TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering
Vol. 68, Issue IV, November, 2025

MODELING THE INTERNATIONAL IMPACT OF UNIVERSITIES USING FUZZY LOGIC

Delia ROZOVLEAN, Alberth-Calin VASIESCU, Roxana KASAI, Monica WOLFF, Larisa IVASCU

Abstract: *The aim of the paper is to present the influence of the main variables that influence the impact of university internationalization, using fuzzy logic. The membership function variables are academic reputation, employee reputation, citations per paper, articles per faculty, international research network, employment results, faculty-student ratio, international student diversity, international staff ratio, inbound exchange student ratio, outbound exchange student ratio and sustainability score. In addition, specific weaknesses in the adoption of sustainable practices are discussed, such as bureaucracy, sustainable challenges, competition and resource allocation. The evaluation of fuzzy rules shows that universities make considerable efforts to internationalize their image and increase their position in university rankings. The limitations of this research refer to the fact that the analysis was carried out for a technical university in Romania, being considered a pilot university.*

Key words: *University, sustainability, education, performance, change management, Internationalization.*

1. INTRODUCTION

In the context of greening higher education institutions [1], several weak points have been identified in association with sustainability inaction. First, universities encounter difficulties in creating research networks due to bureaucratic obstacles. Sustainable challenges are the second big element, as achieving sustainability goals may be difficult and sometimes impossible to achieve in the future. The third element is the stiff competition between universities that can create challenges in maintaining leadership and improving performance. The fourth element is resource allocation, where universities must make sustained efforts to improve their performance in various areas, including education, environment, transport and infrastructure [2-4].

University sustainability represents the active involvement of higher education institutions in the development of strategies for the protection of the natural environment. The way society works today with the emphasis on production and excessive consumption of services and goods will have negative consequences if no action is taken. Universities are forced to adapt to the new requirements appearing on the market, but also to apply the objectives of sustainable development [2].

2. LITERATURE REVIEW

The science of sustainability is related to several disciplines and fields that involve inter, multi- and transdisciplinary research and operationalization [2, 3]. Universities are also financed according to the national metaranking of Romania. At the international level, there are several important rankings. Some of these are considered for the calculation of university positions in the national metaranking [8-12]. Each ranking considers a series of variables with a known or less known weight.

Evaluating several university rankings, a series of variables were identified that contribute to a better position in the rankings. [7]. Details about the indicators are shown in the following:

- *Academic reputation* is considered the strongest indicator, thus showing the global

Received: 10.09.25; **Similarities**: 20.10.25: **Reviewed**: 10.09./ 10.09.25: **Accepted**:19.11.25.

perception of the academic quality of a higher education institution;

- *Employee reputation* is equally important, as it measures employees' opinion of the quality of a university's graduates;
- Another important indicator is *citations per faculty*, as it measures the impact of academic research through the number of citations of some published publications;
- *The ratio per faculty or student* is a substantial indicator that shows the university's commitment to providing individual attention to students;
- *Faculty articles* measure the impact of academic research by the number of citations of the faculty publications. The information is collected in a database, evaluating the research activity of a faculty;
- *The international research network* has been introduced in 2024 to assess university's international research collaborations, showing the importance of global cooperation in research;
- *Employment results,* as well as this indicator, were recently introduced and measured the success of graduates on the labor market, reflected in employment statistics, but also in the quality of jobs obtained;
- *The diversity of international students* as well as *the ratio of international staff* shows that these two criteria evaluate the level of internationalization of the university, showing the diversity of the professional body as well as the student body, together with the global activity of the institution;
- *The ratio of students in inbound exchanges* shows the potential of universities to involve students in exchanges of experience;
- *The ratio of outbound exchange students* is another indicator that helps students participate in internships and educational and cultural exchange programs;
- *The sustainability score* was recently added by QS to assess universities' engagement with social and climate justice issues, being in universities' sustainability initiatives and policies.

These variables will be the basis of the fuzzy methodology applied to model the international impact of universities.

3. UNIVERSITY SUSTAINABILITY AND THE ROLE OF TEACHING STAFF

The process of achieving sustainability in higher education institutions is a complex process. The benefits and advantages offered by achieving sustainability in higher education institutions are major, achieving sustainability involves great efforts [2]. In developed countries, universities focus on investigating environmental problems, finding ways to improve them and solving them, through research and collaboration with national and international organizations [4].

Any university that wants to be supported needs to show increased interest in creating a website that deals with sustainability issues, involving students in activities related to sustainable development [3]. Education for sustainable development should use the possibilities of modern teaching technologies, media and multimedia in combination with the traditions, culture of people and the experience of previous generations. The main objectives of education for sustainable development are [5] (and in the context of [6] and [13-15]): developing a systemic vision and critical thinking; acquiring new knowledge and skills that contribute to achieving the sustainability of society; teaching the need to ensure a healthy lifestyle; the formation of moral values in the context of achieving sustainability; raising awareness regarding the achievement of sustainable consumption.

In carrying out these tasks, it is necessary to change the approaches to the organization of the traditional learning process [5].

4. ANALYSIS USING THE FUZZY LOGIC

For fuzzy modeling, variables identified by reviewing the specialized literature were considered [7-10]. These variables are used during the modeling process and are prioritized according to the results obtained. This prioritization was achieved by identifying the percentage contribution to the improvement of international university impact [11, 12]. An evaluation of the main university rankings

underlines the importance of the important variables. Among them are:

- Academic reputation: 30%;
- Reputation of employers, 15%;
- Citations per paper: 10%;
- College articles: 5%;
- International Research Network: 10%;
- International student diversity: 5%;
- International staff ratio: 5%;
- Faculty-student ratio: 5%;
- Ratio of inbound exchange students: 2.5%;
- Ratio of outbound exchange students: 2.5%;
- Sustainable development of higher education institutions: 15%;
- Sustainability Score: 5%;
- Employment outcomes: 5%;
- Faculty-student ratio: 5%.

