

## THE ANALYSIS OF CRITICAL INCIDENTS OF LOGISTICS SERVICE BY CRITICAL INCIDENT TECHNIQUE

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### Abstract

Critical Incident Technique (CIT) enables the detection of events and behavior which constitute the basis for customer satisfaction and dissatisfaction with logistics service and, simultaneously, the isolation of the key elements of this service. In the paper there are presented the results of the classification of critical incidents through the application of Critical Incident Technique with reference to the logistics service of the customers of the surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship.

**Keywords:** Critical Incident Technique, logistics service, statistical analysis

### 1. INTRODUCTION

The isolation of the main elements of logistics service, among others, postulated by Kempny [1], Kisperska-Moroń, Krzyżaniak [2], Lambert, Stock, Elram [3], Melovic, Mitrovic, Djokaj, Vatin [4], should consist in:

- Establishing the most important purchase decisions and selections made by customers.
- Conducting interviews with customers to specify the significance of the service itself and its individual elements.
- Carrying out group interviews for the same purpose.

One of the research methods in the area of management, enabling the fulfillment of the above tasks, is Critical Incident Technique, CIT, also specified as the technique of critical cases. The creator of this method or the technique was Flanagan [5], an English psychologist who developed it for the research conducted among the armed forces during the Second World War and then applied in industrial establishments.

Critical Incident Technique is the technique of classification based on the analysis of descriptions of critical incidents. It consists of strictly defined procedures of the observation of human behavior and its classification to make it useful while defining the occurring practical problems of the functioning of the company [6].

At the level of data analysis in the procedure, CIT uses the technique of direct interview with customers. Through the interview and observation, the CIT analysis records the events and behavior which have been observed as success or failure in achieving a particular objective. The analyzed relationships are classified in the appropriate pattern, allowing to detect problems and the reasons for them.

The advantage of this method is enabling the detection of events and behavior which constitute the basis for customer satisfaction and dissatisfaction with the service and, simultaneously, the isolation of its key elements. One of the methods of verifying these achievements is conducting the statistical analysis of the data of critical incidents. The aim of the paper is to present the results of classification of critical incidents through the application of Critical Incident Technique, with reference to logistics service of the customers of the surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship [7], and to conduct the statistical analysis of these critical incidents.

### 2. METHODOLOGICAL BASES

At the level of data collection under the procedure of CIT, there was used the technique of telephone and direct interview with the customers of the surveyed cargo motor transport companies. Through the interview and

observation there were obtained descriptions of events and behavior which, at the level of the data analysis under the procedure of CIT, were identified as critical events or incidents. The events and behavior, which were observed as success or failure of logistics service from the perspective of the customers of the surveyed entities, subsequently, were classified in the pattern allowing for the identification of individual elements of this service and, consequently, the detection of problems of logistics service and the reasons for them.

The questionnaire used in the research included open questions allowing for obtaining free opinions of the respondents providing accurate and consistent interpretation and assessment of incidents. The questions referred to the experiences of the respondents in contacts with the surveyed companies in the field of logistics service satisfying or dissatisfying them, the conditions accompanying the assessment of the provided logistics service and the reasons for satisfaction or dissatisfaction with the offer of transport companies.

There were conducted interviews with 294 customers of 147 surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship, i.e. with two customers of each company. The technique of direct interview was applied to 38 respondents, indicated as the customers of 19 companies. On the other hand, the clients of the remaining 128 surveyed companies were interviewed via the telephone interview. All the obtained responses were accurately written down and personal interviews were additionally recorded.

In the survey conducted with the application of the above mentioned questionnaire, there have been taken into account only the events or behavior which were remembered by the customers of the companies as particularly satisfactory or unsatisfactory. The incident was subjected to the analysis if it fulfilled the following criteria:

1. There was interaction between the customer and the surveyed cargo motor transport company for hire or reward of the Silesian Voivodeship.
2. The incident was particularly satisfactory or unsatisfactory from the point of view of the customer.
3. The incident was an individual episode.
4. The incident was so detailed that it could be imagined by the interviewer that i.e. bearing details (date, name of the company), so they could be visualized by the respondent.

The above criteria were fulfilled in 624 responses of the respondents out of which 138 were found insufficiently clear and accurate. Consequently, the analysis was carried out with reference to 486 responses out of which there were isolated 992 individual incidents.

