Çukurova Üniversitesi
Mühendislik Fakültesi Dergisi
Çukurova University
Journal of the Faculty of Engineering
ISSN: 2757-9255 CİLT/VOLUME: 41 SAYI/ISSUE: 3 EYLÜL/SEPTEMBER 2026

Identifying the Causes of Employee Turnover in Manufacturing: A DEMATEL-Based Analysis and Improvement Framework

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Article Info

Received : 04.04.2026
Accepted : 16.07.2026
DOI: 10.21605/cukurovaumfd.1904473

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Keywords

H*uman resource management*
E*mployee turnover*
J*ob resignation*
D*EMATEL*
W*orkforce retention*

How to cite: *AKCAN YETGİN, S., ZATERİ, Ö., (2026). Identifying the Causes of Employee Turnover in Manufacturing: A DEMATEL-Based Analysis and Improvement Framework. Cukurova University, Journal of the Faculty of Engineering, 41(3), 563-577.*

ABSTRACT

Employee turnover intentions and behaviors significantly influence both the psychological and also economic performance of organizations. Identifying the underlying reasons behind employees' decisions to resign is therefore essential for sustaining workforce stability. This study aims to explore the key factors influencing blue-collar employees—particularly skilled and experienced workers—in their intention to leave their jobs within the manufacturing sector. Using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method, the causal relationships and relative dominance among 24 turnover criteria were analyzed to identify the most influential factors. The findings indicate that inadequate wages, unfair management, unbalanced workload distribution, poor communication with supervisors, and lack of a sense of belonging are the most critical drivers of turnover. Based on these insights, targeted improvement strategies are proposed to strengthen employee retention and loyalty in manufacturing organizations.

Üretim Sektöründe İşgücü Devrinin Nedenlerinin Belirlenmesi: DEMATEL Tabanlı Bir Analiz ve İyileştirme Çerçevesi

Makale Bilgileri

Geliş : 04.04.2026
Kabul : 16.07.2026
DOI: 10.21605/cukurovaumfd.1904473

Sorumlu Yazar

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Anahtar Kelimeler

İ*nsan kaynakları yönetimi*
İ*şgücü devri*
İ*şten ayrılma*
D*EMATEL*
İ*şgücü bağlılığı*

Atıf şekli: *AKCAN YETGİN, S., ZATERİ, Ö., (2026). Üretim Sektöründe İşgücü Devrinin Nedenlerinin Belirlenmesi: DEMATEL Tabanlı Bir Analiz ve İyileştirme Çerçevesi. Çukurova Üniversitesi, Mühendislik Fakültesi Dergisi, 41(3), 563-577.*

ÖZ

Çalışanların işten ayrılma niyetleri ve davranışları, kuruluşların hem psikolojik hem de ekonomik performansını önemli ölçüde etkiler. Bu nedenle, çalışanların istifa kararlarının altında yatan nedenleri belirlemek, işgücü istikrarını sürdürmek için çok önemlidir. Bu çalışma, imalat sektöründeki mavi yakalı çalışanların -özellikle vasıflı ve deneyimli işçilerin- işlerinden ayrılma niyetlerini etkileyen temel faktörleri araştırmayı amaçlamaktadır. DEMATEL yöntemi kullanılarak, 24 işten ayrılma kriteri arasındaki nedensel ilişkiler ve göreceli baskınlık analiz edilerek en etkili faktörler belirlenmiştir. Bulgular; yetersiz ücretler, adil olmayan yönetim, dengesiz iş yükü dağılımı, yöneticilerle zayıf iletişim ve aidiyet duygusunun eksikliğinin işten ayrılmanın en kritik nedenleri olduğunu göstermektedir. Bu bulgulara dayanarak, imalat kuruluşlarında çalışanların bağlılığını ve sadakatini güçlendirmek için iyileştirme stratejileri önerilmiştir.

1. INTRODUCTION

The human resources (HR) department plays a pivotal role in shaping the reputation and sustainability of organizations. Beyond recruitment, HR professionals contribute to defining company vision and mission, managing compensation systems, facilitating training and promotion processes, and ensuring employee well-being [1,2]. HR departments also play a central role in managing both hiring and termination processes, which together determine the overall workforce equilibrium of an organization [3].

Retaining skilled employees is one of the most persistent challenges in organizational management. Previous research highlights that turnover intentions are influenced by numerous factors, including job satisfaction, management style, communication quality, compensation structure, and workplace ergonomics. These determinants vary not only by sector but also by individual employee characteristics. Employees may decide to leave due to diverse motivations—ranging from inadequate pay and excessive workload to lack of recognition or poor managerial relations. Managing these factors effectively contributes to overall organizational harmony and productivity. Enhanced job satisfaction, in turn, increases employees' emotional commitment and reduces turnover intentions. Accordingly, this study focuses on understanding the turnover dynamics among experienced and skilled blue-collar workers in the manufacturing industry. Using the DEMATEL method, the study investigates the interrelationships and dominance levels among turnover criteria to determine the most influential causes. The research further proposes improvement strategies for high-value employees and enhance organizational performance. The research further proposes improvement strategies for high-value employees and enhance organizational performance.

Table 1. Previous studies on job leaves

Authors	Method	Authors	Method
Jantan, Hamdan, Othman [7]	Data mining	PérezCampdesuñer et al. [18]	Neural Network
Alao, Adeyemo [8]	Forecasting	Bhuva, Srivastava [19]	Forecasting, data mining
Park, Shaw [9]	Meta-analysis	Stamolampros et al. [20]	Logistic regression
Katsieka, Theodosiou, Morgan [10]	Nomological Network	Michael et al. [21]	Factor analysis
Bellon [11]	Logistic regression	Khalid et al. [22]	Factor analysis
Punnoose, Ajit [12]	Forecasting	Eka et al. [23]	Regression analysis
Presbitero, Roxas, Chadee [13]	structural equation Modeling	Bolt, Winterton, and Cafferkey [24]	Literature review
Javhav [14]	Questionnaire	Khahan et al. [25]	Regression analysis
Rubenstein, Eberly, Lee, Mitchell [15]	Meta-analysis	Rizki, Siti, Arif [26]	Smart-Pls analysis
Sabbagha et al. [16]	Structural equation modeling	Sharmila, Asokan, Rajermani, Kumarashvari [27]	Empirical tests
Aliyu, Nyadzayo [17]	Structural equation modeling	Wong, Wong, Sudhakar [28]	Meta analysis