Solution 1 is detailed in Fig. 1. Following the analysis performed, this solution was identified as relevant for the studied context. It aims to improve academic reputation by capitalizing on the variables presented in Fig. 1. Also, there is shown a Mamdani fuzzy system used to evaluate "Academic reputation" based on three input variables. The system has: 3 inputs, 1 output, and 125 fuzzy rules. The input variables are reputation_of_employers, Citations_per_paper, and College_articles. Each of these inputs has a triangular fuzzy membership function (Figures 2, 3, and 4).

An example of a rule is:

If Reputation_of_employers is High and Citations_per_paper is Medium and College_articles is Low then Academic_reputation is Good`

For example, Fig. 2 contains the membership function for the variable "reputation of employers". The members were established to be able to provide a value of the universities' performance considering the academic aspects.

To achieve a 15% level of employee reputation, two variables were introduced: the number of citations per article (10%) and the number of articles per faculty member (5%), as shown in Fig. 3 - Fig. 5. Subsequently, the rules necessary to complete the analysis were defined. Considering the three input variables and one output variable, a total of 125 rules resulted, as shown in Table 1.

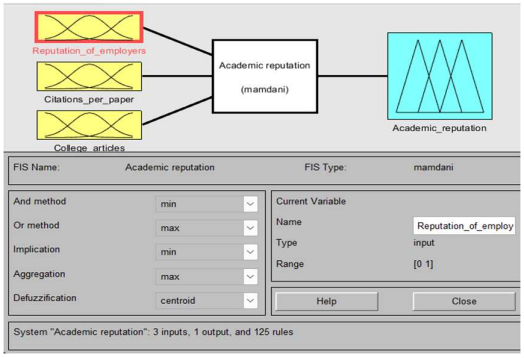

Fig. 1. Mamdani fuzzy system for "Academic reputation"

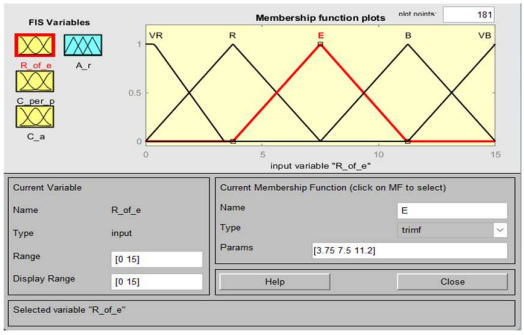

Fig. 2. Membership functions for "reputation_of_employers".

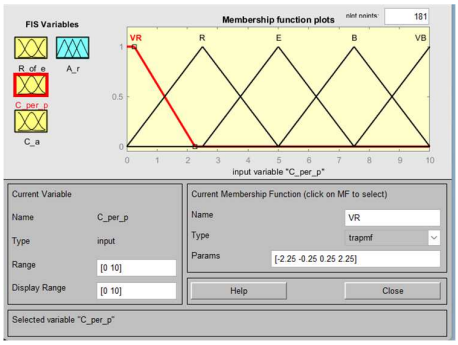

Fig. 3. Membership functions for "Citations_per_paper".

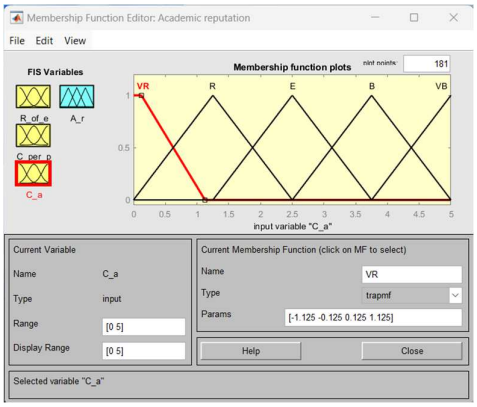

Fig. 4. Membership function for "College_articles".

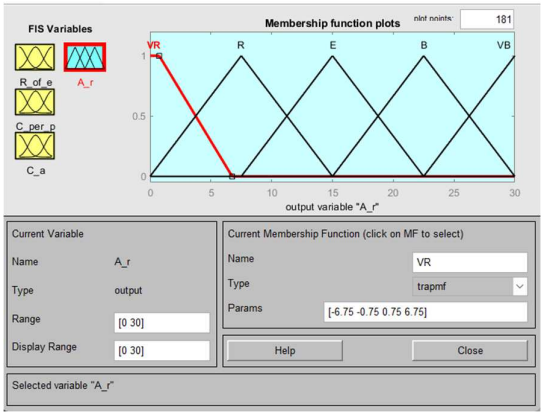

Fig. 5. Membership function "Academic reputation".

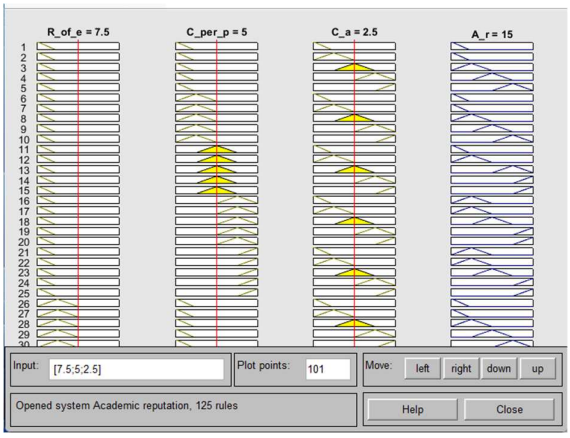

Fig. 6. Example for the random variable.

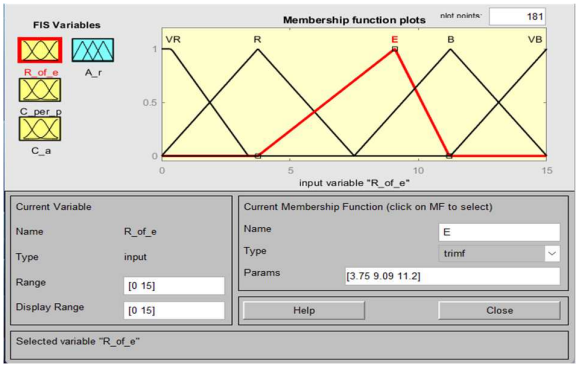

Fig. 7. Membership functions for reputation_of_employers.

