

ANALYSIS OF DETERMINING THE PERCENTAGE OF EMPLOYEE SALARY INCREMENT AGAINST ASSESSMENT RESULTS USING FUZZY LOGIC

Zakwan Hilmy¹, Trisno Susilo², Zalmi Dzirrusydi³, Fajar Tyas Adi⁴, Alyuan Dasira⁵, Muhammad Zaki Prawira⁶, Ardiansyah Pasaribu⁷

Program Studi Teknik Perkapalan Universitas Karimun^{1,2,4,5,6,7}

Program Studi Manajemen Kepalabuhan dan Pelayaran Universitas Karimun²

Email: zakwanhilmy013@gmail.com¹, Susilotrisno@gmail.com², zalmi270288@gmail.com³, fajartyasadi01@gmail.com⁴, alyuan08@gmail.com⁵, zakuprawira30@gmail.com⁶, ardiansikb@gmail.com⁷

Abstract

This research responds to the observations and interviews conducted with PT Mega Teknik Mandiri (MTM), a sub-contractor of PT Karimun Sembawang Shipyard. The findings indicate that the decision-making system for employee salary increases still relies on an outdated and ineffective system. The system for granting salary increases to employees is based solely on assessments from the foreman, which may not be objective. This research aims to analyze whether decision-making optimization methods can be applied to this process. A quantitative method using Fuzzy Logic is employed to determine the percentage of salary increases based on the company's assessment results. Employee assessment will be based on objective criteria, including attitude and work speed, with assessment ranges of 5-10 and 4-10, respectively. The results will be calculated using Fuzzy Logic to determine the percentage of salary increase based on assessment points. For example, an employee with an attitude assessment of 7 and a work speed of 8 would receive a 6.3% salary increase. The same process is applied to other employee assessments to determine the percentage of salary increases for each employee.

Keywords: *Fuzzy Logic, Decision Making, Salary Increase, Assessment.*

Abstrak

Penelitian ini merupakan tindak lanjut dari hasil observasi dan wawancara kepada pihak perusahaan PT. Mega Teknik Mandiri (MTM) yang merupakan sub-kontraktor PT Karimun Sembawang Shipyard. Hasil wawancara dan observasi menunjukkan hingga saat penelitian ini dibuat, sistem pengambilan keputusan dalam kenaikan gaji karyawan masih menggunakan sistem lama dan kurang efektif. Hal ini dikarenakan sistem pemberian kenaikan gaji untuk karyawan dilakukan hanya berdasarkan penilaian sederhana dari mandor. Oleh sebab itu dilakukan penelitian ini untuk menganalisis apakah salah satu metode optimasi pengambilan keputusan dapat diterapkan dalam kasus ini. Penelitian ini menggunakan metode kuantitatif dengan fokus kerja pada penerapan Logika Fuzzy dalam menentukan persentase kenaikan gaji karyawan berdasarkan hasil penilaian pihak perusahaan. Penilaian karyawan akan dilakukan berdasarkan kriteria Sikap dengan range penilaian 5–10 dan Kecepatan Kerja dengan range penilaian 4-10. Hasil yang didapat adalah Logika Fuzzy dapat digunakan untuk mendapatkan persentase kenaikan gaji berdasarkan poin penilaian. Salah satu sampelnya adalah dengan poin penilaian Sikap 7 dan Kecepatan Kerja 8 didapatkan persentase kenaikan gaji sebesar 6.3%. Proses yang sama diterapkan pada hasil penilaian karyawan lainnya sehingga didapatkan persentase kenaikan gaji masing-masing karyawan

Kata Kunci: *Logika Fuzzy, Pengambilan Keputusan, Kenaikan Gaji, Penilaian.*

INTRODUCTION

Each company has its policy for calculating salary increases based on several assessment indicators. This approach aims to improve worker performance. To simplify decision-making, it is important to consider the interconnection between each criterion. The percentage of the salary increase is determined by fulfilling specific conditions (Guin et al., 1996) The results of these decisions are often based on personal opinions and do not accurately reflect the situation. There are several decision-making methods, including fuzzy logic. In fuzzy logic, each indicator is assigned a membership weight that determines the degree to which it is true or false. (Maryaningsih, Siswanto, 2013). This fuzzy logic provides an ambiguous value between a true value (1) and a false value (0) (Hilmy & Abdilla, 2020).