Understanding the causes of employee turnover is essential for both organizations and individuals. Senior management often views turnover analysis as an opportunity to identify underlying issues and to implement preventive measures that can minimize unwanted resignations [4]. Furthermore, addressing the factors that drive employees to leave is a prerequisite for ensuring workforce continuity [5]. Employee demographics—such as age, marital status, education level, and occupational background—are among the most commonly cited determinants of turnover [6]. In addition to demographic characteristics, workload intensity and job stress have been shown to influence employees' intentions to resign. The relationship is generally proportional: as the workload increases, so does the likelihood of turnover. A large body of research has explored turnover behavior using various quantitative and qualitative methodologies. Recent studies are summarized in Table 1, demonstrating the diversity of analytical approaches employed in the field. However, despite extensive research, few studies have combined multi-criteria decision-making (MCDM) techniques with practical improvement proposals. This study addresses that gap by applying the

DEMATEL method to identify causal relationships among turnover criteria in a manufacturing setting. The remainder of this paper is structured as follows: Section 2 details the research methodology; Section 3 presents the empirical application and findings; Section 4 discusses improvement suggestions; and Section 5 concludes with managerial implications and recommendations for future research.

2. METHOD

This study investigates the reasons behind employee turnover within a large-scale manufacturing company. The analysis was conducted in three main stages: (1) Investigation, (2) Analysis, and (3) Improvement.

2.1. Investigation Phase

In the problem identification stage, a *fishbone diagram*—also known as the Ishikawa Diagram —was used to systematically identify potential causes of employee turnover. Originally developed by Professor Kaoru Ishikawa in 1943, this tool helps visualize causal relationships within a process and is widely adopted in quality management [29].

The procedure followed six key steps:

1. Defining the problem collaboratively with experts and managers.
2. Conducting brainstorming sessions to determine main branches of causes.
3. Identifying and labeling sub-causes on each branch of the diagram.
4. Applying the 5W1H framework (*What, Where, When, Why, How, Who*) to refine causal relationships.
5. Reviewing the diagram with expert feedback.
6. Finalizing the diagram after achieving consensus.

2.2. Analysis Phase

After identifying the root causes of turnover using a fishbone analysis, it is necessary to analyze the turnovers. In this study, the DEMATEL method, a multi-criteria decision-making method, was used to examine the weightings of the reasons for turnover and to find the reason with the most significant turnover weight. The DEMATEL method, which allows for graphical data generation, allows for problem planning and solution by making the root cause more meaningful. This method is known as a successful method for determining the interaction between alternatives [30]. The steps followed in the DEMATEL method are listed as follows [31].

Step 1 - Calculating the Direct Relationship Matrix

The values in the direct relationship matrix indicate the direct relationship of variable i on variable j. The degree of comparison is determined as 0: No Effect, 1: Low Effect, 2: Medium Effect, 3: High Effect, and 4: Very High Effect.

$$D = \begin{bmatrix} 0 & d_{1n} \\ d_{n1} & 0 \end{bmatrix} \tag{1}$$

Step 2 - Normalized Matrix Calculation

In this step, normalization is performed by dividing all values in the direct relationship matrix created in the previous step by the largest value in the row and column totals. The smallest value in the row and column is determined, with the diagonal values set to zero, and the following formulas are applied.

$$x = \frac{D}{S} \tag{2}$$

$$S = max\left(\sum_{i=1}^{n} x_{ij}\,,\ \sum_{j=1}^{1} x_{ij}\right) \tag{3}$$

Step 3 - Total Correlation Matrix

In this step, the normalized matrix from the previous step is converted into a total correlation matrix using the following formula. The normalized direct correlation matrix is subtracted from the identity matrix. The inverse of the subtracted matrix is then taken. The subtracted and inversed matrix is multiplied by itself to form the total correlation matrix.

$$T = x + x^2 + \cdots + x^n = x(1-x)^{-1} \quad (4)$$

Step 4 - Determining the Cause-and-Effect Criteria

In this step, the sum of the rows and columns of the matrix from the previous step is determined. A new matrix is created by performing calculations according to the formulas below. After these values are calculated, they are added, and the subtracted value is found. This will create two groups. These groups represent the interaction between the criteria. These are the determination of the cause criteria and the determination of the effect criteria. The values formed by summing are ranked. The highest value indicates a greater correlation with the other criteria, while the lowest value indicates a lesser correlation with the other criteria. In the subtracted values, the variable with a positive result is in the cause group, and the variable with a negative result is in the effect group.

$$S = [Sij]' \; i, j \in (1,2,3, \dots, n) \quad (5)$$

$$D = \sum_{j=1}^{n} S_{ij} \qquad R = \sum_{j=1}^{n} S_{ij} \quad (6)$$

Step 5 - Impact Diagram Map

The impact diagram is drawn using a threshold value determined by the sum and subtraction calculated from the total impact matrix. The impact diagram includes criteria created by adding the horizontal portion of the coordinate plane and criteria created by subtracting the vertical portion. The threshold value is determined by experts or taken as an average. This step is critical for achieving an effective analysis. To ensure accurate and accurate analysis, the graph will be created and interpreted by examining the D+R and D-R values.

2.3. Improvement Phase

In the final phase, solution proposals were developed based on the cause–effect relationships identified in the DEMATEL analysis. The improvement strategies targeted the top five causes of turnover—specifically inadequate wages, unfair management, unbalanced workload, poor managerial communication, and lack of belonging—by introducing measurable, fair, and transparent corrective actions.