Fig. 6 illustrates the internal workings of a Mamdani-type Fuzzy Inference System (FIS), used to model academic reputation (Academic_reputation) based on three input variables: Reputation_of_employers (R_of_e), Citations_per_paper (C_per_p), College_articles (C_a). Each vertical column represents a variable: the first three columns correspond to the input variables, and the fourth corresponds to the output variable. The fuzzy rules are displayed vertically (in total, the system contains 125 rules, and in the analyzed example, 29 rules are activated).

The values entered the system (7.5, 5 and 2.5 for the three inputs) are converted into fuzzy membership degrees, using predefined functions (probably triangular or trapezoidal). For example, the value R_of_e = 7.5 activates mainly "high" fuzzy sets: C_per_p = 5 corresponds to a "Medium" category; C_a = 2.5 activates membership functions corresponding to the "low" categories.

- The activation of these fuzzy sets is highlighted in the diagram by yellow areas indicating the degree of activation for each applicable rule.

Aggregation and defuzzification highlights that the fuzzy outputs resulting from each activated rule are combined (aggregation by the max method) into a single fuzzy set for the output variable Academic_reputation. This is then transformed into a clear numerical value by the defuzzification process. Improvements are summarized in Fig. 7.

Table 1

Fuzzy rules.

CP	VR	R	E	B	VB
VR	VR	VR	R	E	E
R	VR	R	R	E	B
E	R	E	E	B	B
B	E	E	B	B	VB
VB	E	E	B	VB	VB

Table 1 contains a fuzzy decision matrix (or fuzzy rule table) for a system with ordered linguistic values. IN this table we use the qualifier prediction (CP), very low (VR), low/reduced (R), medium/balanced (E), high/good (B), very high/very good (VB).

Each row and column correspond to fuzzy values of the input variables; each cell corresponds to a fuzzy result of the output, also expressed as a linguistic value. The same approach is applied for the next variables. Example of an interpreted rule:

IF input1 is R AND input2 is E → THEN output is E

That is: If the first variable is "Reduced" and the second is "Balanced", then the output is "Balanced".

Each cell can be viewed as a fuzzy rule of the form: *IF (x is A) AND (y is B) THEN (output is C).*

The first three rows of the matrix highlight assessment levels ranging from poor to average, suggesting modest performance in these segments. In contrast, the last three rows indicate an upward trend, with values evolving from average to good. This distribution suggests the existence of qualitative progress in the lower part of the matrix, which can be interpreted either as an improvement in performance or as an area with high development potential.

Initially, the three variables were considered, and it was observed that academic reputation is evaluated as low (15%) in the initial state, Table 2. After the variables were normalized and then subjected to the fuzzification process to determine their degree of membership in fuzzy linguistic sets, the variables were modified using a proprietary strategy and a significant improvement was obtained (30.6%), Table 3. The changes for this improvement in academic reputation are presented below, starting from fuzzification, functions and defuzzification.

The membership function for the linguistic set "E" associated with the input fuzzy variable R_of_e (Reputation_of_employers)`, within a Mamdani fuzzy system, has been modified, Fig. 7. This modification shows that the peak of the function has been moved from 7.5 to 9.09 and contributes to the increase of the simulated academic reputation from 15% to 30%. The rest of the conditions remain unchanged.

Table 2

The results of implementing the rules.

Indicator	Value
Reputation of employees	7.5
Citations per paper	5
Articles of the faculty	2.5
Academic reputation	15%

Table 3

The implementation rules result after improvement.

Indicator	Value
Reputation of employees	5
Citations per paper	5
Articles of the faculty	1
Academic reputation	15%
Academic reputation after improvement	30.6%

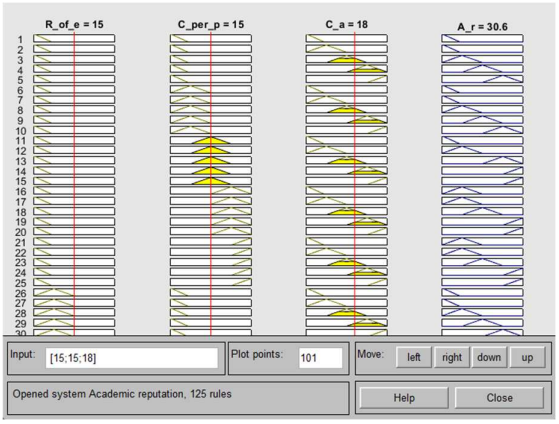

Fig. 8. Example 2 for improved random variable.

Fig. 7 illustrates the membership functions used to assess employer reputation. These functions allow modeling the degree of membership of input values to different linguistic categories, thus contributing to the precise definition of the reputation variable within the analysis system. The choice of membership functions is essential for the accuracy of data interpretation and for generating relevant results in the decision-making process.

Fig. 8 represents a visualization of the activation of fuzzy rules within a Fuzzy Inference System. The red vertical lines indicate the exact values entered for each variable. The yellow triangles show the membership functions activated by the input values. The activation degrees are visibly distributed in the upper area of each column, indicating that the entered values (15 and 18) are considered to belong to fuzzy sets of maximum level (e.g. "Very High"). The column for A_r (academic reputation) shows how these activations are combined to produce a fuzzy result, which is then de-fuzzified (probably by the centroid method) to obtain the final numerical value 30.6%.

Input 1 is shown in the following:

[R_of_e = 15, C_per_p = 15, A_a = 18] → C_ac = 30.6%

Conclusions are summarized in Table 3. Further, Solution 2 is described in Fig. 9.

From the resulting amount of 10% emerges the international research network that supports the change of the traditional learning process.

