

Measurement of Customer Perceptions of Logistics Service Quality

Babatunde Enitan Ogunnowo *, **Salami Suberu Sule**

Department of Business Administration Osun State University, Okuku Osun State, Nigeria

Address: Oke Bale Street, Area 210001, Osogbo, Nigeria

* Corresponding author: b.e.ogunnowo@gmail.com

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ABSTRACT

Currently, logistics service providers experience a high increase in activity. It makes logistics service providers compete with each other in service quality. To be able to compete, logistics service providers need to measure customer perceptions on logistics service satisfaction. The results of measuring customer perceptions can be used to improve the quality of logistics services. This study attempted to measure customer perceptions of third-party logistics (3PL) service users by considering competitor performance factors. This study integrated the Customer Satisfaction Index (CSI) method and the Competitive Zone of Tolerance based Importance Performance Analysis (CZIPA) method to measure customer perceptions and determine the priority attributes for improvement account competitors' performance factors. Based on the research, the CSI method was proven to measure customer perceptions of 3PL service users. CZIPA can determine the attributes that were prioritized for improvement based on the performance of competitors.



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1. Introduction

Customer perception of the services provided by a company is essential in maintaining service quality [1]. Service quality has to be adjusted to the desired service's expectations to satisfy customers [2]. Service quality determines the advantages of a company from competitors [3]. Along with the development of e-commerce, there is increasingly fierce competition among logistics service providers [4]. Quality of logistics services is recognized as a significant business component, competitiveness, and overall customer satisfaction [5]. The quality of logistics services plays a vital role in customer satisfaction [6]. Several empirical studies prove a relationship between improved logistics services quality with increased customer satisfaction [7].

Logistics service quality issues have attracted the attention of many researchers. One of the methods used in measuring customer satisfaction with the quality of logistics services is the logistics service quality method [8] [9]. The logistics service quality method



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ti.jurnal@umm.ac.id

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is also used to measure the service quality of courier services [10] [11], Third-Party Logistics (3PL) [12], and loyalty [13]. Huang, et al. [14] and Xu, et al. [15] used the Importance Performance Analysis (IPA) method to evaluate the quality of logistics services. Hsu, et al. [16] integrated science with a Fuzzy Analytical Hierarchy Process. The Kano method was also implemented to analyze logistic service attributes [17] [18]. Quality Function Deployment chattered by Baki, et al. [19] to assess logistics services' quality. Bottani and Rizzi [20] utilized a fuzzy quality function deployment approach to determine service factors that impact logistics performance, while Meng, et al. [21] combined fuzzy Kano and IPA integration.

Based on previous studies, some of these prior studies only focused on the attributes of logistics services that needed to be improved. Previous research did not measure customer satisfaction comprehensively. To the best of our knowledge, only a few studies related to customer perceptions have taken into account competitors' performance factors. Therefore, this study was intended to measure customer perceptions of 3PL service users by considering competitor performance factors. This research proposed integrating the Customer Satisfaction Index (CSI) and the Competitive Zone of Tolerance Based on Importance Performance Analysis (CZIPA). This research contributes to the field of logistics service improvement by proposing a new framework for measuring customer perceptions of the quality of logistics services

The structure of this paper is presented as follows: section (2) Method presents the framework of the Integration Customer Satisfaction Index (CSI) and the Competitive Zone of Tolerance Based Importance Performance Analysis (CZIPA), data collection, and case studies. Section (3) Results and Discussion discusses the results of validity and reliability tests, measuring customer perceptions with CSI, and mapping attributes based on CZIPA. The final section of this paper provides a conclusion and suggestions for further research.

2. Methods

2.1 The proposed framework for integrating CSI and CZIPA

In this section, a proposed framework for integrating CSI and CZIPA was offered to measure perceptions and attribute mapping. The integration of the CSI method with CZIPA was developed to measure the perceptions of 3PL customers who also considered competitor performance factors. The CSI method is used to measure the perceptions of 3PL service users. Furthermore, the CZIPA method was constructed to map 3PL service performance compared to competitors' performance. The results from CZIPA were then exercised to determine which priority attributes need improvement.