3. APPLICATION AND FINDINGS

3.1. Problem Definition

The empirical analysis was conducted within a large-scale industrial enterprise engaged in the production of cardboard, paper, boxes, and related products, operating across seven sub-factories with approximately 3,000 employees. The research primarily focused on identifying the underlying factors influencing the turnover of *highly productive and skilled personnel*—a group that provides substantial added value to the company. The purpose, in this study, was to reduce voluntary turnover, retain experienced employees, and improve organizational efficiency in a competitive manufacturing environment. A sample of 75 employees who resigned from the company was selected, representing various operational departments. Analysis of the demographic characteristics of this sample (such as age, education level, and years of experience) revealed that approximately 50% of the employees were graduates of vocational high schools and approximately 30% had 5-10 years of work experience.

3.2. Importance of the Study

Certain costs of leaving a job can be incurred by businesses. These costs can be categorized into two categories: direct and indirect costs. Actions such as searching for suitable personnel for an existing position and providing training to ensure they attain the necessary competencies are defined as direct costs. The resulting loss of motivation from the distrust that results from the departure of an employee's teammates is defined as an indirect cost.

If businesses hire less qualified personnel to replace experienced employees who are prone to leaving their jobs, obtaining the necessary training to improve their skills will require both time and expense. This time will also incur costs. When businesses lose qualified personnel, they also lose their market advantage. In a sustainable competitive market, a qualified workforce dominates the market. However, a negative impact on competitiveness will create serious problems for the business [32]. The impression a company leaves on a departing employee is also crucial. A departing employee's negative comments about the company will also impact their immediate and distant surroundings. This negative interaction will affect existing employees within the company. These negative thoughts will even influence the perspectives of new hires [33]. These factors can also disrupt peace within the company and reduce motivation. These declines will lead to inefficiency [34]. Leaving a job can also lead to disappointment. Trying to fill vacant positions with existing employees can also lead to disappointment. Increased workload among employees and failure to meet demand can lead to frustration. In the case of external recruitment, the new employee's adjustment to the job and the progression of the orientation process can lead to uncertainties. These uncertainties can also affect the level of harmony between the new employee, the company, and team members. All of these processes can negatively impact intra-team/inter-team communication and workplace behavior, disrupting harmony within the company. These processes affect suppliers and customers externally, as well as within the company. A negative impact negatively impacts supplier and customer satisfaction. In this way, businesses can experience fluctuations in their market power. This study is considered crucial for eliminating all the negative impacts mentioned.

3.3. Methodology of the Study

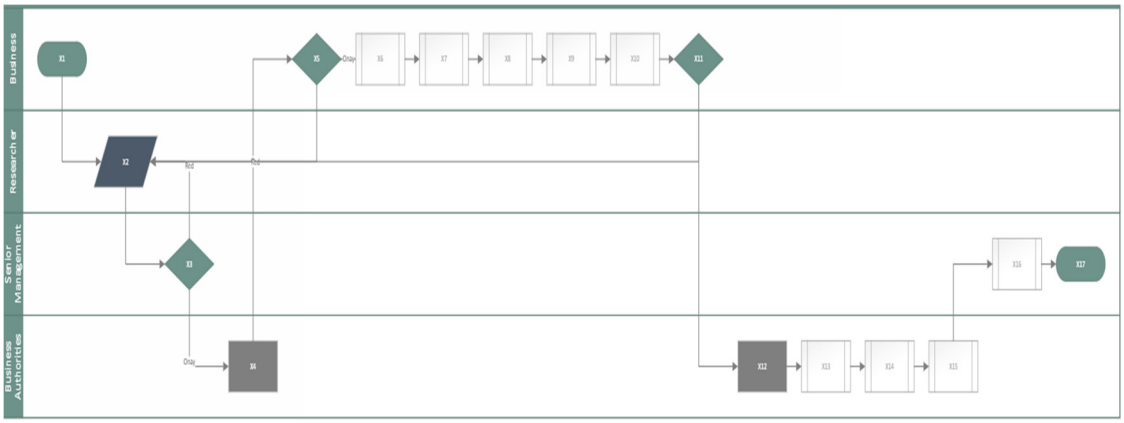


Figure 1. Flow chart of the study

Turnovers are complex patterns. To make this complex structure more understandable, it is necessary to work cyclically. To better understand this complex structure, the flowchart of the study is shown in Figure 1. Examining Figure 1, it was created as the first step, as the problem would be identified within the company. After determining that the core problem was turnover, research was conducted on the solution steps. While creating this diagram, the literature review was kept constantly updated, and each step was reconnected to the literature. As new ideas emerged, the literature was enriched, completing the fishbone diagram. To select the method to be applied as the solution step, a new literature search was conducted. The most appropriate analysis to resolve the complex structure was selected and implemented. Before initiating the improvement work, the literature search was revisited, and the most appropriate improvement work was carried out. Table 2 provides explanations of the codes used in the flowchart.

Table 2. Flowchart terms

Identifying the problem	X1	Mapping the influence diagram	X10
Conducting a literature review	X2	Creating weight rankings	X11
Election of officials to participate in fishbone	X3	Improvement work	X12
Creating the fishbone	X4	Grouping of positions in the business	X13
DEMATEL application	X5	Creating the improvement table	X14
Direct relationship matrix calculation	X6	Determination of improvement calculation criteria	X15
Normalized matrix calculation	X7	Making evaluations	X16
Total relationship matrix	X8	Application to business	X17
Determination the cause-effect criteria	X9		

3.4. Fishbone Method

In the first phase of the implementation, the Fishbone method was used to identify numerous possible reasons for leaving. A brainstorming session with experienced individuals resulted in the formation of ideas about the reasons for leaving. The main arrow of the fishbone diagram is defined as the analysis of the departures. The fishbone diagram was created to capture all possible reasons for leaving (Figure 2).