In the continuation of the research, following the same principle, various input variables and the corresponding output were selected. The first variant was examined and then, by applying a strategy of modifying the input variables, an improvement in the output variable was obtained. After implementing these rules, we randomly selected a value to assess the level of the „international research network". After entering this data, we added all the necessary rules to complete the analysis. Having two inputs and one output, we got a total of 25 rules result, Table 4. Fuzzy rules.

Input 1 is shown in the following:

[I_s_d = 5, I_s_r = 5] → I_r_n= 5%

The proposal for solution 1 improvement was changing values for improvement.

Fig. 10 presents the input variable "The diversity of international students" and of the "International staff", each having a weight of 5%. The improvement is shown in Fig. 14.

Fig. 10 presents the input variables "International student diversity" and "International staff", each with a weight of 5% in the analysis. These variables reflect the degree of internationalization of the institution and contribute to the assessment of openness to collaborations and global perspectives. Integrating these factors into the analysis model allows for a more nuanced assessment of academic performance in an international context.

The distribution of fuzzy values suggests the existence of a transition from a poor level of performance to one close to good, which may signal real potential for improvement. In an applied context (educational, organizational or decision-making), these results can guide targeted interventions to optimize areas of low performance and strengthen those that are growing.

The proposed fuzzy model provides a nuanced and continuous picture of the evaluated performance, avoiding the limitations imposed by binary or categorical classifications. The evolution observed from the upper to the lower ranks suggests the existence of a progress curve, indicating development potential and the effectiveness of improvement strategies.

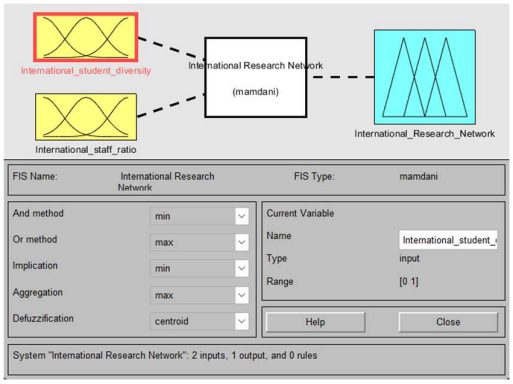

Fig. 9. Defined input and output variables.

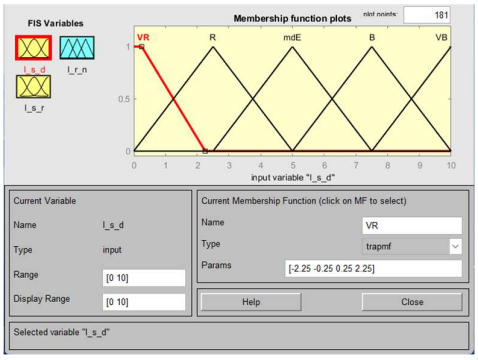

Fig. 10. The input variable "The diversity of international students" and of the "International staff", each having a weight of 5%.

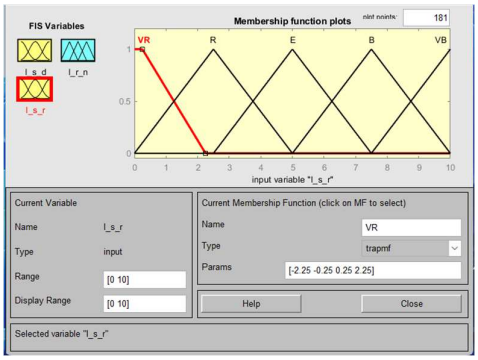

Fig. 11. The input variable "International staff ratio".

Table 4

Fuzzy rules.

CP	VR	R	E	B	VB
VR	VR	VR	R	E	B
R	VR	R	R	E	B
E	R	R	E	E	B
B	R	R	E	B	VB
VB	R	R	E	B	VB

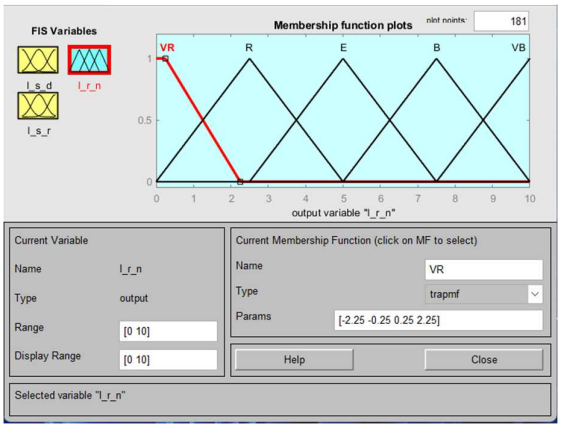

Fig. 12. The output variable "International research network".

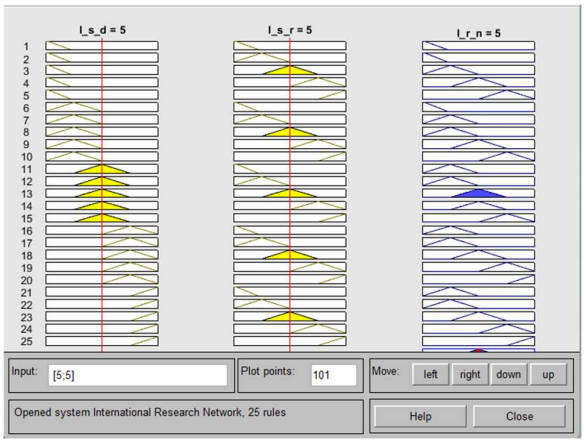

Fig. 13. The "Example for the random variable".

Table 5

The results of implementing the rules.

Indicator	Value
The diversity of international students	5
International staff report	5
International research network	5%

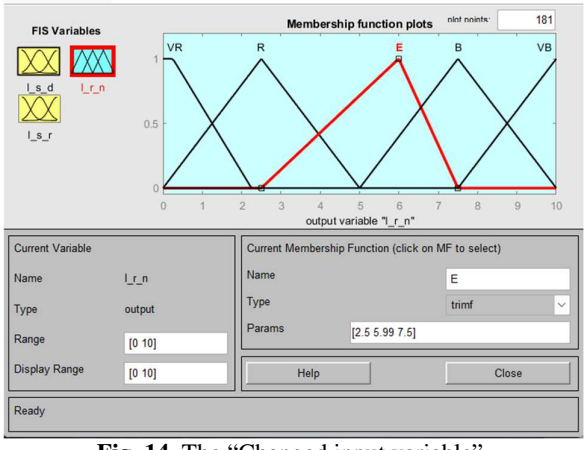

Fig. 14. The "Changed input variable".

