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**Article**

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# MATHEMATICAL MODEL FOR DETERMINING COSTS OF UNSATISFIED CUSTOMERS OF HoReCa INDUSTRY

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## Abstract

Customer relationship management (CRM) plays an important role in ensuring the success of companies. Attracting and retaining valuable, satisfied, and loyal customers are important goals of CRM. The aim of the paper is to highlight the crucial role of the relationship between companies and their satisfied customers in achieving long-term performance. Using mathematical, relational, and accounting models, companies could answer the question posed by the research: "How do we reduce the costs of unsatisfied customers and how do we improve the relationship with customers?". The research results show that by implementing these models, only 2 out of 10 restaurants have positive Net Promoter Score (NPS) and Customer Satisfaction Index (CSI), the costs related to unsatisfied customers being high for all other restaurants. The research results show the number of dissatisfied customers and a plan to turn them into satisfied customers and achieve superior performance. By knowing these issues in advance, companies can improve these relationships, increasing customer satisfaction and loyalty and thus improving their economic performance.

**Keywords:** Customer Relationship Management (CRM), Net Promoter Score (NPS), Customer Satisfaction Index (CSI), satisfied and loyal customers, costs related to dissatisfied customers, HoReCa (hotel, restaurant, and cafe industry)

**JEL Classification:** C40, C55, M31

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## Introduction

The COVID-19 crisis affected all economic activities and processes, including the relationship of organizations with customers, who changed their buying habits, frequency of purchases, visiting times of stores, but also products and favorite brands. It is found that during this period there is an increasingly intense trend of using online retail, parcel deliveries of purchases experiencing a strong increase. Aware of the danger of a considerable decrease in the number of customers, due to the restrictions imposed by the pandemic, organizations sought to maintain their relationship with existing customers, but also to identify new target segments, respectively to adapt to their needs and preferences (Vătămănescu et al., 2021). In this regard, organizations have resorted to strict monitoring of existing problems or risks, of costs, conducting complex analysis of communication between the company and customers, but also monitoring through communication technologies the number of orders and electronic payments over time, acting on consumers through e-commerce tools, e-mail, websites, etc. Of course, companies have sought in this time to increase their own organizational performance, using simulations and modeling, implementing telework or offering the possibility of flexible working time and time of day when employees assume the tasks and responsibilities received (Nemțeanu et al., 2021).

Mathematical modeling and simulation are important in various fields, including CRM. Predicting the evolution of the number of customers using Big Data is one of the emerging areas that have received much attention (Javaid et al., 2020). The two-way relationship between the company and its customers is important, because the parties involved offer and receive benefits simultaneously: customers gain utility, value, trust, reliability, personalization, quality, involvement, meeting social, psychological and/or economic needs, while companies earn value, profit, competitive advantage, information and databases, performance, success, image (Shaw, 2001; Payne and Frow, 2005; Knox et al., 2007; Jha, 2008; Vogt, 2009; Heyn, 2012; Varajao et al., 2013; Perna and Baraldi, 2014; Buttle and Maklan, 2015; Shabdar, 2017).

In order to achieve success in the long run, any company aims not only to increase the number of customers, but especially to increase their satisfaction, because unsatisfied customers act as a barometer in determining the performance of a business, but also an opportunity to turn them into satisfied customers. Knowing in advance the negative opinions and/or reasons why customers are dissatisfied can reduce the gap between them and those who are satisfied. In this sense, it will be used to determine specific indicators, such as NPS (Net Promoter Score), CSI (Customer Satisfaction Index), the 3/10 of CRM principle, application of modeling using mathematical integrals, etc. In order to determine the costs of dissatisfied customers, indicators such as NPS and CSI were determined. The novelty and originality of the research consists in determining the number of dissatisfied customers and transforming them into satisfied customers using the 3/10 principle in the field of CRM and mathematical calculations. The novelty of this study lies in the mathematical calculations that allow finding out in advance the possible future problems related to the costs of poor customer relations and the costs associated with dissatisfied customers. The usefulness of the research results from the importance for any company that wants to reduce its costs, especially when the relationship with customers represents the future of performance for both parties.

In order to implement the research goal, a selection of ten restaurants was used, and the criteria used in choosing the analyzed restaurants were (Cant et al., 2006; Kotler, 2010;

Florea, 2014): i) geographical criteria (analyzed area – the most representative city of Dambovită county, were analyzed responses of customers who frequented restaurants in different areas of the city, of both sexes, in both areas (rural/urban); ii) behavioral criteria (restaurants with the highest flow of customers were chosen, with different loyalties and different degrees of satisfaction); iii) psychographic criteria (with different personal values and opinions, different personalities). In total, 150 respondents were approached, and it was found that only 2 of the 10 analyzed restaurants have a positive Net Promoter Score (NPS) and a Customer Satisfaction Index (CSI), the costs related to dissatisfied customers being high for all other restaurants. By determining the number of dissatisfied customers, we managed to determine a plan necessary to turn them into satisfied customers and achieve superior performance.

The paper is structured as follows: The first section contains an analysis of the literature on management of relationship between the company and its customers, analyzing behavioral vectors such as satisfaction/dissatisfaction or loyalty, while the second section begins by presenting the purpose and objectives of research, but also of NPS and CSI indicators. In the third part, the data and results obtained from the application of NPS, CSI, the specific CRM principle 3/10, the mathematical integral and the determination of the cost of dissatisfied customers are presented. In the proposals and discussions some improvement measures are developed for the analyzed companies that obtained low values for the calculated indicators, measures resulting from the discussions with the surveyed clients. In the discussions, a parallel is made with the existing studies in the field and the originality and novelty of the study are highlighted. Finally, the conclusions of the study are presented, which consist in determining the theoretical implications, the managerial implications and the limits of the study and the future research directions are determined.