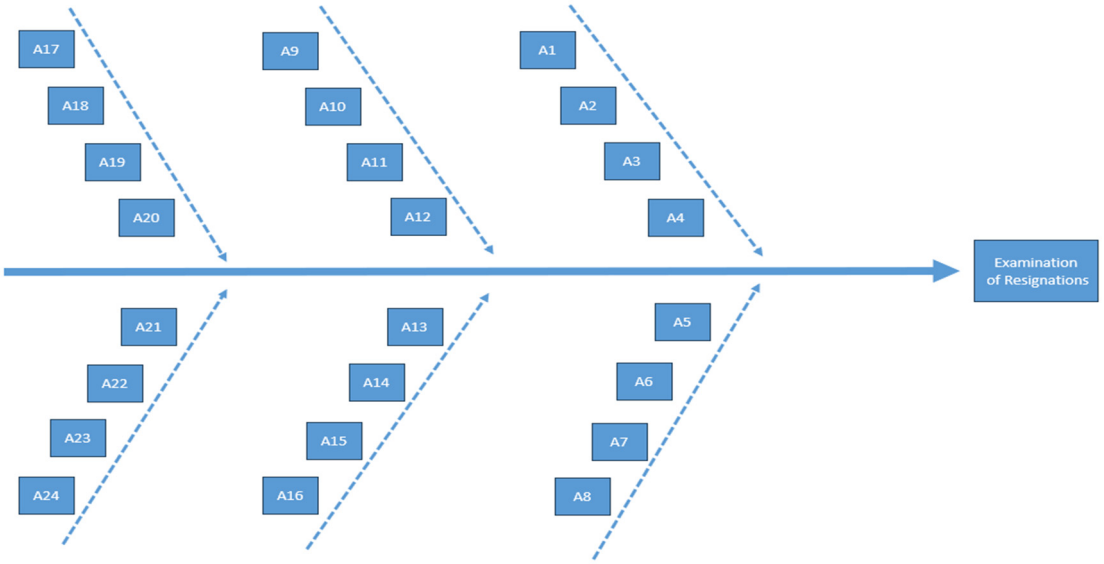


Figure 2. Fishbone diagram for job terminations

Table 3. Fishbone diagram codes

Inadequate wages	A1	Workload	A13
Inadequacy of benefits	A2	Lack of appreciation	A14
Inadequate working hours	A3	Career Opportunities	A15
Non-ergonomic working conditions	A4	Unauthorized Responsibility for the Work Performed	A16
Lack of interdepartmental collaboration	A5	Inadequate Educational Opportunities	A17
Intra-departmental collaboration	A6	Employees at the company are motivated by revenge	A18
Lack of balanced work distribution	A7	Inadequate grievance policy	A19
Unfair management	A8	Insufficient sense of belonging	A20
Contact the administrator	A9	Not allowed to work elsewhere at the company	A21
Failure to set correct goals	A10	Desires to start their own business	A22
Performance evaluation system	A11	Military service, desires to date EYT (people who cannot retire because they do not meet the age requirement)	A23
Bonus system	A12	Resignation due to marriage	A24

A 20-person team consisting of human resources managers, production managers, factory managers, some members of the executive committee, some members of the board of directors, and some employees who were able to gather field observations developed the fishbone diagram. The fishbone representation of job departures is coded. These coding are presented in Table 3. The reasons for these departures are those encountered or likely to be encountered by company officials.

3.5. DEMATEL Method

The first step in applying the DEMATEL method, the direct relationship matrix, was created by considering the arithmetic mean of the data obtained from 75 employees who were planning or inclined to leave their jobs (Figure 3). The DEMATEL analysis was conducted by constructing the direct-relation matrix, normalized direct-relation matrix, and total relation matrix based on expert evaluations. Subsequently, the prominence (D+R) and relation (D−R) values of each criterion were calculated to determine their relative importance and cause–effect relationships. The results revealed that Insufficient Wages was the most influential turnover factor, followed by Unfair Management, Lack of Balanced Work Distribution, Communication with the Manager, and Insufficient Sense of Belonging. These five criteria exhibited the highest priority among all evaluated factors and were therefore identified as the primary drivers of employee turnover. Furthermore, the cause–effect analysis and impact map (Figure 4) demonstrated that turnover factors are interrelated rather than independent, highlighting the necessity of addressing the most influential factors first. Accordingly, the improvement strategies proposed in this study were developed by prioritizing these critical factors to achieve the greatest reduction in employee turnover.