The size of the sample was determined by the guidelines of Flanagan [5], according to which adequate relationship will be achieved if the addition of 100 critical events to the sample brings about the addition of only two or three critical incidents. This method of assessment of the sample size required data collection and analysis in two stages. In the first classification stage there were collected and classified 300 responses of the respondents whereas in the second verifying stage there were collected and classified 186 responses. With the total of 486 responses, there were selected 992 individual critical incidents. Another step of the analysis of the obtained critical incidents was the division of all 922 incidents into categories. Firstly, the responses of the respondents numbered 1-300, including 680 critical incidents, were developed by means of their division into 22 categories. The verifying test, including 312 critical incidents, after a thorough analysis, did not identify any new categories. The obtained results of the classification of critical incidents, occurring in the logistics service of the customers of the surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship are presented below.

### **3. RESULTS AND DISCUSSION**

The results of the classification of all 992 critical incidents, isolated from the respondents' responses to the questions in the questionnaire, allowed to establish 22 categories along with their division into 5 thematic groups. The categories identify the elements of logistics service of the surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship which, in the opinion of the customers, determined the satisfaction of their expectations and requirements, mainly referring to time, reliability, communication and

comfort, using all available forms of logistics activity [8]. The most important classified categories of logistics service were the determinants of availability and quality of services, infrastructure, fleet, after-sales service and logistics consulting, provided to customers by the surveyed business units [9].

The conducting of the subsequent stage of the analysis of the isolated critical incidents was possible due to their segregation into satisfactory and unsatisfactory ones, from the perspective of the customers of the surveyed cargo motor transport companies of the Silesian Voivodeship. The results of the study of the customers' satisfaction with logistics service provided by the analyzed entities, conducted with the application of the CIT method, are presented in **Table 1**.

**Table 1** Classification of critical incidents of logistics service into satisfactory and unsatisfactory for the customers of the surveyed cargo motor transport companies of the Silesian Voivodeship

Group and category of the incident	Type of the result of the incident					
	satisfactory		unsatisfactory		cumulative responses	
	number of incidents	% of incidents	number of incidents	% of incidents	number of incidents	% of incidents
<b>GROUP I. SERVICES</b>						
1. Inquiry response time	16	3.06	18	3.84	34	3.43
2. Availability of services	35	6.69	32	6.82	67	6.75
3. Timeliness of services	41	7.84	54	11.51	95	9.58
4. Accuracy of services	39	7.46	58	12.37	97	9.78
5. Completeness of services	45	8.60	41	8.74	86	8.67
6. Rapidity of order fulfillment	42	8.03	32	6.82	74	7.46
7. Complexity of services	8	1.53	12	2.56	20	2.02
8. Geographical coverage of services	6	1.15	6	1.28	12	1.21
<b>Total for group I.</b>	<b>232</b>	<b>44.36</b>	<b>253</b>	<b>53.94</b>	<b>485</b>	<b>48.9</b>
<b>GROUP II. INFRASTRUCTURE</b>						
9. Terminal security	40	7.65	25	5.33	65	6.55
10. Location	8	1.53	3	0.64	11	1.11
11. Equipment	16	3.06	6	1.28	22	2.22
12. Computerization	19	3.63	18	3.84	37	3.73
13. Compliance with environmental requirements	6	1.15	2	0.43	8	0.81
<b>Total for group II.</b>	<b>89</b>	<b>17.02</b>	<b>54</b>	<b>11.52</b>	<b>143</b>	<b>14.42</b>
<b>GRUPA III. FLEET</b>						
14. Technological advancement of the fleet	30	5.73	40	8.53	70	7.06
15. Fleet age	21	4.02	29	6.18	50	5.04
16. Compliance with environmental requirements	8	1.53	2	0.43	10	1.01
<b>Total for group III.</b>	<b>59</b>	<b>11.28</b>	<b>71</b>	<b>15.14</b>	<b>130</b>	<b>13.11</b>
<b>GROUP IV. POST-SALES SERVICE</b>						
17. Claims and complaints	20	3.82	25	5.33	45	4.54
18. Monitoring of services	9	1.72	2	0.43	11	1.10
19. 24-hour service	3	0.58	1	0.21	4	0.40
<b>Total for group IV.</b>	<b>32</b>	<b>6.12</b>	<b>28</b>	<b>5.97</b>	<b>60</b>	<b>6.04</b>
<b>GROUP V. LOGISTICS CONSULTING</b>						
20. Competences and experience	29	5.54	2	0.43	31	3.12
21. Flexibility	41	7.84	53	11.30	94	9.47
22. Credibility	41	7.84	8	1.70	49	4.94
<b>Total for group V.</b>	<b>111</b>	<b>21.22</b>	<b>63</b>	<b>13.43</b>	<b>174</b>	<b>17.53</b>
<b>Grand Total</b>	<b>523</b>	<b>100</b>	<b>469</b>	<b>100</b>	<b>992</b>	<b>100</b>

In accordance with the indications in **Table 1**, all critical incidents, categorized into 22 elements of logistics service and grouped into 5 thematic groups, result from satisfactory and unsatisfactory experiences of the customers with logistics service provided by the surveyed cargo motor transport companies of the Silesian Voivodeship. The results of the division of the incidents clearly indicate similar reasons for satisfaction and dissatisfaction of the customers with logistics service. The frequency of feeling satisfaction or its lack by the customers is the variable.