## **1. Management of the relationship between the company and customers**

Customer relationship management (CRM) has become a critical research topic for researchers and practitioners (Liu et al., 2020). CRM is a multi-faceted process activated by new technologies, which addresses the consumer with multiple needs (Saint Clair and Forehand, 2020), respectively who buys a wide range of items due to marketing tactics used by companies (Sokolova and Li, 2021). Customer relationship management processes and systems are increasingly used, being crucial in managing contemporary business challenges (Capuano et al., 2021). In fact, CRM must be properly understood and used appropriately at the level of corporate governance. CRM is based on innovative data management technologies on them, which aim to improve customer satisfaction, loyalty and profitability through effective relationships developed over time by an organization with them (Bashar et al., 2020).

Social media has brought important changes in CRM, literature (Marolt et al., 2020) considering e-CRM as the strategy through which the company's objectives align with the interests, preferences and expectations of internal customers, employees, but also those of external customers, i.e. consumers. Thus, e-CRM is based on different stages of development, namely: consumer-brand matching (Gilal et al., 2021) based on facilities and passion; consumer-organization matching (Hu et al., 2021) which refers to the efficiency of the policies, actions and employees of the considered company; consumer – environment match through which environmental challenges and public health problems are managed (as the

COVID-19 pandemic could be considered) (Carnevale and Hatak, 2020), respectively digital consumer – digital marketing match by resorting to various new communication technologies for the procurement process (Reich and Pittman, 2020). No company can afford to make mistakes or waste resources; only by implementing an e-CRM program they can have better control over customer relations.

The use of Big Data systems in relation to customers will lead to increased sales (Hallikainen et al., 2020) and to the establishment of pricing strategies based on personalization/customization (Li et al., 2020). The smart IoT environment is accelerating changes in CRM (Yan et al., 2020), which is one of the fastest growing business solutions in recent years (Guerola-Navarro et al., 2020). Digitization reveals a great impact on industries and facilitates the development of new products, changing the rules of competition (Gellweiler and Krishnamurthi, 2020), but also traditions, respectively purchasing behaviors, which are mainly aimed at using artificial intelligence and/or robots in many fields of activity (Pelău et al., 2021). Modern commerce frequently uses customer attention when shopping online – through photos, images, audio-video files – using the principle of “seeing is like touching” (Jai et al., 2021). Consumer decisions occur in an interactive context of social relations facilitated by technology (Hamilton et al., 2020). The benefits of CRM are crucial for entrepreneurial success (Gil-Gomez et al., 2020), being supported by technologies and obtaining information about buyers (Itani et al., 2020).

Companies have as their main objective in addition to making a profit, maintaining and developing relationships with customers (Gibbs and Humphries, 2009). When customers enter into a relationship, they must obtain a representative added value for them, contentment, but also satisfaction. In this context, the definition of satisfaction is: if you get what you wanted, if your requirements are met, you are satisfied (Hill and Alexander, 2006). There is important evidence that customer satisfaction is a predictive indicator of companies' future financial performance (Bhattacharya et al., 2020). Satisfied customers are economically active, being prone to take risks more easily in terms of purchasing a new product from a company they know and with which they have a relationship based on trust. At the same time, these customers generate high returns for the companies with which they have developed relationships, always returning to it and buying back their products. On the other hand, dissatisfied customers bring risks to a company, which must reduce or even eliminate any risk or uncertainty that may arise from approaching them (Fornell et al., 2020). A very satisfied customer becomes very loyal to the company over time, reaching a loyalty that tends to the maximum, while a just satisfied one reaches an average loyalty, an unsatisfied one to a low loyalty, and the dissatisfied to the lack of loyalty (Hill and Alexander, 2006).

Customers prefer the purchases of a company's brands or products due to the motivations of i) hedonistic consumption consisting of feelings, beliefs, gender differences (Govind et al., 2020), age and human proximity (Wu et al., 2021), privacy issues (Okazaki et al., 2020), the secret of joy (Rodas and John, 2020), the experience of using luxury products (Wang et al., 2021); ii) rational consumption: based on low or free price in the mind of the consumer (Ku and Suk, 2020), cost, convenience or reliable online reviews (Lantzy et al., 2021); iii) consumption based on loyalty – personal: experience, preference, behavior and communication of the sales force (Packard and Berger, 2021), resilience and perseverance (Good et al., 2021), accessible spaces and attachment (Borghini et al., 2021) or the characteristic flavor of food (Hildebrand et al., 2020); iv) social consumption: brand standardization (Nath et al., 2020), global brands incorporating local cultural elements (Nie

and Wang, 2019), the influence of family, friends or experts, personalized advertising (Hess et al., 2020) and the language used to convey brand messages (Pezzuti et al., 2021).

In the 21<sup>st</sup> century, companies must offer a reasonable level of customer satisfaction and loyalty and challenge their desire to return constantly and continuously to the company's products/services, making them happy, helping them to make friends in difficult times for the company or causing them to recommend the company's products to others, to continue to buy the company's brands and/or products, even if it has increased the prices of the products or has not developed new variants of the existing ones (Hennig-Thurau and Hansen, 2013). Any company needs to be customer-centric in order to challenge the customer to buy, gain their trust, and increase their satisfaction (Hill and Alexander, 2006).