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	Row Total
A1	0,000	2,273	2,364	2,455	2,364	2,636	2,455	3,091	2,636	2,727	2,545	2,364	2,909	2,182	2,636	2,455	2,545	2,545	2,091	2,364	2,364	2,636	2,273	2,273	57,182
A2	2,909	0,000	2,455	1,909	1,727	2,091	2,182	2,727	2,818	2,636	2,455	2,455	2,909	2,727	2,455	2,455	2,455	2,364	2,545	2,455	2,273	1,818	1,909	1,818	54,545
A3	2,818	2,545	0,000	2,636	3,000	2,818	2,727	2,727	2,727	2,909	2,455	2,364	2,727	2,455	2,545	2,364	2,273	1,818	2,364	2,273	2,273	2,000	2,000	1,727	56,545
A4	2,636	2,455	3,000	0,000	2,273	2,364	2,545	2,364	2,545	3,091	2,727	2,727	2,636	2,636	2,636	2,818	2,182	2,182	2,727	2,455	2,364	1,909	1,727	1,727	56,727
A5	2,000	2,091	2,364	2,364	0,000	2,818	2,364	2,364	2,818	2,182	2,727	2,545	2,000	2,182	2,455	2,182	2,273	2,364	2,182	2,545	2,091	2,182	2,273	2,000	53,364
A6	1,909	1,818	1,818	2,000	2,727	0,000	2,364	2,182	2,636	2,455	3,000	2,636	2,182	1,909	2,455	2,364	2,091	2,091	1,818	1,818	2,000	1,636	1,636	1,818	49,364
A7	2,455	2,545	2,455	2,545	2,727	2,636	0,000	2,818	2,455	2,545	2,000	1,909	2,273	2,636	2,455	2,455	2,727	2,727	2,182	2,636	2,182	2,455	2,273	2,091	56,182
A8	2,818	2,636	2,545	2,455	2,364	2,273	2,455	0,000	2,455	2,636	2,091	2,000	2,636	2,818	2,455	2,636	2,545	2,636	2,636	2,455	2,455	2,455	2,273	2,364	57,091
A9	2,636	2,455	2,455	2,818	2,818	2,818	2,545	2,364	0,000	2,182	2,636	2,182	2,273	2,091	2,545	2,364	1,909	2,000	2,000	2,000	1,727	2,000	2,000	1,818	52,636
A10	2,636	2,636	2,091	2,364	2,091	2,273	2,455	2,636	2,455	0,000	2,545	2,000	2,364	2,455	2,364	2,545	2,364	2,636	2,182	2,636	1,909	1,909	1,909	2,000	53,455
A11	2,364	2,182	2,182	2,182	2,818	2,909	2,273	2,182	3,000	2,091	0,000	2,909	2,545	2,273	2,636	2,364	2,182	2,091	2,273	2,182	2,091	2,000	1,727	1,636	53,091
A12	2,273	2,182	2,091	2,182	2,818	2,909	2,182	2,273	2,727	2,182	2,727	0,000	2,545	2,364	2,727	2,273	2,273	2,545	2,182	2,455	2,091	1,909	1,818	1,455	53,182
A13	2,273	2,182	2,273	2,091	2,364	2,455	2,636	2,182	2,455	2,364	2,273	2,364	0,000	2,455	2,818	2,455	2,091	1,909	2,182	2,455	2,364	2,000	1,818	1,909	52,364
A14	2,818	2,727	2,455	2,545	2,364	2,636	2,636	2,636	2,455	2,364	2,273	2,091	2,455	0,000	2,182	2,364	2,091	2,182	2,455	2,636	2,545	2,182	2,091	2,000	55,182
A15	2,182	2,182	2,182	2,364	3,091	3,091	2,364	2,364	3,364	2,273	3,000	2,818	2,545	2,273	0,000	2,273	2,273	2,273	2,091	2,182	2,091	2,273	1,909	1,727	55,182
A16	2,545	2,545	2,455	2,364	2,455	2,364	2,364	2,636	2,909	2,364	2,455	2,545	2,818	2,273	2,545	0,000	2,273	2,182	2,182	2,455	2,182	1,909	1,909	1,909	54,636
A17	2,818	2,727	2,455	2,545	2,455	2,364	2,545	2,545	2,636	2,636	2,455	2,273	2,455	2,636	2,091	2,364	0,000	2,182	2,455	2,455	2,273	2,545	2,364	2,364	56,636
A18	2,909	3,000	2,727	2,727	2,273	2,364	2,636	2,364	2,455	2,455	2,727	2,455	2,818	2,727	2,182	2,636	2,727	0,000	2,273	2,455	2,000	2,091	2,000	2,000	57,000
A19	2,818	2,818	2,636	2,545	2,273	2,364	2,727	2,909	2,545	2,727	2,364	2,182	2,455	2,727	2,273	2,636	2,545	2,455	0,000	2,455	2,091	2,455	2,364	2,364	57,727
A20	2,909	2,727	2,636	2,636	2,364	2,455	2,818	2,455	2,455	2,727	2,455	2,455	2,727	2,909	2,545	2,455	2,182	2,455	2,636	0,000	2,455	2,364	2,273	2,273	58,364
A21	2,727	2,545	2,545	2,545	2,455	2,455	2,727	2,455	2,364	2,545	2,182	2,455	2,455	2,727	2,364	2,000	2,091	2,000	1,909	2,182	0,000	2,000	2,091	2,091	53,909
A22	2,818	2,545	2,455	2,455	2,273	2,455	2,727	2,636	2,455	2,909	2,455	2,273	2,727	2,818	2,364	2,364	2,364	2,364	2,455	2,364	2,545	0,000	2,000	2,000	56,818
A23	3,000	2,818	2,636	2,455	2,273	2,273	2,818	2,727	2,727	2,727	2,636	2,364	2,818	2,727	2,545	2,273	2,545	2,364	2,455	2,545	2,364	2,364	0,000	2,364	58,818
A24	3,000	2,818	2,455	2,636	2,364	2,182	2,909	2,727	2,545	2,727	2,455	2,545	2,818	2,636	2,545	2,364	2,545	2,364	2,364	2,364	2,182	2,182	2,091	0,000	57,818
TOTAL COLUMN	60,273	57,455	55,727	55,818	56,727	58,000	58,455	58,364	60,636	58,455	57,636	54,909	59,091	57,636	56,818	55,455	53,545	52,727	52,636	54,818	50,909	49,273	46,727	45,727	

Figure 3. Direct relationship matrix

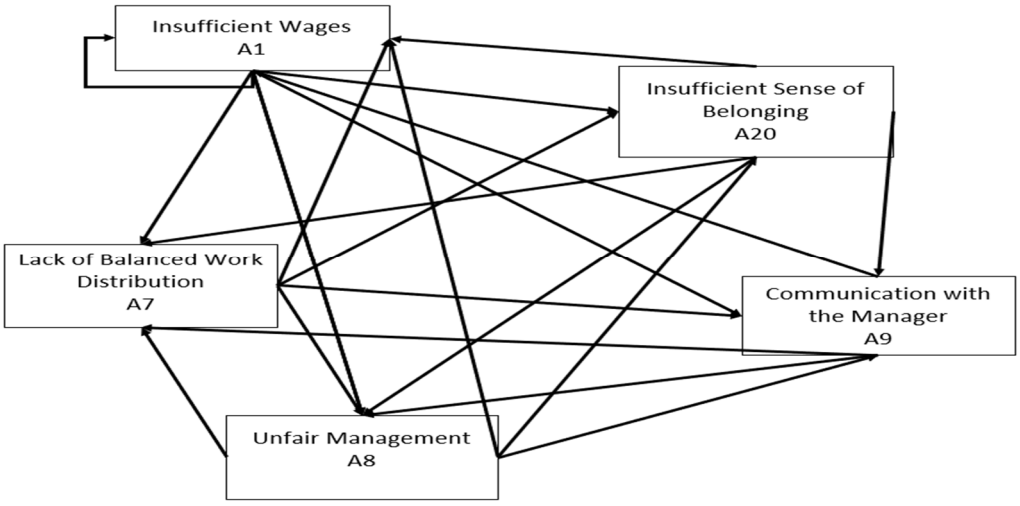


Figure 4. Mapping the influence diagram

4. IMPROVEMENT WORKS

The factors most heavily contributing to turnover were identified using the DEMATEL method and were listed as follows: inadequate pay, unfair management, unbalanced work distribution, communication with the manager, and a lack of sense of belonging. The improvement project aimed to address the first five criteria listed above. The steps of the improvement project are as follows:

Step 1: All positions within the company were individually evaluated, and a grouping system was implemented. This led to the decision to evaluate the positions in two groups. The first group comprised employees with less experience, lower qualifications, and less ability to learn and develop. The second group was determined to include employees capable of performing more critical and value-added tasks. The improvement groupings thus established are shown in Table 4.

