

CUSTOMER RELATIONSHIP ASSESSMENT USING FUZZY LOGIC

Delia ROZOVLEAN¹,
Alberth-Călin VASIESCU², Paula Roxana KASAI³

Abstract. *Sustainability is an important approach for all organizations. Social responsibility is also included among the important principles of sustainability. This responsibility involves activities for employees, customers, society and other stakeholders. Communication with customers is important in transport companies. This research evaluates the quality of customer communication within a transport company and proposes improvements following fuzzy logic modeling. The results obtained show that customer relations must be constantly improved. Research limitations refer to the sample of companies involved in the present research.*

Abstract. *Sustenabilitatea este un demers important pentru toate organizatiile. Printre principiile importante ale sustenabilității, se înscrie și responsabilitatea socială. Această responsabilitate implică activități pentru angajați, clienți, societate și alte părți interesate. Comunicarea cu clienții este importantă în companiile de transporturi. Această cercetare evaluează calitatea comunicării cu clienții în cadrul unei companii de transporturi și propune îmbunătățiri în urma lodelării cu logica fuzzy. Rezultatele obținute arată că relațiile cu clienții trebuie îmbunătățite constant. Limitările cercetării se referă la eșantionul de companii implicate în cercetarea prezentă.*

Keywords: communication, sustainable development, costumer, optimization, intelligent management, quality.

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1. Introduction

The concept of sustainability represents the possibility of developing without depleting natural resources for the future [1], [2], [3], [4] Making good choices to help the environment can seem like a daunting task, but there are lots of simple, small things that can be done to make a positive impact. By the word reduction, we can understand energy saving, where clear actions are established to increase the degree of education and awareness among students regarding sustainable

¹ Ph.D. Student, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, (delia.rozovlean@upt.ro).

² Student, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, (alberth.vasiescu@student.upt.ro).

³ Ph.D. Student, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, (roxana.kasai@student.upt.ro).

development and environmental responsibility, cooperating against climate change [1].

By the word reuse, we can understand the reuse of single-use plastic, which is one of the most polluted products in the world today. Using reusable packaging such as lunch boxes, water bottles or coffee cups would all together reduce the amount of trash entering the environment [1].

The word recycling can be understood as the process of taking waste and transforming it into something new and useful. This process reduces the number of raw materials on the planet as well as reducing the amount of waste [1].

74.5% of Europe's population lives in cities with easy access to the Internet and a great openness to purchase any product from any corner of the world. By choosing from a wide range of products, one can pay easily, quickly, and safely, anytime, and anywhere [3].

For many years the need to diversify ranges and the study of consumption trends show that last-mile deliveries are expected to increase by 78% by 2030. The number of transport vehicles and deliveries will increase by up to 36% in the 100 largest cities of the world. We can translate this as a big impact on the environment and we will witness an increase in carbon emissions by 6 to 25 million tons by 2030 [5], [6], [7].

Currently, the United Nations defines sustainable development as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition wants to provide a dynamic balance between resources and needs, also framing social responsibility [9].

Sustainable development even in logistics is amplified by a dynamic, subjective, and constantly changing factor, namely consumer behavior [2].

2. LOGISTICS WITH RESPONSIBILITY

In the field of logistics in particular, companies face a series of challenges that have an impact on human existence. Emissions, resource consumption and waste disposal are topics of concern to global logistics players [8], [9].

According to data from the European Environment Agency, the proportion would increase to 40% of carbon emissions by 2050 if no action is taken. There are specialists who mention some simple solutions such as: optimized routes, shortest possible distances without too much load, efficiency by changing the fleet or better fleet management [9].

2.1. Relationship between client and a transport company

The company' relationship with customers is based on principles such as trust, professionalism, and satisfaction. The company is committed to providing high quality transport and logistics services tailored to the specific needs and requirements of its customers. This relationship is supported by several key factors [10], [11], [12], [13]:

- ✓ *Consultancy and collaboration in the development of solutions:* The company adopts a consultative approach in the relationship with its clients. The company's team works closely with customers to deeply understand their needs and requirements, offering customized solutions adapted to the specifics of each project or transport. This collaboration begins at the planning stage and continues throughout the relationship.
 - ✓ *Transparent and accessible communication:* Communication is an essential element of the company' relationship with its customers. The customer service team is available to answer customer questions and concerns, providing them with clear and up-to-date information on the status of shipments and available solutions. The company promotes open and transparent communication, where customers are constantly and correctly informed.
 - ✓ *Flexibility and adaptability:* The company is aware that customer requirements may vary and may be subject to change. Therefore, the company is flexible and adapts to the specific requirements of each customer. The company team is responsive to market changes and industry developments, offering customized and tailored solutions based on the ever-changing needs of its clients.
 - ✓ *Close collaboration in implementation:* After defining the optimal solution, the company works closely with its customers to ensure a smooth implementation. The dedicated team provides support and assistance at every stage of the implementation process, guaranteeing a smooth and efficient transition to the company's services.
 - ✓ *Commitment to Quality and Safety:* The company provides high quality services and ensures safe and secure transportation of goods to its customers. Quality and reliability are always a priority for the company, which places great emphasis on meeting the highest standards of safety and performance.
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- ✓ **Constant monitoring and feedback:** The company constantly monitors the performance of its services and solicits feedback from customers to identify the strengths and weaknesses of its processes. This approach allows company to continuously improve its services and ensure the satisfaction of its customers.
- ✓ ***Efficient handling of requests and complaints:*** The company's customer service team is dedicated to the efficient handling of all customer requests and complaints. Every request is handled with professionalism and promptness, and customers receive quick responses and effective solutions to solve their problems.

Through these constant efforts and commitment to service excellence, the company builds and maintains long-lasting and trusted relationships with its customers, becoming a trusted partner in the field of transportation and logistics [10].

2.2. Improving customer relations using fuzzy logic

In this subchapter, the relationship between the company and its customers, including the customer Pfizer, will be explored through the lens of fuzzy logic. Fuzzy logic provides a way to interpret and analyze the truth value of propositions along a continuum between 0 and 1, rather than being limited to strictly true or false binary values.

The use of fuzzy logic in the analysis of the relationship between the company and its client Pfizer allows for a more flexible and adaptable approach, consistent with the variable and sometimes ambiguous nature of business relationships. This method of analysis can help evaluate and adjust relationship functionalities to more accurately meet customer needs and requirements.

By applying fuzzy logic, aspects that are not always clear or well defined in the relationship between the company and the customer can be better identified and managed. 0 and Duration as input variables, and Delivery Quality as output, Figure 1.

Input variables Output variables

- | | |
|-----------------------------------|---------------------------------------|
| - Capacity (C) [1.5; 4] | - Delivery quality (C_liv) [0; 100%] |
| - Price (P) [6; 16] | |
| - Duration (D) h [10,000; 30,000] | |
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The product of communication and price gives us the secondary variable.

The discourse universe for intensity, tension, filament quality and duration is covered by 5 linguistic values:

FR – very reduced

R – reduced

md – mean

M - large

FM – very high

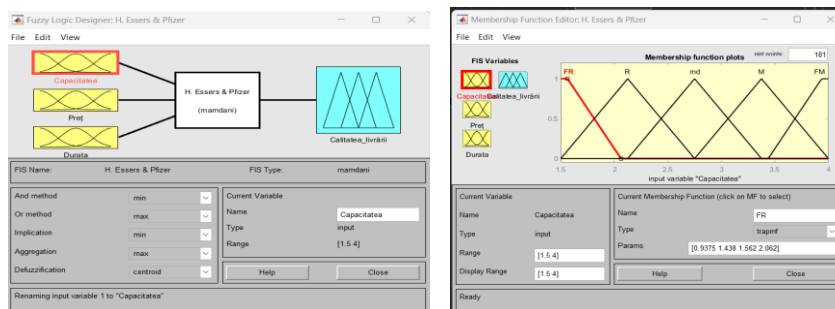


Fig.1. The general data

After entering this data, we added the necessary rules to complete the analysis. Due to the three inputs and one output, a total of 125 rules resulted, Table 1, Table 2.

Table 2. The rules for framework

C P	FR	R	md	M	FM
FR	FR	FR	R	md	md
R	FR	R	R	md	M
md	R	md	md	M	M
M	md	md	M	M	FM
FM	md	md	M	FM	FM

Table 3. The rules for framework (2)

C_liv	FR	R	md	M	FM
FR	FR	FR	R	md	M
FR	FR	FR	R	md	M
R	FR	R	M	FM	FM
md	R	R	md	FM	FM
md	R	R	md	FM	FM
FR	FR	FR	R	md	M
R	FR	R	M	FM	FM
R	FR	R	M	FM	FM
md	R	R	md	FM	FM
M	FR	R	md	M	FM
R	FR	R	M	FM	FM
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M	FR	R	md	M	FM
M	FR	R	md	M	FM
FM	FR	FR	R	md	M
md	R	R	md	FM	FM
md	R	R	md	FM	FM
M	FR	R	md	M	FM
FM	FR	FR	R	md	M
FM	FR	FR	R	md	M