The framework for integrating the CSI and CZIPA methods is presented in Fig. 1. The first stage was the development of a logistic service attribute instrument. At this stage, five types of questionnaires were designed. They were the 3PL interest and performance questionnaires, the interest and competitor performance questionnaires, and the customer expectation questionnaire. Each questionnaire had 19 logistics service quality attributes to measure customer perceptions of 3PL service providers. The assessment of the questionnaire attributes used a Likert scale with a value range of 1 to 5. In the 3PL interest questionnaire and the competitor interest questionnaire, one means very insignificant, and five means is very significant. For the 3PL performance questionnaire and the competitor performance questionnaire, one means strongly disagree, and five means strongly agree. For the customer expectation questionnaire, one means really not expecting, and five means were expecting.

Stage 2 was distributing questionnaires and testing the validity and reliability of the instruments used. At this stage, the selected respondents should be able to represent the population. In the validity test, the instrument was valid if the product-moment correlation value $> r$ table. Furthermore, the instrument was said to be reliable if the Cronbach's Alpha value was > 0.600 .

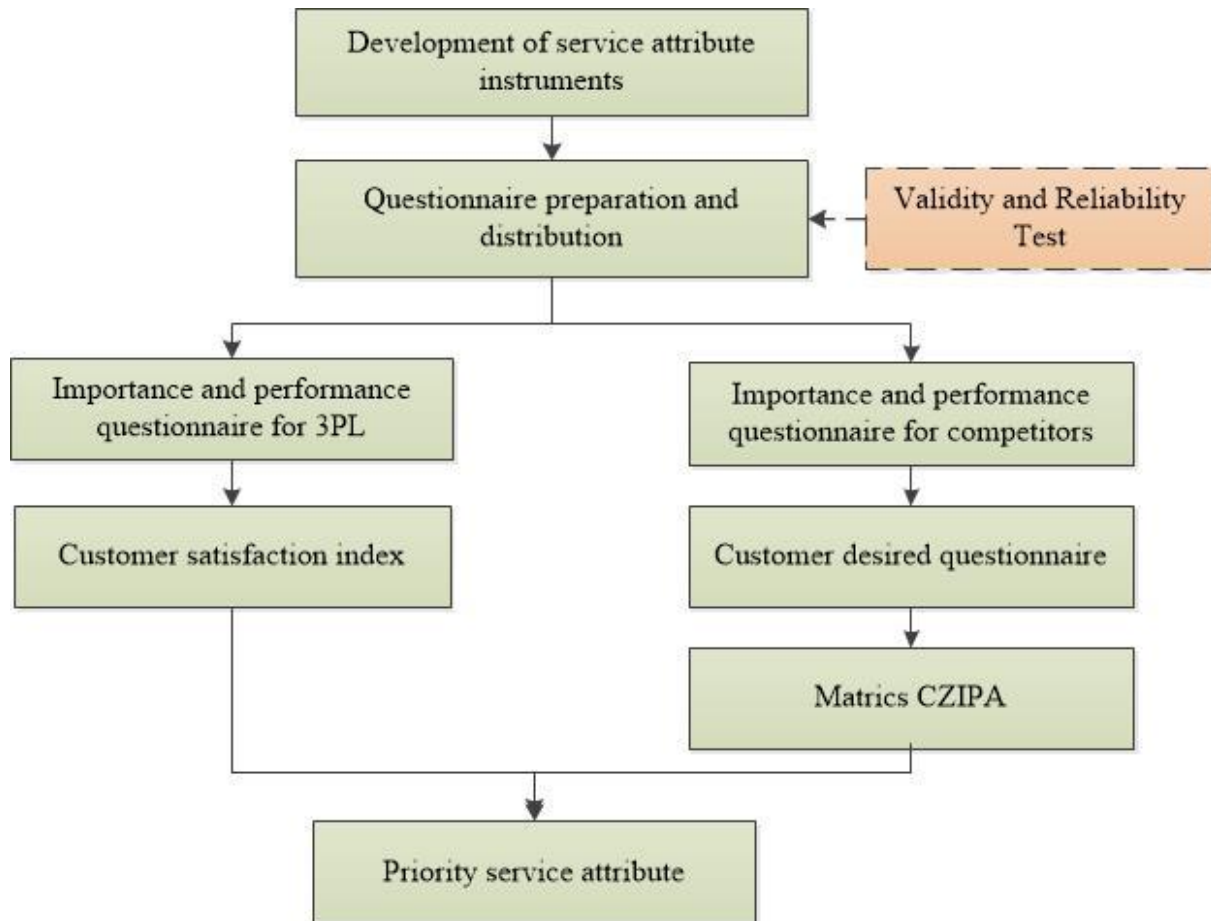


Fig. 1. CSI and CZIPA Integration Framework

The following are some of the notations used in this study:

- n : Number of visitors
- y_i : Attribute importance value (y) the-i (th)
- n : Number of visitors
- x_i : Attribute performance value (x) the-i(th)
- WFi : Weight Factor the-i (th)
- WSi : Weight Score the-I (th)
- HS : Maximum scale used
- I_f : Importance of service attributes value for the company
- I_c : Importance of service attributes value to competitors'

- Pf : Service attribute performance value for the company
- Pc : Service attribute performance value for competitors
- FPS : Company performance value
- CPS : Competitor performance value
- FDS : Customer expectations value
- CPS : Competitor performance value

Table 1. Logistics service quality attributes

Dimension	Attributes	Items	References
Personal Contact Quality	PQ1	Customer Service tries to understand the problems experienced by customers	[13] [22]
	PQ2	Customer Service solves problems experienced by customers	
	PQ3	Staff provide answers or respond to problems in delivery	
Information Quality	IQ1	Availability of information related to available services	[10]
	IQ2	Delivery services provide actual information regarding shipments	
Ordering Procedures	OP1	Delivery services provide facilities for taking goods to the customer	[7]
	OP2	Ease of procedure in ordering services	
Order Accuracy	OA1	Delivery rarely contains the wrong item	[22]
	OA2	Delivery rarely contains the wrong quantity	
Order Condition	OC1	The package is not damaged	[23]
	OC2	Package damage due to delivery often occurs	
Order Quality	OQ1	The replacement item that is sent worked fine	[7]
	OQ2	Equipment and spare parts are rarely incompatible	
Order Discrepancy Handling	OD1	The quality mismatch correction delivered is satisfactory	[8] [24]
	OD2	The non-conformance process report is sufficient	
	OD3	Responses to reports of quality discrepancies are satisfactory	
Timeliness	TI1	The time between placing a requisition and accepting a shipment is short	[25] [26]
	TI2	Delivery arrived on the date promised	
	TI3	The amount of time it takes to generate a returned requisition is concise	

Stage 3 was the measurement of customer perceptions using the CSI method. The first step was to calculate the Mean Importance Score (MIS) and Mean Satisfaction Score (MSS). MIS was the average importance which can be seen in equation (1). MSS was the average performance which can be seen in equation (2). For the next stage, calculating the factor weight and weight score with equations (3) and (4). The final stage in measuring customer perceptions was calculating the customer satisfaction index using equation (5).

$$MIS = \frac{\sum_{i=1}^n y_i}{n} \quad (1)$$

$$MSS = \frac{\sum_{i=1}^n x_i}{n} \quad (2)$$

$$WF = \frac{MIS_i}{\sum_{i=1}^p MIS_i} \times 100\% \quad (3)$$

$$WS_i = WF_i \times MSS \quad (4)$$

$$CSI = \frac{\sum_{i=1}^p WS_i}{HS} \times 100\% \quad (5)$$

After measuring customer perceptions of 3PL service users, stage 4 was mapping the 3PL service attribute performance using the CZIPA method. This mapping aimed to determine the service attributes that were prioritized for improvement. The first step was to calculate Difference in Importance (DI) and Difference in Performance (DP). DI is the gap between the value of interest for 3PL and the value of interest for competitors. DP is the gap between the performance scores for the 3PL and the performance scores for competitors. To find the DI and DP values, it can be seen in equation (6).

$$DI = I_f - I_c \quad (6)$$

$$DP = P_f - P_c \quad (7)$$

The CZIPA method considered competitor performance factors as the minimum service threshold. Therefore, the next stage was to make the difference in performance value as a Competitive Service Adequacy (CSA). CSA is defined as the adequacy of competitive services. The CSA formula can be seen in equation (8). The next step was to calculate the Competitive Zone of Tolerance (CZOT) value. The value of CZOT indicates the tolerance range provided by customers of 3PL service users on the performance of service attributes. The CZOT formula can be seen in equation (9). After calculating the CZOT, the Competitive Service Quality Ratio (CZSQ) was determined. CZSQ value projects the position of the 3PL service attribute performance compared to competitors' service attribute performance. The value of the Competitive Service Quality Ratio can be seen by doing equation (10).