Table 4. Improvement grouping

Position	Qualification group
Purification team leader	2
Coil cutting operator	2
Warehouse team leader	2
Electric-press operator	2
Electrical maintenance team leader	2
Forklift operator	2
Dough preparation operator	2
Scrap expert	2
Scrap field supervisor	2
Construction technician	2
Production team leader	2
Quality control team leader	2
Weighbridge reporting leader	2
Boiler team leader	2
Boiler operator	2
Control room operator	2
Drying press operator	2
Mechanical maintenance team leader	2
Pulper operator	2
Excavator operator	2
Shift supervisor	2
Purification personnel	1
Coil cutting personnel	1
Warehouse staff	1
Electrical maintenance personnel	1
Dough preparation personnel	1
Scrap personnel	1
Firefighters	1
Quality control personnel	1
Door control personnel	1
Boiler staff	1
Chemical preparation personnel	1
Drying press personnel	1
Mechanical maintenance personnel	1
Pulper staff	1
Hygiene personnel	1
Documentation staff	1
Packaging staff	1

Step 2: The goal is to create a structure based on the groups identified in the previous step. This will allow for the alignment and priorities between tasks. Positions divided into two will be integrated into different systems to identify unique tasks. Improvement gap tables have been created to identify unique tasks. Groups will be included

in an extra category for tasks performed within them. Personnel assuming the roles of Team Leader and Supervisor will be evaluated under Category E for that day.

Table 5. Improvement difference table (1st group)

Registration number	Name surname	Position	C	B	A	E	C day	B day	A day	E day	Total
			150	250	300	450					0
			150	250	300	450					0
			150	250	300	450					0
			150	250	300	450					0
			150	250	300	450					0

Table 6. Improvement difference table (2nd group)

Registration number	Name surname	Position	C	B	A	E	C day	B day	A day	E day	Total
			200	300	350	475					0
			200	300	350	475					0
			200	300	350	475					0
			200	300	350	475					0
			200	300	350	475					0

Administrator Approval

Positions designated as Group 1 and Group 2 will receive a bonus for improvement equal to the number of days they worked for value-added work in the current month. This will minimize the inadequate wages, which are the first in the weighting of terminations revealed by the DEMATEL method. Because improvement wages will be calculated based on the number of days the employee worked for value-added work under fair management and will be processed using system data on the digital platform, the compensation system is aligned with fair management. Groups 1 and 2 were determined based on the importance of the work performed. Groups were compensated within each group. In this way, compensation will be based on the importance of the work performed, ensuring a balanced work distribution (Table 5, Table 6). Step 3: It should be clearly determined which category the employees divided into groups will be included in the improvement program. Performance calculation criteria have been established to ensure the system is managed fairly. Performance calculation criteria are evaluated separately for line performance and individual performance, and then combined to form an overall assessment. This evaluation will be wage-based, aiming to minimize manual intervention in the compensation to ensure a fair structure. Therefore, employees will receive improvements based on the value-added work they perform within their group's category. The 20-person team formed to create the fishbone diagram determined the individual and line performance breakdowns, too. Table 7 was created for this purpose.

Table 7. Improvement calculation criteria

Performance Calculation Criteria		
Personal performance	**Line performance**	**Result**
A	A	**A**
A	B	**A**
A	C	**B**
B	A	**A**
B	B	**B**
B	C	**C**
C	A	**B**
C	B	**C**
C	C	**C**

The production line performance evaluation was based on eight key performance criteria determined by the company. These criteria and their corresponding weights were established according to the organization's performance assessment system. Productivity (15%), PTS Entry Rate (15%), Quality Product Rate (15%), and GMP Score (15%) were assigned the highest weights, reflecting their critical role in production efficiency and quality assurance. OEE (Overall Equipment Effectiveness) (10%), Internal Customer Complaint (10%), Number of Cards (Yellow/Red/White) (10%), and Work Accident Rate (10%) each accounted for 10% of the total

performance score. The overall line performance score was calculated by combining the weighted contributions of these eight criteria, resulting in a total performance value used for evaluating production line performance. The criteria determined in line performance are explained as follows:

- ✓ Productivity: Planned to be calculated as man-hours per ton.
- ✓ OEE: Planned to be calculated as (Net Productivity + Waste Production) / Time Set for Order Completion.
- ✓ Quality Product: Planned to be calculated as 1- (Waste / Gross Production).
- ✓ Availability: Planned to be calculated as (Actual Working Time + Capacity Loss Time) / Time Set for Order Completion.
- ✓ PTS (product and tracking system): Planned to check specifications. For example, moisture checks should be performed 10 times a day, with checks every 30 minutes.
- ✓ Internal Customer Complaints: Planned to be collected as errors identified by personnel within the line.
- ✓ Quality Product Rate: This is the rate of products that meet the specified quality standards.
- ✓ GMP (Good manufacturing practices): This will be determined as inspection outputs.
- ✓ Number of cards: A yellow card indicates near misses, a white card indicates malfunctions that can be resolved within the day, and a red card indicates tasks that the maintenance team has planned and resolved.
- ✓ The occupational accident rate is defined as the rate of workplace accidents occurring in the factory.
- ✓ Line performance: The current employee's contribution to the day, along with the contributions of other team members, will be automatically entered into the system to create a total value. Automatically capturing this value is a step toward establishing a fair system. This will ensure that all employees on that line receive the same value without discrimination. This aims to foster a sense of belonging and foster team spirit within the team. If the total value generated from the team's data is between 0 and 50, it will be rated C, between 50 and 75, B, and between 75 and 100, A.