The goal of any manager is to reduce the number of unhappy, dissatisfied customers. Customer dissatisfaction has a greater short-term effect compared to customer satisfaction (Malshe et al., 2020). The dissatisfied customer determines costs for the company as follows: if he is dissatisfied with previous experience, he will make his next purchase or transaction elsewhere or file a complaint, which could cost the company an average of \$ 26.85 (Zairi, 1998). A single dissatisfied customer can damage the company's well-cultivated market image (Knox et al., 2007). A negative shopping experience could cause a rumor (Olson and Ahluwalia, 2021). Due to human psychology, a dissatisfied client is more likely to talk about this topic more often than a satisfied client. The loss of a customer is the loss of an opportunity for the company (Knox et al., 2007). Dissatisfied customers file complaints, but their number must be increased, because their ideas can be considered a "gift" for the company, being a way to improve the business (Reich and Pittman, 2020).

## 2. Research methodology

The purpose of this study is to determine the number of dissatisfied customers and transform them into satisfied customers, using the 3/10 principle in the field of CRM: a satisfied customer brings at least 3 more customers; a dissatisfied customer will talk about his negative experience to 10 other potential customers (Raab et al., 2008); a single dissatisfied customer could cancel the effect of 3 satisfied customers. Starting from this idea, the customers' existing on the NPS scheme were transferred to the loyalty scheme, subsequently determining the number of satisfied customers using the mathematical integral calculations. The gap between dissatisfied and satisfied customers at each restaurant and the cost of a dissatisfied customer was determined based on the 3/10 principle. Thus, in the end, the costs of dissatisfied customers on each restaurant were determined. In order to achieve performance according to the 1/1 principle, several measures have been developed for restaurants that have the highest dissatisfied customer costs, based on the answers to the question: "What were the reasons for awarding points between 0-6 on the NPS scale?"

NPS has become a practical tool for determining the performance used in the COVID-19 pandemic period and will surely be used after this crisis (Aguinis and Burgi-Tian, 2021). NPS is a recent model, developed in 2006 that provides quantitative evaluations, determining customer satisfaction and the degree of loyalty required to increase overall performance (Florea et al., 2018). The calculation formula of NPS is (Sauro and Lewis, 2016; Reichheld and Markey, 2011):

$$NPS = \frac{(P-D)}{N_{tic}} \times 100 = P \% - D \% \quad (1)$$

where: P- promoters, Pa- passives, D- detractors, and Ntic (the total number of investigated persons) = (P)+(Pa)+(D).

This score can vary from - 100 to + 100 (Freed, 2013). An NPS value above 50% is considered a good score, and one above 70-80% is considered a very good one (Tatzesberger and Sawhney, 2017), but most companies get an average score around 15% (Bremer and McKibben, 2016). Many indicators fail to determine performance (Lean manufacturing, Six Sigma, or Benchmarking), but NPS (also considered the indicator of determining customer happiness) succeeds (Davis et al., 2020), being considered along with CLV (Customer Lifetime Value) an indicator very important used in CRM (Baxter, 2020). NPS is an important self-assessment tool (Blokdyk, 2019), which helps organizations outperform their competitors (Reichheld and Markey, 2011). NPS measures the loyalty of customers who think positively about products or services or employees or a brand and share their opinion with other potential customers (Sauro, 2015; Chernev, 2017). NPS measures satisfaction (Farris et al., 2017) and is an indicator of growth potential (Padveen, 2017).

The three specific categories of the model are (Neidhardt and Wörndl, 2019; Campbell-Pretty and Wilson, 2020): i) promoters (score 9-10) – means “absolutely!” and represents the green area of the model (Christensen, 2017), are enthusiastic, happy with their relationship, loyal, repeat shopping, talk about the company and its products with friends, offer positive feedback, suggestions (Reichheld and Markey, 2011); ii) passives (score 7-8) – means “probably yes!” and represents the yellow area of the model, customers are satisfied, but not enthusiastic or loyal, from this point of view are not included in the formula. They are unlikely to recommend the company's products and are easily attracted to competitors (Tarnowska et al., 2019); iii) detractors (score 0-6) - 0 and 1 means “certainly not!”, 2, 3, and 4 mean “better not!”, and 5 and 6 mean “I don't know!”, being the red area of the model, customers are neither satisfied nor loyal. Not all detractors are anti-promoters, but their recommendations are weak, discouraging friends from buying (Sauro, 2015), they are not happy with the relationship and lower employee morale (Reichheld and Markey, 2011). They make complaints, spread negative news and reduce performance (D'Alessandro et al., 2020), often criticizing high prices and employee attitudes.

The CSI is a tool for measuring total customer satisfaction. The CSI calculation formula is (Sugandhi, 2003):

$$CSI = \frac{\text{total grades obtained by the company based on customer feedback}}{\text{total grades expected by the company to obtain from customers}} \quad (2)$$

CSI can take values between 0-100 or 0-10 (Hill and Alexander, 2006) and a maximum satisfaction index of 100% can be obtained. CSI helps companies determine their competency to meet customer needs and helps sales staff monitor the effort to become customer-oriented (Sugandhi, 2003). It is used for internal purposes such as: monitoring the improvement of services, motivating employees and in determining the total level of customer satisfaction (Hill and Alexander, 2006).