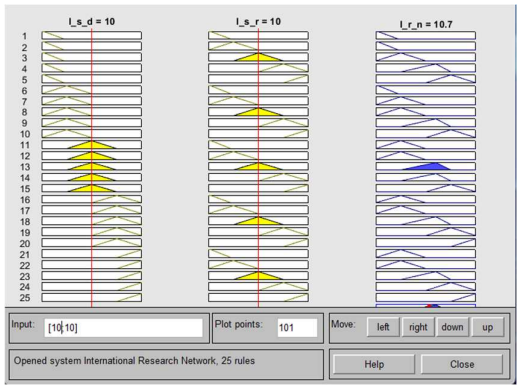

Fig. 15. The "Example for improved random variable".

Table 6

The implementation rules result after improvement.

Indicator	Value
The diversity of international students	5
International staff report	5
International research network	5%
International research network after improvements	10.7%

Table 7

Fuzzy rules.

CP	VR	R	E	B	VB
VR	VR	VR	R	E	B
R	VR	R	R	E	B
E	R	R	E	E	B
B	R	R	E	B	VB
VB	R	R	E	B	VB

This analysis can constitute a valid foundation for decision-making, strategic planning or resource allocation according to the identified performance levels.

Input 1 is shown in the following:

[I_s_d = 10, I_s_r = 10] → I_r_n= 10.7%

Conclusions are summarized in Table 6.

Solution 3 is shown in Fig. 16. The following is a system for evaluating the "Faculty-student ratio" indicator based on two input determinants Ratio_of_inbound_exchange_students and Ratio_of_outbound_exchange_students. Both input variables are treated as fuzzy by membership functions (visible on the left side of the image), on a normalized numerical domain of [0, 2.5]. The system contains 25 fuzzy rules, which express logical relationships of the type:

If Ratio_of_inbound_students is high and ratio_of_outbound_students is low then Faculty_student_ratio is good.

The result of the two variables is 5% and shows that the faculty-student ratio helps to

acquire new knowledge and skills that contribute to the achievement of university sustainability (Fig. 17). After entering this data, we added all the necessary rules to complete the analysis. Having two inputs and one output, we got a total of 25 rules, Table 7. Fuzzy rules.

Input 1 is shown in the following:

[R_of_i_e_s = 1.25, R_of_o_e_s= 1.25] → F_s_r = 2.5%

The proposal for improving solution 1 was changing values for improvement. Fig. 18 presents the "Example for the random variable". The improvement is presented in Fig. 19. Solution 4 is presented in Fig. 20 (the inference system used in assessing the sustainable development of higher education institutions). The presented Mamdani fuzzy system integrates three relevant indicators – sustainability score, faculty-student ratio and an additional coefficient (R_fs) – to assess the level of sustainable development of a higher education institution.

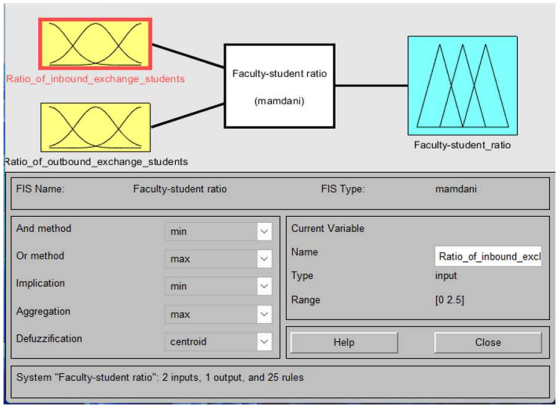

Fig. 16. The entering input and output variables.

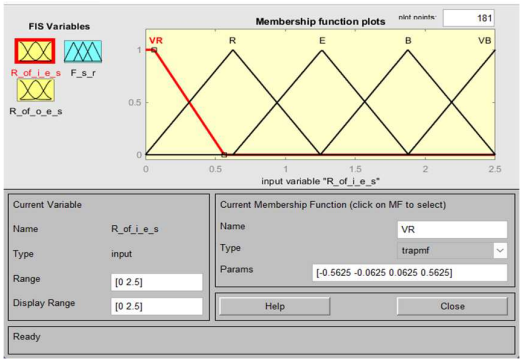

Fig. 17. The input variable "Ratio of inbound exchange students" and "Ratio of outbound exchange students" having a percentage of 2.5% each.

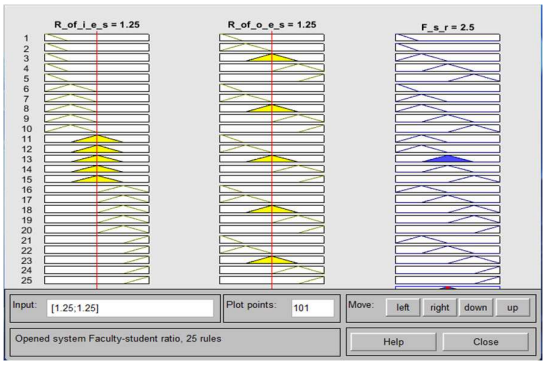

Fig. 18. The "Example for the random variable".

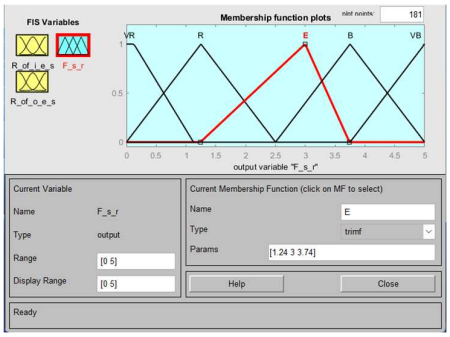

Fig. 19. Presents the "Changed input variable".