$$CSA = FPS - CPS \quad (8)$$

$$CZOT = FDS - CPS \quad (9)$$

$$CZSQ = \frac{CSA}{CZOT} \tag{10}$$

In the last stage, mapping was carried out with the CZIPA matrix to determine the position of the performance attributes of the 3PL service providers. The CZIPA matrix has four quadrants as in the method Importance Performance Analysis (IPA). Quadrant A shows attributes that have a high importance score but have low performance. The service attributes in this quadrant have a high priority for improvement. Quadrant B indicates service attributes that are considered both by customers and customers feel happy. Service attributes that are in this quadrant need to be maintained. Quadrant C pinpoints service attributes with low performance and importance values. Attributes in quadrant D have good performance scores but low importance values. Furthermore, the CZIPA matrix can be seen in Fig. 2.

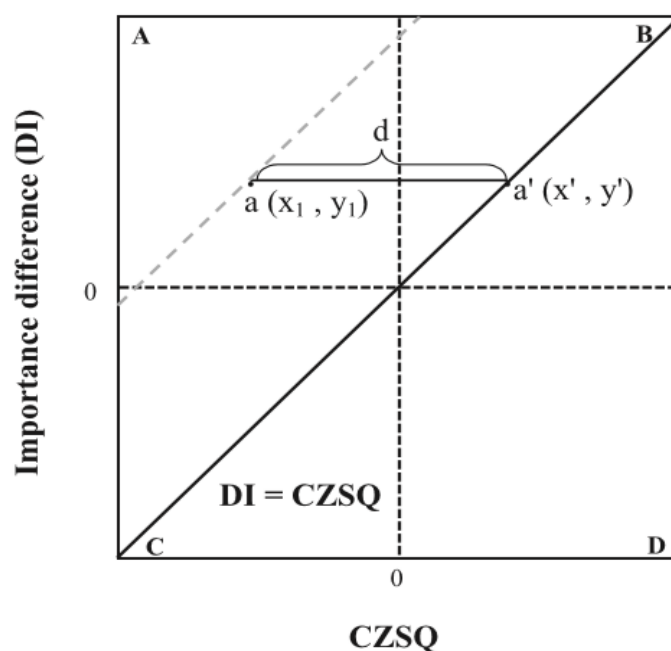


Fig. 2. CZIPA Matrix

2.2 Data collection and case study

The important thing in determining priority attributes for improvement is to consider competitor performance factors [27]. The object of this research was a 3PL service provider. The research period ran from July - October 2020. The sampling technique used was non-probability sampling. Questionnaires were distributed to 120 respondents. This study implemented the dimensions and attributes of logistic service quality, which are presented in Table 1.

Table 2 projects the demographics of the study respondents. The majority of respondents were female (54.17%) than male (45.83%). Based on age, the majority of respondents were 20-25 years old (51.67%). Most of the service users were students (80.83%).

3. Results and Discussion

This section describes the results of measuring customer perceptions, mapping the position of service performance compared to competitors, and prioritizing attributes for improvement. This paper presents the integration of CSI and CZIPA methods to solve logistics services' quality. The mapping of service positions compared to competitors was made with the help of SPSS 21. The CZIPA map showed the position of service performance on service attributes in each quadrant.

Table 3, Table 4, and Table 5 present a recapitulation of the validity test results. The overall attributes of importance level, 3PL performance, competitor importance level, competitor performance, and customer expectations had correlation values > 0.179 (r table). Furthermore, Table 6 portrays the recapitulation of the reliability test results. The overall data had Cronbach's Alpha values > 0.6 . Therefore, the overall data was said to be reliable. These results prove that the instruments used were valid and reliable and could be used for the next stage.

Table 2. Respondents Demography

Variables	Factors	Respondents	Percentages (%)
Gender	Male	55	45.83
	Female	65	54.17
Age	20 – 25 years old	62	51.67
	26 – 30 years old	43	35.83
	31 – 35 years old	9	7.50
	>35 years old	6	5.00
Occupation	Students	97	80.83
	Workers	23	19.17