Personal performance was evaluated using eight criteria established by the company as part of its employee performance assessment system. The criteria and their corresponding weights were determined according to the organization's internal evaluation framework. Contact with the First Manager (15%), Health Reports Received (15%), Unannounced Absence from Work (15%), and Warning/Defense/Discipline (15%) were assigned the highest weights, reflecting their significant impact on individual performance evaluation. Communication with Colleagues (10%), Unpaid Leave (10%), Compliance with Occupational Health and Safety Rules (10%), and Job Tracking (10%) each accounted for 10% of the total performance score. The overall personal performance score was calculated by combining the weighted contributions of these eight criteria and was subsequently used as one of the inputs in the analysis.

The criteria are defined in personal performance as follows:

- ✓ Communication with the Immediate Manager: This is the value that the immediate superior in the employee's hierarchy will take the initiative to communicate with the current employee.
- ✓ Communication with Colleagues: This is the value that the immediate superior in the employee's hierarchy will take the initiative to evaluate the current employee's compatibility with their field colleagues.
- ✓ Reports Received and Unpaid Leave: This is the value created today to ensure the job continuity of the current employee and enhance their sense of belonging.
- ✓ Unannounced Absence from Work: This is the value developed to increase the awareness of responsibility of the current employee and to enhance job continuity.
- ✓ Warning/Defense/Discipline: This is the value created today to ensure that the current employee works in compliance with the company's rules and regulations with other employees and their managers.
- ✓ Occupational Health and Safety Rules: This is the value created to ensure that the current employee complies with the occupational health and safety rules within the workplace.
- ✓ Work Tracking: This value is created to ensure that current employees keep track of their assigned daily tasks and work to be done.
- ✓ Reports Received, Unpaid Leave Rate, Unannounced Absence, Warning/Defense/Discipline, Occupational Health and Safety Rules, and Work Tracking will be automatically entered into the system. This data will be specific to the employee and will be automatically retrieved from the system. In the Communication with the Immediate Manager and Communication with Colleagues categories, the immediate manager will take the initiative to assign a value between 1 and 100. The system will convert the given value into a percentage. The purpose of creating these values is to foster a sense of belonging among employees, managers, and the company. The total of the values will be included in the calculation.

The sum of the total values will result in a personal performance score. This total value will be categorized as C if it falls between 0 and 50, B if it falls between 50 and 75, and A if it falls between 75 and 100.

This improvement initiative will reduce the turnover of high-value-added employees. This method was developed by combining inadequate pay, the most significant reason for turnover, with other sub-categories. Each month, employees will receive their improvement pay in the category based on the criteria they worked on each day. In determining this improvement pay, the calculation criteria based on line performance and individual performance were developed, taking into account management's fairness. Thus, if production volume, in other words, the line's performance, is high, employees on that line will be fairly graded. Because a large portion of the data will be automatically extracted from the system, employees with similar jobs and similar qualifications will receive improvement fairly, without manual intervention. High improvement rates will put employees ahead in future promotions. In the adjustment made to the balanced job distribution process, employees were grouped according to the difficulty of their tasks. The compensation structures of this grouping system, designated as Group 1 and Group 2, are also different. Employees will be assigned to the group based on their workload and will receive a recovery allowance based on their workload. To strengthen communication with management, a personal performance assessment process has been incorporated. This creates a framework that prioritizes not only line performance but also individual performance when determining performance criteria. It is planned that employee appointments will be made based on the tangible value of qualified work days in the recovery allowance. This will increase employee recognition and foster a sense of belonging. Suggestions for other reasons for leaving the job are provided, as shown in Table 8.

Table 8. Improvement suggestions

Reasons for leaving a job	**Suggestions**
Inadequate wages	Improvement work has been undertaken. The work is planned to be fee-based.
Unfair management	Improvement work has been carried out. Improvement data should be in a digital environment, and manual intervention is planned to be minimal.
Lack of balanced work distribution	Improvement efforts have been implemented. Categories have been created based on the difficulty of the work area and groupings have been made based on the distribution of work performed. The goal is to measure employees performing similar tasks digitally and at the same level.
Contact the administrator	Improvement efforts have been undertaken. A value has been added to individual performance to measure managers and teammates. This will strengthen communication.
Insufficient sense of belonging	Improvement work has been undertaken. While personal performance criteria were being established, the goal was to develop a sense of belonging.
Lack of appreciation	It is suggested that assignments and task updates should be planned based on the 6-month – 1-year – 2-year study data of the improvement work results.
Non-ergonomic working conditions	It is recommended that a detailed analysis be made of the air conditioning of the work areas.
Inadequate working hours	It is suggested that work that exceeds working hours should be eliminated as a necessity, and should be composed of volunteers, and have the same amount of work as the number of volunteers.
Failure to set correct goals	It was suggested that the target values be lowered and set at achievable levels. This way, staff would experience the satisfaction of achieving the goal and would work with greater determination in the next goal-setting period.
Career opportunities	It has been suggested that staff be allowed to change units or transfer from one department to another of their choice.
Inadequacy of benefits	Administrative leave of 6 days for the death of a parent or sibling has been recommended. 5 days of companion leave have been recommended for first-degree hospitalizations. Administrative leave of 2 days for electricity, water, natural gas, and transportation has been recommended for personnel moving houses who update their residence permits.
Workload	The number of personnel should be increased, and unit hour calculations should be updated.
Performance evaluation system	Performance evaluation criteria should be updated.
Inadequate complaint policy	An online complaint platform should be created so that staff can easily submit their complaints anonymously.
Collaboration between departments	To increase collaboration between departments, common goals should be established. It is recommended that departments collaborate with each other on the same goal.
Inadequate educational opportunities	Training programs should be defined for personnel based on training periods. These training programs should be aimed at staff development.