Sample size: The research was conducted on 150 customers (119 women and 31 men), with different education (120 higher education, 30 secondary education), from different areas (108 from urban and 42 from rural area), on to the relationship with 10 restaurants from Targoviste, Dambovită County, Romania. The questionnaire was applied face to face (15 questionnaires) and online (135 questionnaires). The data were collected using the question: “How likely are you to recommend (the product, service or brand analyzed) to a

friend or colleague using the 0-10 scale?”, “What are the reasons why you awarded between 0-6 points?”. The answers were added as input data from the survey, and they were processed and modeled using new methods and calculations, to achieve the objective of the study. The tools used for data processing are: NPS method, CSI, 3/10 CRM principle, cost-based method, mathematical integral, and Excel application. Analysis tools: the research started from the following existing principles in the field of CRM: a satisfied customer brings at least 3 more customers; a dissatisfied customer will talk about his negative experience to 10 other potential customers (Raab et al., 2008); a single dissatisfied customer could cancel the effect of 3 satisfied customers.

### 3. Presentation of data and results

The research was performed on 10 restaurants in Targoviste, on 150 customers who frequented the analyzed restaurants (which are marked as R1-R10 for ethical and strategic reasons). R1, R5 and R7 are on the outskirts of the city (but at different points), R2, R6 and R9 are in the new city center, R3, R4 are in the old city center, R8, R10 are outside the city/center, but in a picturesque and historic area. Thus, in the first part of the model were determined using the scale 0-6 the number of dissatisfied customers and between 7-10 the number of satisfied customers. Based on the formula described above, NPS and CSI were determined (Table no. 1).

**Table no. 1. Points obtained by the analyzed restaurants, NPS and CSI**

Rest.	UC							$\Sigma 1$ (UC <sub>i</sub> )	SC				$\Sigma 2$ (SC <sub>i</sub> )	TC ( $\Sigma 1 + \Sigma 2$ )	NPS	CSI
									NEL		EL					
	0	1	2	3	4	5	6		7	8	9	10				
R01	0	9	9	9	22	18	13	80	26	18	4	22	70	150	-36	59.4
R02	9	13	22	31	26	13	18	132	4	9	5	0	18	150	-84.6	38.1
R03	0	0	4	5	0	18	13	40	18	44	26	22	110	150	5.3	74.8
R04	0	0	0	0	4	9	9	22	13	31	35	49	128	150	41.3	83.9
R05	4	0	9	4	5	5	18	45	26	18	26	35	105	150	10.6	72.8
R06	9	13	31	9	22	4	26	114	18	5	9	4	36	150	-67.3	43.5
R07	0	0	0	4	9	22	9	44	31	39	18	18	106	150	-5.3	72.2
R08	4	4	0	0	0	4	4	16	22	9	62	41	134	150	58	82.8
R09	4	5	22	9	13	22	13	88	5	18	26	13	62	150	-32.6	65.9
R10	13	18	4	31	5	26	9	106	13	9	13	9	44	150	-56	46.2

Notes: UC – unsatisfied customers, SC – satisfied customers, NEL – non-enthusiastic and loyal, EL-enthusiastic, and loyal, TC – total customers

It can be observed that R2 and R6 have the lowest values for NPS, -84.6 and -67.3, respectively, and the highest values are for R8 (58) and R4 (41.3). According to the literature, a score over 30% is good, and an excellent score is over 50%. Thus, R4 obtained an NPS of 41.3, being a good score and R8 obtained the only score above the limit of 50%, the one of 58%, being an excellent score. With the exception of 2 restaurants, all the analyzed



restaurants have low scores, which means that they have to improve their relationship with customers; 6 restaurants have negative scores (5 of them being low and very low, between -32.6 and -84.6%). Analyzing the CSI (general customer satisfaction) it can be seen that the lowest values are obtained by the same restaurants: R2 (38.1) and R6 (43.5), and the highest values are obtained for R4 (83.9) and R8 (82.8).

The connection between loyalty and satisfaction (SL) for the 10 analyzed restaurants, is made by: i) the NPS model with its scale between 0 and 10 (whose points were put on the SL model); ii) the SL model (Hill et al., 2007), based on customer satisfaction and loyalty, was calculated on a scale from 1 to 10 for satisfaction and from 0 to 100% for loyalty, as shown in table no. 2.

**Table no. 2. Loyalty, customer satisfaction/dissatisfaction and NPS**

C/S/L	Satisfaction/dissatisfaction (according to NPS and SL model)	Loyalty (according to the SL model)
Dissatisfied customers	(0-1) – “certainly not”	Saboteur (0-20%)
	(2-4) – “rather not”	Desertion Zone (20-40%)
	(5-6) – “I don’t know”	Indifference Zone (40-60%)
Satisfied customers	(7-8) – “probably yes”	Affection Zone (60-80%)
	(9-10) – “absolutely yes”	Apostle (80-100%)

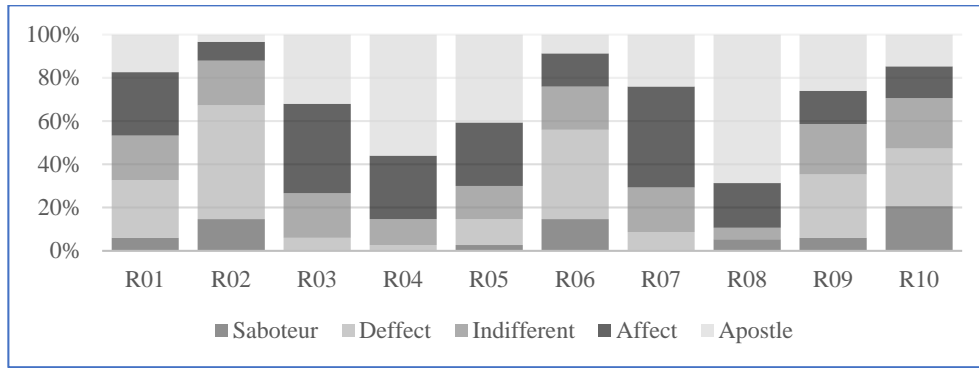
The number of customers who responded on the NPS-specific 0-10 scale was established on the five loyalty categories (Table no. 3).