Table 3. 3PL Validity Test

Attributes	Importance correlation (r)	Performance correlation (r)	r table	Decision
PQ1	0.323	0.304	0.179	Valid
PQ2	0.412	0.408	0.179	Valid
PQ3	0.455	0.413	0.179	Valid
IQ1	0.318	0.374	0.179	Valid
IQ2	0.401	0.416	0.179	Valid
OP1	0.336	0.316	0.179	Valid
OP2	0.439	0.428	0.179	Valid
OA1	0.440	0.384	0.179	Valid
OA2	0.313	0.451	0.179	Valid
OC1	0.377	0.301	0.179	Valid
OC2	0.394	0.410	0.179	Valid
OQ1	0.364	0.388	0.179	Valid
OQ2	0.343	0.319	0.179	Valid
OD1	0.401	0.408	0.179	Valid
OD2	0.457	0.398	0.179	Valid
OD3	0.392	0.371	0.179	Valid
TI1	0.305	0.428	0.179	Valid
TI2	0.412	0.440	0.179	Valid
TI3	0.361	0.382	0.179	Valid



Table 4. Competitor Validity Test

Attributes	Importance correlation (r)	Performance correlation (r)	r table	Decision
PQ1	0.384	0.340	0.179	Valid
PQ2	0.471	0.454	0.179	Valid
PQ3	0.490	0.434	0.179	Valid
IQ1	0.344	0.398	0.179	Valid
IQ2	0.426	0.403	0.179	Valid
OP1	0.382	0.307	0.179	Valid
OP2	0.455	0.466	0.179	Valid
OA1	0.411	0.331	0.179	Valid
OA2	0.341	0.464	0.179	Valid
OC1	0.307	0.310	0.179	Valid
OC2	0.312	0.409	0.179	Valid
OQ1	0.359	0.358	0.179	Valid
OQ2	0.334	0.388	0.179	Valid
OD1	0.420	0.437	0.179	Valid
OD2	0.472	0.392	0.179	Valid
OD3	0.405	0.342	0.179	Valid
Tl1	0.389	0.464	0.179	Valid
Tl2	0.457	0.451	0.179	Valid
Tl3	0.359	0.389	0.179	Valid

Table 5. Validity Test of Customer Expectations

Attributes	correlation (r)	r table	Decision
PQ1	0.397	0.179	Valid
PQ2	0.453	0.179	Valid
PQ3	0.461	0.179	Valid
IQ1	0.387	0.179	Valid
IQ2	0.411	0.179	Valid
OP1	0.394	0.179	Valid
OP2	0.429	0.179	Valid
OA1	0.448	0.179	Valid
OA2	0.403	0.179	Valid
OC1	0.491	0.179	Valid
OC2	0.353	0.179	Valid
OQ1	0.462	0.179	Valid
OQ2	0.390	0.179	Valid
OD1	0.385	0.179	Valid
OD2	0.455	0.179	Valid
OD3	0.418	0.179	Valid
Tl1	0.383	0.179	Valid
Tl2	0.406	0.179	Valid
Tl3	0.427	0.179	Valid

Table 6. Reliability Test

Reliability Test	Cronbach's Alpha	Value limit	Decision
3PL Importance	0.68	0.6	Reliable
3PL Performance	0.72	0.6	Reliable
Competitor Importance	0.74	0.6	Reliable
Competitor Performance	0.65	0.6	Reliable
Customer Expectations	0.67	0.6	Reliable

3.2 Measuring customer perceptions with CSI

The results of measuring customer perceptions of 3PL service performance are presented in Table 7. Based on the calculation results, several findings were highlighted: the higher the MIS value indicated that the customer felt that the service attribute was considered very important to be given. Conversely, the lower the MIS value indicated that the service attribute was less important to provide. The lower the MSS value suggested that the customer perception of service attributes was bad. Conversely, the higher the MSS value resulted the customer's perception of the service attribute was satisfactory. From the calculation results, the 3PL customer satisfaction index was 64.86%.

Table 7. Customer Satisfaction Index

Attributes	MIS	MSS	WF	WS	WT	CSI
PQ1	3.44	3.77	5.42	20.42	324.28	64.86
PQ2	3.46	2.63	5.45	14.30		
PQ3	3.53	2.53	5.55	14.06		
IQ1	3.05	4.30	4.80	20.66		
IQ2	3.62	2.74	5.70	15.62		
OP1	3.01	4.27	4.74	20.22		
OP2	3.36	2.71	5.29	14.33		
OA1	3.83	2.44	6.02	14.71		
OA2	3.13	4.42	4.92	21.74		
OC1	3.15	2.70	4.96	13.40		
OC2	3.73	2.41	5.87	14.13		
OQ1	3.02	4.26	4.75	20.23		
OQ2	3.34	3.68	5.26	19.39		
OD1	3.09	2.70	4.87	13.15		
OD2	3.52	3.45	5.54	19.11		
OD3	3.20	2.90	5.04	14.62		
Tl1	3.45	3.83	5.43	20.78		
Tl2	3.30	2.98	5.20	15.46		
Tl3	3.29	3.47	5.18	17.97		

