stage a search for the intersection of numbers obtained from 39 parameters with 40 TRIZ problem solving principles is carried out. After that, elimination is carried out by eliminating numbers that do not experience repetition or only appear once and selecting numbers that appear more than once.

Based on Table 9, the results of the elimination of contradictions can be obtained from the concept of solving in accordance with the existing problems, namely principle number 10 (preliminary action or preparation), 20 (continuity of useful action or continuation of benefits) and 23 (feedback or reciprocity).

4. Proposed Improvement Solution

After getting the numbers that appear more than once, these numbers become the solution to the identified problems, then define these numbers into the form of a standardized solution so that it is easily accepted, digested and understood by the Hijrah FT Untirta Canteen and becomes a proposed improvement that can be used as a consideration in improving or improving the quality of existing problems.

Problems: "Having clean and well-maintained toilets"

In this statement, problem solving principle number 10 is obtained, namely preliminary action or preparation, where this principle means taking preparatory steps for objects or systems, either as a whole or only part of the component. A solution can be proposed based on the TRIZ problem solving principle, namely: The canteen building manager performs routine maintenance on the cleanliness of the toilets, either every other day or according to the time available.

> 1) The canteen building manager conducts regular checks of the toilets for damage before the damage gets bigger. Problems: "Having a clean and well-maintained handwashing station". In this statement, problem solving principle number 10 is obtained, namely preliminary action or preparation, where this principle means taking preparatory steps for the object or system, either as a whole or only part of the component.

A solution can be proposed based on the TRIZ problem solving principle, namely:

a. The canteen building manager conducts routine maintenance on the cleanliness of the handwashing stations, either every day in the afternoon or according to the time available.

b. The canteen building manager conducts routine checks of the hand washing station for damage that occurs in the hand washing station before the damage gets bigger.

2) Problems: "Menu book availability". In this statement, problem solving principle number 20 is obtained, namely continuity of useful action, where this principle means allowing the object or system to continue working at full load to identify its strengths and weaknesses. A solution can be proposed based on the TRIZ problem solving principle, namely:

a. Canteen tenants or waiters provide menu books for canteen customers.

b. Check whether or not providing a menu book provides more benefits to canteen customers, if it provides benefit, it can be continued.

3) Problems: "Have enough tables and chairs, clean and well-maintained." In this statement, problem solving principle number 23 is obtained, namely feedback or reciprocity, where this principle means making corrections or retesting to improve the process or take the necessary actions. A solution can be proposed based on the TRIZ problem solving principle, namely:

> a. Canteen tenants or waiters do routine cleaning or checking tables and chairs both before customers come to eat and after customers leave after finishing their food, whether the tables and chairs are clean or not.

4) Problems: "Comfortable cafeteria (not hot and not noisy)" In this statement, problem solving principle number 20 is obtained, namely continuity of useful action, where this principle means allowing the object or system to continue working at full load to identify its strengths and weaknesses. A solution can be proposed based on the TRIZ problem solving principle, namely:

a. The canteen building manager provides or buys fans or blower fans at several points of the canteen that are felt to be hotter than other points.

b. Checking whether or not providing fans or blower fans provides more benefits to canteen customers, if it provides benefits can be continued.

Table 9.
Elimination of contradictions

Code	Improving Feature	Worsening Feature	Principle	Elimination Result
X21	Duration of action by a stationary object (16)	Loss of time (25)	10, 23, 28	
X22	Duration of action by a stationary object (16)	Loss of time (25)	10, 23, 28	
X24	Quantity of substance (26)	Difficulty of detecting and measuring (37)	20	10, 20 and 23
X25	Speed (9)	Adaptability (35)	15, 23, 25	
X20	Quantity of substance (26)	Difficulty of detecting and measuring (37)	20	

5. Conclusions

The service quality rating at the Hijrah FT Untirta Canteen stands at 3.64, indicating satisfactory service. Areas identified for improvement include maintaining the cleanliness of the canteen's toilets and hand washing stations, ensuring the availability of menu books, providing sufficient and well-maintained tables and chairs, and creating a comfortable atmosphere at the canteen (avoiding excessive heat and noise).

The suggested improvements, based on the research findings, entail routine maintenance of toilets and hand washing stations by the canteen building manager, provision of blower fans, and cooperation from canteen tenants to supply menu books and uphold cleanliness standards for tables and chairs.

Declaration statement

Shanti Kirana Anggraeni: **Conceptualization, Methodology, Software and Resources, Supervision**. Nuraida Wahyuni: **Supervision, Visualization, Investigation**. Umi Noer Amanah, Evi Febianti: **Writing-Original Draft, Data Processing, Editing**. Ratna Ekawati: **Supervision.**

Disclosure statement

The authors report there are no competing interests to declare.

Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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