**Table no. 3. Calculations for the five loyalty categories according to NPS**

Rest	S	D	I	A	Ap	Uc	Sc	Tc	Uc (%)	Sc (%)
R01	9	40	31	44	26	80	70	150	53%	47%
R02	22	79	31	13	5	132	18	150	88%	12%
R03	0	9	31	62	48	40	110	150	27%	73%
R04	0	4	18	44	84	22	128	150	15%	85%
R05	4	18	23	44	61	45	105	150	30%	70%
R06	22	62	30	23	13	114	36	150	76%	24%
R07	0	13	31	70	36	44	106	150	29%	71%
R08	8	0	8	31	103	16	134	150	11%	89%
R09	9	44	35	23	39	88	62	150	59%	41%
R10	31	40	35	22	22	106	44	150	71%	29%
T average	11	31	27	38	43	69	81	150	46%	54%

Notes: S – saboteur, D – desertor, I – Indifferent, A – Affection, Ap – Apostle; Uc – Unsatisfied customers, Sc – Satisfied customers, Tc – total customers.

By transforming each value obtained into percentages and representing these values for each restaurant analyzed, the following graphical representation is obtained (Figure no. 1).



**Figure no. 1. Representation of the loyalty chart for the 10 restaurants analyzed**

From this representation it is observed that: i) from the “saboteur” group the highest values are for R10 (31 clients accounting for 21%), R2 (22 clients - 15%) and R6 (22-15%); ii) from the group of “deserters”, the highest values are recorded in the case of R2 (79 customers-52%) and R6 (62 customers-41%); iii) from the “indifferent” group we find the highest values for R9 and R10 by 24%; iv) from the “affection” group the highest values are for R7 (70- with 46%) and R3 (62- with 41%); v) from the “apostles” group the highest values are in the case of R8 (103- with 69%) and R4 (84- with 56%). As can be seen, the 10 restaurants analyzed have an average of 46% dissatisfied customers and 54% satisfied customers.

The use of the mathematical integral allows the determination of the value of satisfied/dissatisfied customers. Based on the 3/10 principle, explained above, the value of satisfied customers (who spread word to three other customers) and dissatisfied customers (who tell 10 other customers) was determined, and to limit their scope, the value of satisfied customers was determined between 3 and 9 (up to 10, the value for dissatisfied customers), and dissatisfied customers between 10 and 16, to keep the same value gap, ie a step of 6.

Determining satisfied customers using the mathematical integral:

$$R1 = \int_3^9 70dx = 70 \cdot x|_3^9 = 420 \quad (3)$$

$$R2 = \int_3^9 18dx = 18 \cdot x|_3^9 = 108 \quad (4)$$

$$R3 = \int_3^9 110dx = 110 \cdot x|_3^9 = 660 \quad (5)$$

$$R4 = \int_3^9 128dx = 128 \cdot x|_3^9 = 768 \quad (6)$$

$$R5 = \int_3^9 105dx = 105 \cdot x|_3^9 = 630 \quad (7)$$

$$R6 = \int_3^9 36dx = 36 \cdot x|_3^9 = 216 \quad (8)$$

$$R7 = \int_3^9 106dx = 106 \cdot x|_3^9 = 636 \quad (9)$$

$$R8 = \int_3^9 134dx = 134 \cdot x|_3^9 = 804 \quad (10)$$

$$R9 = \int_3^9 62dx = 62 \cdot x|_3^9 = 372 \quad (11)$$

$$R10 = \int_3^9 44dx = 44 \cdot x|_3^9 = 264 \quad (12)$$

Determining dissatisfied customers using the mathematical integral:

$$R1 = \int_{10}^{16} 80dx = 80 \cdot x|_{10}^{16} = 480 \quad (13)$$

$$R2 = \int_{10}^{16} 132dx = 132 \cdot x|_{10}^{16} = 792 \quad (14)$$

$$R3 = \int_{10}^{16} 40dx = 40 \cdot x|_{10}^{16} = 240 \quad (15)$$

$$R4 = \int_{10}^{16} 22dx = 22 \cdot x|_{10}^{16} = 132 \quad (16)$$

$$R5 = \int_{10}^{16} 45dx = 45 \cdot x|_{10}^{16} = 270 \quad (17)$$

$$R6 = \int_{10}^{16} 114dx = 114 \cdot x|_{10}^{16} = 684 \quad (18)$$

$$R7 = \int_{10}^{16} 44dx = 44 \cdot x|_{10}^{16} = 264 \quad (19)$$

$$R8 = \int_{10}^{16} 16dx = 16 \cdot x|_{10}^{16} = 96 \quad (20)$$

$$R9 = \int_{10}^{16} 88dx = 88 \cdot x|_{10}^{16} = 528 \quad (21)$$

$$R10 = \int_{10}^{16} 106dx = 106 \cdot x|_{10}^{16} = 636 \quad (22)$$

According to previous calculations: i) the percentage of satisfied customers (54%) is higher than that of dissatisfied customers (46%), according to loyalty and satisfaction calculations (Table no. 4); ii) the number of satisfied customers (+4878) is higher than the number of dissatisfied customers (-4122), based on the mathematical integral calculations (Table no. 4). The graphical representation of satisfied/dissatisfied customers for the 10 restaurants analyzed is represented below (Figure no. 2). The following restaurants have dissatisfied customers and need to take improvement measures: R1, R2, R6, R9 and R10.