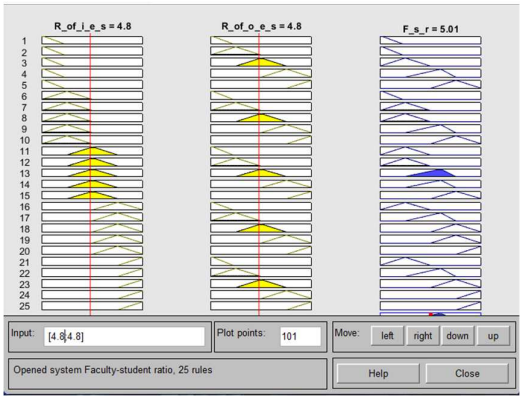

Fig. 20. The "Example for improved random variable"

Table 8

Presents the results of implementing the rules.

Indicator	Value
Ratio of inbound exchange students	1.25
Ratio of outbound exchange students	1.25
Faculty-student ratio	2.5%

Table 9

The implementation rules result after improvement.

Indicator	Value
Ratio of inbound exchange students	1.25
Ratio of outbound exchange students	1.25
Faculty-student ratio	2.5%
Faculty-student ratio after improvement	5.01%

Through 125 fuzzy rules, the model allows for a flexible, interpretable and uncertainty-tolerant assessment of institutional performance in the field of sustainability, providing a defuzzified numerical output that can be used for benchmarking or strategic decision-making (Fig. 21). An example of a rule is:

Sustainability_Score is high and Faculty-student_ratio is Balanced and R_fs is good

Then

Sustainable_development_of_higher_education_institutions is Strong

Fig. 22 shows the definition of a trapezoidal fuzzy membership function (trapmf) for the input variable "Sustainability score". The VR (Very Low) function for the input variable S_s is defined as a symmetric trapezoidal function centered around the value 0.125, representing very low values of the sustainability score. Through this function, the fuzzy system can activate rules associated with a very low Sustainability_Score, which will negatively influence the overall assessment of sustainable development (S_d_of_h_e_i). The same algorithm is used for each input function.

Education for sustainable development implies the growth of a systematic vision, but also the acquisition of new knowledge and skills. After entering this data, we added the necessary rules to complete the analysis (Fig 23 – Fig. 25). Due to the three inputs and one output, a total of 125 rules result. After implementing these rules, we randomly selected a value to assess the level of academic reputation, Table 10 Fuzzy rules. Input 1 is shown in the following: *[S_s= 3.96, F_s_r= 3.52, R_f_s= 2.01] → S_d_of_h_e_i= 11.8%*

The improvements proposed for solution 1 are for changing values for improvement.

Fig. 26 presents the "Example for the random variable". The following improvements were underlined in Fig. 27 that presents the "Changed input variable". The summary of the conclusions is presented in Table 12. Through an evaluation of each solution offered, the following conclusions presented in Table 13 can be systematized.

Table 10 contains a fuzzy decision matrix (or fuzzy rule table) for a system with ordered linguistic values. IN this table we use the qualifier prediction (CP), very low (VR), low/reduced (R), medium/balanced (E), high/good (B), very high/very good (VB). Each row and column correspond to fuzzy values of the input variables. Each cell corresponds to a fuzzy result of the output, also expressed as a linguistic value.

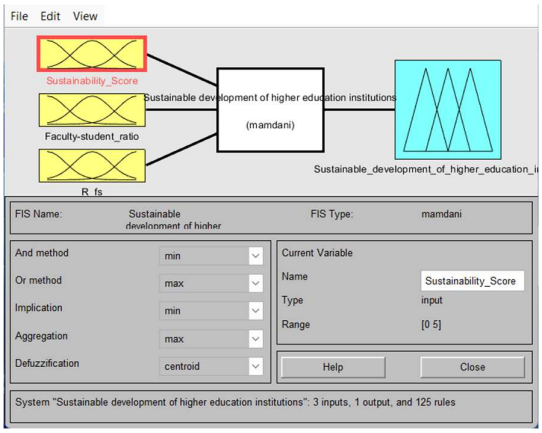

Fig. 21. The entering input and output variables

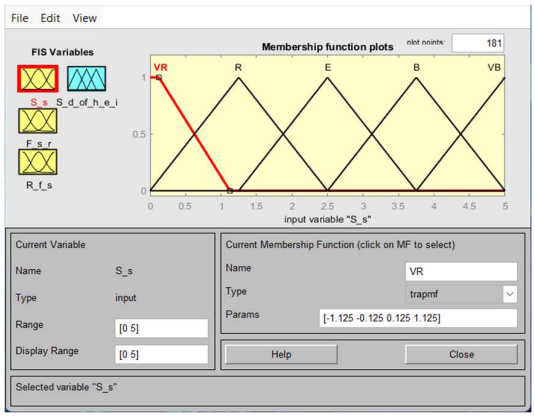

Fig. 22. The input variable "Sustainability score" having a percentage of 5%.

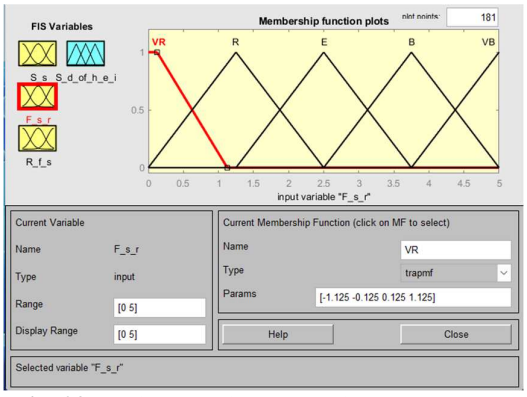

Fig. 23 The input variable "Employment results".