3.3 Mapping attributes with CZIPA

From the measurement results of customer satisfaction on current service performance, it was shown that it was necessary to make improvements to service attributes to increase customer satisfaction. Benchmarking the performance of service attributes on competitors' service attributes' performance was necessary to determine the current service performance position. It was carried out to determine the priority for



improvement of service attributes. Based on Table 8, several interesting findings were known. Among others, the greater the value of DI indicated that the attribute was considered very important to be provided by the service provider. There were a total of 11 attributes that were considered vital by customers. Then, the smaller the DP value suggested that the service attribute performance was worse than the competitors. In total, there were ten service attributes that customers rated poorly.

The CSA score showed the adequacy of competitive services. It was also found that the greater the CZOT value, the greater the tolerance range provided by the customer to the service attribute performance. CZSQ scores were divided into three categories. 4 service attributes were included in the first category with a CZSQ value of more than 1. This result showed that 3PL service performance was above competitors' service performance. CZSQ values between 0 and 1 suggested that service performance was at the same level as competitors or even better. Ten service attributes had CZSQ values of less than 0, which indicated that the 3PL service attribute performance was worse than its competitors' service performance. Attributes that fall into this category included "Customer Service in solving problems experienced by customers (PQ2)", "Staff providing answers or responding to problems in delivery (PQ3)", "Delivery services provide actual information related to shipments (IQ2)", "Ease of procedure in ordering service (OP2)", "Delivery rarely contains the wrong items (OA1)", "Packages are not damaged (OC1)", "Package damages due to frequent delivery (OC2)", "Correction of quality mismatches delivered satisfactory (OD1)", "Response to report of satisfactory quality difference (OD3)" and "Delivery arrives on the promised date (Tl2)". Service attributes with the smallest d value were prioritized for repair. Nine attributes had a negative d value, namely PQ2, PQ3, IQ2, OP2, OA1, OC1, OC2, OD1, and Tl2.

Table 8. Competitive Zone of Tolerance Based on Importance Performance Analysis

Attributes	DI	DP	CSA	CZOT	CZSQ	d
PQ1	0.20	0.73	0.73	1.05	0.70	0.50
PQ2	0.35	-0.82	-0.82	0.70	-1.17	-1.52
PQ3	0.32	-0.92	-0.92	0.73	-1.26	-1.58
IQ1	-0.10	1.65	1.65	1.53	1.08	1.18
IQ2	0.48	-0.66	-0.66	0.65	-1.01	-1.50
OP1	-0.14	1.83	1.83	1.61	1.13	1.28
OP2	0.13	-0.73	-0.73	0.65	-1.13	-1.25
OA1	0.55	-1.20	-1.20	0.65	-1.85	-2.40
OA2	-0.08	1.89	1.89	1.58	1.19	1.28
OC1	-0.04	-0.53	-0.53	0.97	-0.54	-0.50
OC2	0.51	-1.16	-1.16	0.70	-1.65	-2.16
OQ1	-0.17	1.75	1.75	1.48	1.18	1.35
OQ2	0.13	0.74	0.74	1.15	0.64	0.52
OD1	-0.10	-0.44	-0.44	1.07	-0.41	-0.31
OD2	0.28	0.48	0.48	1.18	0.41	0.13
OD3	-0.20	-0.13	-0.13	1.18	-0.11	0.09
Tl1	0.11	0.73	0.73	1.00	0.73	0.62
Tl2	-0.02	-0.17	-0.17	0.90	-0.19	-0.17
Tl3	0.09	0.36	0.36	1.15	0.31	0.22

The determination of priority attributes was based on three criteria: the location of the attributes in the quadrant, the value of CZSQ, and the d value. The competitive zone of tolerance matrix based on importance-performance analysis (CZIPA) showed which attributes should be prioritized for improvement. Attributes that prioritized improvement had a negative competitive service quality ratio (CZSQ) value had a negative d value and were in quadrant A. As seen in Fig. 3, there were six (6) attributes that received priority for improvement. The attributes were then sorted based on the lowest d value. So the order was "Delivery rarely contains the wrong items (OA1)", "Package damages due to frequent delivery (OC2)", "Staff provides answers or responds to problems in delivery (PQ3)", "Customer Service solves problems experienced by the customer (PQ2)", "Delivery service provides actual information related to shipments (IQ2)", "Ease of procedures in service ordering (OP2)".