Previous research has shown that decision making using fuzzy logic is more accurate and more efficient than using forecasting methods(Andani, 2013).

PT Mega Teknik Mandiri (MTM) is a subcontractor at PT Karimun Sembawang Shipyard, providing services and construction. During an interview with one of MTM's managerial members, it was concluded that the criteria for measuring worker performance is not effective in determining salary increases. Instead, MTM raises salaries based on uniformity and equality of salary values with other subcontractors. The absence of an updated assessment system is a contributing factor to potential errors in the evaluation process. The absence of an updated assessment system is a contributing factor to potential errors in the evaluation process. Currently, the assessment is solely based on the foremen's evaluation, which may not be accurate. In order to solve this problem, this study proposes the use of fuzzy logic to calculate the percentage of salary increase for employees, the result of which will be based on a more objective evaluation method.

Fuzzy Logic Control

Fuzzy logic is one part of artificial intelligence. It was first introduced by Lotfi A. Zadeh, professor of computer science from the University of California, Barkeley. In 1965, Zadeh modified set theory where each member has a degree of membership that has a continuous value between 0 and 1. This set is called a fuzzy set. Fuzzy logic has several implication models. The method in this research uses the Sugeno fuzzy type. Sugeno Fuzzy Logic is fuzzy logic where the input is in the form of words and the output is a mathematical result.

Fuzzification

This stage serves to convert input signals that are firm to fuzzy sets using fuzzification. In fuzzification, there is a fuzzy set membership function, which is a curve that describes the mapping of input to membership degrees between 0 and 1. Each fuzzy set membership function has several membership parts. Determination of the input value with a triangular membership function is determined using equation 1. So that a membership value is obtained with a range of 0 to 1 in the fuzzy function triangle.

RESEARCH METHOD

In this research, quantitative data analysis methods are used quantitative data analysis methods for the analysis of employee job evaluation data for salary increase through the use of fuzzy logic. The names, positions, and salaries of employees are shown in Table 1.

Table 1. PT MTM Basic Salary List

No	Nama	Posisi	Daftar Gaji Pokok		
			Basic/Jam	Transport	Makan
GRINDER					
1	Awi	Grinder	Rp 15,000	Rp 15,000	Rp 15,000
2	Bonar H	Grinder	Rp 15,000	Rp 15,000	Rp 15,000
3	Rabikin	Grinder	Rp 15,000	Rp 15,000	Rp 15,000
4	Faisal	Grinder	Rp 15,000	Rp 15,000	Rp 15,000
5	Jupri	Grinder	Rp 15,000	Rp 15,000	Rp 15,000
6	Wahyudin	Grinder	Rp 15,000	Rp 15,000	Rp 15,000

The Company will evaluate each employee to determine the percentage of increase in his or her salary. The evaluation criteria are shown in Table 2.

Table 2. Assessment Criteria

SIKAP		KECEPATAN KERJA	
1	Tidak Sopan	1	Lambat
2	Sopan	2	Sedang
3	Sangat Sopan	3	Cepat

In the attitude criteria, the rules are given into 3 parts, namely Disrespectful, Polite, and Very Polite. Meanwhile, the work speed assessment criteria are divided into 3 parts, namely Slow, Medium, and Fast. The assessment weights for the criteria are shown in Table 3:

Table 3. Assessment Range

RANGE	
SIKAP	5 - 10
KECEPATAN KERJA	4 - 10

Logic operations are operations that combine and modify two or more fuzzy sets. The resulting membership value of the combined sets is referred to as the firing strength or α . (Official, 2017). In fuzzy sets there are 3 types of basic operations created by Zadeh, namely as follows:

- a. The “and” operation represents the intersection operation on a set, α . The intersection operation on a set, α , is represented by the 'and' operation. The intersection operation on a set, α , is represented by the 'and' operation. This is achieved by taking the least value between two or more sets, as shown in equation 1..

$$\mu A \cap B = \min(\mu A [x], \mu B [y]) \quad (1)$$

- b. The “or” operation is obtained by taking the greatest value between two or more sets, and is related to the combination operation on set α . It can be described using equation 2..

$$\mu A \cup B = \max(\mu A [x], \mu B [y]) \quad (2)$$

- c. The "not" operation, corresponding to the complement operation on a set, α is obtained by subtracting the membership value of an element on the set from 1.