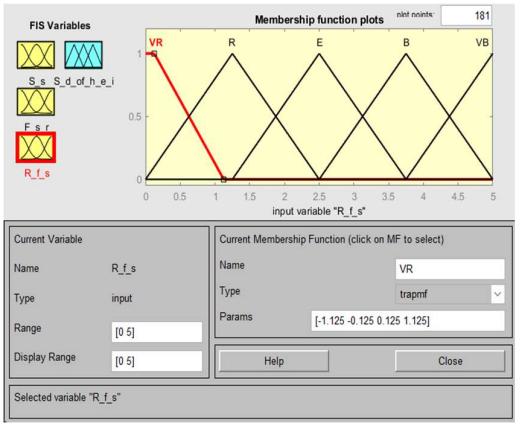

Fig. 24. The input variable "Faculty-student ratio".

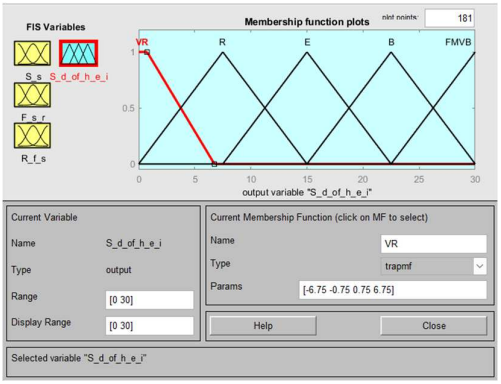

Fig. 25. The output variable "Sustainable development of higher education institutions".

Table 10

Fuzzy rules for the level of academic reputation.

c	VR	R	E	B	VB
VR	VR	VR	R	E	E
R	VR	R	R	E	B
E	R	E	E	B	B
B	E	E	B	B	VB
VB	E	E	B	VB	VB

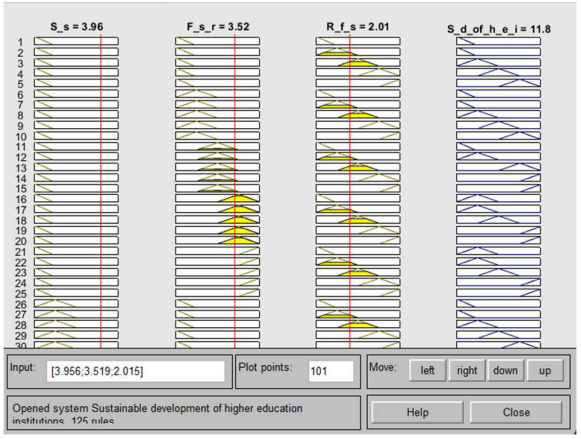

Fig. 26. Presents the "Example for the random variable".

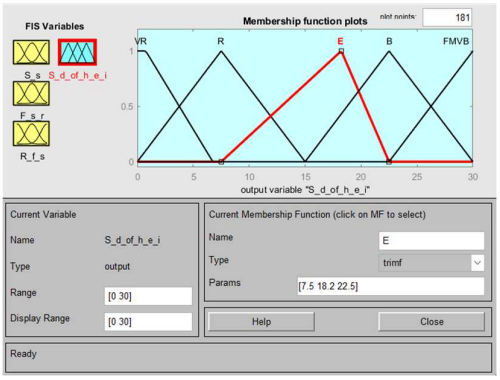

Fig. 27. Presents the "Changed input variable".

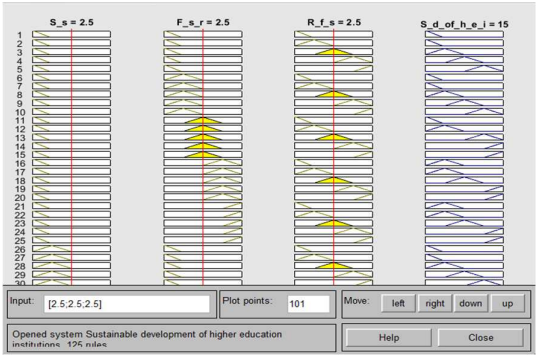

Fig. 28. Presents the "Example for improved random variable".

Table 11

The results of implementing the rules.

Indicator	Value
Reputation of employees	3.96
Citations per paper	3.52
Articles of the faculty	2.01
Academic reputation	11.8%

Table 12

The implementation of rules results after improvement.

Indicator	Value
Reputation of employees	3.96
Citations per paper	3.52
Articles of the faculty	2.01
Academic reputation	11.8%
Academic reputation after improvement	15%

The matrix fuzzy analysis highlights a clear upward trend in performance, starting from lower values and gradually reaching higher thresholds. The model suggests the existence of a favorable framework for continuous development providing a solid basis for strategic planning and decision-making. Academic reputation can be improved from 11.8% to 15% through internal strategy regarding the top of the function, Table 11 and Table 12.

Table 13

The analysis of the solutions obtained.

Solution	Description	Disadvantage
Academic reputation: 30%	The members were established to be able to provide value for the universities' performance considering the academic aspects.	Sustainable universities have important tasks outlined, but sometimes impossible to achieve in the future.
International Research Network: 10%	From the resulting amount of 10% emerges the international research network that supports the change of the traditional learning process	There is a great need to create an international research network within universities, but sometimes they face difficulties due to bureaucracy and need support and help in their improvement process.
Faculty-student ratio: 5%	The result of the two variables is 5% and shows that the faculty-student ratio helps to acquire new knowledge and skills that contribute to the achievement of university sustainability.	Higher education creates a direct impact on the local environment, that's why tough competition and a fight for leadership was launched, causing the universities to always compete.
Sustainable development of higher education institutions: 15%	Education for sustainable development implies the growth of a systematic vision, but also the acquisition of new knowledge and skills.	Universities are forced to make sustained efforts to improve their reported performance for the variables of education, environment, transport and infrastructure.