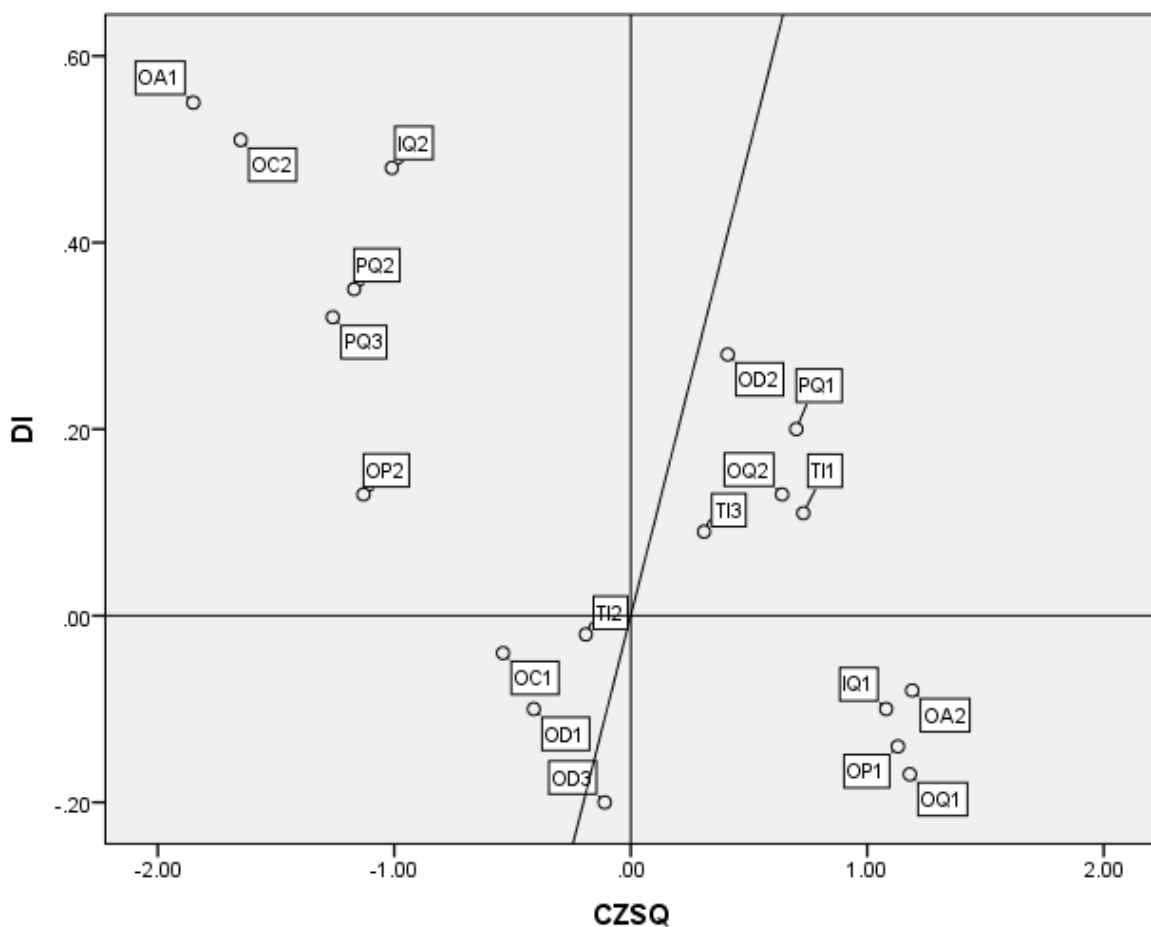


Fig. 3. CZIPA Matrix of 3PL

4. Conclusion

This study was intended to measure customer perceptions of the quality of logistics services. This study has successfully proposed a framework for measuring customer perceptions and mapping attributes. The results showed that the customer satisfaction

index for the 3PL service was not satisfactory. The value suggested the need for efforts to improve service quality. Efforts to improve service quality should be prioritized for attributes that received priority improvements. The results showed that integrating the CSI and CZIPA methods could measure customer perceptions of 3PL service users and determine priority attributes to be improved by considering competitors' performance. Suggestion for further research is to determine more specific competitors to improve the accuracy of the research results.

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