Table 8. *Continued*

Reasons for leaving a job	Suggestions
Unauthorized responsibility for the work performed	It has been suggested that responsible positions should be responsible for the task given.
Employees in the business purpose revenge	Common areas within the business should be determined, and social activities should be planned.
Bonus system	It is proposed to regulate the bonus system.
Intra-departmental collaboration	It was suggested that common goals be determined within the department.

5. DISCUSSION

The findings of this study are largely consistent with the existing literature on employee turnover, particularly in labor-intensive manufacturing environments. According to the DEMATEL analysis, inadequate wages emerged as the most influential factor affecting turnover intentions among blue-collar employees. This finding supports the arguments presented by Clark [35], who emphasized that compensation structures constitute one of the major determinants of employee resignation behavior. Similarly, Bellon [11] highlighted that the salary offered during the recruitment process has a significant influence on future turnover decisions, arguing that accurate wage determination at the hiring stage can reduce employee resignation rates. The present study confirms these conclusions by demonstrating that wage dissatisfaction remains the dominant driver of turnover among experienced manufacturing workers. Furthermore, unfair management practices were identified as another critical factor influencing employee turnover. This result is consistent with the findings of Burgess et al. [36], who argued that fairness in managerial practices and employee relations significantly affects workforce stability. Similarly, Böckerman et al. [37], through a probit model analysis, emphasized the importance of perceived managerial justice in reducing turnover tendencies. Yang et al. [38] also associated unfair management practices with career dissatisfaction and employee resignation behavior, while Katsieka et al. [10] incorporated fair management structures into a nomological network model explaining turnover intentions. These studies support the present research findings, which indicate that employees are highly sensitive to fairness, transparency, and equal treatment within organizational processes. Another important finding of the study is the strong effect of unbalanced workload distribution, poor communication with supervisors, and insufficient sense of belonging on turnover intentions. Khalid et al. [22] emphasized that balanced workload distribution positively affects job satisfaction and reduces turnover intentions, while Eka et al. [23] demonstrated through regression analysis that workload balance significantly influences employee satisfaction in SMEs. In manufacturing organizations, employees exposed to excessive or unfair workloads may perceive organizational inequality, which eventually increases resignation tendencies. In addition, communication with supervisors was identified as a significant turnover determinant in this study. Delfgaauw [39] stated that employees seek continuous managerial communication beginning from the recruitment process and that weak communication negatively affects organizational attachment. Likewise, Alao and Adeyemo [8] included communication capability among the critical decision rules affecting turnover prediction, while Sharmila et al. [27] confirmed the importance of manager–employee communication in the garment industry. Finally, insufficient sense of belonging emerged as another influential factor contributing to turnover behavior. Presbitero et al. [13] demonstrated through structural equation modeling that employees who share similar organizational values exhibit lower turnover intentions. Fletcher et al. [40] further emphasized that emotional conditions and burnout directly affect turnover behavior and suggested that strengthening employees' sense of belonging can improve workforce retention. In this context, the present study contributes to the literature by not only identifying the causal relationships among turnover factors through the DEMATEL method but also proposing practical improvement strategies focused on fair compensation, balanced workload distribution, managerial communication, and organizational belonging in manufacturing.

6. CONCLUSIONS

This study investigated the reasons behind employee turnover among blue-collar workers in a large-scale manufacturing company by employing the DEMATEL method. Unlike conventional turnover studies that primarily focus on descriptive or correlational relationships, this research revealed the causal structure and interaction intensity among 24 different turnover criteria. The analysis demonstrated that employee turnover is not driven by a single factor, rather, it emerges from the combined influence of organizational, managerial, and

individual conditions. The DEMATEL findings showed that inadequate wages constitute the most influential determinant of turnover, followed respectively by unfair management practices, unbalanced workload distribution, ineffective communication with supervisors, and a weak sense of belonging.

Based on these findings, the study proposed a set of practical improvement strategies. First, wage structures should be reviewed according to job difficulty, skill level, and market conditions in order to establish a fair and transparent compensation system. Second, management practices should be redesigned to increase justice, participation, and communication between supervisors and employees. Third, workload distribution should be balanced through systematic job analysis and staffing adjustments. Finally, organizational commitment should be strengthened by improving recognition systems, creating clearer career paths, and enhancing employees' sense of belonging through participative and supportive workplace practices. From a theoretical perspective, the study contributes to the employee turnover literature by demonstrating the applicability of DEMATEL in identifying the causal relationships among turnover factors in the manufacturing sector. From a managerial perspective, the findings provide a decision-support framework for practitioners seeking to reduce turnover among skilled and experienced employees.

Despite these contributions, the study has certain limitations. Since this study was conducted in a single manufacturing company with a sample of 75 former employees, the findings may have limited generalizability. Future studies are encouraged to validate the proposed framework using larger samples from multiple organizations and different industrial sectors, thereby improving the external validity of the results.

The empirical application was conducted in a single manufacturing company and relied on the evaluations of 75 employees who had left the organization. Therefore, the findings may not be generalized to all sectors or organizational contexts. Future studies may expand the sample size, compare different industries, or integrate DEMATEL with other multi-criteria decision-making methods such as ANP, AHP, or TOPSIS. In addition, future research may investigate the long-term effectiveness of the proposed improvement strategies after implementation. In conclusion, reducing employee turnover in manufacturing organizations requires a proactive and systematic approach. Organizations that establish fair compensation systems, strengthen managerial practices, distribute workloads equitably, and foster a stronger sense of belonging are more likely to retain their qualified workforce and sustain their competitive advantage.

Beyond identifying the factors leading to employee turnover, the proposed approach demonstrates the potential of integrating data-driven decision-making into human resource management. By systematically evaluating employee- and production-related performance indicators together with the DEMATEL methodology, the proposed framework represents a practical example of a smart human resource management system. Such digitalized evaluation models can support organizations in identifying turnover risks, improving employee retention strategies, and making more objective HR decisions. This approach may be particularly valuable for small and medium-sized enterprises (SMEs), where effective utilization of limited human resources is critical for achieving sustainable organizational performance and competitiveness.

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