**Table 4. Determining the value gap for satisfied/dissatisfied customers**

Rest	Pt. Sc (+)	Pt. Uc (-)	Dif val. Sc/Uc (+/-)
R01	420	480	- 60
R02	108	792	- 684
R03	660	240	+420
R04	768	132	+636
R05	630	270	+360
R06	216	684	- 468
R07	636	264	+372
R08	804	96	+708
R09	372	528	- 156
R10	264	636	- 372
<b>Σ</b>	<b>4,878</b>	<b>4,122</b>	<b>+756</b>

Notes: Sc – satisfied customers, Uc – unsatisfied customers

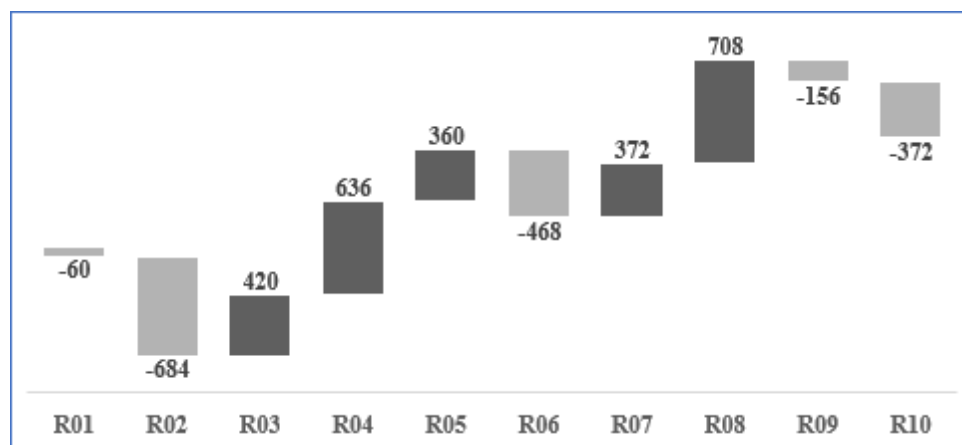


Figure no. 2. Graphical representation of Sc/Uc using the mathematical integral

Based on the principles that 1 dissatisfied customer provides this information to 10 other customers and 1 satisfied customer provides this information to 3 other customers, we need to consider this and make other determinations (Table no. 5) to quantify the costs associated with dissatisfied customers. According to the author (Graham, 2014):  $C_{uc/y} = A_{cm} \times C_{sb} \times C_{s/p}$  (21) where:  $C_{uc/y}$  = annual cost of an unhappy (dissatisfied) customer,  $A_{cm}$  = analyzed consumer market, %  $C_{sb}$  = % of customers who changed business due to poor experience, %  $C_{s/p}$  = % of customers who had changed the business and claim that the company could have prevented this.

Extracting the data from table no. 1 about the total respondents ( $A_{cm}$ ), about the customers who changed the business due to poor experience (in our case the customers who rated between 0-6 points) and about the customers who changed the business and say that the company could have to prevent it (in our case the customers who offered 7 and 8 points), the cost of dissatisfied customers per month ( $C_{uc/m}$ ) and per day ( $C_{uc/d}$ ) could also be determined (Table no. 5).

Table no. 5. Cost of an unhappy/dissatisfied customer

Rest	Acm	Csb (0-6p)	Csb %	Cs/p (7-8p)	Cs/p %	Cuc/y	Cuc/m	Cuc/d	Cuc (EUR)
	1	2	3=2/1	4	5=4/1	6=1*3*5	7=6/12	8=7/30	9=8/5
R01	150	80	53.333	44	29.33	234666.7	19555.556	651.85	130.37
R02	150	132	88	13	8.66	114400	9533.33	317.77	63.55
R03	150	40	26.667	62	41.33	165333.3	13777.77	459.25	91.85
R04	150	22	14.667	44	29.33	64533.3	5377.77	179.25	35.85
R05	150	45	30	44	29.33	132000	11000	366.66	73.33
R06	150	114	76	23	15.33	174800	14566.66	485.55	97.11
R07	150	44	29.333	70	46.66	205333.3	17111.11	570.37	114.07
R08	150	16	10.667	31	20.66	33066.67	2755.55	91.85	18.37

Rest	Acm	Csb (0-6p)	Csb %	Cs/p (7-8p)	Cs/p %	Cuc/y	Cuc/m	Cuc/d	Cuc (EUR)
R09	150	88	58.667	23	15.33	134933.3	1124.44	374.81	74.96
R10	150	106	70.667	22	14.6667	155466.7	12955.55	431.85	86.37
$\bar{X}$								392.92	78.58

Notes: C<sub>sb</sub>% = % of customers who changed business due to poor experience, C<sub>s/p</sub>% = % of customers who changed business and claim that the company could have prevented this, C<sub>uc</sub>/y or m = annual cost/monthly of an unhappy (dissatisfied) customer.