The classification of each of the evaluation criteria for the determination of the rules in the fuzzification is determined by the company. The range of salary increase rules determined by the company is shown in Table 4 and Table 5.

Table 4. Matrix of Rule Assessments

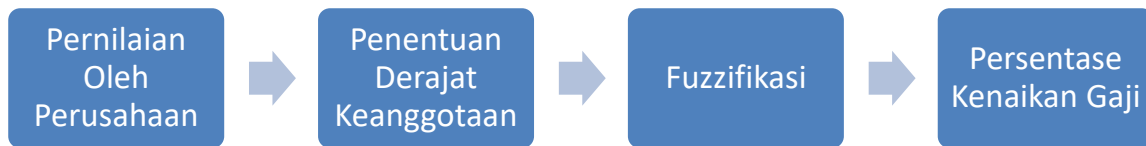
Sikap			
Kecepatan Kerja	Tidak Sopan	Sopan	Sangat Sopan
Lambat	Sangat Sedikit	Sedikit	Sedang
Sedang	Sedikit	Sedang	Banyak
Cepat	Sedang	Banyak	Sangat Banyak

Table 5. Rule Assesments

No	Jenis	%
1	Sangat Sedikit	3.0%
2	Sedikit	4.5%
3	Sedang	6.0%
4	Banyak	8.0%
5	Sangat Banyak	10.0%

The calculation results display the percentage of salary increases based on the review results, as shown in the flowchart in Figure 6.

Figure 1: Research's Flow Chart



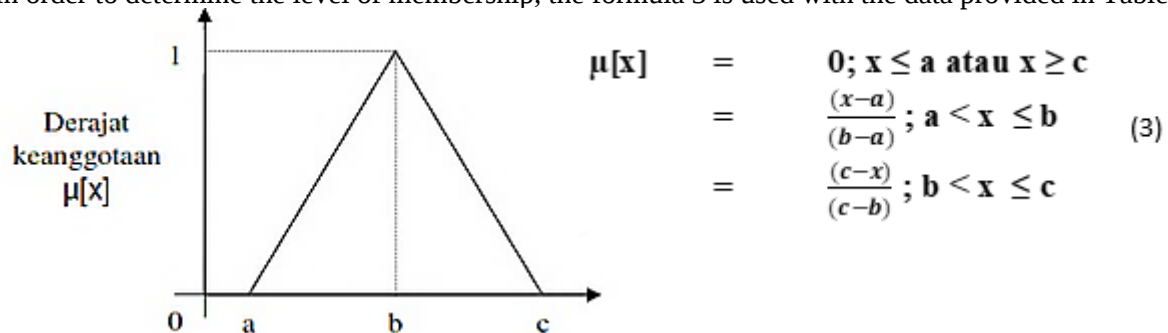
RESULTS and DISCUSSION

As mentioned earlier in the research flow, the first step of this fuzzy analysis is to obtain the evaluation results of the company. The evaluation results for each employee are shown in Table 6.

Table 6. Employee's Assessments Score

No	Nama	Sikap	Kecepatan Kerja
1	Awi	7	8
2	Bonar H	7.5	8
3	Rabikin	8	7
4	Faisal	7	7
5	Jupri	8	8
6	Wahyudin	7.5	9

In order to determine the level of membership, the formula 3 is used with the data provided in Table 6.



Formula 4 is used for the calculation of the weight average after the achievement of the membership degree.

$$Z = \frac{\sum \mu_i . z_i}{\mu_i} \quad (4)$$

As an example, one employee will be taken with the company's assessment results to be calculated manually as shown in Table 7:

Table 7. The Sample of assessments Score

Nama	Sikap	Kecepatan Kerja
Awi	7	8

1. Fuzzy Graph Generation and Predicate Alpha Calculation

A fuzzy graph can be created based on the assessment range determined by the company, as shown in Figures 2 and 4. The graph/function used in this study is a triangular function.