1. If $C = FR$ and $P = FR$ and $D = FR$ then $C_liv = FR$
2. If $C = FR$ and $P = FR$ and $D = R$ then $C_liv = FR$
3. If $C = FR$ and $P = FR$ and $D = md$ then $C_liv = R$
4. If $C = FR$ and $P = FR$ and $D = M$ then $C_liv = md$
5. If $C = FR$ and $P = FR$ and $D = FM$ then $C_liv = M$
6. If $C = FR$ and $P = R$ and $D = FR$ then $C_liv = FR$

7. If $C = FR$ and $P = R$ and $D = R$ then $C_liv = FR$
8. If $C = FR$ and $P = R$ and $D = md$ then $C_liv = R$
9. If $C = FR$ and $P = R$ and $D = M$ then $C_liv = md$
10. If $C = FR$ and $P = R$ and $D = FM$ then $C_liv = M$
11. If $C = FR$ and $P = md$ and $D = FR$ then $C_liv = FR$
12. If $C = FR$ and $P = md$ and $D = R$ then $C_liv = R$
13. If $C = FR$ and $P = md$ and $D = md$ then $C_liv = M$
14. If $C = FR$ and $P = md$ and $D = M$ then $C_liv = FM$
15. If $C = FR$ and $P = md$ and $D = FM$ then $C_liv = FM$
16. If $C = FR$ and $P = M$ and $D = FR$ then $C_liv = R$
17. If $C = FR$ and $P = M$ and $D = R$ then $C_liv = R$
18. If $C = FR$ and $P = M$ and $D = md$ then $C_liv = md$
19. If $C = FR$ and $P = M$ and $D = M$ then $C_liv = FM$
20. If $C = FR$ and $P = M$ and $D = FM$ then $C_liv = FM$

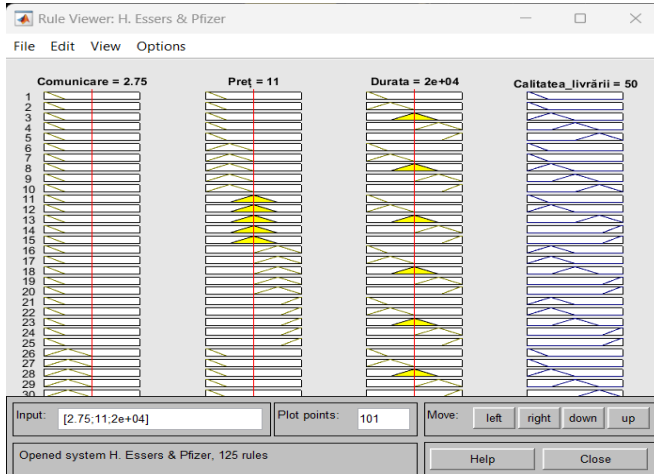
Within the article, a series of rules were selected from the 125 developed. After implementing these rules, we randomly selected 2 values to evaluate the satisfaction level of customers using our product, also watching the attached images from the program, Table 3.

Table 4. Results of implementing the rules

No.	Capacity	Price	Term	Quality of delivery
1	3	6	2e+04	50%
2	1.75	8.25	2.32e+04	52%

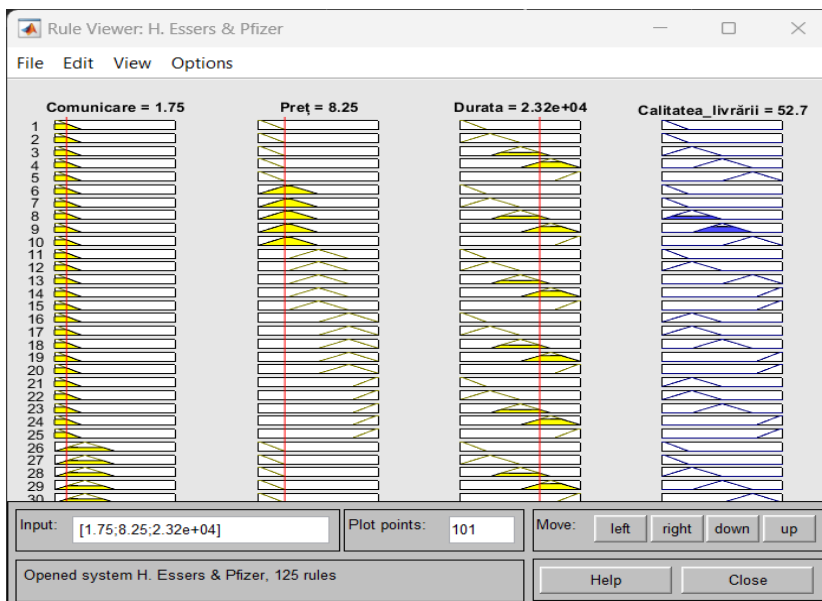
Input 1:

$[I= 3, U= 6, D= 2e+04] \rightarrow C_{liv}= 50\%$

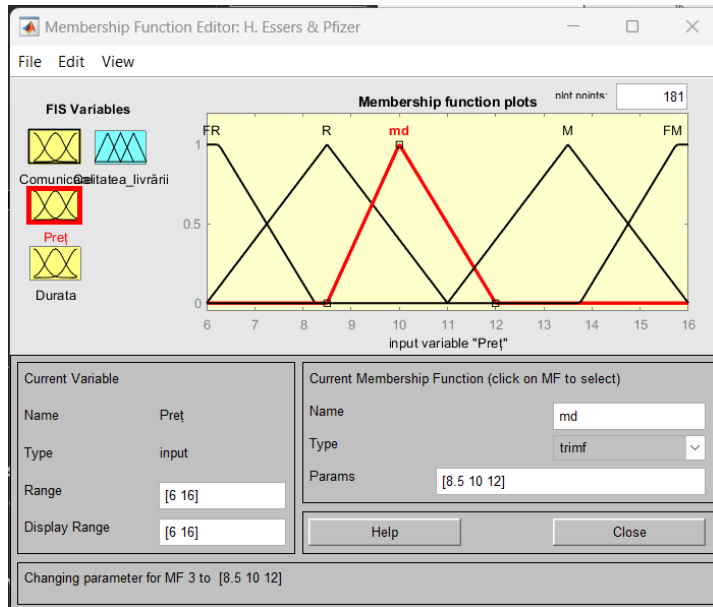


Input 2:

$[I= 1.75, U= 8.25, D= 2.32e+04] \rightarrow C_{liv}= 52\%$

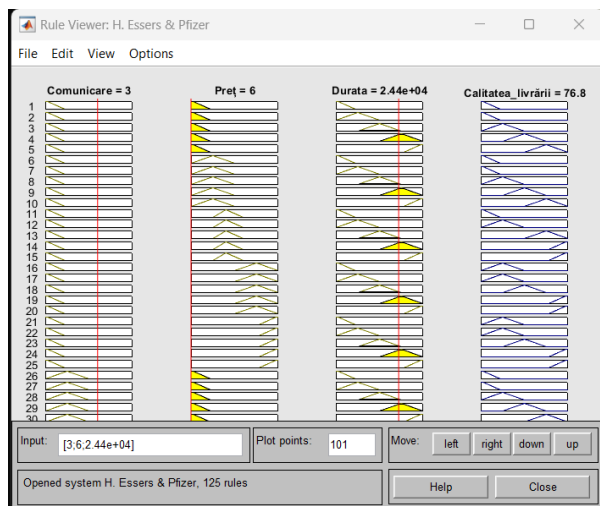


Improvements:



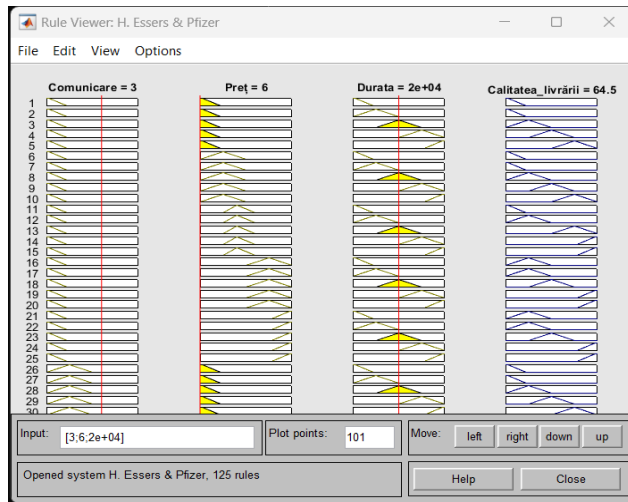
Input 1:

[I= 3, U= 6, D= 2.44e+04] -> C_liv= 76.8%



Input 2:

[I= 3, U= 6, D= 2e+04] -> C_liv= 64.5%



Final results:

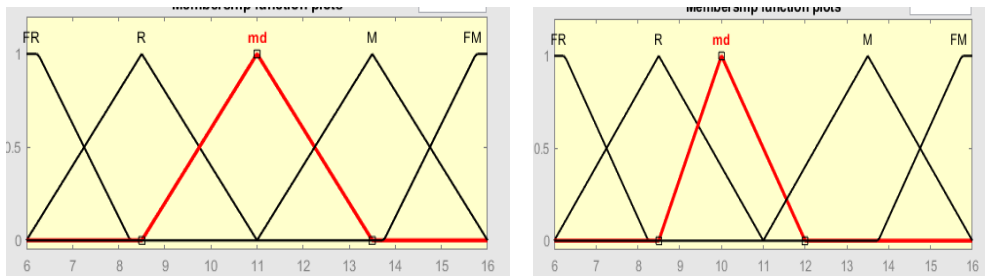


Table 5. Rules implementation results after improvement

No.	Capacity	Price	Term	Quality of delivery	Delivery quality after improvement
1	3	6	2e+04	50%	76.8%
2	1.75	8.25	2.32e+04	52%	64.5%

Analyzing the relationship between input variables and delivery quality can provide valuable information for streamlining the performance of the relationship between the transport company and its customer, Pfizer. In the context of this collaboration, delivery quality (C_{liv}) is a crucial factor that can be influenced by several variables, among which the ones mentioned are Capacity (C), Price (P), and Duration (D). Where:

- ✓ Capacity refers to the volume or quantity of products that company can carry for Pfizer. Greater capacity can improve Delivery Quality through increased flexibility in handling large orders or seasonal variations in

demand. However, excess capacity can lead to higher costs, affecting the final price.

- Streamlining strategy: Balancing capacity with current and forecasted demand. Using data analytics technologies to anticipate demand variations and adjust capacity accordingly.
- ✓ The price of transportation services can have a significant impact on the relationship between company and Pfizer. A competitive price that still reflects the quality and reliability of the service can strengthen this relationship.
 - Streamlining Strategy: Implementing a flexible pricing structure that can adapt to different levels of service requested by Pfizer. This may include options for fast delivery, low costs for high volume, or additional value-added services.
- ✓ Duration refers to the time required to deliver products from company to Pfizer. In the pharmaceutical industry, time can be critical, especially for products that require special transport conditions or are intended for urgent use.
 - Streamlining Strategy: Streamlining transportation routes and using technology to monitor and reduce delivery time. Partnerships with other logistics entities can also be a solution to offer faster or more efficient routes.

To improve the quality of delivery between company and Pfizer, it is essential to pay attention to how capacity, price and duration influence this performance dimension. The strategic approach must be holistic, considering how each of these variables can be improved to support the goals of both parties in the relationship. Through detailed analysis and continuous adjustments, companies can ensure a successful collaboration that promotes efficiency, streamlined costs and customer satisfaction.

The evolution of the number of employees shows an increase in the number of employees during the analyzed period, Figure 2. In detail, in 2021 the company registered an increase of 58 employees, and in 2022 their number increased by 30. This may reflect the dynamics of organizational development during this period.

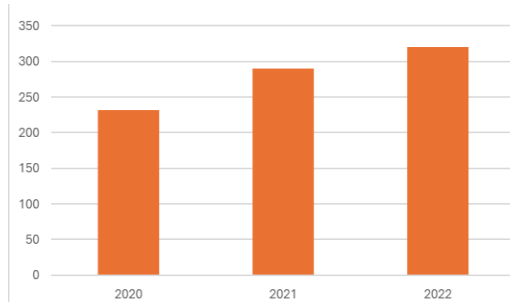


Fig.2. Diagram of the evolution of the number of employees

This ratio evaluates the proportion of the company's debt to its turnover. More simply, it indicates how much of the company's annual revenue would be needed to cover all debts, assuming they were to be paid instantly. In other words, a lower ratio is preferable because it shows less debt compared to income.

3. Conclusions

The overall performance of the company is medium. This value indicates a satisfactory fit. In this context, it is recommended to adopt an offensive strategy, which involves:

- ✓ Establishing new strategic objectives to direct activities to more promising areas.
- ✓ Restructuring where necessary to streamline operations and improve performance.
- ✓ Termination of unprofitable activities to focus resources on profitable segments.
- ✓ Bringing a moderate influx of capital and know-how to support innovation and development.

R E F E R E N C E S

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