As it can be seen, the average daily cost of a dissatisfied customer is EUR 78.58. The highest costs for a dissatisfied customer are for R1 (130.3 EUR) and R7 (114.07 EUR). The lowest are for R4 (35.85 EUR) and R8 (18.37 EUR), showing that these analyzed restaurants are the best performing and have a positive and strong relationship with their customers. Based on these calculations, the rate of lost and attracted customers can be determined (Table no. 6).

According to principle 3/10, satisfied customers pass on their experience to another 3 customers (Sc \* 3), and dissatisfied customers to another 10 (Uc \* 10); the difference between them refers to newly attracted customers (Nac) or lost customers (Lc). This difference between lost and attracted customers (DI-a), the cost of a dissatisfied customer (Cuc) and the rate of lost/attracted customers (RI-a) are determined in table no. 6.

**Table no. 6. Customer satisfaction and dissatisfaction calculation (principle 3/10)**

Rest	Sc	Uc	Sc*3	Uc*10	Nac	Lc	DI-a	Cuc	RI-a
	1	2	3	4	5=3-1	6=4-2	7=6-5	8=7*78.58 Eur	9=6/5
R01	70	80	210	800	140	720	580	45,576.4	5.14
R02	18	132	54	1320	36	1188	1152	90,524.16	33
R03	110	40	330	400	220	360	140	11,001.2	1.63
R04	128	22	384	220	256	198	-58	-4,557.64	0.77
R05	105	45	315	450	210	405	195	15,323.1	1.92
R06	36	114	108	1140	72	1026	954	74,965.32	14.25
R07	106	44	318	440	212	396	184	14,458.72	1.86
R08	134	16	402	160	268	144	-124	-9,743.92	0.53
R09	62	88	186	880	124	792	668	52,491.44	6.38
R10	44	106	132	1060	88	954	866	68,050.28	10.84
<b>Cuc</b>					<b>1,626</b>	<b>6,183</b>	<b>4557</b>	<b>358,089.06</b>	
<b><math>\bar{X}</math> (RI-a)</b>						<b>3.802</b>			

Notes: Sc – satisfied customers, Uc – dissatisfied customers, Nac – attracted new customers, Lc – lost customers, Cuc – cost of an dissatisfied customer, RI-a – rate of lost customers

The total cost of dissatisfied customers is 358,089.06 EUR. R4 and R8 earn a profit, while R2 and R6 have the highest costs. Thus, these restaurants need to plan to improve the relationship with dissatisfied customers and increase profits. This means that an attracted customer can lose almost 3,802 dissatisfied customers, and the company must find solutions to attract more customers, at least to have a ratio of 1/1. As can be seen, the principle “one dissatisfied customer could cancel the effect of 3 satisfied customers” is fulfilled.

#### 4. Proposals and discussions

Based on an open discussion with customers with a score between 0 and 6 points, the problems they had with the restaurants were found, so some measures were developed and restaurants could turn them into satisfied customers, being able to reduce the costs of dissatisfied customers (Table no. 7).

**Table no. 7. Measures to reduce the costs of dissatisfied customers**

Rest	Cuc/rest (Eur)	Measures resulting from unsatisfied customer responses
R1	45,576.4	More emphasis on the internal atmosphere created for customers and the relationship created with them (choice of musical themes).
R2	90,524.16	More time invested and value offered to customers (the restaurant must increase the degree of comfort created for customers; the renovation could have involved a designer, because the space was covered, and customers can no longer see each other). The restaurant is designed more for events than for everyday meetings. Staff need to improve their communication and networking skills.
R3	11,001.2	Further investment is still required to obtain the comfort of customers (they complain about the low temperature in the restaurant in the winter season).
R4	-4,557.64	Increased attention to keeping customers satisfied and reducing the number of complaints (about high prices, menu diversification or reduced space). It requires more time invested in networking and listening to customer issues.
R5	15,323.1	The restaurant must consider the value for money.
R6	74,965.32	Caring for customers, offering them a more diverse menu.
R7	14,458.72	Customers complain about the design, which is not related to a common theme (internal and external), parking space must be enlarged, there is parking but only for a small number of cars.
R8	-9,743.92	They need to be careful to keep customers from making a profit and to maintain a lasting and ongoing relationship based on trust.
R9	52,491.44	Measures to diversify the menu and the atmosphere created will be taken into account.
R10	68,050.28	The restaurant must improve its atmosphere and relationship with customers, actions that will be undertaken by restaurant staff (skills, communication, attention).

If they are going to implement some improvement measures, the analyzed restaurants (measures determined by questioning these customers, could reduce costs and improve performance. This means that for an attracted and satisfied customer they can lose almost 3,802 dissatisfied customers and the company must find solutions. to attract more customers at least to have a ratio of 1/1. As it can be seen, the principle “one dissatisfied customer could cancel the effect of 3 satisfied customers” is met. Based on the 3/10 principle (Table no. 8) and on the equation for equality  $x + y = 150$  ( $3 * x = 10 * y$ ), it results that  $x = 116$  and  $y = 34$ , so that the satisfied customers ( $Sc$ ) are at least equal to the dissatisfied customers ( $Uc$ ) and to obtain a ratio of 1/1.