The above relationships are confirmed by the statistical analysis of the data presented in Table 1. An attempt to study the relationships in terms of five thematic groups separately has been made using the formulas [10]:

**1)  $\chi^2$  test of independence:**

$$\chi^2 = \sum_{i=1}^r \frac{(n_i - np_i)^2}{np_i} \quad (1)$$

where:

$\chi^2$  - chi-squared dependence coefficient

$r$  - number of class intervals

$n$  - sample size

$p$  - probability that the attribute adopts the value belonging to the  $i$ th class interval

$np$  - the number of units that should be included in the  $i$ th class interval, with the assumption that the attribute has a distribution compliant with the hypothesis

The results of the measurement of the test of independence for five thematic groups separately, obtained after the application of the above formula, are the following:

- For Group I. Services:  $\chi^2 = 7.194$ .
- For Group II. Infrastructure:  $\chi^2 = 3.979$ .
- For Group III. Fleet:  $\chi^2 = 5.246$ .
- For Group IV. Post-sales service:  $\chi^2 = 5.769$ .
- For Group V. Logistics consulting:  $\chi^2 = 36.834$ .
- Totally for Groups I - V:  $\chi^2 = 21.215$ .

**2)  $\chi^2$  with Yates correction :**

$$\chi^2 = \frac{(|ad - bc| - \frac{n}{2})^2 n}{(a + b)(c + d)(a + c)(b + d)} \quad (2)$$

where:

$a, b, c, d$  - values corresponding to the frequency of individual fields of the four-fold table

The results of the measurement of  $\chi^2$  with Yates correction, after the application of the above formula, have been obtained for thematic groups III., IV. and V., and they are the following:

- For Group III. Fleet:  $\chi^2$  with Yates correction = 3.746.
- For Group IV. Post-sales service:  $\chi^2$  with Yates correction = 3.762.
- For Group V. Logistics consulting:  $\chi^2$  with Yates correction = 33.880.

**3)  $\varphi$ -Yule coefficient:**

$$\varphi = \sqrt{\frac{\chi^2}{n}} \quad (3)$$

where:

$\varphi$  - Yule coefficient

The results of the measurement of  $\varphi$ -Yule coefficient for five thematic groups separately, obtained after the application of the above formula, are the following:

- For Group I. Services:  $\varphi$ -Yule = 0.122.
- For Group II. Infrastructure:  $\varphi$ -Yule = 0.167.
- For Group III. Fleet:  $\varphi$ -Yule = 0.170.
- For Group IV. Post-sales service:  $\varphi$ -Yule = 0.250.
- For Group V. Logistics consulting:  $\varphi$ -Yule = 0.441.

- Totally for Groups I - V:  $\phi$ -Yule = 0.146.

#### 4) Czuprow's convergence coefficient:

$$T = \sqrt{\frac{\chi^2}{n\sqrt{(r-1)(s-1)}}} \quad (4)$$

where:

$T$  - Czuprow's convergence coefficient

$r$  - number of rows

$s$  - number of columns

The results of the measurements of Czuprow's convergence coefficient for five thematic groups separately, obtained after the application of the above formula, are the following:

- For Group I. Services: T-Czuprow = 0.075.
- For Group II. Infrastructure: T-Czuprow = 0.118.
- For Group III. Fleet: T-Czuprow = 0.143.
- For Group IV. Post-sales service: T-Czuprow = 0.211.
- For Group V. Logistics consulting: T-Czuprow = 0.371.
- Totally for Groups I - V: T-Czuprow = 0.103.

## 4. CONCLUSIONS

The obtained results discussed above confirm the existence of the statistical relationship between the analyzed variables. In the case of using arrays (mainly association arrays), with the expected frequencies less than 5 or  $20 < N < 40$ , for  $\chi^2$ , there was applied Yate's correction [7]. Due to an increase in the frequency in individual cells, resulting from aggregation of data, there was indicated a general trend/relationship between the examined categories. As a whole, the relationship was found statistically significant with moderate strength. In the case of the data disaggregated to the level of specific groups, only in the case of incidents in the field of logistics consulting, there was confirmed statistically significant relationship, with satisfaction as the result of the incident. Therefore, the conducted statistical analysis of critical incidents of logistics service in the surveyed cargo motor transport companies for hire or reward of the Silesian Voivodeship, isolated through the application of Critical Incident Technique, confirmed the regularity of the previously assumed dependencies.

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