(Gunawan et al., 2013). Furthermore, the calculation is carried out to find the alpha predicate of each indicator or assessment criteria as follows Figure 3 and Figure 5:

Figure 2: Fuzzy Graph of Attitude Assessment

KALKULASI PENIILAIAN SIKAP

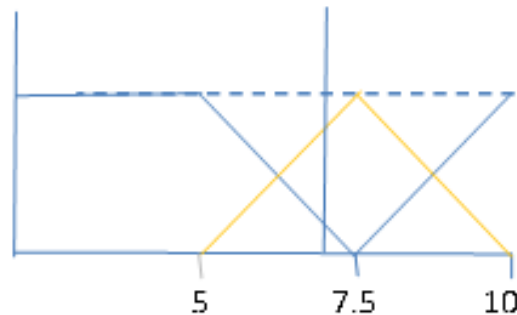
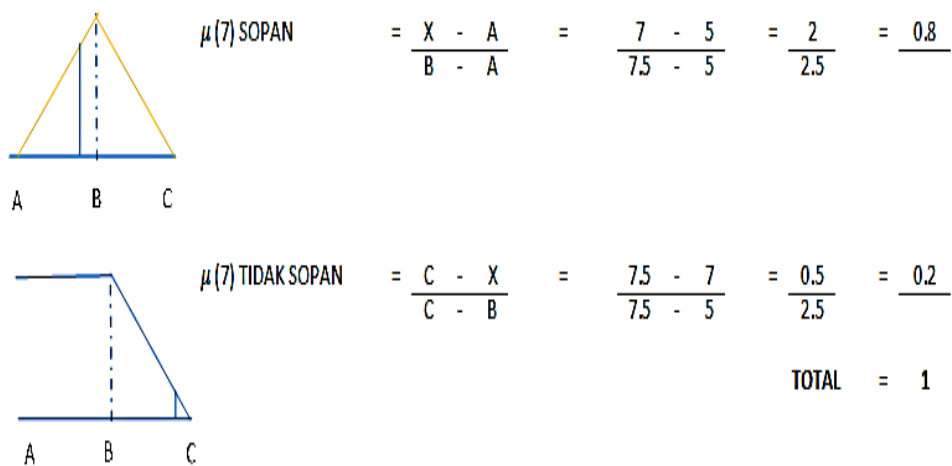


Figure 3: Alpha Predicate Calculation of Attitude Criteria



The Attitude criteria calculation resulted in an alpha predicate of 0.8 for Polite and 0.2 for Disrespectful. The sum of the two alpha predicates was tested and resulted in 1, indicating no errors in determining the degree of membership based on the results of the attitude assessment with 7 assessment points.

Figure 4: Alpha Predicate Calculation of Work Speed Criteria

KALKULASI PENIILAIAN KECEPATAN KERJA

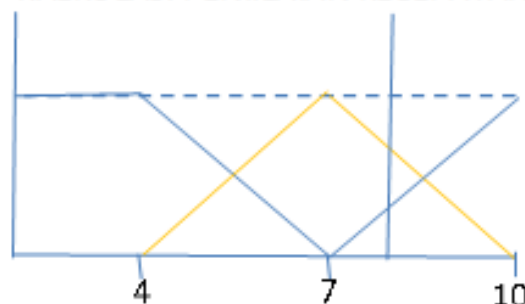
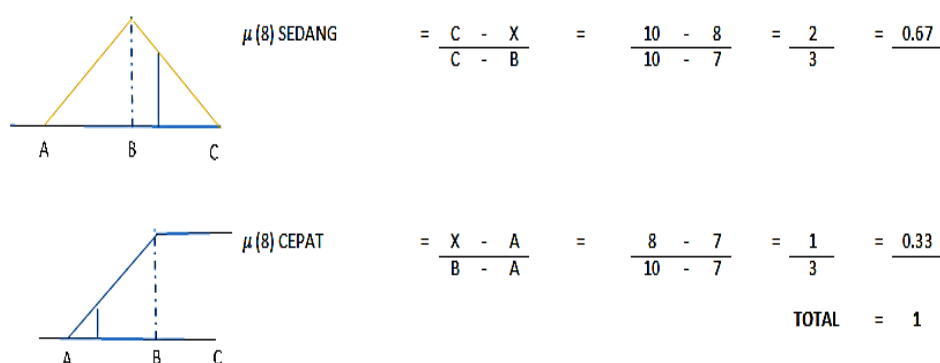


Figure 5: Alpha Predicate Calculation of Work Speed Criteria



The calculation of the alpha predicate resulted in a score of 0.67 for the medium work speed criteria and a score of 0.33 for the fast criteria. The two alpha predicates were summed, resulting in a total of 1, indicating a successful calculation.