6. CONCLUSION

In conclusion, the Mamdani fuzzy system analyzed provides a flexible and interpretable logical framework for assessing the sustainable development of higher education institutions. By integrating relevant input variables such as sustainability score, faculty-student ratio and other institutional indicators, the system allows for the formulation of nuanced assessments that are adaptable to the uncertainty of real data. The rigorous definition of membership functions and the use of well-structured fuzzy rules ensure a coherent qualitative interpretation, and the defuzzification process provides a useful numerical output in making strategic decisions regarding institutional performance and progress towards sustainability. Sustainability should not be perceived as an impediment, but as a guiding principle that influences the daily work of universities, both personally and professionally. For higher education teachers and administrators, maintaining the balance between efficiency and sustainability is essential in the development and implementation of study programs. This implies an integrated vision that ensures academic and social progress, while respecting the limits of the environment. Ultimately, the success of university institutions in the global landscape depends on their ability to integrate these variables and respond to challenges in a sustainable way, thus contributing to the sustainable development of society.

Adopting sustainable strategies can represent a competitive advantage for universities, strengthening their international reputation and attracting students, researchers and funding from various parts of the world.

It is essential that all stakeholders recognize the importance of sustainability and work together to achieve common goals. Only through a joint and coherent effort can bureaucratic barriers, competitive challenges and resource allocation difficulties be overcome. In this way, universities can become engines of sustainable progress, contributing to the development of a society that values the balance between present needs and responsibility towards future generations.

7. REFERENCES

[1] Huckle, J., Even More Sense and Sustainability, 2012. In: *Environmental Education Research*, 18/6, pp. 845-858, 2012.

[2] Rosendaal, H., *Strategic Issues in University Management*, 2010, Available at:

https://www.researchgate.net/publication/254859218_Strategic_Issues_in_University_Management
[3] Sarni, W., Capozucca, R. *Sustainability 2.0.: Using Sustainability to Drive Business*
[4] *Innovation and Growth*. Available at: https://apo.org.au/node/28369
[5] Suslenco, A. *The Contribution of Innovative Changes to the Strategic Development of Universities in the Context of Achieving Sustainability.* In: Lumen Proceedings, Vol. 17, World LUMEN Congress/2021, Iași, Editura LUMEN, 2022, pp. 611-629. ISSN (on-line) 2601 – 2529, 2021. Available at: https://proceedings.lumenpublishing.com/ojs/index.php/lumenproceedings/article/view/705/743
[6] Sirbu, R. M., Popescu, A. D., Borca, C., Draghici, A., *A study on Romania sustainable development*, Procedia Technology, 19, 416-423, 2015.
[7] Draghici, A., Baban, C. F., Ivascu, L.V., Sarca, I., *Key success factors for university–industry collaboration in open innovation,* Proceedings of the ICERI2015, ISBN: 978-84-608-2657-6, 7357-7365, IATED, 2015.
[8] Ivascu, L., Cioca, L.I., *Occupational Accidents Assessment by Field of Activity and Investigation Model for Prevention and Control,* Safety Journal, 5(1), 12, 2019.
[9] Ivascu, L., Mocan, M., Draghici, A., Turi, A., Rus, S., *Modeling the green supply chain in the context of sustainable development*, 4th World Conference on Business, Economics and Management (WCBEM-2015), 26, pp. 702-708, 2015.
[10] Rampelt, F., Orr, D., Knoth, A., *Bologna Digital 2020. White Paper on Digitalisation in the European Higher Education Area*, Berlin: Hochschulforum Digitalisierung (HFD), 2019.
[11] Taucean, I., Tamasila, M., Ivascu, L., Miclea, S., Negrut, M., *Integrating Sustainability and Lean: SLIM Method and Enterprise Game Proposed*, Sustainability Journal, 11(7), 2103, 2019.
[12] Trandabat, A.F., Pislaru, M., Brinzila, M., *SiadEnv - Environmentally Friendly E-Building Energy Management System*, Environmental Engineering and Management Journal, 11(3), pp. 687-694, 2012.
[13] Zaman, G., Gherasim, Z., *Criteria, and principles of sustainable development from the point of view of its resources*, Bulletin AGIR, 4, pp. 137-139, 2006.
[14] Commission européenne, Stratégie de l'Union européenne en faveur du développement durable, 2002.
[15] Church, C., *Useful Experiences in Sustainable Development*, Ed. Academia Română, 1997.

Modelarea impactului internațional al universităților folosind logica fuzzy

Impactul internațional al universităților este tot mai important pentru că se dorește internaționalizarea și îmbunătățirea competitivității. Scopul lucrării este de a prezenta influența principalelor variabile care influențează impactul internaționalizării universităților, folosind logica fuzzy. Variabilele funcțiilor de apartenență sunt reputația academică, reputație academică, reputația angajaților, citări per lucrare, articole per facultate, rețea internațională de cercetare, rezultate ale angajării, raportul facultate-studenți, diversitatea studenților internaționali, raportul personalului internațional, raportul studenților de schimb la intrare, raportul studenților de schimb la ieșire și scorul de sustenabilitate. În plus, sunt discutate punctele slabe specifice în adoptarea practicilor sustenabile, cum ar fi: birocrația, provocările sustenabile, concurența și alocarea resurselor. Evaluarea regulilor fuzzy arată că universități depun eforturi considerabile pentru a-și imaginea internațională și-și crește poziția în clasamentele universitare. Limitele acestor cercetări se referă la faptul că analiza a fost efectuată pentru o universitate tehnică din România, fiind considerată.

Delia ROZOVLEAN, PhD. Student, Politehnica University of Timisoara, Faculty of Management in Production and Transportation, delia.rozovlean@upt.ro
Alberth-Calin VASIESCU, Master Student, Politehnica University of Timisoara, Faculty of Management in Production and Transportation, alberth.vasiescu@student.upt.ro
Roxana KASAI, PhD. Student, Politehnica University of Timisoara, Faculty of Management in Production and Transportation, roxana.kasai@student.upt.ro
Monica WOLFF, PhD., Lecturer, Politehnica University of Timisoara, Faculty of Management in Production and Transportation, monica.wolff@upt.ro
Larisa IVASCU, PhD., Professor, Department of Management, Politehnica University of Timisoara, Timisoara, Romania, larisa.ivascu@upt.ro