**Table no. 8. Ratio 1/1 between satisfied/dissatisfied customers and principle 3/10**

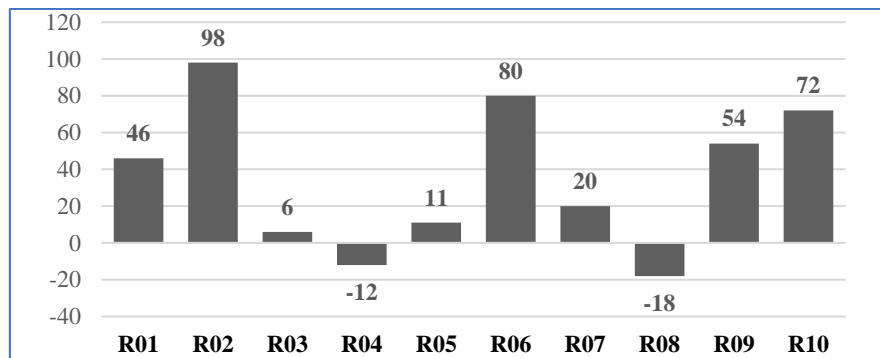
Restaurant	Sc	Ecuation ( $Sc=Uc$ )	Newly attracted customers
R01	70	116-70	46
R02	18	116-18	98
R03	110	116-110	6
R04	128	116-128	-12

Restaurant	Sc	Equation (Sc=Uc)	Newly attracted customers
R05	105	116-105	11
R06	36	116-36	80
R07	106	116-106	20
R08	134	116-134	-18
R09	62	116-62	54
R10	44	116-44	72
$\Sigma$			357

Notes: Sc- satisfied customers, Uc- dissatisfied customers

Analyzed restaurants, according to the equalization equation, in which the number of satisfied customers is at least equal to the number of dissatisfied customers and the 3/10 principle is met, 357 of new customers must be converted into loyal customers to achieve this condition and obtain profit.

The restaurants that need to attract more customers are R2 (98 customers), R6 (80 customers) and R10 (72 customers) (Figure 3). Again, the same restaurants need to improve the relationship with their customers. The methods used showed that these restaurants need to improve their CRM process, using: NPS, CSI, mathematical integral, cost method, principle 3/10 and the equation  $Sc = Uc$ . As can be seen, R4 (-12) and R8 (-18) are well positioned in the relationship with customers. They also obtained higher values for NPS, so our calculations are confirmed and well selected. Knowing this problem in advance, organizations could better understand their losses, costs, number of potential customers lost, when they could start to improve customer relationship or better to hire more qualified sales force to improve relationships with the customers.



**Figure no. 3. Number of new customers to be converted to loyal for each restaurant analyzed**

This study analyzes NPS, CSI, implements principle 3/10 of CRM and determines the cost of dissatisfied customers in the field of HORECA. Several studies have been conducted using indicators for research such as NPS (Hamilton et al., 2014; Laitinen, 2018; Fisher and Kordupleski, 2019; Aguinis and Burgi-Tian, 2021) and CSI (Koehl, 2008; Sandoiu, 2008; Ilieska, 2013; Sun and Kim, 2013; Turkyilmaz, 2013), but regarding the determination of satisfaction based on the use of the 3/10 principle (which is only a theoretical part) has not been applied so far in any research. Therefore, this theoretical principle, transferred by the authors in practice, is an approach of originality and novelty in the field of CRM, and

especially of determining the degree of customer satisfaction and customer costs dissatisfied with the relationship they have with companies.

### Conclusions

This article presents a new approach in CRM based on the use of mathematical, relational, and accounting models. These models are of great importance for researchers and professionals, due to the turbulent economic environment (such as during COVID-19), high costs, the era of the relationship we are in and the use of BIG Data, challenging business objectives and performance.

The study indicates that the application of NPS, CSI, CRM-specific 3/10 principle and the determination of dissatisfied customer costs are significant tools for optimizing organizations and their customer relationships. Thus, it has been shown that there is a direct relationship between these models and the determination of the costs of dissatisfied customers and the degree of loyalty of satisfied customers. The results show that only two restaurants (R4 and R8) obtained a NPS with a good score and an excellent score. The rest of the analyzed restaurants obtained low scores, having to improve their relationship with customers. Analyzing the CSI (overall customer satisfaction) it was observed that the lowest values are obtained by the same restaurants.

The theoretical implications brought by this study lie in bringing to the forefront the literature in the field of CRM and mainly customer satisfaction, through models to determine the degree of satisfaction and, implicitly, to achieve sustainable performance through relationships. From the analysis of the total costs of future dissatisfied customers and those specific to each restaurant, the study highlights several implications at the managerial level: i) determining unsatisfied customers and implicitly measures to transform them into satisfied customers, using simple and inexpensive models; ii) the calculations show that for an attracted and satisfied customer, the company can lose about four dissatisfied customers, and it must identify solutions to attract more customers, at least to have a ratio of 1/1, according to principle 3/10; iii) based on the 3/10 principle and the equality equation: companies can determine the required number of attracted new customers who need to be converted into loyal customers in order to achieve this condition and make a profit; iv) based on these models, companies can determine if they are well positioned in the relationship with customers, but must maintain their position to stay longer in a lasting relationship.

The research is limited by the small number of restaurants analyzed (only 10), and the analysis is performed in only one area. But future research can be done for more companies, in different fields and for much larger areas. Improving values for NPS and CSI, increasing the rate of return, reducing the number of dissatisfied customers, converting them into satisfied customers and maintaining customer acquisition costs are just a few methods that can be implemented by any organization that wants sustainable performance.

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