2. Weight Average

After obtaining the alpha predicate, the Weighted Average (Z) calculation is performed to determine the percentage of salary increase based on the company's predetermined rule. The alpha calculation results in

$$\begin{aligned}\mu[\text{SOPAN}] &= 0.8 \\ \mu[\text{TIDAK SOPAN}] &= 0.2 \\ \mu[\text{SEDANG}] &= 0.67 \\ \mu[\text{CEPAT}] &= 0.33\end{aligned}$$

The smallest predicate alpha is determined by using the equation $\mu A \cap B = \min(\mu A[x], \mu B[y])$ with the criteria adjusted according to Table 4.

$$\begin{aligned}\text{SOPAN} - \text{SEDANG} &= \text{SEDANG} &= 0.67 \\ \text{SOPAN} - \text{CEPAT} &= \text{BANYAK} &= 0.33 \\ \text{TIDAK SOPAN} - \text{SEDANG} &= \text{SEDIKIT} &= 0.2 \\ \text{TIDAK SOPAN} - \text{CEPAT} &= \text{SEDANG} &= 0.2\end{aligned}$$

The calculation for the Weighted Average results is as follows:

$$\begin{aligned}Z &= \frac{\sum \mu_i \cdot z_i}{\mu_i} \\ Z &= \frac{8.8\%}{1.40} \\ &= 6.3\%\end{aligned}$$

The percentage increase is 6.3% of base salary based on the calculation above. The calculation for other employee appraisal data follows the same method as above. The calculation results are presented in Table 8.

Tabel 8. Final Calculation of Salary Increment

No	Nama	Penilaian Sikap		Gaji Pokok Awal (Rp)	% Kenaikan Gaji	Penambahan Gaji (Rp)	Gaji Pokok Akhir (Rp)
		Sikap	Kec. Kerja				
1	Awi	7	8	15,000.00	6.3%	945.00	15,945.00
2	Bonar H	7.5	8	15,000.00	6.7%	1,005.00	16,005.00
3	Rabikin	8	7	15,000.00	6.4%	960.00	15,960.00
4	Faisal	7	7	15,000.00	5.7%	855.00	15,855.00

5	Jupri	8	8	15,000.00	7.3%	1,099.50	16,099.50
6	Wahyudin	7.5	9	15,000.00	7.3%	1,099.50	16,099.50

According to Table 8, the company will provide salary increases based on the results of the evaluation of each employee's attitude and work speed criteria.

CONCLUSION

Based on the results and discussion, it can be concluded that the use of Fuzzy Logic in making employee salary increase decisions can be done properly according to the criteria for attitude and work speed that have been assessed by the company. Therefore, based on the performance of the employees in the field, the percentage of salary increase can be determined objectively. The managerial implementation that is obtained and can be applied to the financial payroll system is that in the future the company can conduct a periodic evaluation, the results of which can be used to determine the policy of increasing the salary of employees by a given percentage. The risk of giving a salary increase percentage to incompetent employees can be minimized in addition to objective and fair evaluation.

REFERENCES

- Andani, S. R. (2013). Fuzzy Mamdani Dalammenentukan Tingkat Keberhasilan Dosen mengajar. *Seminar Nasional Informatika 2013, 2013*(semnasIF).
- Edy Victor Haryanto, Fina Nasari², (2015). 'PENERAPAN METODE FUZZY MAMDANI DALAM MEMPREDIKSI TINGGINYA PEMAKAIAN LISTRIK (STUDI KASUS KELURAHAN ABC)', STMIK AMIKOM Yogyakarta, ISSN.3, 115–19
- Bissey, S., S. Jacques, and J. C. Le Bunetel, (2017). 'A Relevant Fuzzy Logic Algorithm to Better Optimize Electricity Consumption in Individual Housing In This Paper, an Electrical Energy Management System, That Implements an Overall Electricity Consumption PredictionModel, Was Proposed. This Model Was Esta', *Renewable Energy and Power Quality Journal*, 1.15, 103–107 In this paper, an electrical energy manage
- Guin, M. M., Kato, H., Yamaguchi, H., Maeda, M., & Miyanaga, M. (1996). Reduction of skin friction by microbubbles and its relation with near-wall bubble concentration in a channel. *Journal of Marine Science and Technology*. <https://doi.org/10.1007/BF02390723>.
- Gunawan, R., Aisjah, A. S., & Masroeri, A. A. (2013). Perancangan Sistem Kontrol Sandar Kapal Otomatis Berbasis Logika Fuzzy di Pelabuhan Tanjung Perak Surabaya. In *Sandar Kapal Menggunakan Logika Fuzzy*.
- Hilmy, Z., & Abdilla, I. (2020). STUDI KASUS PENERAPAN LOGIKA FUZZY PADA PROSES PEMILIHAN KAPAL BARANG. *JURNAL JALASENA*, 2(1). <https://doi.org/10.51742/jalasena.v2i1.173>
- Maryaningsih, Siswanto, M. (2013). Metode Logika Fuzzy Dalam Sistem Pengambilan Keputusan Penerimaan Beasiswa. *Jurnal Media Infotama*.
- Official, U. O. (2017). *E Learning Logika Fuzzy Part 1*. Youtube. www.youtube.com/watch?v=tcwghBIH0PI
- Dharma Dharshin, Rekha R., and Vidhyapriya R. (2016). 'POWER SYSTEM PLANNING USING ANN WITH FUZZY LOGIC AND WAVELET ANALYSIS', *ICTACT Journal on Soft Computing*, 7.1, 1319–23
- Simanjuntak, Eko Suharyanto, C., dan Khairiyah R. (20018). Fuzzy Sugeno Untuk Menentukan Penilaian Kompetensi Karyawan Pt Schneider Batam. *Jurnal Information System Developmen*, 3(2),97-103
- Simanjuntak, P., Eko Suharyanto,C.(2019). Fuzzy Inference System Dalam Menentukan Status Malnutrition Pada Balita Di KotaBatam. *Jurnal Edit Informatika*, 5(2),29-41.
- Siswanto, D. J., Tegor, T., Haqiqi, F., Yusmalina, Y., & Susanto, A. (2022). Human Resources Management in The Country's Border Region Faces Industry 4.0 and The Covid-19 Pandemic. *Al-Tanzim: Jurnal Manajemen Pendidikan Islam*, 6(1), 228-242.
- Rosalina, Fifi D, Yuniar Farida, and Abdulloh Hamid,(2016) 'METODE LOGIKA FUZZY SEBAGAI EVALUASI DISTRIBUSI TENAGA LISTRIK', 2.1, 22–29.
- Tegor, Johannes, Jaya, R. I. K., Thasimmim, S. N. (2023). Skill, Transformational Leadership, And

- Competitiveness: Relationships In A Love Triangle. *Al-Tanzim: Jurnal Manajemen Pendidikan Islam*, 7(2), 422-434.
- Tegor and Umar, Husein. (2017). Compensation analysis in relationship moderation between transformational leadership style and work environment on the employee performance. *Russian Journal of Agricultural and Socio-Economic Sciences*, 71(11).
- Tegor., Susanto, Alpino., Togatorop, Veterson., Sulivyo, Lod., Siswanto, Dwi Joko. (2020). *Metodologi Penelitian Kualitatif dan Kuantitatif*. Yogyakarta: Penerbit Lakeisha.
- Tegor., D., Joko, D., & Siagan, M. (2020). *Manajemen Sumber Daya Manusia*. Yogyakarta: Penerbit Deepublish.
- Tegor, T., Thasimmim, S. N., Dianasari, E. L., & Yusmalina, Y. (2023). The influence of work discipline in mediating work environment relationships on job satisfaction. *Jurnal Cafetaria*, 4(1), 106-112.
- TEGOR, T. S., THASIMMIM, S. N., & SUSANTO, A. PERSONAL SKILLS AND EMPLOYEE ENGAGEMENT IN PERFORMANCE IMPROVEMENT.
- Tegor, T., Yusmalina, Y., & Haqiqi, F. (2021). PENERAPAN STANDAR AKUNTANSI DAN KUALITAS APARATUR TERHADAP LAPORAN KEUANGAN PEMERINTAH DAERAH (Studi Kasus pada Dinas Pekerjaan Umum dan Penataan Ruang Kabupaten Karimun). *JURNAL CAFETARIA*, 2(1), 13-24.